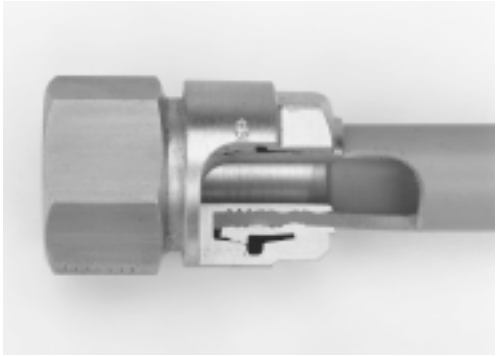
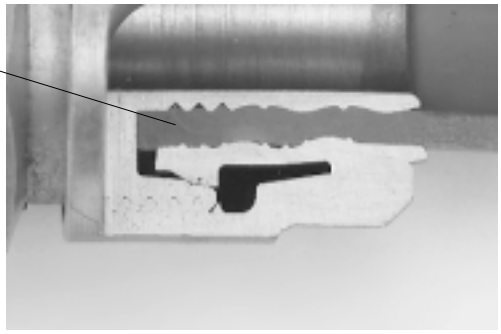
INSTAFLEX Jointing

Compression Jointing

Cross section of compression joint



Gripping spigot



Introduction
A compression joint is a brass fitting comprising of a number of parts, into which the prepared PB pipe is inserted. As the pipe is inserted into the fitting it is pushed over an internal gripping spigot.

When the pipe is fully inserted, the locking mechanism of the compression fitting is then tightened. This compresses the pipe against the gripping spigot achieving the water tight seal without the use of any sealing material. It also secures the pipe firmly in place.

There are two methods of preparing PB pipe for compression joints.
For 16 to 25mm a calibrating tool is used to stretch the pipe so it will go onto the gripping spigot.

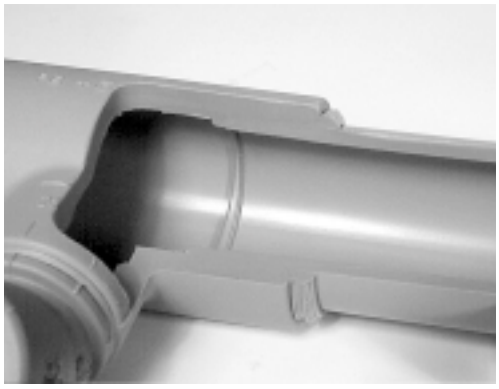
For 32mm and above the pipe needs to have a layer of PB reemed from the inside to enable it to fit onto the gripping spigot.

There are two mechanisms for compressing the pipe against the gripping spigot.

For 16 to 20mm a nut, containing a split ring, is tightened with a spanner. This compresses the split ring which then grips the pipe.

For 25mm and above a clamping loop is tightened around the pipe, by screwing an allen key bolt until it is tight, thus gripping the pipe.

Fusion Jointing



Cross section through a fusion joint

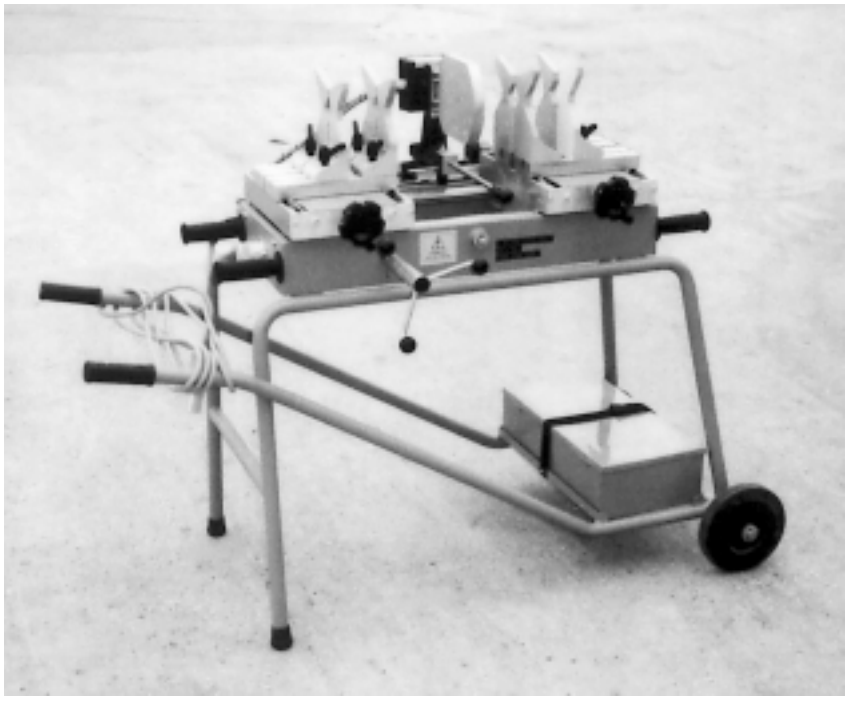
Both pipe and fitting are heated on a heater tool.

They are then brought together and held for a preset time

Introduction

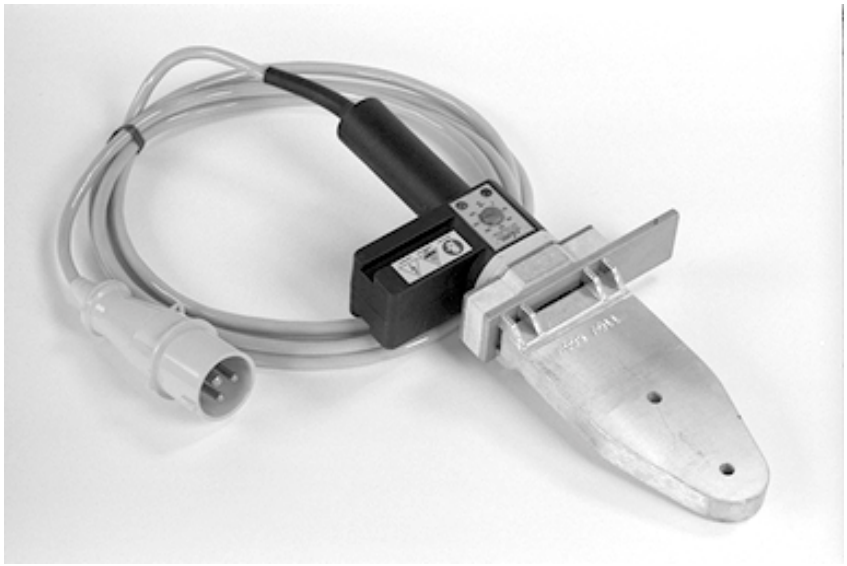
A fusion joint is where two pieces of plastic (usually the pipe and the fitting have been heated by a heating tool until their surfaces melt. Then the two molten surfaces are brought together and joined. As they cool the two molten surfaces join together into one homogeneous component.

This can be accomplished with either hand held fusion tools, which are suitable for pipe sizes 16 to 63mm



Or bench mounted fusion machines which are suitable for pipe sizes 25 to 110mm but normally only used on 75-110mm sizes.

Hand held fusion joints 16 to 63mm



Hand held heating element

This section covers;
the tools required for hand held fusion jointing,
setting up the tools for use,
preparing the pipe and fittings for jointing,
fusing the pipe and fitting together on a bench and
fusing the pipe and fitting together in situ.

Tools
The hand held fusion kit may be hired or purchased, please contact George Fischer Sales Ltd. Tel: 01203 535535,

Equipment required is:-
Hand held heating element:
110 volt used to heat the bushes.

Heating bushes

Heating bushes:
16 to 63mm, these are used to melt the pipes and fittings.

Temple sticks

Temple sticks:
These are wax crayons which melt at specific temperatures. They are used to check the heater bushes are operating at the correct temperature.

Template

Template:
Used to mark the pipe to check it is inserted the correct depth into the fittings.

Heat resistant gloves

Gloves:
Heat resistant, used to prevent burns when the heater bushes are changed or cleaned.

Timer

Timer:
This must be used for every fusion joint to check that the "exact" heating time for fusion joints is used.

Pipe Shears

Pipe shear:
For snipping through pipe sizes 16 to 25mm o.d. at a 90° angle

Roller pipe cutters

Pipe cutter:
For cutting the 25 to 63mm pipe by rotating around the pipe and tightening the handle until the cutting wheel slices through the pipe at a 90° angle.

Chamfering tools

Chamfering tool:
For chamfering the end of the pipes for 25 to 63mm pipe.

Cleaning fluid & cloths

Cleaning fluid & lint free cloth: Apply the cleaning fluid to cloth to clean the pipe and fittings.

The **G clamp** is secured to the bench and the hand held heating element is slipped into it.

Support base

Support base to hold the hand held heating element upright when being used to do jointing around the site.

Plastic support handle

Either -
Plastic support handle
This is screwed into the hand held heating tool and is used to hold it steady as joints are being made in situ.

Wooden support handle

Or
Wooden support handle
This is used to hold the heater plate of the hand held heating tool steady when joints are being made in situ.

Note
When the hand held fusion tool is hired most of the above tools come as standard. They are also sold as a complete package with a new hand held fusion tool. (Except cleaning fluid and lint free cloth, which must be purchased separately.)

Preparing the hand held fusion tool for use

Hand held fusion tool

Although the hand held fusion tool is portable and suitable for use in situ, it is best to use it at a fixed location with the tool mounted on a bench.

Warning
The hand held fusion tool is hot when in use, it should not be located where untrained staff can accidentally knock into it. It should ideally be marked with a clearly visible warning signs identifying that it is hot. It may be required by the Safety Officer on the building site, to cordon off the working area around this tool.

Mount the fusion tool on a firm, suitable, work surface. The fixing method depends on the type of tools which come with the hand held fusion tool

Secure fixing plate to the bench

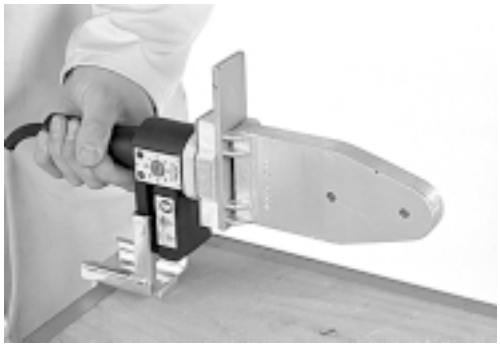
Either
Flat plate
This should be secured near the edge of a working surface
The plate is placed on a clean flat part of the work surface.
G clamps are then used to fix the plate to the surface. (‘G’ clamps are not supplied by George Fischer)

Secure fusion tool to the fixing plate

The metal end of the hand held fusion tools is placed into the flat plate and secured in place with the winged bolt.

Secure the clamp to the bench

Or
The support 'G' clamp is secured to one edge of a working surface. By rotating the handle below the clamp until it is tight.



Slip the fusion tool into the clamp

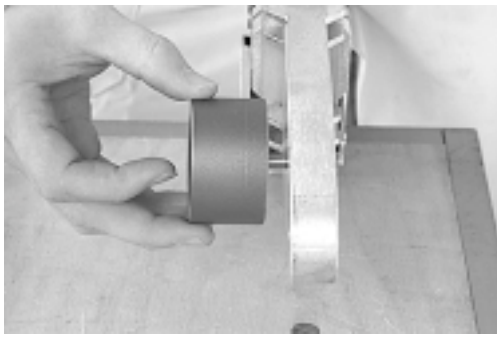
The plastic end of the hand held fusion tool is slipped into the support clamp. This will firmly hold the fusion tool in place and does not need any securing.

The fusion tool heater plate has two holes in it and can maintain two sets of heater bushes, at the correct temperature, at the same time.
The hole furthest from the handle can take heat bushes from sizes 16 to 25mm.
The hole closest to the handle can take heat bushes from sizes 16 to 63mm.

Insert the bolt through the bush

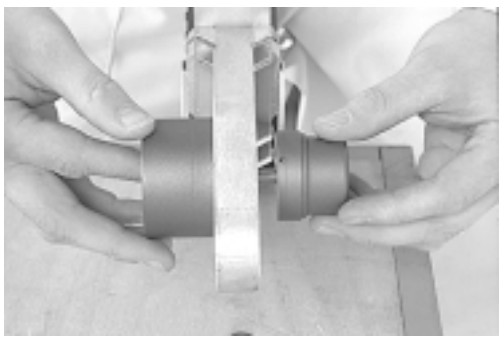
When the hand held fusion tool has been secured, the heating bushes can be attached to it.

The allen key bolt is inserted through the bush socket, with the screw thread facing out.



and through the heating element

The screw and the bush socket are put onto the fusion tool, through the appropriate hole.



Screw the other bush onto the bolt

The other end of the bush set is screwed onto the protruding bolt.

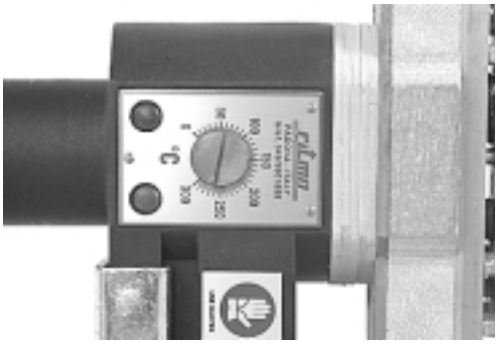
Tighten the bolt

The bolt is tightened with an allen key, to ensure there is a good surface contact between the bush and the heater plate. The bush heats up through conduction from the heater element. **It is important to have good surface contact between the bush and the heater plate.**

Yellow temple stick is used to check the element has reached the correct temperature _It should melt

The fusion tool is plugged into a 110 volt supply and allowed to heat up for about 5 mins The temperature is checked using the temple sticks to confirm the heater bushes are at the correct working temperature. Firstly the **yellow** temple stick is gently marked on the outside of the bush socket, this should melt at 253°C.

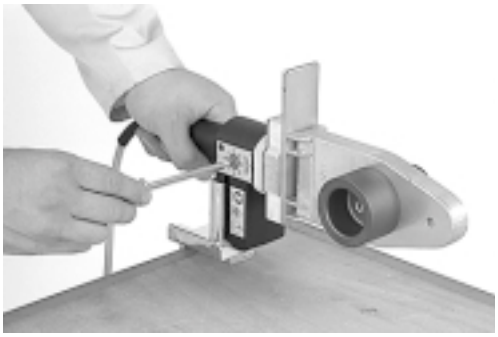
Note
Wax from the temple sticks must not come into contact with any surface on the bushes which will be in contact with the pipe or fittings, as this could effect the quality of joints and lead to leaks.



If the wax melts and maybe smoke a little, we can tell that the bushes are **above** the minimum temperature required for socket fusion jointing.

If the wax does not melt the bush is not yet up to the correct working temperature, which is 265°C.
Check the fusion tool has power to it (its lights are on) and try again in 5 - 10 mins.

Temperature controller



If it still doesn't melt the heater bush is not reaching the correct working temperature. The thermostatic control may need to be turned up a fraction (one millimetre clockwise on the scale).

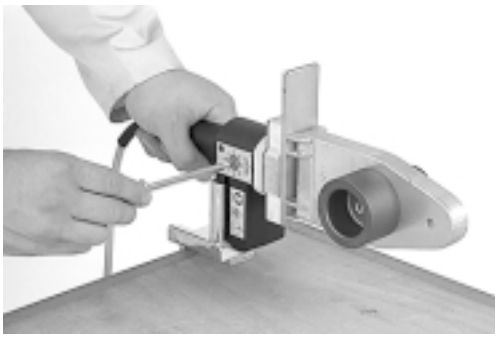
If the above steps is performed several times and the thermostatic control cannot be further adjusted, there may be a fault with the fusion tool and George Fischer should be contacted Tel: 01203 535535

When the bushes are above the minimum working temperature they must then be checked to ensure they are **below** the maximum working temperature.

Red temple stick is used to check the element has not exceeded the correct temperature. It should not melt

The **red** temple stick is gently marked on the outside of the bush, the wax will melt at 253°C.
If the wax does not melt the bush is within the correct working temperature.

If the wax is left on the bushes for more than 5 seconds it will start to bake. This is not an indication that the temperature is too high.



Adjust if necessary

If the wax melts quickly and maybe smokes a little, then the fusion tool is above the correct working temperature.

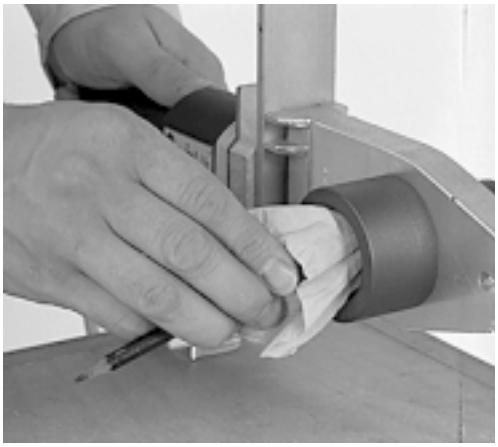
The thermostatic control on the side of the fusion tool needs to be turned down a fraction (one millimetre anti-clockwise on the scale).

Allow the tool about 5 mins to cool a little and check the temperatures again with both the yellow and red temple sticks.

If the above steps is performed several times and the thermostatic control cannot be further adjusted, there may be a fault with the fusion tool and George Fischer should be contacted Tel: 01203 535535

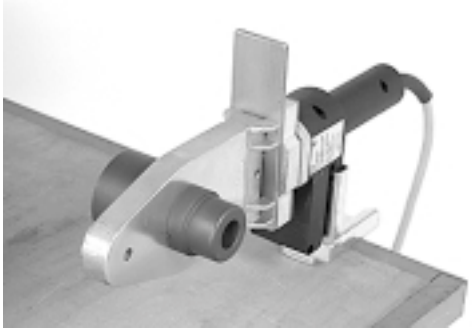
Clean outside of bush

Check the bushes are clean, using a piece of dry lint free cloth to rub off any debris. To clean inside the smaller bushes the cloth can be wrapped around a piece of dowelling or wooden pencil.



Clean inside of bush

Warning
Do not use a screwdriver or metal object as this will damage the Teflon coating on the bushes.



Fusion tool ready for jointing

The hand held fusion tool should now be firmly fastened on the working surface, the heater bushes in place and the tool at the correct working temperature.

The fusion tool is now ready to begin fusion jointing.

Preparing the fitting

Moisten cloth with cleaning fluid

Clean the polybutylene fittings internally with Tangit KS. Reiniger, cleaning fluid.

Apply the cleaning fluid to a clean, dry lint free cloth.

Clean inside of fitting

Rub the moist cloth firmly around the inside of the fitting on all faces to be fusion joined.

Place the cleaned fitting carefully on the working surface, avoid any moisture or dirt getting inside the fitting.

Note:
Do not touch the inside of the fitting with your hands since this will dirty the fitting and it will need to cleaned again.

Several fittings can be pre-cleaned in this way, so long as the cloth is dampened with fluid and clean, and the assembly area is not dusty or wet.

