electrofusion jointing

Electrofusion welding system is now considered the most highly developed and safe method for realizing polyethylene jointings. Electrofusion, thanks to its versatility, can weld together pipes or fittings with different polyethylene and different thickness as long as there is compatibility of melt flow index and raw material density.
The reference standard for electrofusion jointings is UNI 10521.

electrofusion socket and fittings

The jointing quality directly depends on strictly compliance with the following instructions.

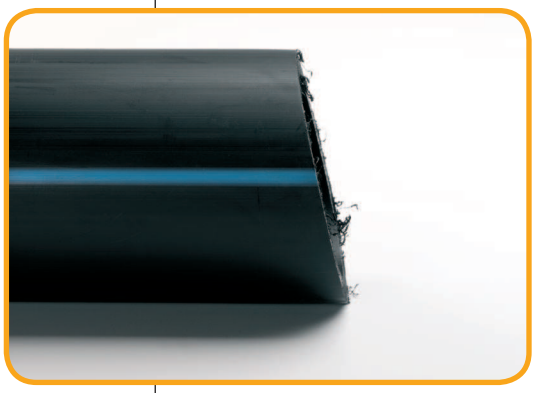
preparation

The jointing process must be carried out in a dry and protect place. In case of adverse ambient conditions (rain, high humidity, wind) suitable measures must be taken to protect the welding operation. The ambient temperature must always be between

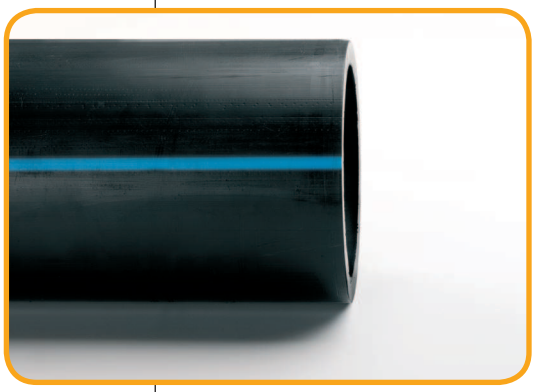
-5°C and +40°C

Critical element for the jointing reliability is the preparation of the pipe surface where the fitting will be welded – removal of the superficial oxidized layer and cleaning of the the pipe surface on the complete contact area of the fitting.
In order to achieve a quality jointing, the welding must be carried out strictly respecting the following procedures.

Check and prepare all the materials necessary for the welding process:
- EF control unit
1. EF fitting
2. aligning clamp
3. manual of mechanical scraper
4. pipe cutter
5. detergent
6. strong soft paper or cleaned cloth
7. indelible marker pen



Visually check that the pipe/fitting surface is free of defects such as cuts, abrasions, etc. The pipes/fittings ends to be welded must be **cut at right angle** using proper **pipe cutters**.



Avoid to use excessive ovalized pipes. In any case maximum **ovalization** cannot exceed **1,5 %** (UNI 10521) calculated as follows:

$$OV = \frac{d_{emax} - d_{emin}}{d_n} \cdot 100$$

d_e = external diameter
d_n = nominal diameter

Bending and ovalization can be reduced by unrolling the pipe at least **24 hours** before its laying and using special re-rounder.

Clean the pipe ends from dust, dum, grease, dirt, etc.
Mark the scraping area with an indelible marker pen. The scraping area must be **10 mm** larger than the insertion depth of the fitting.

Remove the oxidized surface from the pipe, by scraping it.
The removal of the superficial oxidized layer must be done using the manual scraper supplied with the control unit, or using special mechanical pipe scrapers.
Remove an uniform surface **for a depth of approximately 0,1 mm for pipe diameter $d_n \leq 63$ mm and 0,2 mm for $d_n > 63$ mm.**
Using manual scraper, consider the procedure as correct, when an uniform PE shaving is attached to the pipe end. Then remove it by slightly rounding off (at 45° angle) the pipe end.
AVOID ABSOLUTELY other scraping equipment such as abrasive paper, rasp, emery wheels, saw blades, etc.