Preparing the pipe

The pipe must be cut at right angles using the appropriate pipe cutters. Shears for pipes from 16 to 25mm.

Use pipe shears to cut pipe up to 25mm

Use roller cutters on pipe above 25mm

Roller cutter for cutting pipes from 25 to 63mm.

The pipe should not be cut with a hacksaw or similar serrated blade as this will leave unacceptable burrs.

Check pads are clean.

The pipe must be free from deep scratches and burrs.
16 and 20mm o.d. pipes do not need chamfering.

Chamfering pipes from 25 to 63mm o.d.

Check the pads on the chamfering tools are free from grit, as this will scratch and damage the pipe when it is being chamfered.

Put pipe up to the blade.

Check the blade on the chamfering tool is in contact with the pipe and will remain in contact with the pipe throughout its chamfer.

Places pipe over central spindle.

Put the centre spindle on the inside of the pipe wall, the blades (which are at an angle) should be in contact with the pipe about half way down the blades and be able to remain in contact for at least half the pipes width as the pipe is chamfered.

Spindle may need adjusting. Loosen nut to adjust spindle and then re-tighten it.

If the above situation is not true the relative position of the blades can be adjusted, by loosening the nut on the central spindle and moving it closer or further away from the blades as required.

Then firmly tightening the nut on the spindle to grip it in its new position. (this adjustment should not be required often, but it is occasionally necessary).

Loosen the guide pads

When the cutting blades are correctly adjusted for wall thickness the guidance pads on the chamfering tool need to be adjusted to suit the pipe size.

Twist the black lever on the chamfering handle, anti-clockwise, this should loosen the guidance pads.

Push pads firmly against pipe wall

Put the central spindle roller inside the pipe and push the chamfering pads firmly up to the wall of the pipe.

Tighten pads in position

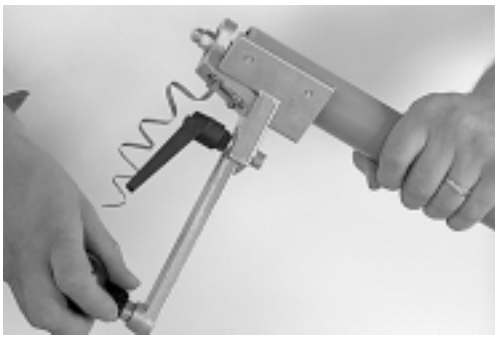
Whilst holding the pads and spindle roller firmly against the pipe, tighten the black lever on the chamfering tool.

When the lever has been tightened, it may be in a difficult position to allow easy chamfering, it can be moved to a different position, by pulling the lever away from the chamfering tool about 5mm, at this point it disengages the tightening bolt and will move freely to a more suitable position.

Push and turn chamfering tool

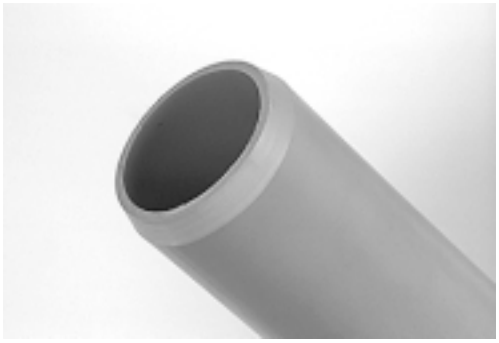
The chamfering tool spindle is inserted into the pipe, and then pushed firmly against the end of the pipe.

Whilst still pushing the chamfering tool firmly onto the end of the pipe, rotate the tool clockwise



Remove swarf

As the tool rotates, pipe swarf should start to be pealed from the pipe, if the pipe is not being pealed the chamfering tool must be pressed more firmly onto the end of the pipe.

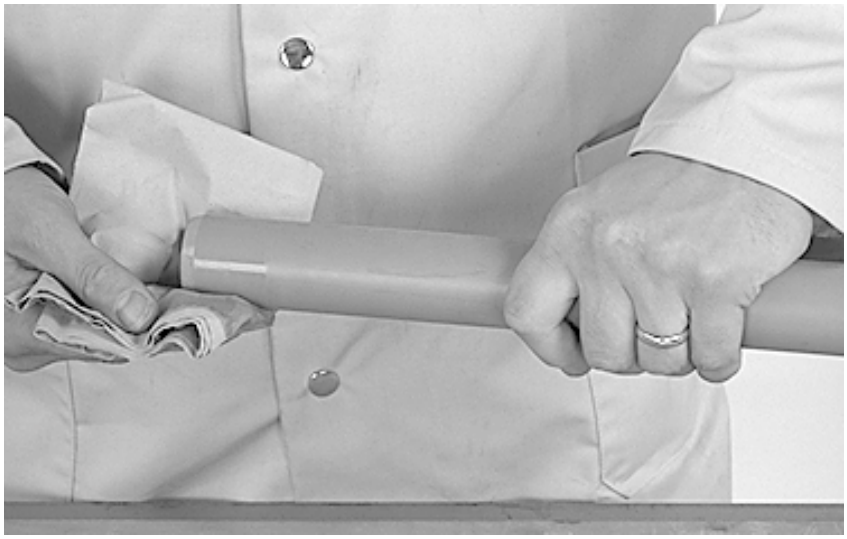


Chamfer pipe to 1/2 wall thickness

The pipe must be chamfered until the end of the pipe wall is down to about half its original thickness. The chamfer should be at an angle of about 15°.

Moisten the cloth with cleaning fluid

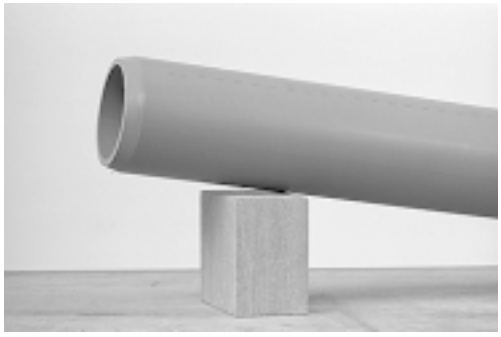
The chamfered pipe now needs to be cleaned externally with Tangit K.S Reiniger, cleaning fluid.
Apply the cleaning fluid to a clean, dry, lint free cloth.



Clean the pipe

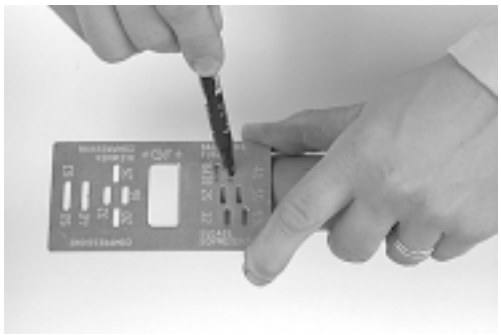
Rub the moist cloth firmly around the outside of the pipes about 50mm up the pipe. This should remove any dirt and the printed markings on the pipe (if it does not you may be using the wrong cleaning fluid).

Note:
Remember not to handle the outside of the cleaned pipe with your hands as it will require cleaning again.



Support the pipe ends

If you have to put the pipe down, ensure the clean end does not come into contact with the surface.



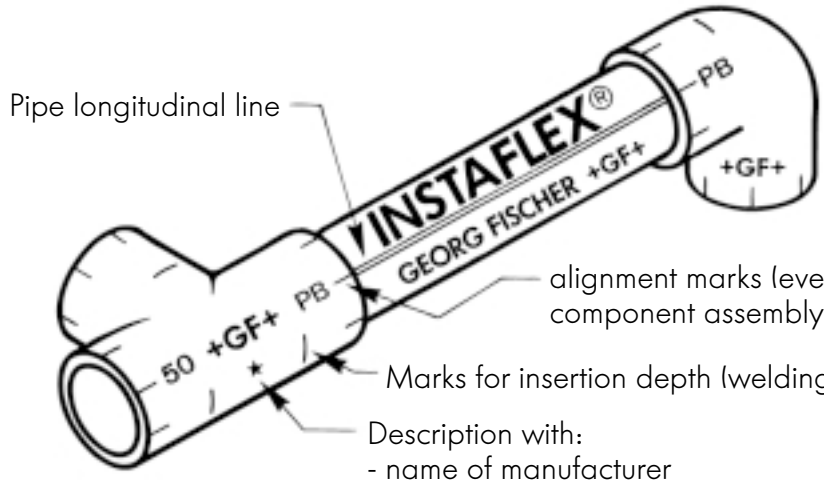
Mark the insertion depth

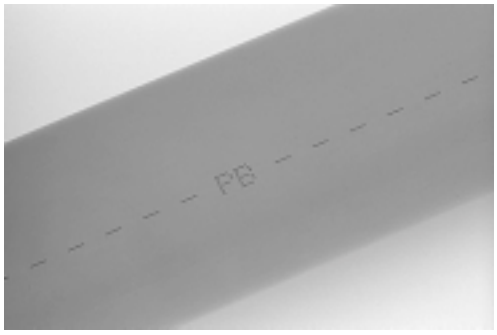
Mark the insertion depth of the pipe with a template after the pipe has been cleaned.

Pipe size o.d.	Insertion depth
16mm	17mm
20mm	17mm
25mm	20mm
32mm	22mm
40mm	24mm
50mm	28mm
63mm	32mm

The pipe is now ready for fusion jointing

Fusing the pipe and the fitting together





Alignment line on the pipe

The pipe has a line down one side and the fittings have external markings every 45°. These are to enable installers to pre-fabricate the pipes and fittings whilst keeping them in true alignment.

Alignment marks on the fitting

The fittings also have a mark showing the insertion depth of the pipe into the fitting. This enables the installers to measure the centre to centre distances of branches on site or from drawings and cut the pipes to exactly the right length. This subject is covered in more detail elsewhere and is call the **"Z" dimension method** it makes pre-fabricating pipework simple.

Long lengths of pipe will need to be supported during the fusion process, approximately at the same height of the fusion tool, to keep them straight as the joint is made. This can be achieved with a bench or boxes or similar support. This will be required on both sides of the fusion tool.

The timer has to be set for the required fusion time according to the pipe size being jointed. (See the times listed to the left).

The timer can be reset to zero by pressing both the second and the minutes buttons simultaneously, the seconds button is then pressed to set the correct fusion time on the timer.

The start button will start the timer and also stop the alarm, although the alarm will automatically stop after 10 seconds. The timer will then return to the original time (just set) for repeats of the same pipe size, do not reset the timer.

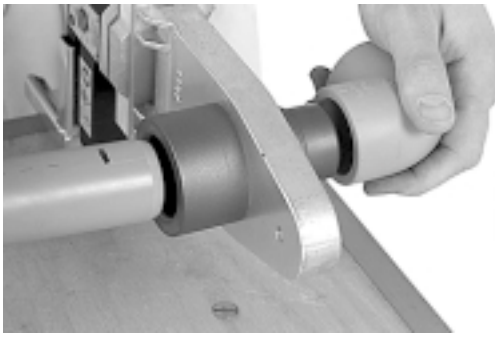
The fusion time varies for the pipe size being used

Pipe Size o.d.	Time
16mm	6 secs
20mm	7 secs
25mm	7 secs
32mm	10 secs
40mm	14 secs
50mm	18 secs
63mm	22 secs

Note
These times are critical and should always be measured with a timer

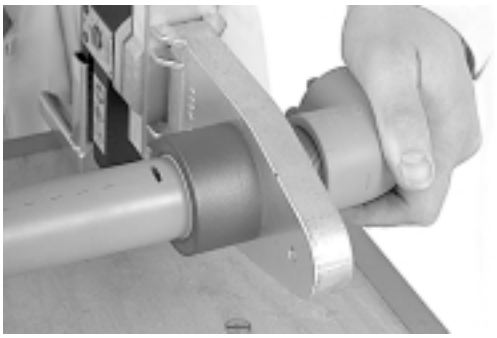
Check the fusion temperature of the bushes is within limits with the temple sticks, described earlier.

The pipe is held in one hand and the fitting is held in the other hand.
The alignment of the pipe and fitting must be checked before you start jointing.



Simultaneously push the pipe

The pipe and fitting are pushed **simultaneously** onto the heater bushes, in a steady motion. Larger pipe sizes will require more effort and the pipe will be harder to push onto the bush than the fitting.



and the fitting onto the heater bush

As they are pushed onto the bushes they will start to melt.

2-3mm short of the mark on the pipe

The pipe is pushed into the bush socket until the insertion depth mark is about 2mm short of the bush socket. If you push any further, the mark will disappear under the bead of the melting PB.

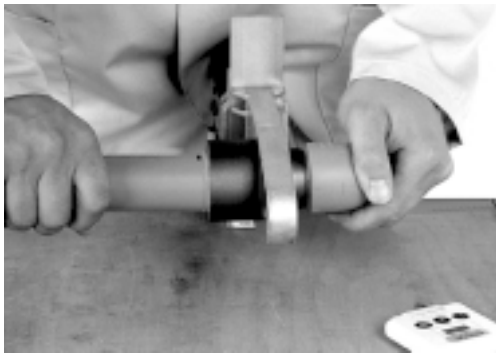
and up to the edge of the fitting

The fitting is pushed onto the bush until it reaches the first ridge on the bush.

Start timer

The timer is started when both the pipe and fitting are fully inserted onto the bushes.

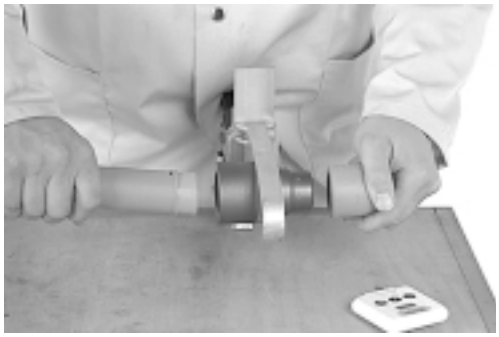
The operator will have to briefly take one hand off either the pipe or the fitting to press the start button on the timer. It is normal to take your hand off the fitting.



Pipe & fitting fully on heater being held in position

The pipe and fitting must both be held in place throughout the fusion process. Gentle pressure should be maintained to help them stay fully inserted onto the fusion tool. Also keeping them straight and level.

When the timer beeps withdraw the pipe and fitting from the fusion tool, this should be done in a fluid movement not too fast or slow.



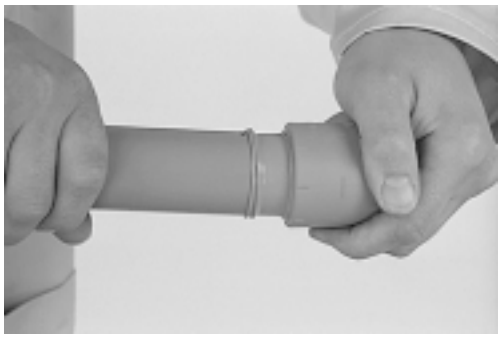
Simultaneously withdraw both pipe and fitting from heater bushes

It will be difficult to withdraw the pipe and fitting at first as they will tend to stick to the bushes, as they are withdrawn further they will move more freely, so less pressure will be required. It is important to withdraw them in a gradual movement as this reduces the amount of molten material left on the bushes and results in better joints (this will come with practice).

Quickly insert pipe into the fitting

Quickly align the pipe and fitting and bring them together.

Note:
It is important to bring the pipe and fitting together quickly to prevent their surfaces cooling and drying



Push together without twisting

As you bring the pipe and fitting together you will have to push the pipe into the fitting. This must be done quickly and firmly.

Note:
Do not twist the pipe when pushing together as this will weaken the bond and may lead to failures.

Push up to the insertion mark

Push the pipe into the fitting up to the end of the weld. i.e. Where the insertion mark is, stopping just short of the insertion mark.
Normally there will be two beads of soft P.B one on the fitting and one on the pipe. This demonstrates a perfect joint.

You need to maintain slight pressure holding them together otherwise they will tend to push apart.

Maintain pressure on joint for holding time

You will have to maintain this pressure for the holding time which is listed below for different pipe sizes.

Pipe o.d.	Holding Time in secs
16mm	15
20mm	15
25mm	15
32mm	20
40mm	20
50mm	30
63mm	30

Lay joint on a flat surface for cooling time

After the holding time has elapsed the pipe and fitting can be put gently to one side, on a level surface, to cool.

Note:

It is important to handle the newly made joint with care, to avoid putting a strain on it, as it is still very soft, until the cooling time has elapsed.

The newly made joint must be left undisturbed for minimum of the times listed below to cool

Pipe o.d.	Cooling Time in mins.
16mm	2
20mm	2
25mm	2
32mm	4
40mm	4
50mm	4
63mm	6

Clean both bushes with a dry lint free cloth

After each joint is made rub a dry/ clean cloth over the bush and socket to check they are free from any deposits of P.B.

Inspect joint

After the joint has been made, especially when you are using INSTAFLEX for the first time, check your workmanship. Learn from any mistakes and improve your jointing techniques.
A reference list is given at the end of the section of common fusion jointing faults to check and learn from.

After the cooling time the pipe and fitting are strongly fused together and can be handled normally
After 1 hour after the last joint has been made a full system pressure test up to 15 bar can be undertaken.

Hand Held fusion jointing in situ

Hand held tool

Hand held tool on stand with insulation cover

So far in this section we have dealt with using the hand held fusion tool bench mounted, it can also be used in situ. The fusion process is the same, here we examine the ways in which the hand held tool can be used in situ.

Note
The hand held fusion tool is hot. When it is being transported around the site it must have its cover in place. When it is not being held it must be placed in a suitable support (provided with each fusion tool) not laid on its side on the floor. It must be located where it will not cause an accident or hazard. It must not be left unattended when switched on.

Making joints in situ will normally involve 2 people, one to hold the fusion tool and one to hold the pipe and fitting

Warning
It is important to remember that the whole heater plate is hot, not just the bushes. When jointing in situ it is important to prevent the heater plate coming into contact with nearby plastic pipes and fittings as it will melt them.

If any components are damaged in this way, although they may not instantly leak, they will have a shorter life expectancy and should be replaced.

Note: Very Important
Because of the short heating times it is not recommended for 16 and 20mm joints, electrofusion is safer

Using the plastic handle

When using the hand held fusion tool for joints in situ attach the spare handle

either
The plastic handle, is screwed onto the heater plate

Using the wooden handle

or
The wooden handle is hooked over the end of the pipe

In order to make hand-held fusion joints in-situ two installers are required. The fusion tool is held in both hands by one fitter and pushed into the pipe, which is supported by the other fitter who at the same time pushes the fitting onto the fusion tool.

After the correct fusion time the fusion tool is pulled off the pipe and the fitting is simultaneously pulled off the fusion tool.

The fusion tool is withdrawn from between the pipe and the fitting. The fitting is then quickly pushed onto the pipe and held in place for the holding and cooling time.

Note:
It is important to use the timer. The timer provided by George Fischer can be attached to a belt or pocket. It can normally be operated by the fitter holding the fusion tool after pushing it into the pipe.

Bench mounted fusion jointing machine 25 to 110mm

Prisma 110 bench mounted socket fusion machine

This section covers the tools required for bench mounted fusion jointing; setting up the tools for use; preparing the pipes and fittings for joining; fusing the pipes and fittings together with the bench mounted fusion machine.

Tools

The bench mounted fusion kit may be hired or purchased. Please contact George Fischer Sales at Coventry Tel: 01203 535535.

The equipment required is a **Prisma 110, bench mounted socket fusion machine** (110 volts) which has wheels at one end and handles at the other, to enabled it to be moved around similar to a wheel barrow.

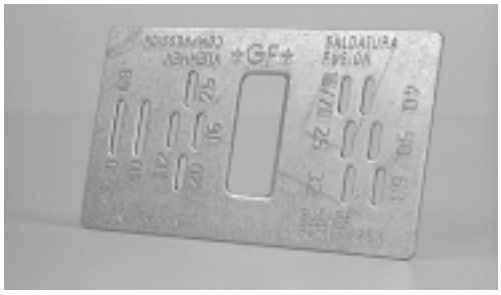
Temple sticks

Heater bushes

Heating bushes 25mm to 110mm these are used to melt the pipe and fittings.

Temple sticks, these are wax crayons which melt at specific temperatures, they are used to check the heater bushes are operating at the correct temperature.

Gloves



Template

Template is used to mark the pipe, to ensure that it is inserted to the correct depth into the fittings. For pipe sizes 16mm to 63mm only.

Gloves. Heat resistant gloves must be used to prevent burns when the heater bushes are changed or cleaned.

Timer

Timer This must be used for every fusion joint to check that the 'exact' heating time for fusion jointing is used.

Roller cutters

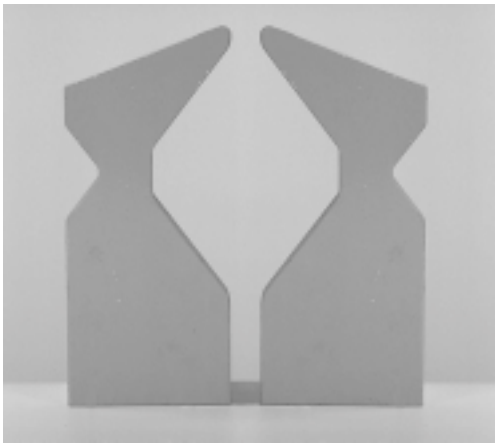
Pipe cutters for cutting the pipe by rotating them around the pipe and tightening the handle, until the cutting wheel slices through the pipe at 90° angles, to the pipe
One size for 25 - 63mm pipes
One size for 75 - 110mm pipes.

Cleaning fluid and cloth

Chamfering tools (right)

Chamfering tools for chamfering the end of the pipe in preparation for fusion jointing.
One size for 25 - 63mm pipes
One size for 75 - 110mm pipes.

Cleaning fluid & **Lint free cloth**
Apply the cleaning fluid to cloth to clean the pipe.



Pipe clamps

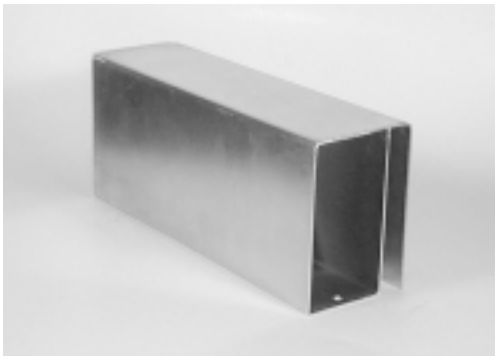
Pipe clamps. These are attached to the Prisma 110, and are reversible for supporting different pipe sizes.
One side holds pipes from 25mm to 63mm. the other side holds pipes from 75mm to 110mm.
These supports come in pairs for different purposes, one set holds the pipe, the other set holds the fitting. It is important not to get the two sets mixed.

Bench rotating handle

Bench rotating handle. This is a loose handle which must be removed when the bench mounted fusion jointed machine is being moved around the site. It is used to operate the insertion mechanism on the machine.

Pipe support stand

Pipe support stand. This is used to support a length of pipe at the pipe clamping side of the bench mounted fusion machine to prevent the pipe slipping out of the machine as fusion joints are made.

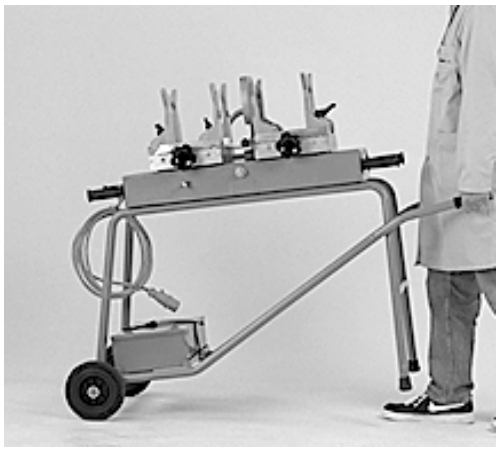


Backing plate

Backing plate. This is put over the rear fitting clamps when fusing elbows above 50mm to provide back support to the elbows and stop them slipping out of the clamps during jointing

Note:-
Most of the above tools come as standard with the hired bench mounted fusion jointing machine They can also be sold as a complete package with a new bench mounted fusion jointing machine. With the exception of cleaning fluid and lint free cloth, which must be purchased separately.

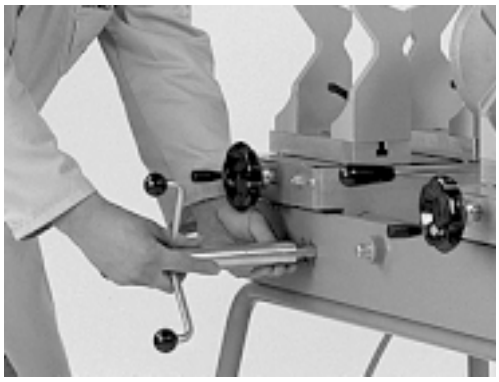
Preparing the bench mounted fusion jointing machine for use



The fusion machine is mobile

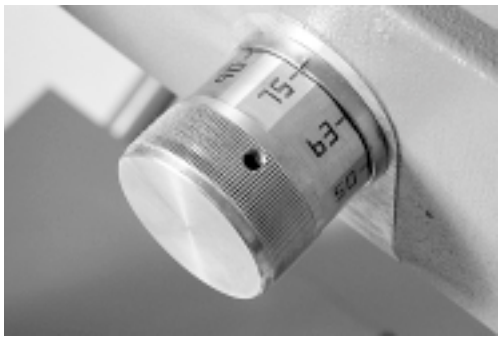
The Prisma 110, bench mounted fusion machine is provided with wheels to make it suitable for moving around site, to different locations as necessary.

Note
The bench mounted jointing machine has components which get very hot when it is in use. It should not be located where untrained staff can accidentally come into contact with it. It should be marked with clearly visible warning signs identifying that it is hot. It may be required by the Site Safety Officer to cordon off the working area around this tool.



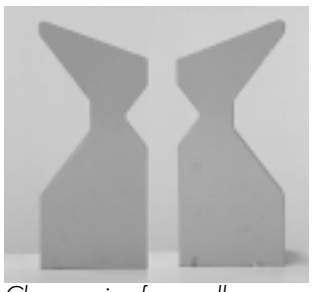
Attach the handle

Locate the bench rotating handle onto the steel shaft protruding from the side of the machine, this is achieved by pushing it onto the shaft.

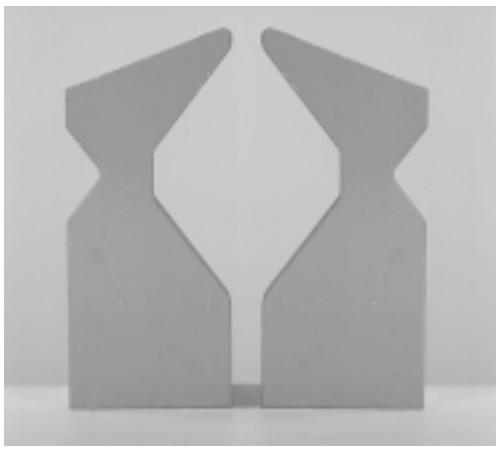


Set the pipe size dial

Set the pipe size dial, located at one end of the machine, to the size of the pipe being jointed.



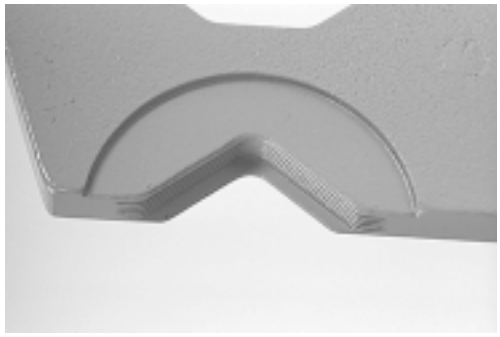
Clamp grips for small diameter pipework



Clamp grips for large diameter pipework

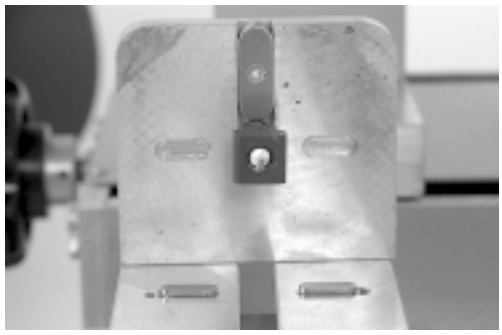
Fix the pipe clamps to the Prisma 110. For pipe sizes 25 to 63mm have the small pipe grips facing into the centre of the machine.

For pipe sizes 75 to 110mm have the large pipe grips facing into the centre of the machine.



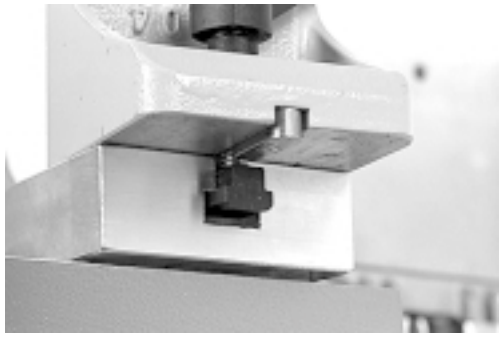
Front clamp for fittings

Fix the **front fitting support clamp** to the bench mounted fusion machine. This clamp is the only clamp which is fixed in the same position every time. It can not be moved forward or backward on the fusion machine like the other clamps



Front clamp alignment shims

There are two depressions under the clamp for shims to be inserted and aligned with the depressions on the bench. Checking the shims are in the correct place and the clamps are flat on the guide rails, the bolts are then firmly tightened to hold them in place.



Slide the clamps onto the rail

The clamps are fixed onto the guide rail on the fusion machine, with locking bars, which are held loosely to the pipe clamps with bolts and slipped into the guide rails.

Tighten the front clamps

The front clamps are secured by tighten the fixing bolt with an allen key.

Do not get the clamps mixed up. Pipe support clamps are smaller.

Fix the **rear fitting supporting clamps** to the bench mounted fusion machine

The pair of **rear fitting support clamps** have larger jaws than the 2 pairs of **pipe support clamps.** Do not get them mixed up as this will result in joints which are out of alignment.

Fit the rear clamps

Slide the clamps to the required position and tightened up.

A quick release mechanism on the bolts enables them to be easily tightened or loosened. To operate the mechanism, lift the black handle, this will disconnect it from the bolt, the handle can then be moved freely without tightening or loosening the bolt to get it out of the way.

Tighten with lever

Lowering the handle will make it grip the bolt, which can then be tightened or loosened as required.
The 2 clamps should be set up opposite each other when holding a fitting to ensure it is supported squarely.

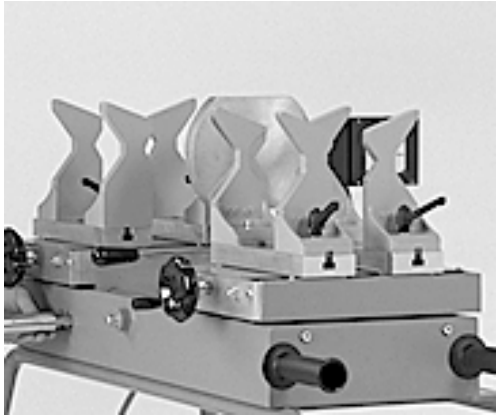
Set clamps up in pairs

Slide the clamps forward or backward on the side rails to suit different fitting types and sizes.

Clamps may be moved on the rail

Fix the **front and back pipe support clamps** on the bench mounted fusion machine.

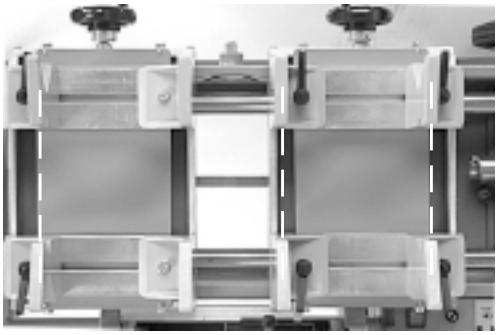
This comprises of two pairs of identical support clamps. Before fitting check the two clamps on the left are exactly the same as each other and the two clamps on the right are exactly the same as each other, and the exact mirror of the left hand clamps.



All 8 clamps need positioning

There should now be eight clamps fitted to the machine set out in four pairs directly opposite each other.

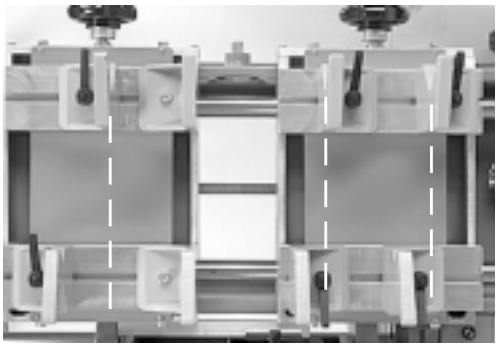
Always ensure clamps are aligned



Slide the clamps to the required position and tightened up using the quick release mechanism described earlier.

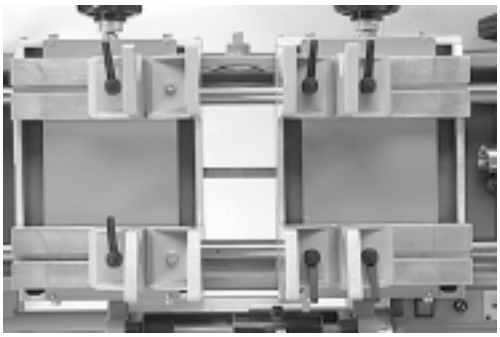
Correct!
Each pair of clamps should be directly opposite each other, to ensure the pipe is held straight.

Do not misalign clamps



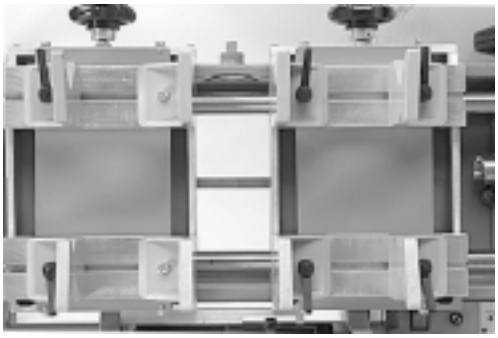
Wrong!
Clamps should not be positioned like this. They should always be opposite their matching counterpart

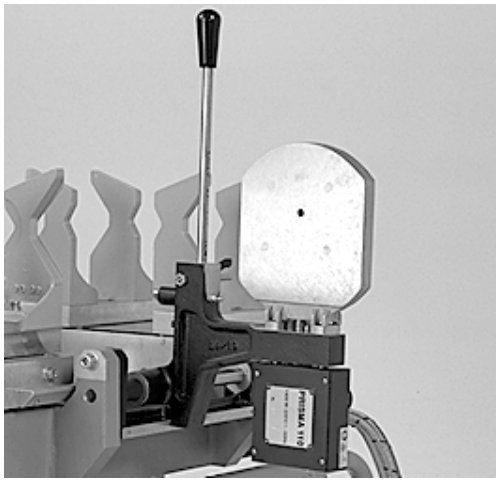
Clamps can be placed close together...



Slide the pairs of clamps closer together or further apart depending on the item being assembled.

or far apart



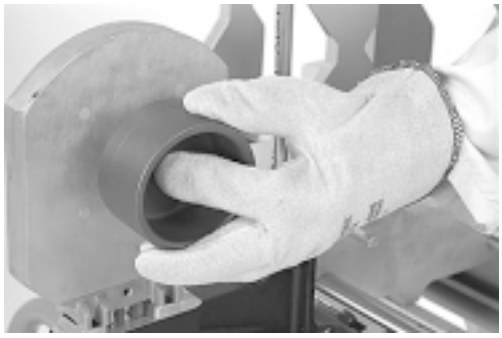


The heater plate

When the support clamps are attached the heater bushes can be fixed to the heater plate.
The heater plate can heat bushes from 25 to 110 mm, which are the sizes the clamps supplied are suitable for. (Extra bushes will be required for 16 - 20mm jointing)

Push the bolt through the bush

The allen key bolt is inserted through the bush socket with the screw thread facing out.

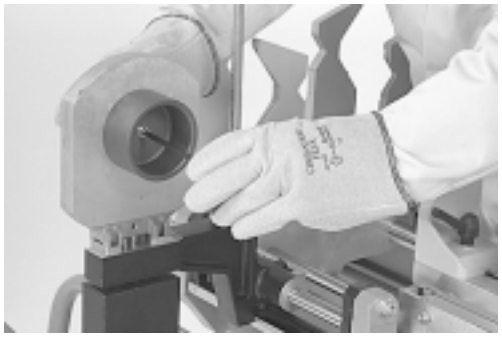


Position the bush on the heater plate

The bolt screw, with the bush socket attached, is pushed through the hole in the heater plate. Check the heater bush is facing the same side as the clamps for holding the fittings and the heater socket is facing the clamps which will grip the pipe.

Screw the other bush onto the heater plate

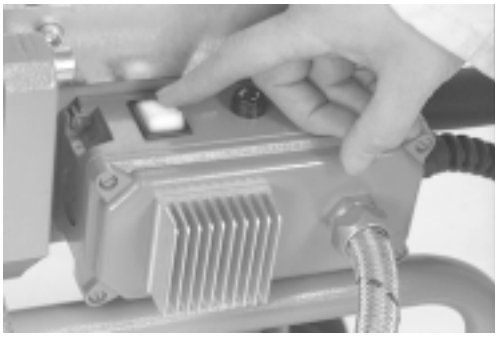
The other end of the bush set is screwed onto the bolt screw protruding through the heater plate.



Tighten the bolt with an allen key to secure the bushes in place

The bolt is tightened with an allen key to ensure there is a good surface contact between the bush set and the heater plate. The bush set heats up through conduction from the heater plate.