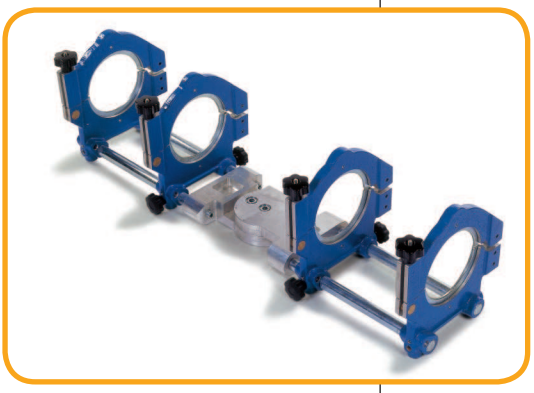
cleaning

Just before inserting the fitting on the pipe, clean the scraped surface using strong soft paper drenched with a suitable detergent (isopropyl alcohol or Tangit KS) to remove traces of dust, grease, etc.

Clean with the same detergent the inner surface of the fitting, which has to be removed from its protective wrapping only at the moment of use.
Do not touch with hands the just cleaned surfaces.

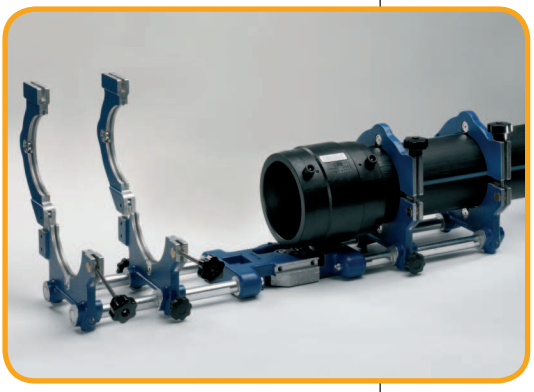
The **aligning clamp** must be used for all diameters to be welded which:

- protects, during the electrofusion and the subsequent cooling, mechanical stresses on the jointing;
- allows to revise possible off-centering between both ends to be welded and to recover the out-of-round of parts, if ovalized.

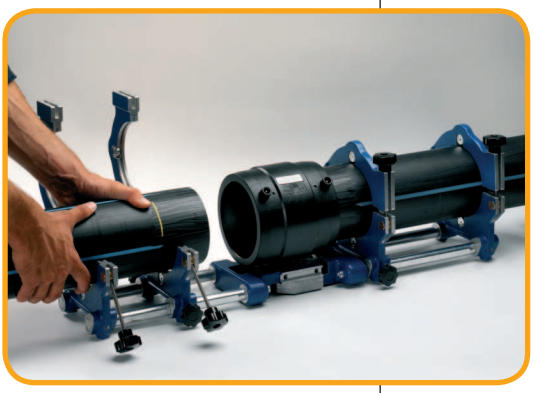


In case of EF socket without central stop, sign a mark, using an indelible marker pen, on the two ends to be welded corresponding to the depth of insertion, equal to half length of the socket.

Insert the socket up to the location mark. Fasten the pipe into the aligning clamp.



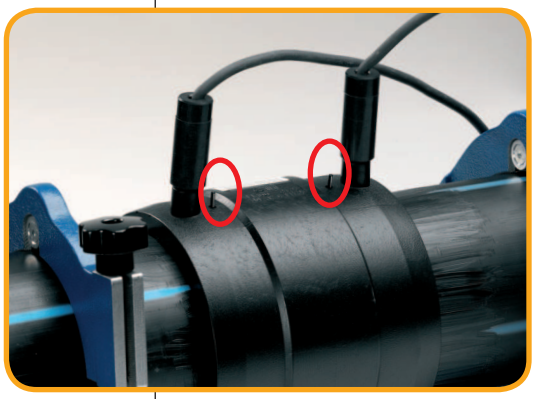
Insert the other end of the socket up to its location mark and fasten it into the aligning clamp. Now the socket is centred on the two parts to be welded.
It is recommended to mark the pipes after positioning it for at least 1/3 of their circumference close to the fitting in order to check once welding is completed that the jointing has not moved.



fusion

Connect the plugs of the control unit to the terminals on the fitting and proceed with the set-up of the welding parameters, strictly following the instructions of the welding unit.