Note:
When handling the bushes or heater plate always wear heat resistant gloves



Switch on the machine

The fusion tool is plugged into 110volt supply and switched on, allowing about 5 mins. to heat up.

A red light will be illuminate to indicate the power is on and a green light will illuminate to indicate when there is power going to the heater plate.

The red and green lights should illuminate

The heater plate is thermostatically controlled and the green light will switch on and off as it maintains the heater plate temperature.

The temple sticks are used to confirm the heater bushes are at the correct working temperature. The temple sticks are made of wax which will melt at specific temperatures.

Tap the bush with the yellow temple stick

First the **yellow** temple stick is marked on the outside of the bush socket, this should melt at 253°C.

If the wax melts and possibly smokes a little, we can tell that the bushes are above the **minimum** temperature required for socket fusion jointing.

If the wax does not melt, the bush is not yet up to the correct working temperature. Check the fusion machine is still switched on and has power to it, then leave it 5-10 mins, and then try again.

Note
It is important that no wax from the temple stick falls onto the surfaces of the bushes, which will be in contact with the pipe or fittings, as this could effect the quality of joints and lead to leaks.

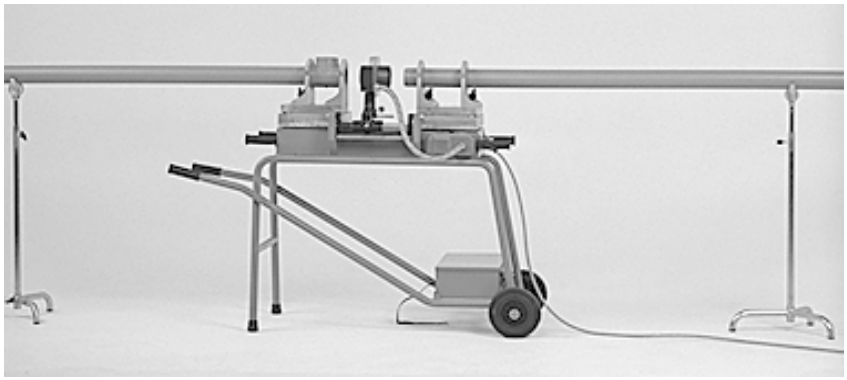
If it does not melt increase the temperature gradually

If it still doesn't melt the heater bush is not reaching the correct working temperature. The thermostat control, situated by the On switch, may need to be turned up slightly (one millimetre clockwise on the scale).

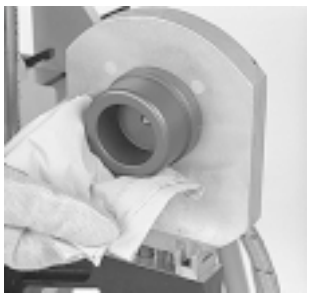
If the above step is performed several times and the thermostat control can not be adjusted any higher, then there may be a fault with the fusion machine and George Fischer should be contacted, Tel: 01203 535535.

Tap the bush with the red temple stick

Lower the temperature if the wax melts



Pipe supports stands must be used to support long lengths of pipe



Clean the bushes with dry lint free cloth

Note:
Do not use a screwdriver or metal object as this will damage the Teflon coating on the bushes

When the heater bushes are above the minimum working temperature we must then check that they are below the **maximum** working temperature.

To do this the **red** temple stick is marked on the outside of the bush socket, the wax will melt at 253°C.

If the wax does not melt, the bush is within the correct working temperature. If the wax is left in the bushes for more than 5 seconds, it will start to bake. This is not an indication that the temperature is too high.
If the wax melts quickly and possibly smokes a little, then the fusion tool is above the correct working temperature and needs adjusting. The thermostat control on the side of the fusion machine needs to be turned down slightly (1 mm anti-clockwise on the scale).

Allow the fusion machine about 5 mins to cool a little and check the temperature again with both yellow and red temple sticks.

If the above task is performed several times and the thermostatic control can not be adjusted any further, there may be a fault with the fusion machine and George Fischer Sales should be contacted, Tel: 01203 535535.

The pipe support stand is used to support the pipe whilst jointing and can be placed where it counter balances the pipes weight. It is useful when assembling long lengths of pipe to support them from both sides. Boxes or conventional pipe supports can achieve this.

Check the bushes are clean, using a piece of dry lint free cloth to rub off any debris. To clean inside the smaller bushes, the cloth can be wrapped around a piece of dowelling or a wooden pencil.

The fusion machine is now ready to begin fusion jointing.

Preparing the Fitting

Moisten the cloth with cleaning fluid

Clean the polybutylene fittings internally with the Tangit KS, Reiniger, cleaning fluid.

Apply the cleaning fluid to a clean, dry, lint free cloth.

Rub the moist cloth firmly around the inside of the fitting on all faces to be fusion joined. Place the cleaned fitting carefully on the working service surface, avoid any moisture or dirt getting inside the fitting.

Clean the inside of the fitting

Note:
Remember not to handle the inside of the fittings with your hands as you will make them dirty and you will need to clean them again.

Several fittings can be pre-cleaned in this manner, at any one time, provided the cloth is still clean and moist with cleaning fluid, and the assembly areas is not dusty or wet.

Preparing the pipe

Cut the pipe with roller cutters

The pipe must be cut at right angles using the appropriate pipe roller cutters.

For pipes below 40mm the pipe can be held by hand as the roller cutter is rotated around it.

Large pipe diameters can be held in the machine

For pipes above 50mm it is easier to cut them if you use the clamps on the fusion machine to hold the pipe steady whilst you use the roller cutter to cut the pipe.

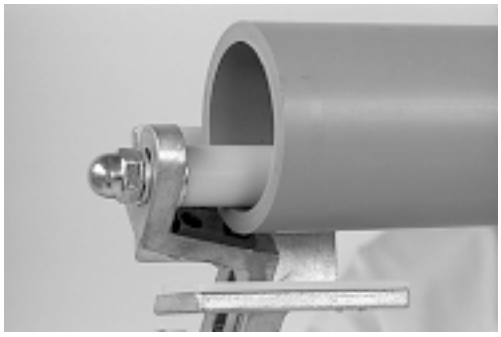
The pipe should **not** be cut with a hacksaw or similar serrated blade as this will leave unacceptable burrs. The pipe must be free from deep scratches and burrs.

Select chamfering tool checking that the pads are clean

Chamfering pipes from 25 to 110mm o.d

Two tools are required, the smaller tool is used to chamfer pipes 25 to 63mm, diameter, the larger tool is use to chamfer pipes 75 to 110mm diameter.

Check the pads on the chamfering tools are free from grit, as this will scratch and damage the pipe when it is being chamfered.



Push the pipe up to the blades

Check the blade on the chamfering tool is in contact with the pipe and will remain in contact with the pipe throughout its chamfer.

Put the centre spindle on the inside of the pipe wall, the blades (which are at an angle) should be in contact with the pipe about half way down the blades, and be able to remain in contact for at least half the pipes width as the pipe is chamfered.

If the above situation is not true the relative position of the blades can be adjusted, by loosening the nut on the central spindle and moving the spindle closer or further away from the blades as required.

Then firmly tightening the nut on the spindle to grip it in its new position. (This adjustment should not be required often, but it is occasionally necessary)

Put the pipe over the spindle and loosen the guidance pad holder

When the cutting blades are correctly adjusted for the pipe wall thickness, the guidance pads on the chamfering tool need to be adjusted to suit the pipe size.
Twist the black lever on the chamfering handle anti-clockwise, this should loosen the guidance pads.

Hold the pads tight to the pipe wall and tighten

Put the central spindle roller inside the pipe and push the chamfering pads firmly up to the wall of the pipe.

Whilst holding the pads and spindle roller firmly against the pipe, tighten the black lever on the chamfering tool.

Move the lever out of the way

When the lever has been tightened, it may be in an awkward position to allow easy chamfering, it can be moved to a different position by pulling it away from the chamfering tool handle by about 5mm. At this point it disengages the locking bolt and will move freely to a more suitable position.

Push and rotate chamfering tool

Once the guidance pads are set up for a particular pipe size, they can chamfer many pipes of that size without being adjusted again.

The chamfering tool spindle is inserted into the pipe, and the chamfering tool is pushed firmly against the end of the pipe.
For pipes above 50mm it is easier to chamfer if you use the clamps on the fusion machine to hold the pipe stationary while you chamfer the end.

Larger pipe diameters can be held in the machine

Still pushing the chamfering tool firmly onto the end of the pipe, rotate the tool clockwise.
As the tool rotates, pipe swarf should start to be peeled from the pipe. If the pipe is not being peeled the chamfering tool must be pressed more firmly onto the end of the pipe.

Chamfer pipe to 1/2 wall thickness

The pipe must be chamfered until the end of the pipe wall is down to about half its original thickness. The chamfering should be at an angle of about 15°.

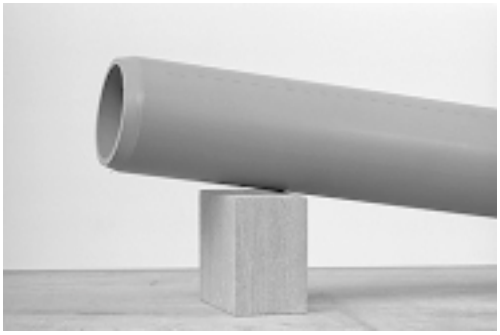
Apply cleaning fluid to cloth

Clean the pipe

The chamfered pipe now needs to be cleaned externally with Tangit KS. Reiniger, cleaning fluid.

Apply the cleaning fluid to a clean, dry, lint free cloth.

Rub the moist cloth firmly around the outside of the pipe, about 50mm up the pipe. This should remove any dirt and the printed markings on the pipe (if it does not, you may be using the wrong cleaning fluid).



Keep the clean pipe end off the surface

Note
Remember not to handle the outside of the cleaned pipe with your hands as this will make it dirty and it will need cleaning again.

If you have to put the pipe down, ensure the clean end does not come into contact with the surface.

Mark the insertion depth

Mark the insertion depth of the pipe with a template after the pipe has been cleaned.

Pipe o.d.	Insertion depth
16mm	17mm
20mm	17mm
25mm	20mm
32mm	22mm
40mm	24mm
50mm	28mm
63mm	32mm
75mm	36mm
90mm	42mm
110mm	48mm

Below 63mm this can be done with a template

Above 63mm you will need to use a tape measure

The pipe is now ready for fusion jointing.

Fusing the pipe and fittings together

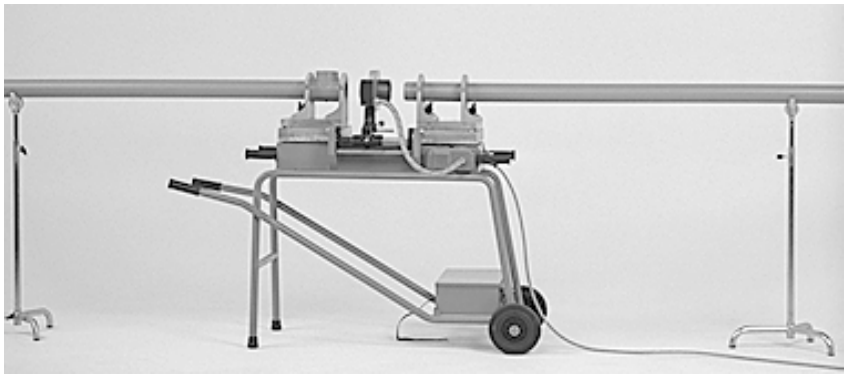
Alignment line on pipe

Alignment mark on fitting

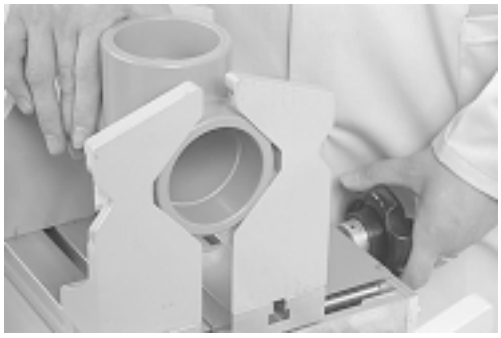
All the pipes have a line down one side and the fittings up to 63mm have external markings every 45°. These are to enable installers to pre-fabricate the pipes and fittings whilst keeping them in perfect alignments.

The fittings below 63mm also have a mark showing the depth to which the pipe is inserted into them. This is to allow installers to measure the centre to centre distance of branches on site or from drawings and cut the pipes to exactly the right length. This subject is covered in more details elsewhere and is called the **Z Dimension Method** it makes pre-fabrication of pipework easy.

Long lengths of pipe will need to be supported during the fusion process, approximately to the same height of the fusion machine, keeping them level as the joints are made. The pipe support clamps will help achieve this, supporting the pipes on both sides of the fusion tool. This may be insufficient on its own and extra pipe support stands or boxes should be used.



Support the pipes



Place fitting up to edge of clamp

The fitting must be placed squarely into the fitting support clamps. The face of the fitting must be placed flush with the lips at the edge of the clamps, checking all four points where fitting is gripped by the clamp.

Note:
Ensure the support clamps are the correct way around on the fusion machine, for the fitting sizes being used, see "section preparing the bench mounted fusion jointing machine for use", for more details on this. (**Page 38**)

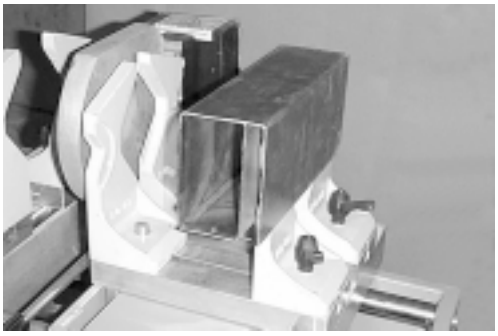
Adjust rear clamps to grip fitting

The rear fitting support clamps may be moved backwards or forwards to grip a suitable point on the fitting (you must not try to hold the pipe with the rear support clamps since they will be to large for the pipe).

Tighten the hand wheel

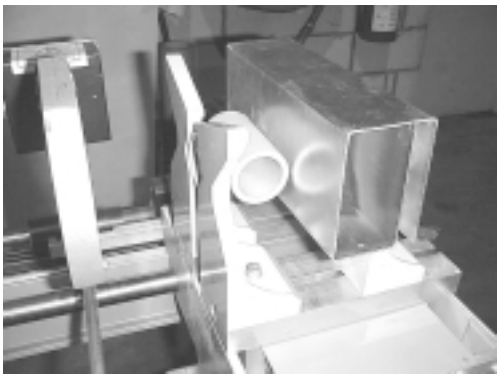
The fitting is then clamped in the support clamp by rotating the clamp opening/closing handle until the fitting is held firmly.

As the clamp grips the fitting, its alignment must be checked to ensure it is straight.



For small fittings put the backing plate on clamps

When fusing an elbow or tee outlet, the rear fitting support clamps will not be able to grip it. Place the backing plate on the rear fitting support clamps.

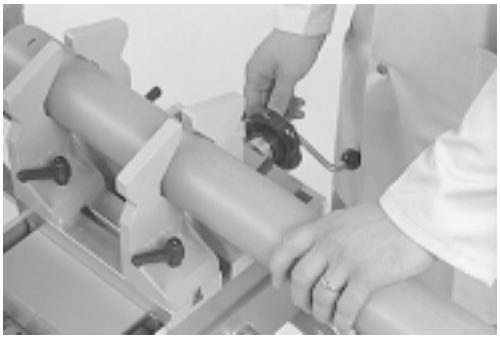


Push backing plate up to fitting and tighten the lever

Move both clamps forward so that they push the backing plate up against the back of the fitting and then tighten the quick release bolts.

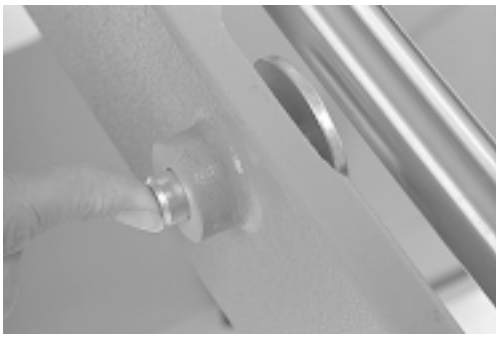
Rotating knob for adjusting size dim

When the heater bushes are in place check the pipe size selection dial is set to the correct size for the pipe you are jointing.



Hold the pipe in the clamps

Fit the pipe into the pipe clamps, by rotating the clamp opening/closing handle, until the pipe loosely gripped.

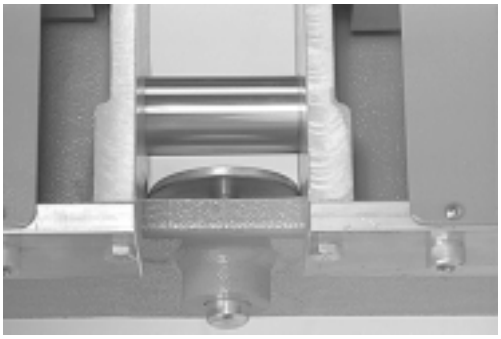


Push and hold button

Push and hold the stop button in.

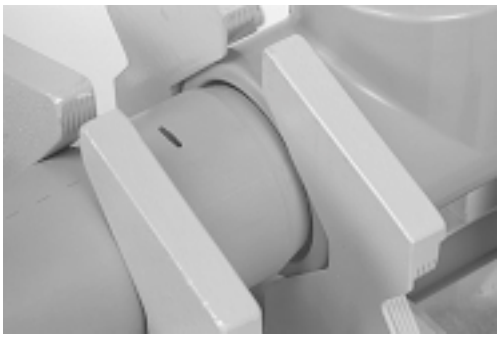
Rotate hand wheel

Rotate the large bench rotating handle clockwise until the pipe and fitting supports touch the stop button.



Release button

Release the stop button.



Push pipe forward

Loosen the pipe support clamps and push the pipe forwards in the clamp so that the edge of the pipe is between 1- 2mm within the fitting.

Tighten support clamps

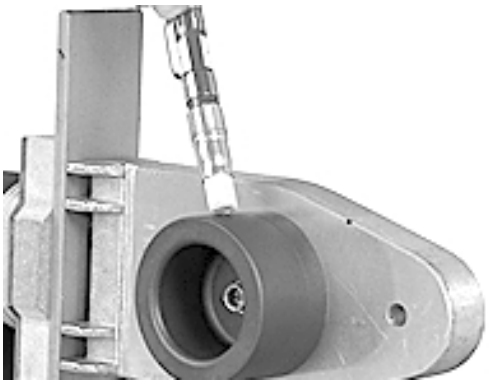
Tighten the pipe support clamp, so the pipe is held firmly in place checking the pipe is accurately centred within the fitting.

Use the timer for all joints

Check the timer has been set for the required fusion time of the pipe size being joined. See list below

Fusion times vary for each pipe size being used.

Pipe o.d.	Fusion time
16mm	5 secs
20mm	6 secs
25mm	6 secs
32mm	10 secs
40mm	14 secs
50mm	18 secs
63mm	22 secs
75mm	26 secs
90mm	30 secs
110mm	35 secs

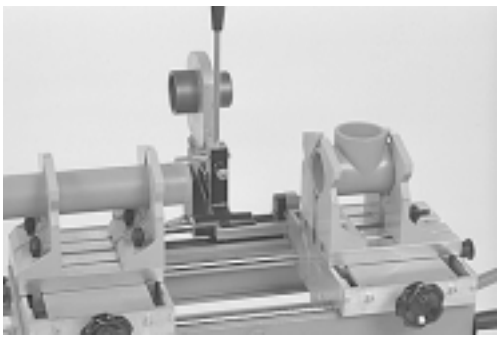


Prior to jointing check the temperature of the bushes

Check the fusion temperature of the bush is within limits with the temple sticks, as described earlier, just before jointing.

Set the timer

The timer can be reset to zero by pressing both the second and minute buttons simultaneously. The seconds button is then pressed to set the correct fusion time on the timer. The start time button will start the timer and also stop the alarm, although the alarm will automatically stop after 10 seconds. The timer will then return to original time set. For repeats of the same pipe size do not reset the timer.

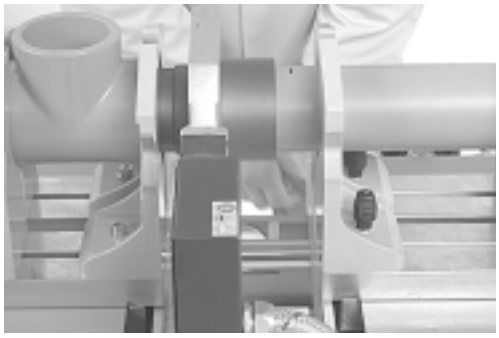


Turn the bench rotating handle anticlockwise until pipe and fitting are as far apart as possible.

Turn the large bench rotating handle anti-clockwise, until the pipe and fitting are as far apart as possible.

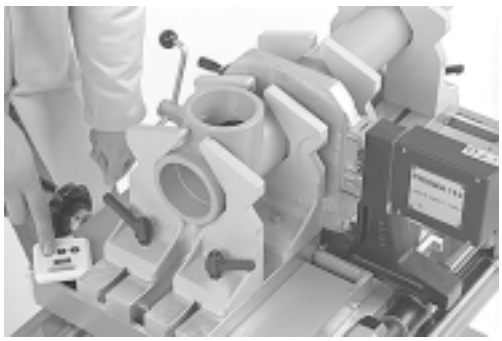
Lower the heater plate

Lower the heater plate between the pipe and fitting.



Rotate the handle clockwise

Turn the bench rotating handle clockwise to bring the pipe and fitting onto the heater bushes.

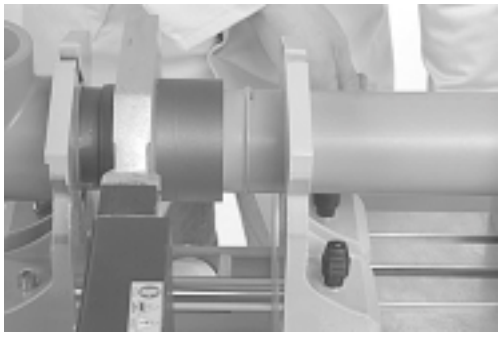


Push pipe and fitting onto heater bush

Keep turning the handle until it cannot be rotated any further. The heater plate will move during the last part of insertion as it is automatically self centring.

Start timer

When the pipe and fitting are fully inserted start the timer.

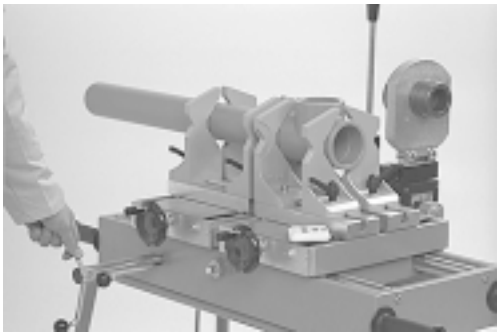


When the timer beeps withdraw pipe and fitting

When the timer beeps gently turn the bench rotating handle anticlockwise with drawing the pipe and fitting from the heater bushes. When the pipe and fitting are free of the heater bushes continue turning the handle quickly until it reaches the stop.

Lift heater plate

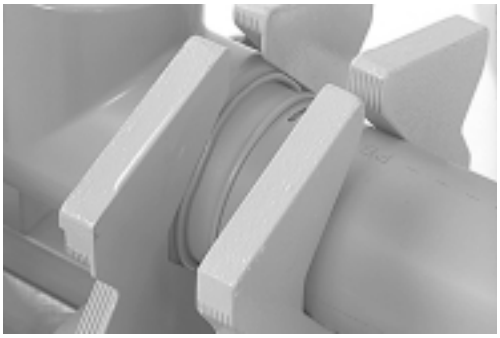
Quickly lift the heater plate from between the molten pipe and fitting.



Quickly bring pipe and fitting together

Quickly turn the bench rotating handle clockwise to bring the pipe and fitting close together.

As they come into contact slowly continue to rotate the handle so the pipe inserts gently into the fitting until it can go no further.



Push up to the insertion mark

The mark indicating the insertion depth should be near the molten bead of PB or half covered. If it is 4mm or more away from the fitting the pipe or fitting may have slipped within the clamps.

Quickly release one of the clamps and manually push the pipe or fitting up to the insertion mark, then re-tighten the clamp when the pipe is fully inserted into the fitting.

Maintain slight pressure on the handle

A slight pressure needs to be maintained on the hand wheel throughout the to prevent the materials natural tendency to push apart. This is just for the holding times listed below.

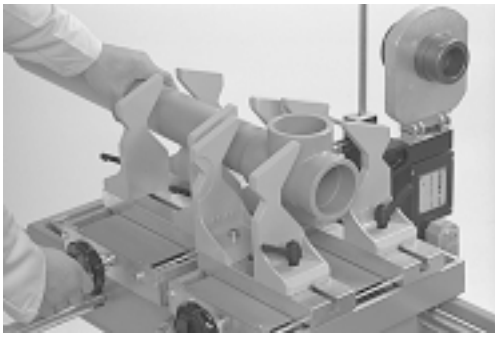
o.d. pipe	Holding time
16mm	20 secs
20mm	20 secs
25mm	20 secs
32mm	20 secs
40mm	20 secs
50mm	30 secs
63mm	30 secs
75mm	60 secs
90mm	75 secs
110mm	90 secs

Note
It is important when moving the pipe and fitting in and out of the bushes, or into each other, to move them firmly but gently to achieve the best joint.
It is also important to move them quickly between the heater plate and jointing to minimise the time they are exposed to free air and cooling.

Undo support clamps Release fitting first (support when releasing)

After the holding time, the pipe and fitting may be carefully released from the clamps by turning the hand wheels anti-clockwise.

Note: It is important to avoid any strain on the fittings until the cooling time has elapsed.



Then release the pipe (support when releasing)

The fitting should always be released first and the clamp opened wide enough so that it is clear of the fitting just in case the pipe moves when released.

The pipe is then released. As the pipe clamp is opened the pipe should be supported with one hand to reduce movement.

The pipe and fitting can be gently put to one side, on a flat surface to cool for the required cooling times listed below.

Set aside to cool

o.d pipe	Cooling time
16mm	4 mins
20mm	4 mins
25mm	4 mins
32mm	4 mins
40mm	4 mins
50mm	4 mins
63mm	6 mins
75mm	6 mins
90mm	6 mins
110mm	6 mins

After which they can safely be handled normally.

Use two people for long lengths

If the fitting already has a pipe in one end before jointing, more care will have to be taken to avoid straining the new joint when releasing the fitting and pipe and setting it aside. This can normally be achieved by two people working together.

Alternatively if the pipe and fitting is left in the bench clamps for the full cooling time, it can then be handled normally by one man.

Clean outside the bush

Clean inside the socket

When each joint is made rub a clean, dry cloth over the bush and socket in the fusion well to check they are free from any residue of P.B.

After the joint has been made, especially when you are using INSTAFLEX for first time, check your workmanship, learn from any mistakes to improve your fusion jointing technique.

At the end of this section there is a list of faults to check and learn from but three common examples are given below.

Inspect your own workmanship

Uneven bead

1/ If the bead of P.B around the external junction between pipe & fitting is uneven, i.e there is a high build up in 2 or 4 locations and a low build up in 2 or 4 locations, this indicates the fitting has been gripped too tightly by the clamp in the fusion machine, tighten the clamps less next time.

Over insertion

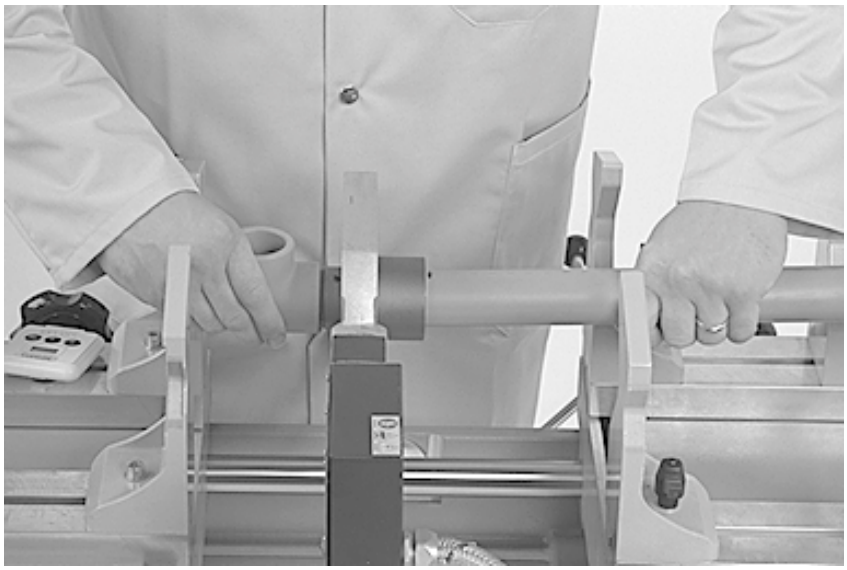
2/ If the insertion mark is not visible, then the pipe is over inserting into the fitting. This is either the result of the pipe size dial being set for the wrong pipe size or the pipe being inserted too far into the fitting when the stop was in place.
Identify cause and correct.

Under insertion

3/ If the insertion mark is clearly visible by 4mm or more, then the pipe is being under inserted in to the fittings. This is either the result of the pipe size dial being set for the wrong pipe size, or the pipe not being brought close enough to the fitting when the stop was in place, or the pipe or fitting slipping in the clamps when they are being joined.
Identify cause and correct.

Wait one hour after the last joint has been made before filling the system with water and pressure testing up to 15 bar pressure.

Special Fusion jointing using the bench mounted socket fusion machine



Heater plate lowered

Heater plate raised

With difficult assemblies like small pipes, awkward shapes or reducing bushes, the bench mounted fusion machine can still be used to assemble these items, except it has to be used slightly differently.

Hand held fusion joints with the bench mounted

The bench mounted fusion tool can be used to do joints as if it was a hand held fusion tool.
This can be done with either the heater plate in its lowered position, with all the clamps and slide fully open and as far away from the heater plate as possible.

or with the heater plate in its raised position.

Fusing small pipes with the bench mounted fusion machine

The bench mounted fusion machine, does not come supplied with bushes for fusing 16mm and 20mm pipes and fittings. These will have to be ordered separately in order to use this machine for joining pipes and fittings of these sizes.

Since 16 and 20mm pipes are too small to fit in the clamps of the bench mounted fusion machine the only method to jointing these sizes is to fuse them by using the hand held jointing technique. Refer to the section for hand held fusion jointing for more information.

Fusing reducing bushes into fittings

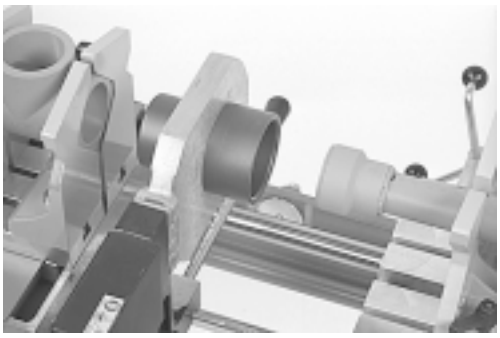
Fuse the pipe into a reducer

What follows is a summary of additional instructions for fabrication of reducing bushes fused into fittings. For full details of bench mounted fusion jointing please refer to earlier instructions.

The simplest method of fusing a reducer into a fitting is to fuse the reducer onto the pipe first, then continue as detailed below.

Hold the pipe in the clamp...

Hold the pipe with the reducer already fused onto the end in the small pipe clamps.
The fitting will be held with the large fitting clamps.



...and join as normal

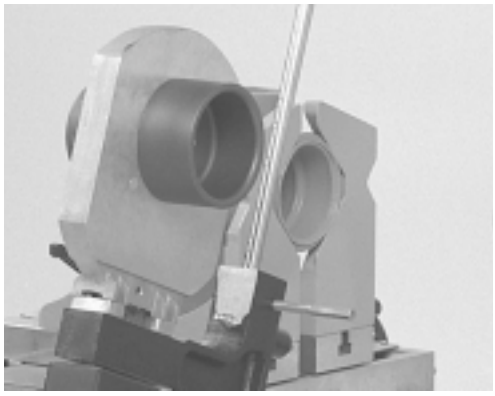
Continue the fusion process as normal.

The fitting is held in the clamps while the reducer is held by hand.

To produce a fusion joint between a fitting and a reducer without first fusing the reducer to the pipe can be achieved by holding the reducer in the hand

The fitting is still held in the clamps but you manually push the reducer into the heater bush as you rotate the handle to bring the fitting onto the bush.

You can support your arm on the pipe clamp to aid withdrawing the fitting.



Tilt the heater plate out of the way.

Remove the heater plate...

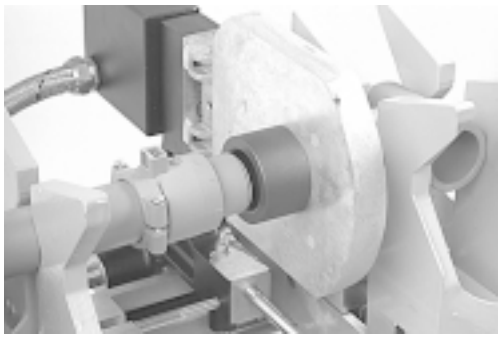
Push the reducer into the fitting

... and manually push the reducer into the fitting.

Hold reducer in place

Hold the reducer in the fitting for the holding time. Remember to check its alignment before it cools.

Fusing Electrofusion spigots onto fitting



Place spigot on pipe

It is easier to put the electrofusion spigot onto a piece of pipe prior to fusing. Tighten the screws to hold it in place.

Push spigot with pipe into heater bush

Carry on with a normal jointing procedure to make the joint.

Alternatively reducers can be fused onto the pipe as if a hand held joint is being made. Refer to the section for hand held fusion jointing for more information.

When fusing 16 and 20mm pipes into a reducer, this operation can only be performed by using the hand held jointing technique. Refer to the section for hand held fusion jointing for more information.

The reducer has no insertion mark. The correct insertion mark is up to the end of the reducer.

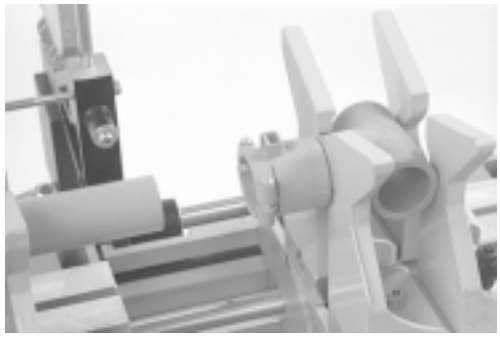
Note.
With small reduction changes i.e. 25mm reduced to 20mm it is difficult to tell which side of the fitting is reducing. Do not melt the side of the fitting with printed writing on. The other side has a pre-moulded chamfer.

Hold spigot whilst withdrawing

It is necessary to hold the electrofusion spigot as you withdraw it from the heater bush.

Push spigot into fitting

Push the electrofusion spigot into the molten fitting.



Withdraw pipe

After the holding time release the screws and withdraw the pipe from the electrofusion spigot.

Electrofusion Jointing

This section covers the tools required for electrofusion jointing, setting up the tools for use, preparing the pipes and fittings for jointing. Fusing the pipes and fitting together with the electrofusion machine.

Electrofusion control unit

Primary cable 110v

welding cable

Primary cable 240v

Pipe shears

Pipe roller cutters

Cleaning fluid and cloth

Important:
It should be noted that electrofusion and socket fusion fittings are not always compatible. The length of the spigot does not permit a joint to be made.

Tools

Electrofusion control unit is a fully automatic unit for fusing pipe and electrofusion fittings together, it can operate at either 240 volts or 110 volts. This is suitable for fusing all electrofusion joints from 16mm 110mm.

Welding cable this has a plug at each end, one end is screwed onto the top socket of the electrofusion control unit, the other in is plugged into an electrofusion fitting to make joints.

Primary cable 110v This has a plug at each end. One end is screwed onto the bottom socket of the electrofusion control unit, the other end is plugged into a 110 volt building site power transformer, to provide power to the electrofusion control unit.

Primary cable 240v. This has a plug at each end. One end is screwed onto the bottom socket of the electrofusion control unit, the other end is plugged into a 240v socket to provide power to the electrofusion control unit.

Pipe shears for snipping through pipes 16 to 25mm o.d.

Pipe roller cutters for cutting the pipe at right angle.
One size for 25-63mm pipes.
One size for 75-110mm pipes.
The pipe must not be cut with a saw or serrated blade since this will leave unacceptable burrs.

Cleaning fluid for cleaning the pipe

Lint free cloth Apply the cleaning fluid to the cloth to clean the pipe.

Note:
The new electrofusion control unit is now supplied with 3 outputs.

Note:
Only the cables come as standard with the electrofusion control unit. The other tools can be obtained separately or are available as standard tools with INSTAFLEX socket fusion machinery. Cleaning fluid and lint free cloth must be purchased separately.

Preparing the electrofusion control unit for use

The electrofusion control unit is portable

The electrofusion control is small and relatively light weight device and is designed for ease of transportation around site.
Internally it is a complicated electrical device and can easily be broken or develop a fault if dropped. Care must be taken when in use to always place it on a flat and level surface where it is unlikely to be knocked off or damaged.

Attach the power cable (110v Primary cable shown)

To operate select whether you will be using a 240 volt domestic power supply or a 110 volt building site power source and select the lead with the appropriate plug.

Attach the primary power cable to the control unit by plugging it into the socket at the bottom of the box, then rotating the outer plastic ring on the plug clockwise. The thread will secure the cable to the control unit.

Attach the welding cable

Attach the welding cable to the control unit by plugging it into the socket at the top of the box, then rotating the outer plastic ring clockwise the thread will secure the cable to the control unit.

Note:
The new electrofusion control unit is now supplied with 3 outputs.

Plug in and check that all lights come on

Plug the control unit primary cable into a power source. All the lights on the front of the control panel should illuminate briefly while the control unit conducts a self diagnostic test.

When this is completed the "power" light in the bottom right hand corner should remain illuminated, this indicates the control unit is ready to begin welding.

Ready light on

If the alarm light comes on, there may be a fault with the unit and George Fischer Sales Ltd. should be contacted Tel: 01203 535535.

The electrofusion control unit will operate satisfactorily within the conditions listed below.

	110v		240v	
	Min	**Max**	**Min**	**Max**
Mains voltage	88v	127v	185v	264v
Mains frequency	47Hz	65Hz	47Hz	65Hz
Temperature	15°C	40°C	15°C	40°C

8

Preparing the fittings

Clean the polybutylene fittings internally with Tangit KS. Reiniger, cleaning fluid.
Apply the cleaning fluid to a clean, dry, lint free cloth.

Moisten cloth with cleaning fluid

Rub the moist cloth firmly around the inside of the fitting, on all faces to be joined

Clean the fitting

Place the cleaned fitting carefully on the working surface. Avoid any moisture or dirt getting inside the fitting.

Note
Do not handle the inside of the fitting after cleaning it as your hand will dirty the fitting and it will need to be cleaned again.

Several fittings can be pre-cleaned at one time, so long as the cloth is still moist with cleaning fluid and the assembly area is not dusty or wet.

Snip the pipe sizes 25mm and below.

Cutting pipe sizes 25mm and above.

Preparing the pipe.

The pipe must be cut at right angles, using the appropriate pipe cutters. Shears for pipe 16 up to 25mm and roller cutter for pipes above 25mm.

The pipe should not be cut with a hacksaw or similar serrated blade as this will leave unacceptable burrs, and probably result in a cut which is not at right angles to the pipe, which is very important.

The pipe must be free from deep scratches and burrs.

Note
The pipes in all sizes must NOT be chamfered

Moisten cloth with cleaning fluid

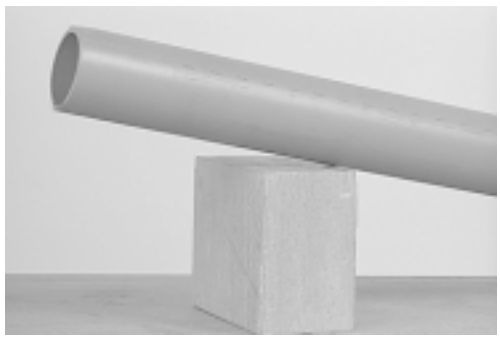
Apply the cleaning fluid to a clean dry, lint free cloth.

Rub the moist cloth firmly around the outside of the pipe about 100mm up the pipe for fittings below 63mm and about 200mm up the pipe for fittings above 63mm. (It is necessary to clean the pipe this far, because when making electrofusion joints it is standard practice to slip the fitting fully onto one end of the pipe).

This should remove any dirt and the printed marks on the pipe (If it does not you may be using the wrong cleaning fluid)

Clean the pipe

Note
Remember not to handle the outside of the cleaned pipe with your hand as this will make it dirty, and it will need to be cleaned again.
If you have to put the pipe down ensure the clean end does not come into contact with any surfaces.



Keep cleaned pipe off surfaces

Mark insertion depth with a tape measure...

Mark the insertion depth on the pipe after it has been cleaned.
Do not use a wax pencil to mark the insertion depth.

Pipe o.d.	Insertion depth
16mm	27mm
20mm	30mm
25mm	34mm
32mm	37mm
40mm	40mm
50mm	44mm
63mm	50mm
75mm	67mm
90mm	73.5mm
110mm	80mm

...or mark insertion depth from centre mark on fitting

The insertion depths shown above are the distance from the centre to the edge of the electrofusion fitting, so a fitting of the appropriate size which has a mark showing its centre can be used as an aid for marking the insertion depth.

Note
It is important to mark both ends of pipe which will be inserted into the electrofusion fittings, to avoid errors.

The pipe is now ready for electrofusion jointing.

Electrofusing the pipe and fittings together

Alignment line on pipe

All the pipes have a line down one side and the fittings have external marks every 45° these enable installers to keep prefabricated pipes and fittings in the correct alignment when doing electrofusion joints on site.

The pipes will touch in the centre of the electrofusion sockets, the other fittings have a "Z" dimension shown in the product guide, to help calculate what lengths to cut pipes to. So it is easy to calculate the lengths of the pipes required for electrofusion installations. The "Z" dimension method is described elsewhere.

Marks at 45° intervals to aid alignment

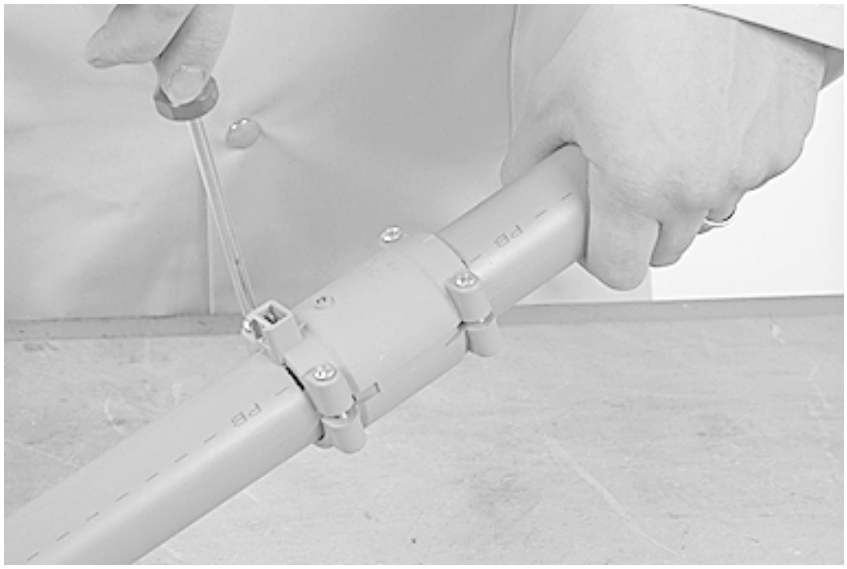
The electrofusion fittings are usually used to join pre-fabricated pipework sub-assembled together on site.

Electrofusion spigots, elbows, tees and reducers
The electrofusion spigots sizes from 16 to 63mm o.d. are usually fused with socket fusion into the end of a fitting, typically an elbow or tee.

When jointing in situ the prepared pipe end is then inserted its full distance into the spigot, elbows, tees or reducers and the 2 screws on either side of the fitting are firmly tightened to prevent the pipe from slipping out.

The electrofusion fitting will now be ready for jointing.

Electrofusion socket
The electrofusion sockets are available in all sizes from 16 to 110mm. They normally have the full length of the socket slipped onto one pipe end.



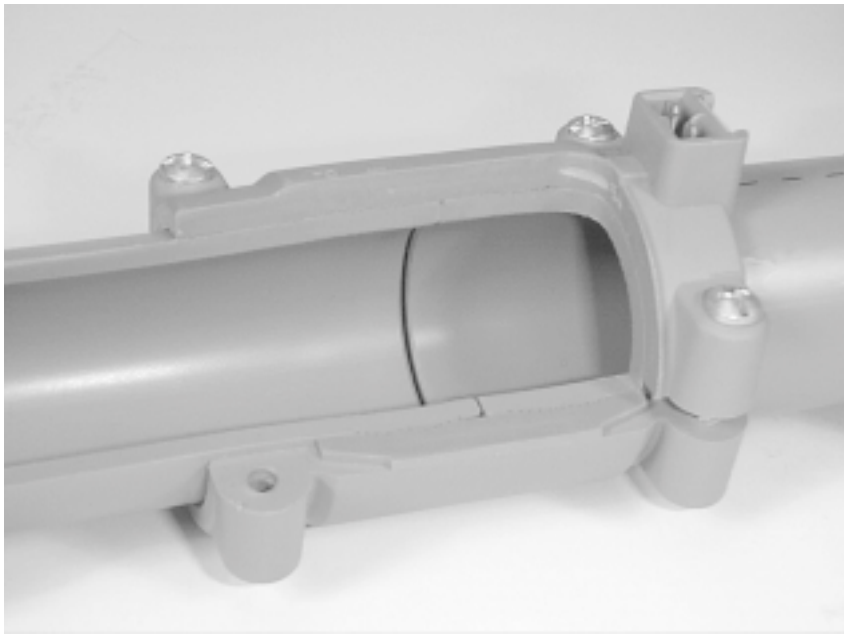
Note: Electrofusion fittings now use an allen key fixing and not screwdriver fixing as illustrated in these examples.

The other pipe end is brought up flush to the pipe end with the electrofusion socket.

The socket is slipped over both pipe ends, so the insertion marks on both pipe ends are just disappearing this confirms the pipe ends are positioned exactly in the centre of the electrofusion fitting.

The 4 screws around the electrofusion socket are tightened to hold the pipes firmly in place.

The electrofusion socket is now ready for jointing



Cross section through an electrofusion joint

Jointing electrofusion fittings to the pipe

The fusion joint occurs between the outside wall of the pipe and the inside surface of the electrofusion fitting.

As a result the electrofusion fittings will be a permanent part of the pipe work system.

The screws on the fittings only hold the pipe and fittings together when prior to and during electrofusion jointing process. They do not add mechanical strength or extended life expectancy.

Plug in welding cable

To make an electrofusion joint simply plug the welding cable from the electrofusion control unit, into the electrofusion fitting.

You will hear a beep as the cable is plugged in and the ready light, on the electrofusion control unit should come on.

Note:
The new electrofusion control unit is now supplied with 3 outputs.

The 'Ready' light should be on

If the alarm comes on, do not use this fitting and return it George Fischer for examination/replacement.

Note
With 75, 90 and 110mm electrofusion sockets and all electrofusion tees and elbows each end is joined separately. It is important to plug the welding cable into all ends of the fitting before starting any joints. So the electrofusion control unit can perform its diagnostics on the fitting to check that no faults exist. (If you do not do this you could find you have fused one end. But the other end has a fault and you need to cut the half fused electrofusion fitting out and replace a length of pipe).

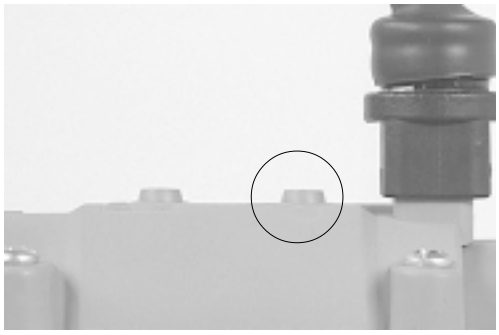
If the fitting does not have a fault, simply press the start button.

No timer has to be set.

Press 'Start'

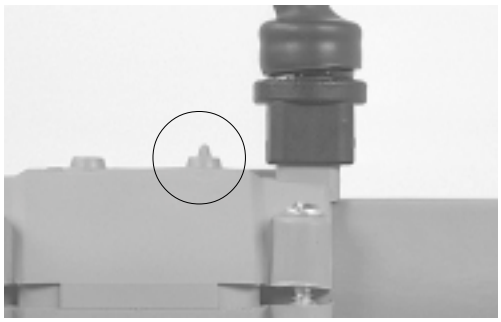
The electrofusion process is fully automatic, it will recognise the fitting being fused and automatically fuse it for the correct time, but the fusion times are listed below for reference.

Pipe o.d. mm	Total fusion time seconds
16mm	45
20mm	50
25mm	65
32mm	75
40mm	85
50mm	105
63mm	120
75mm	105 each end
90mm	110 each end
110mm	120 each end



Joint indicator starts to show

As the electrofusion control unit is fusing the pipe and fitting together, a little indicator pip will rise from within the fitting to indicate a joint has been successfully made.



Joint indicator fully showing

Although the electrofusion fitting gets warm during the electrofusion process, it is never unsafe, or too hot to handle.

If for any reason the indication pip does not rise or you are uncertain the joint had been made (someone may have switched off the power) or a fault develops during the fusion process. Leave the fitting for a minimum of 1 hour, then you can go back and re-make the joint safely.

Hold the joint in place

When the joint has been completed a beeper will sound and the end light will come on. This indicates that a successful joint should have been made.

During electrofusion jointing the pipe and fitting should not be moved, or subjected to unnecessary stresses. The pipe and fitting should be allowed to cool for a few minutes after each joint has been made, before being moved or subjected to stress.

Note:
The new electrofusion control unit is now supplied with 3 outputs.

'End' light will show when the joint is complete

Minimum cooling times before moving pipe and fittings

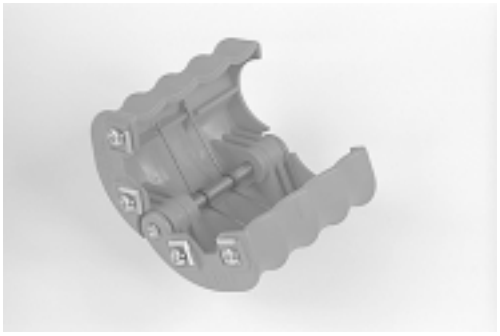
Pipe o.d.	Minimum cooling time
16mm	4 mins
20mm	4 mins
25mm	4 mins
32mm	4 mins
40mm	4 mins
50mm	6 mins
63mm	6 mins
75mm	6 mins
90mm	6 mins
110mm	6 mins

Remove the welding cable

Wait one hour after the last joint has been made before filling the system with water and pressure testing, up to 15 bar pressure.

Cutting and joining the INSTAFLEX sleeve

Pipe shears



Sleeve cutter

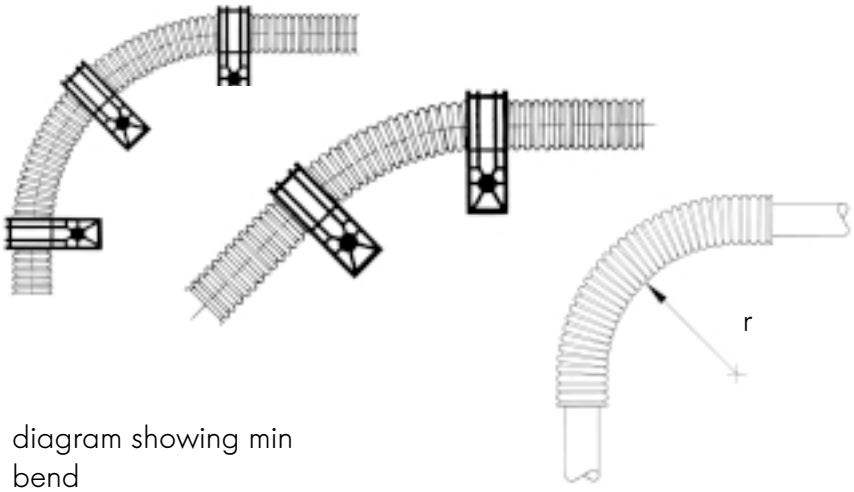


diagram showing min bend

This section covers the tools required for the INSTAFLEX sleeve cutting and joining.

Tools

Pipe shears for cutting through the pipe and sleeve together from 16 to 25mm o.d.

Sleeve Cutters for cutting the sleeves for 16 to 25mm pipe, with the pipe in place without damaging the pipe.

These tools can be purchased from George Fischer, when ordering the pipe and fittings

Applications for sleeve

The sleeve is usually used as a carrier duct for INSTAFLEX pipework, where the pipework is to be buried in the floor and screeded over or in the wall and plastered over

Because of its flexible nature, INSTAFLEX pipes can easily be withdrawn from its sleeve thereby meeting the Building Regulations that a buried pipe should be accessible through its length.
To ensure the pipe can be withdrawn, from the sleeve, the sleeve should have as few bends as possible no sharper than 8 pipe diameters radius

Minimum bending radius for different pipe sizes is

Pipe size o.d.	Min bend radius
16mm	130mm
20mm	160mm
25mm	200mm

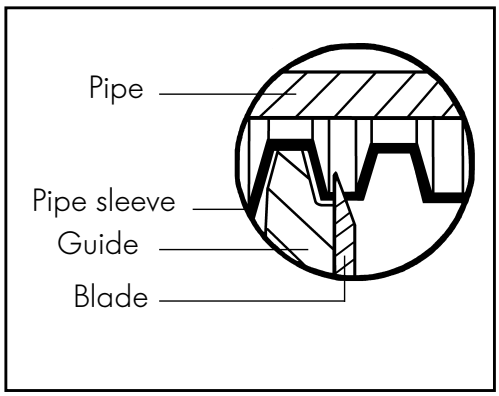
Pipe shears can cut through pipe and sleeve

Cutting the sleeve
The pipe shears can be used to cut through the pipe and sleeve together The pipe shears can also be used to cut through the sleeve if there is no pipe within it.

Sleeve safely cuts the sleeve

If you wish to cut the sleeve without cutting the pipe within the sleeve the sleeve cutter must be used.

Note
Do not attempt to cut the sleeve with a bare blade, like a knife as this will inevitably lead to the pipe being nicked which will reduce its life expectancy.



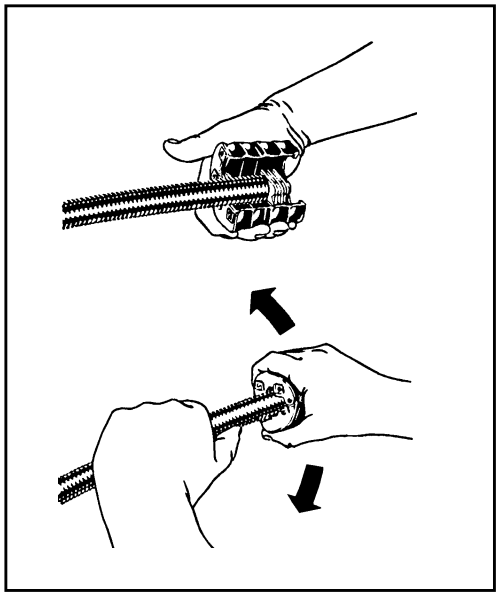
internal parts of pipe sleeve cutter

The cutter is a valuable aid in the safe cutting of the pipe sleeve containing a pipe. The pipe cannot be damaged with this tool

Position the guides on the sleeve as shown

Sleeves for 16, 20 and 25mm o.d pipes can be cut with the pipe sleeve cutter.

Place the cutter into the protective pipe groove.



Press the cutter jaws to close on each other

Press the cutting jaws lightly together and twist back and forth over 90°.

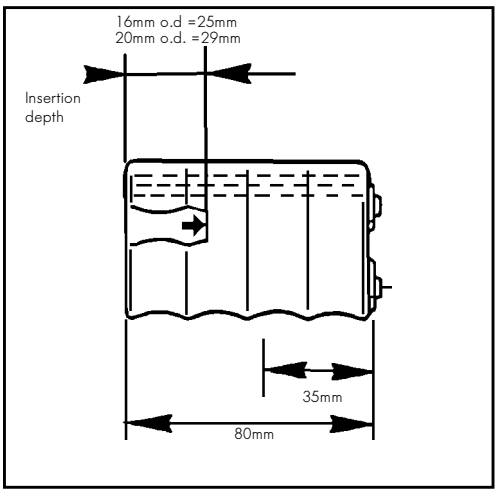
Twist the cutter forward and backward whilst holding the sleeve stationary

Remove the cut-off pipe sleeve piece from the cutter by hand.

Insert the pipe into the fitting

Push the sleeve up

Fix the cover in place



Joining the sleeve to fittings

There are a variety of fittings which include a cover which holds the pipe sleeve.

The pipe is inserted into the fitting (see Section 2, Assembling compression joints).

The sleeve is brought into place

The sleeve gripping part of the fitting cover is fastened around the sleeve.

Checking the mechanism grips the grooves in the sleeve.

No specific cleaning or sealing is required for the sleeve.

The cutting lengths of the protective pipe are, 35mm for single valve connections, 80mm for double valve connections.

Insertion depths for compression joints

16mm o.d = 25mm
20mm o.d = 29mm

which are marked on the pipe cutter.

Cutting and preparing INSTAFLEX carrier.

It is not compulsory to use pipe support carrier, but where it is used it must be used properly. This section gives a little advice for preparing INSTAFLEX pipe support carrier for use, so that it will not damage the pipes.

Tools

Hacksaw and file

Hacksaw for cutting the carrier.

File For smoothing rough burrs from the edge of the carrier

Method

The carrier is used to reduce the quantity of the pipe supports used on hot and cold water installations.

The carrier is cut with a hacksaw.

Cut to length with hacksaw

The rough edges are smoothed with a file to prevent them damaging the pipe.

File the edges smooth

Handling and Storage Instructions for INSTAFLEX

INSTAFLEX must be stored properly on site

Handling pipes.
INSTAFLEX pipes are very flexible, they will bow when carried. It is important to prevent the pipe from rubbing on the floor, which will damage them when they are transported around site.

When moving 6m lengths of pipe, use 2 men to carry them.
When moving 3m lengths of pipe, one man can carry the pipe, but he must hold the pipe in the centre, high enough from the ground to prevent it from scuffing. Do not drag pipes across the floor.

Small sizes may be coiled to make transporting easier. Do not leave the pipes coiled for long periods of time as this can lead to a permanent bow. Care should be taken to ensure the pipes do not come into contact with any sharp objects as this may damage the pipes surface.
When mechanical handling is used, metal hooks **must not** come into direct contact with the pipes.

Storing pipes.
INSTAFLEX pipes can develop a permanent bow if stored incorrectly. This will make pipes difficult to install. INSTAFLEX should be stored flat at all times (not vertically or allowed to sag).

INSTAFLEX should be stored on a soft surface, like wood (clean scaffolding boards), this will prevent the pipes being scratched while they are stored and when they are withdrawn for use.

Pipes should be stored in neat stacks. Pipes of different sizes should be stacked separately. Where this is not possible, larger pipes should be stacked on the bottom.

No more than 8 pipes should be placed directly on top of each other. Pipes should be protected from sunlight. Long periods of time in the sun can lead to oxidisation of the surface of the pipes, which will affect jointing.
Pipes should be kept reasonably clean i.e. not left on the floor or in the mud.

Storing fittings.
INSTAFLEX fittings are usually provided in sealed plastic bags. The fittings should be kept in these bags until they are required. This will keep the fittings clean and prevent them from being damaged.

COSHU Regulations for cleaning fluid

Date of issue: September 1995

GEORGE FISCHER SALES LIMITED
Paradise Way, Coventry CV2 2ST
Tel 01203 535535 Fax 01203 530450/1

Health and Safety at Work Act 1974

Hazard Data Sheet

The Product: Tangit KS Reiniger (Special Cleaner)
Cleaner based on Ethanol.
Declaration according 91/155/EEC:
90% Ethanol
Symbol: F
R-Phrases: 11
CAS No. 64-17-5

Hazards: R11 highly flammable
The solvents contained in the product evaporate during drying time and the vapours may form explosive highly inflammable vapour-air mixtures.

First Aid Procedures:

Inhalation: Remove to fresh air. Intensive inhalation: remove to fresh air, give oxygen, seek medical advice in hospital.

Skin contact: Rinse with running water and soap. Skin care. Remove contaminated clothes.

Eye contact: Immediately flush eyes with copious amounts of running water (for 10 minutes), put on a bandage with sterile gauze, see an oculist.

Ingestion: Flush oral cavity, drink plenty of water, see a physician.

Fire Fighting measures:

Do not inhale combustion gases

Extinguishing media: Suitable for all regular extinguishing materials. In case of fire, cool endangered containers with water spray.

Extinguishing media which must not be used for safety reasons: none known.

Special exposure hazards arising from the product itself, from combustion products or from resulting gases: can form explosive gas-air mixtures.

Special protective equipment for firefighters: wear protective equipment. Wear self-contained breathing apparatus.

Accidental release measures:
Personal precautions: Ensure adequate ventilation. Keep away ignition sources. Wear protective equipment.

Environmental precautions: Do not allow to enter drainage system, surface or ground water.

Methods of cleaning up/removing: Remove with liquid absorbing material (sand, peat, sawdust). Dispose of contaminated material as waste - see Disposal considerations.

Handling and Storage:

Handling: Ventilate working rooms thoroughly. Avoid naked flames, sparking and sources of ignition. Switch off electrical devices. Do not smoke. Do not weld. Do not empty waste into waste water drains.
Avoid open flames and sources of ignition. No smoking.

Storage: Ensure adequate ventilation. Close the container carefully after use and store it at a good ventilated place. Store protected from heat influence. Store at temperatures under 50°C. Store only in the original container.
Do not store together with edibles or other consumable substances.
Storage class: VCI-storage Class: 3A (BRD)

Exposure Controls/Personal Protection:

Information on the system design: Ensure for good ventilation/suction. Draw off vapours directly at the point of generation and exit. In the case of regular work, provide bench mounted extraction equipment.

Components with specific control parameters:
Ethanol
CAS No. 64-17-5
MAK 1000ppm (1900mg/m3)

Personal protection; Do not breathe dust and vapours. Avoid skin contact. Do not eat, drink or smoke while working. Avoid alcohol consumption when working with the product. Wash hands before work breaks and after finishing work.

Respiratory protection: When processing large amounts wear suitable breathing mask when there is inadequate ventilation.
Hand protection: Solvent proof protective gloves
Eye protection: Wear protective glasses in the event of spray hazard
Skin protection: Suitable protective clothing.

Physical and Chemical Properties:

Physical state:	Liquid
Colour	Colourless
Odour	Alcohol-like
pH	Not applicable
Boiling Point	78°C
Flash Point	+ 12°C Abel Pensky
Autoflammability:	Product is not self-igniting
Limits of explosion:	Lower 1.8 Vol % Upper 19 Vol % (literature)
Vapour pressure:	(20°C) 58 mbar (highest partial vapour pressure)
Relative density:	(20°C) 0.789 g/cm3
Solubility:	(20°C) miscible in water
Viscosity:	Watery
Ignition temperature	+ 425°C DIN 51794

Stability and Reactivity:

Conditions to avoid: No decomposition if used according to specification
Materials to avoid: None known is used for its intended purpose
Hazardous decomposition products: None if used for intended purpose

Toxicological information:
Inhalation: The toxicity of the product is due to its narcotic effect after inhalation. Injuries to health cannot be excluded after longer or repeated exposure.

Ecological Information:
Based on the components contained in the product and/or structurally comparable substances the following ecological data are to be expected:

Persistence and Degradability: The material is degraded quickly. The total of the organic substances contained in the product reach at least 60% BOD28/COD in the closed bottle test or at least 70% DOC removal in the modified OECD screening test. (OECD limits for classification "readily biodegradable"; at least 60% BOD28/COD resp. at least 70% DOC).

Aquatic Toxicity: Acute fish toxicity: EC50 100 mg prod./l (golden orfe, DIN 38412T15 or zebra fish, ISO 7346)
Acute bacterial toxicity: EC50 100 mg prod.l (oxygen consumption test with Ps. putida)
Keep from entering waste water, soil or surface waters.

Disposal Considerations:
Special waste incineration with the approval of the responsible local authority. Only emptied packages with traces of dried product and without solvent vapours are to go for recycling.

Regulatory information:
Classification and labelling according to Hazardous Materials Statutes:

Symbols of danger:

F Highly flammable

R-Phrases:

R11 Highly flammable
Further advice:
R18 In use, may form flammable/explosive vapour-air mixture

S-phrases:

S2 Keep out of reach of children
S7 Keep container tightly closed
S16 Keep away from sources of ignition no smoking
S23 Do not breathe vapour
S29 Do not empty into drains
S46 If swallowed seek medical advice immediately and show this container or label

Further Advice:

S37/39 Wear suitable gloves and eye/face protection
S51 Use only in well ventilated areas.

Other information:
This information is based on our current level of knowledge and relates to the product in the state in which it is delivered. It is intended to describe put products from the point of view of safety requirements and is not intended to guarantee any particular properties.

For further information contact:

01606 593933 - Manufacturer - Henkel Home Improvement & Adhesive Products
01203 535535 - Distributor - George Fischer Sales Limited

Safety considerations for machinery

Comply with the requirements of the current health and safety as work act. At all times, when using any machinery.
If you notice a problem attend to it yourself or point it out to a supervisor to have it attended to.

Safety recommendations

When using all plastic pipe welding apparatus, tools, the fundamental premises for reducing the risk of accident are careful and scrupulous handling and compliance with the instructions for their use and with current accident prevention regulations.

Negligence and failure to comply with accident prevention regulations can cause accidents at work.

Electric wiring to the power supply
The electrical distribution board where the apparatus is to be connected must be of the ASC type and therefore comply with the safety requirements of the CEI 17-13/1 and 17-13/4 standards; in particular, it contain one or more highly sensitive differential circuit-breakers that are triggered within 0.4 sec in the event of dispersions to earth, so as to protect the operator of the apparatus in the event of direct or indirect contact with any live parts (e.g. in the case of a faulty earthing connection), plus thermal and magneto-thermal protection devices sized according to the output of the equipment requiring protection (fig.1).
Power takeoffs and their relevant protection devices must be identified by means of suitably worded stickers.
The power takeoffs on the distribution board must have a protection rating of at least IP 44 (fig.2).

Electric wiring to the apparatus
The electric wiring between the job-site distribution board and the apparatus must be achieved using H07RN-F or similar abrasion and chemical-resistant cables; any extension leads must be made of the same type of cable and have a conductor cross-section suited to the power output of the apparatus, or preferably greater according to the length of the extension lead.
.
The cables must not be laid in areas traversed by vehicles or pedestrians in order to avoid their being damaged and becoming potentially dangerous; when this is unavoidable, special protection must be provided against mechanical damage or accidental contact with job-site machinery. The direct laying of cables underground is to be avoided: in such cases heavy-duty PVC cable ducts must be used.

Earthing
There must be a single earthing connection for the whole job-site: the earthing resistance value must be suited to the protection devices used and must ensure that no metal part liable to come into contact with an electric conductor can reach an electric potential in excess of 25 V.
The earthing system must be prepared and tested by qualified staff and the installation must be reported to the authorities concerned.
It is only when the standards for a proper earthing system have been complied with that Class I apparatus can be considered safe from the point of view of the risk of electric shock.

Recommendations for the proper use and storage of electrical apparatus:

To reduce the risks (of electric shock) to a minimum, the apparatus must be used and stored properly: in particular:-

- Avoid using temporary power connections that have not been made in compliance with the standard requirements.
- Always avoid physical contact with any live parts.
- Do not disconnect the plug from the socket by pulling on the cable.
- Do not drag, carry or lift the apparatus by means of the cable.
- Do not step on the cable or stand heavy or sharp objects, or objects at a temperature which may be critical for the resistance of the insulation (70°C) on the cable.
- It is absolutely forbidden to use electrical apparatus in wet areas: ensure that gloves, shoes, any protective gear and the apparatus itself are always dry.
- Do not spray water or any other liquids in the direction of the apparatus.
- Periodically (of after any abnormal situation) check the insulation of the electric cable and all the insulated parts of the apparatus; bear in mind that any infiltration of dirt combined with a high degree of humidity turns materials which were originally valid electrical insulators into conductors
- Check the conditions of the cable insulation, especially in line with the fair lead and cable grip, or in any other places liable to particular mechanical strain.
- Avoid using the apparatus in critical environmental conditions (e.g. extreme temperatures, high relative humidity, lightning etc.)
- If the apparatus is used in restricted spaces, with a high level of humidity, in ship-yards or in areas surrounded by metal, make sure that the equipment is powered by means of a SELV (Security Extra Low Voltage 48v) system or through electrical separation with added equipotential link.
- Check at least once a month that the differential circuit-breaker trips properly.
- Get the earthing system checked by qualified staff.
- Clean the apparatus carefully, paying particular attention to ensure that the substances used are suitable and cannot damage the insulation do not use solvents, petrol or abrasive .
- Store all the electrical equipment in a dry place and out of the reach of persons unauthorized to use the apparatus.
- Avoid using electrical apparatus in the presence of inflammable gases, steam, fumes or dust unless the apparatus involved carries the special symbol certifying that it has been designed and made with specific materials and methods which make it explosion-proof.
- On completion of the welding jobs, or during interruptions, make sure that the apparatus is disconnected from the power supply (by means of an omnipolar circuit breaker with suitable electrical contacts or by disconnecting the plug from the power supply socket).
- Before operating the apparatus again, make sure that it has not been damaged or man-handled in such a way as to make it dangerous to use.

It is only when the above recommendations and current regulations (particularly the CEI standards 64-8 and 64-8/7 (fig 5),

17-13/1 and 17-13/4) have been scrupulously complied with the necessary steps will have been taken to prevent accidents at work. It is always advisable for specialized personnel to provide an accurate training, information and updating of the operators of electrical appliances.

What to avoid doing
Do not use tools or machines with housing or grips that are cracked or deformed, particularly if they are made of plastic; any dirt and damp penetrating in cracks can carry electricity, consequently causing an electric shock if there is any damage to the insulation of the machine or apparatus.

Avoid accidentally turning on the machine
Before connecting it to the power supply, make sure that the machine and all its accessories are switched off.

Avoid working in dangerous environments
In the event of having to use the machine in an excavated pit, make sure that the walls of the excavation are properly supported by means of stays or barriers to avoid any earth or stones falling away and damaging the machine and any of its component parts or creating a hazard to the operator.

In the event of welding operations in narrow spaces (e.g. excavations, pits, boiler rooms, etc.) it is essential for the operator to be supervised by somebody on the outside; also make sure that inside the pit there is no infiltration of water or other fluids that might come into contact with the apparatus and thus place the operator at risk (of electric shock).

Avoid using the machine or apparatus in the presence of inflammable or explosive liquids or mixtures (Class C1 and C3Z1 areas) as this could cause an outbreak of fire or an explosion, with the consequent risk of injury for the operator and damage to the surrounding environment.

If a crane is used for transporting or positioning the machine inside an excavation, make sure that the machine is well attached by means of hooks, belts or ropes suited to the weight of the apparatus (check the weight of the machine); should the machine drop, even from not very high, it could injure the operator (by squashing him) and damage the apparatus. In any case, avoid standing or working under the suspended machine (fig. 6).

In the event of having to work on job-sites in the vicinity of water or other liquids, or alongside barges, boats, ships or the like, it is compulsory to use low-voltage (48 V) machinery and equipment in order to safeguard the operator from the risk of electric shock.

Do not perform welding on pipes which contain or have previously contained materials which, in combination with heat, give off explosive or toxic gases that would prove dangerous for the operator.

Fumes and gases that are inevitably caused by the welding process may become dangerous if they are breathed in over a period of time, so it is advisable to provide suitable ventilation in the working area; if this is impossible, it is compulsory to provide breathing apparatus and a supply of air or adopt other methods to enable proper breathing and ventilation in the working area.

Avoid working with the machine in environments saturated with fumes from varnishes, de-greasers, fuels or the like, irritation to the eyes and respiratory tract are the first symptoms of intoxication; in such cases, it is essential to stop the work and provide better ventilation of the working area.

Do not place the equipment in areas which are particularly dirty or dusty.

Maintenance of tools
Sharp, clean tools produce better results and are safer to use.
Immediately replace any worn, broken or lost parts; it is not permitted to use a machine with components which are either no longer capable of functioning properly or missing; worn, broken or lost components can be a source of danger to the operator: the machine could suddenly fail, placing the safety of the surrounding environment at risk.

Check that the accessories are coupled safely to the machine: if a clamp or reduction fitting is not well attached to the machine, it could drop (together with the pipe) as a result of the welding process.
For any replacement operations, use only spares which can be obtained through George Fischer Sales Ltd.
Tel: 024 7653 5535.

Use suitable working clothing (fig.7)
Do not wear baggy clothing or jewellery, as these can become caught up in moving parts of the machine and become a hazard to the operator.

The operator must always wear:

protective gloves, mittens or other suitable means for protecting his hands

anti-accident footwear suitable for use on the job-site

a boiler suit or work overalls

Avoid keeping any rags or other items hanging from pockets as they could become caught up in the moving machine tools and prove dangerous for the operator.
Avoid wearing loose belts or shoes with the laces undone as these could become caught up in moving parts of the machine and prove a danger for the operator.

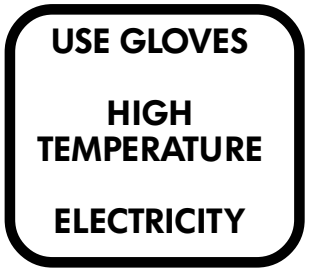
The operator should not have long hair or a long beard to avoid the risk of getting caught up in the moving parts if the machine; alternatively, operators must use appropriate protective coverings which safely contain their hair or beard.

Keeping the work place clean and tidy
Untidy and dirty work places and work benches are not only a sign of inefficiency, but also a source of accident; it is essential to keep the work place clean and tidy.

Mud and grease could cause the tools being used to slip, with a consequent risk of injury for the operator; it is essential to provide clean resting surfaces, such as panels or tables of some kind, which will give protection from dirt; **it is essential to make sure that the surface on which the machine is**

operated has the necessary stability to guarantee the performance of good-quality welding and avoid the danger of it toppling over, as this would be a source of danger for the operator (squashing or other injury) and would cause damage to the machine parts.

Keep visitors away
Keep visitors at a safe distance from the work place: outsiders coming close to the machine may obstruct the work in progress and become a danger to themselves and to the operator.



Make sure that the job-sites where work is in progress are protected and suitably signposted, as required by accident prevention regulations, so as to impede access to unauthorized persons (fig.8).
Make sure that the barriers used to prevent access to visitors on the job-site are at a sufficient distance to guarantee the safe transit of any passers-by.
Always avoid the machine being used by untrained staff (fig.9).

ANALYSIS OF POTENTIAL RISKS AND SAFETY MEASURES
The machines must be used only by trained staff; the use of the machine by unqualified staff may place both the operator and the surrounding environment in danger.
The operator takes up the position in front of the machines and must always have a full view of the operations being performed.

The heater plate
The heating element can reach temperatures of about 300°C; it is essential to take the utmost care in its handling and to rigidly comply with the following recommendations:

Use protective gloves

Always grasp the heater exclusively by means of the grips provided.

Always remove the plug from the socket when the jointing operation has been completed

Never touch the heating surfaces of the heaterplate with bare hands, to check the temperature (during tests), use only temple sticks or special contact thermometers .

The basic machine
Check that the pipes and/or fittings to be welded are securely locked in place so that the welding can be done with the utmost precision, without the risk of the parts falling out, which would be hazardous for the operator.

During the welding process, the operator must have enough work space around the machine so that no part of their body comes into accidental contact with the machine.

Attached to the machine is a table indicating all the risks for which it is impossible to provide adequate safety precautions during the design stage (fig. 10).

GEORGE FISCHER CANNOT TAKE RESPONSIBILITY FOR ANY DAMAGE TO PERSONS OR PROPERTY THAT ARE CAUSED BY FAILURE TO READ AND COMPLY WITH THIS MANUAL BY AUTHORIZED OR UNAUTHORIZED STAFF.

On the basis of an analysis of the technical features of the welding machines in terms of the aspects of machines safety and operation, the following table has been drawn up to indicate each type of danger deriving inevitably from the proper use of the machine, together with an evaluation of the risk, a description of the safety device provided at the design stage and any particular indications on the machine or supplementary information.

Danger	**Risk evaluation**
Electrocution (electric shock)	moderate risk with a low probability of occurrence
Squashing between clamps	mild risk with a low probability of occurrence
Squeezing between carriages	moderate risk with a low probability of occurrence
Burning due to fire or explosion	severe risk with a very low probability of occurrence
Scorching due to contact with the thermoplate	moderate risk with a modest probability of occurrence
Getting caught up in the machine's moving parts	mild risk with a low probability of occurrence
Squashing due to falling machine	mild risk with a low probability of occurrence

Safety device or warning signal	**Supplementary information**
Highly-sensitive differential circuit-breaker	See safety recommendations
Warning signs attached to machine (see Fig. 10)	Analysis of danger See safety recommendations
Warning signs attached to machine (see Fig. 10)	Analysis of danger
Suitable clothing	See safety recommendations
Tripod support	See safety recommendations

Operational tests and ordinary maintenance

Before proceeding with welding operations, perform the following tests, making any necessary adjustments to the machine.

Check that the rated voltage for the machine and all its component parts corresponds to the mains power supply.

The machine's sliding-carriages and heaterplates's guides must always be kept clean.

With each welding cycle, clean the non-stick surfaces of the heater bushes at working temperature, using soft paper soaked in spirit (use heat resistant gloves).

Check the quality of the Teflon-coated surface on the sockets; any deep or severely scored surfaces are not permitted.

Check the proper operation of the thermostat by measuring the surface temperature of the sockets with a contact thermometer.

Check the locking capacity of the clamp jaws.

If any defects are detected in any one or more of the above aspects, it is essential to call George Fischer Sales Ltd. Tel 024 7653 5535 for advice.

Common faults in fusion jointing

External view of perfect joint

Internal view of perfect joint

Over insertion
- no mark visible

Over insertion
- intruding into pipe bore

Keep insertion mark visible

The purpose of this section is to illustrate typical common faults which can occur when fusing INSTAFLEX joints. This will enable corrective action to be taken to prevent the re-occurrence of these faults and therefore maintain a high quality of workmanship and avoid problems in the future.

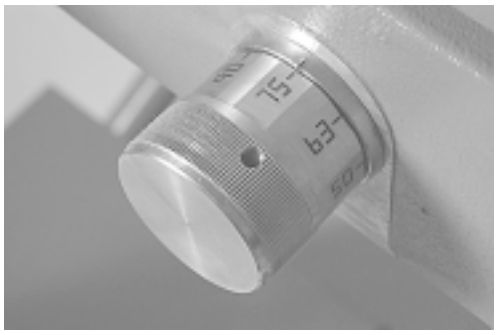
Perfect Joint
Firstly we should identify what is a perfect joint. Externally there should be two roughly even beads of P.B. at the junction of the pipe and the fitting and the insertion mark should be clearly visible.
Internally there should be a sharp pipe edge and a small even bead of material, which does not exceed the visible pipe wall thickness

Over Insertion
This is caused when jointing the pipe is inserted too far into the heater bush and/or too far into the fitting. In both cases the insertion mark on the outside of the pipe will have disappeared.

If the pipe is inserted too far into the heating bush it may cause the end of the pipe to melt inwards, this will result in even amount of intrusion around the pipe bore.
If the pipe is inserted too far into the fitting, it will cause the small bead of material inside the fitting to intrude into the pipe bore.

Over insertion will not mean that a joint will leak, it will simply interfere with fluid flow. If only a few of these occur it will have no noticeable effect on fluid flow. It becomes a problem if this is a regular occurrence when it may reduce fluid flow rates.

The solution is to keep to the insertion markings visible when making a joint.



Check depth dial.

If making a joint with the fusion jointing machine ensure the depth dial is correctly adjusted for the appropriate pipe size being jointed.

Under insertion - mark short of fitting.

Under Insertion
This occurs in the fusion process when the pipe is not inserted far enough into the heater bush and/or too little into the fitting.
In both cases the insertion mark on the outside of the pipe will be over 3mm away from the fitting.
If the pipe is not inserted far enough into the heating bush, but is inserted its full distance into the fitting, there will only be one bead of excess P.B. on the outside of the fitting.

Under insertion of pipe into heater bush.

If the pipe is inserted the correct distance into the heater bush, but not far enough into the fitting (or not held firmly in place during the holding time). There will be a grove between the 2 beads of molten material of the pipe and fitting.

Under insertion of pipe into fitting.

Under insertion will not always mean a pipe will leak straight away. It will probably mean a joint has a reduced life expectancy, this will be proportional to the degree of under insertion.

The solution is to check the fusion mark is only 1–2 mm short of the heater bushes when fusing the pipe. And about 2-3 mm short of the fitting when joining the pipe.

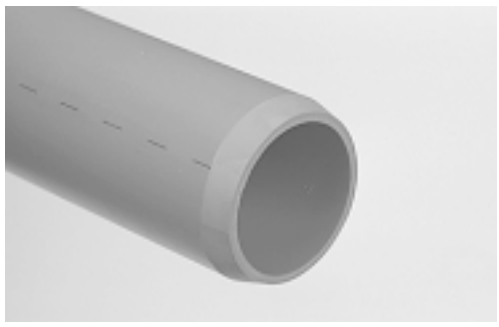
Keep holding the pipe and fitting together during the jointing time.

It is important to maintain the pressure on the pipe and fitting for the duration of the holding time.

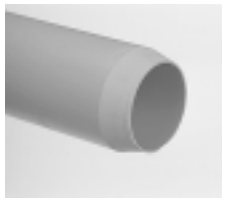
Check the pipe size dial on the bench mounted fusion machine is correctly set for the appropriate pipe size being joined since this dictates the insertion depth.

Under chamfering.

Leads to excess PB in fitting

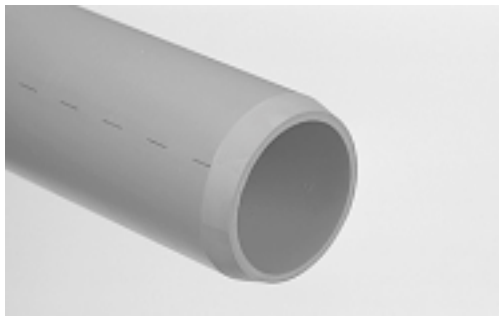


Chamfer to 1/2 wall thickness



Over chamfering

No bead within the fitting



Chamfer to 1/2 wall thickness

Over heating causes the pipe to collapse

Check the temperature

Adjust temperature if necessary

Under chamfering

This is where insufficient P.B. is peeled away from the INSTAFLEX pipe when it is chamfered. Sometimes the chamfer can be uneven (less P.B. is taken from one side of the pipe than the other).

After fusion jointing there is excess and often uneven build up of molten P.B. inside the pipe.

This will not cause a joint to leak. It will simply interfere with flow of fluid to a small degree. It should have no overall effect on fluid flow throughout a system.

The solution is to chamfer the pipe slightly deeper, until the pipe wall is half of its original thickness.

Over chamfering

This is where excessive P.B. is peeled away from the INSTAFLEX pipe when it is chamfered.

After fusion jointing there is no discernable P.B. molten bead within the pipe.

Over chamfering will not result in instant leaks within the pipes. It may reduce the life expectancy and strength of the joint.

The solution is to chamfer the pipe a little less, so the end of the pipe after chamfering appears to have a wall thickness half of the original thickness.

Over heating

This is usually where INSTAFLEX is left in the heating bushes for too long, or the heater plate is running at too high a temperature.

It can be seen that the pipe wall within the fitting it no longer smooth and round because it has started to collapse.

Over heating will not normally cause a joint to leak. It will simply interfere with fluid flow. It may become a problem if this is a regular occurrence, as it could reduce fluid flow rates.

Check the temperature of the heater bush with the temple sticks, to see if it is running too hot. If it is turn it down. Allow 5 minutes to cool and re-check.

Check timer & pipe size chart

You may need to speed up the insertion

If it is not, check the timer is set at the correct time for size of pipe and fitting.
If both of the above are correct, you may be inserting and withdrawing the pipe too slowly, resulting in the ends being in the bushes too long. Try and speed up the insertion and withdrawal process a little and see if this improves the joint quality.

Under heating
This usually occurs where INSTAFLEX is not heated long enough in the heater bushes. It can also occur when the heater plate is not hot enough. It should be noticed during assembly that it is more difficult that normal to push the molten pipe and fitting together.

Under heated fitting - The bead is too small

The bead that normally occurs on the outside of the pipe will be smaller. If only the fitting is heated and not the pipe (or visa versa) there will only be one molten bead. The bushes may not be tight enough on the heater plate. These fitting will always fail.

Single bead fitting or pipe not heated at all

Under heating will frequently cause a joint to leak. If you think a fitting and pipe is under heated, don't risk it, throw it away and try again.

Check heater is switched on

Check the bush is tight

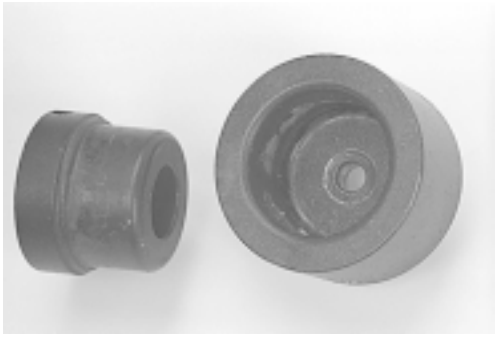
Check there is still power to the heater plate (i.e. the power on red light will be on and the green thermostat light will be flicking on and off.) Check all connections and switch back on.

Check heater bush temperature

Check the allen key bolt, securing the bushes, is fully tightened to ensure there is good conductivity between the heater plate and bushes. Check the temperature of the bushes, with the temple sticks. Adjust the temperature if necessary, wait 5 minutes to heat up.
If all of the above were OK, check the timer is set for the correct time for the pipe size being jointed.

Adjust temperature if necessary

If none of the above are wrong, contact George Fischer Sales Ltd Tel: 01203 535335 for advice.



Dirty bushes

Clean bushes thoroughly

Dirty joints are visible externally

Excessive residue on the bushes
This usually occurs on old and worn bushes, or dirty bushes, but it can occur if the pipe/fitting are withdrawn too fast.
If the bushes are old and worn, contact George Fischer Tel: 01203 535535, and arrange for replacement /recoated bushes.

If the bushes are dirty, clean them thoroughly with spirit and a lint free cloth wrapped around a pencil.

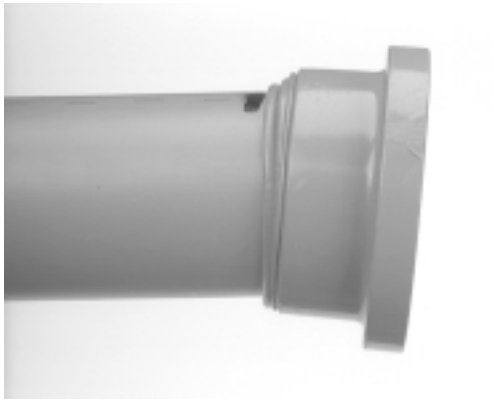
Withdrawing the pipe too quickly, is a common problem when partly trained staff are becoming familiar with hand held fusion jointing. They have to take more care to withdraw the fitting more gradually. This will come with experience. Until then the bushes must be thoroughly cleaned between every joint.
Sometimes withdrawing the pipe and fitting too fast will leave P.B. in the bush and create a web P.B. strands. Ignore this, and quickly re-join the pipe and fitting as normal. (The P.B. web of strands will re-melt in the molten joint and not effect the joint quality). More gradual withdrawal of pipe and fitting is required. Clean excess residue from the pipe and fittings.
This will not cause joints to fail in the short or long term. It will simply take more time to clean the bushes between each joint. If the bushes are not cleaned properly between each joint and residue is left on the bushes this could cause long term problems with dirty joints see the section below.

Dirty joints
Dirty joints are visible after a joint has been made because the external and internal beads of molten P.B. will be slightly or noticeably brown.
Dirty joints are an indication that a residue of P.B. is being left on the bushes after each joint (this is not always noticeable at a glance). This P.B. residue is then baking on the hot bushes and turning brown or even black.

Dirty joints are visible internally

Clean bushes thoroughly

Slight misalignment when bringing pipe and fittings together



Check alignment from two plains from the top and from the front. Slight misalignment can be corrected during the holding time

When the next joint is made the baked P.B. is sticking to the molten P.B. and becoming trapped in between the joint.
Dirty joints are weaker joints and they may take weeks or even months before they fail.
As soon as it is noticed that joints are slightly brown, the bushes must be cleaned thoroughly with spirit and lint free cloth wrapped around a pencil.
If the above does not prevent the problem, then replace the bushes with new /recoated bushes. Contact George Fischer Sales Ltd. Tel: 01203 535335.

Misalignment
This usually occurs with hand held joints. As they are brought together sometimes it is difficult to bring the pipe exactly into the centre of the joint.

This is noticeable within the fitting by a small amount of extra material occurring on one side of the pipe.

This will not cause a joint to leak. It will simply interfere with fluid flow to a small degree. It should have no overall effect on fluid flow through a system.

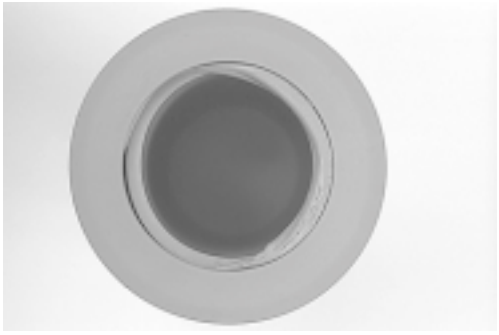
Note:
It is far more important to ensure that the two molten surfaces of pipe and fitting are brought together quickly rather than to spend time trying to get the joint alignment perfect when they should be cooling down.
Aligned joints will become easier for installer, the more joints they make by hand.

During the hold time, there is a time to ensure the pipe and fitting are straight compared to each other. This is done visually in 2 plains. From the front and from the top. The pipes can be moved slightly, when soft to bring them into alignment. But they must not be twisted.

Misaligned bench mounted fusion joint

If pipes are misaligned when being joined on the bench mounted fusion machine this could be due to:
The clamps may be loose, check and tighten the bolts. If they are not loose check the clamps are in the correct position as detailed in the section for setting up the bench mounted fusion machine.

Misaligned bench mounted fusion joint



Uneven fusion bead around the pipe and fitting
With a hand held tool. This is usually because the pipe and/or fitting is being held in the fusion tool at an angle (i.e. not at 90° to the face of the heater tool). This will heat the pipe and/or fitting too much on one side.

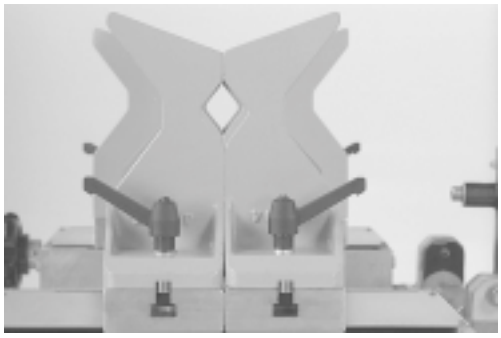
This will not cause a joint to leak or affect its life expectancy. It is simply a poor appearance.

This can be overcome by holding the pipe and fitting straight in the fusion tool. Often it will help if the pipe is supported through its length by pipe supports to the same height as the fusion tool.

Uneven fusion joint

With the bench mounted fusion machine. An uneven bead is normally the result of over tightening of the pipe clamp or fitting clamp. This will cause areas where the bead is thick and areas where the bead is thin. This will not normally cause leaks, only if there is no bead in the areas which should have a thin bead. It can be resolved by not tightening the clamps as much next time.

With the bench mounted fusion machine. If the bead is more on one side than the other, it is likely that the pipe clamps are loose on the slide.



Check and tighten the bolts. If they are not loose, check the clamps are in the correct position as detailed in the section for setting up the bench mounted fusion machine.

Please Note.

If you continue to have difficulties please contact the George Fischer Sales Office who will be able to provide further advise.

INSTAFLEX® Installation Quick Reference Guide

For full details refer to full INSTAFLEX Training Manual

Socket Fusion Jointing

1. Chamfer pipe ends
2. Clean pipe & fittings
3. Check heater bushes temperature
4. Check and clean heater bushes
5. Set timer to correct heating time
6. Mark fusion depth with gauge
7. Make joint but Do Not Twist after insertion only adjust for squareness
8. Hold pipe & fitting together for required holding time
9. Carefully put pipe and fitting down for cooling time

For 16 to 110mm Pipe & Fittings Polybutylene (PB) Socket Fusion Jointing

Pipe outside diameter o.d. (mm)	Wall thickness minimum mm	Welding length L (mm)	Heating time t (sec)	Holding time t_1 (sec)	Cooling time t_2 (min)
16	2.0	15	6	15	4
20	2.0	15	7	15	4
25	2.3	18	7	15	4
32	3.0	20	10	20	4
40	3.7	22	14	20	4
50	4.6	25	18	30	4
63	5.8	28	22	30	6
75	6.8	31	26	60	6
90	8.2	36	30	75	6
110	10.0	42	35	90	6