NOTE: If there is an accidental interruption during the welding cycle, operation can only be repeated after the electrofusion joint has totally cooled (minimum 1 hour, but verifying the real cooling of the fitting). This operation can be done only once.



When the fusion cycle is completed, verify the fusion indicators coming out. The fusion indicators are located near the terminal connection of the fitting.

WARNING: the coming out of the fusion indicators is only a confirmation that the heating cycle has been occurred, and not an indication that the welding cycle is correctly done.

cooling

In order to avoid possible stresses on the jointing, strictly respect the cooling time indicated on the bar-code of the fitting or which appears on the display of the welding unit.
According to the diameter welded, cooling time varies from **10** to **30** minutes. No forced cooling methods admitted (water, compressed air, etc.). It is advisable to write with an indelible marker pen the time when the jointing will be completely cooled (i.e. if the jointing is carried out at 4.00 pm, write on the fitting 4.20 pm).
The pipeline can be put into pressure not before 2 hours from the last fitting welding.

electrofusion tapping and spigot saddles

preparation

The jointing process must be carried out in a dry and protect place. In case of adverse ambient conditions (rain, high humidity, wind) suitable measures must be taken to protect the welding operation. The ambient temperature must always be between

-5°C and +40°C

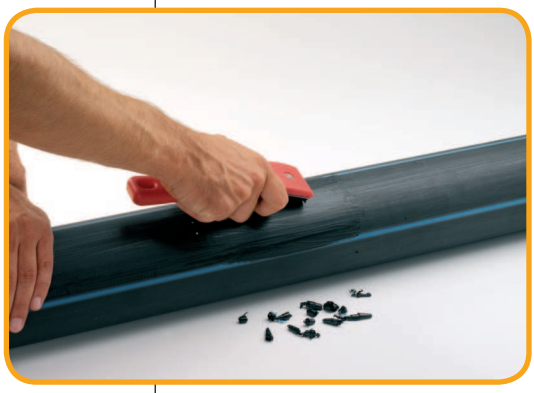
Critical element for the jointing reliability is the preparation of the pipe surface where the fitting will be welded – removal of the superficial oxidized layer and cleaning of the the pipe surface on the complete contact area of the fitting.
In order to achieve a quality jointing, the welding must be carried out strictly respecting the following procedures.

Check and prepare all the materials necessary for the welding process:
- EF control unit
1. upper saddle
2. blank saddle
3. bolts kit
4. manual scraper
5. detergent
6 strong soft paper or cleaned cloth
7. manual or pneumatic screwdriver
8. hexagonal key
9. indelible marker pen

Visually check that the pipe surface to be welded is free of defects such as cuts, abrasions, etc.

scraping

Clean the pipe from dust, dirt and grease etc. Place the upper saddle on the pipe. Mark the pipe surface all around the upper saddle with an indelible marker pen in order to identify the scraping area.



Remove the oxidized surface from the pipe, by scraping it.
The removal of the superficial oxidized layer must be done using the manual scraper supplied with the control unit. Remove an uniform surface **for a depth of approximately 0,1 mm for pipe diameter $d_n \leq 63$ mm and 0,2 mm for $d_n > 63$ mm.**
AVOID ABSOLUTELY other scraping equipments such as abrasive paper, rasp, emery wheels, saw blades, etc.

cleaning

Just before positioning the saddle on the pipe, clean the scraped surface using strong soft paper drenched with a suitable detergent (isopropyl alcohol or Tangit KS) to remove all traces of dust, grease, etc.

With the same detergent, clean the inner saddle surface, which has to be removed from its protective wrapping at the moment of use.
Do not touch with hands the just cleaned surfaces.

saddle positioning on the pipe

Insert the hexagonal nuts in the seats on the blank saddle. Insert the bolts and washers in the upper saddle.
Position the saddle on the pipe, centering it on the scraped surface.

Clamp the saddle on the pipe by tightening the four connection bolts. Tightening is done in a criss-cross way, using an allen-head screwdriver or wrench (depending on the type of bolt) until the saddle is fully tightened.

fusion

Connect the plugs of the control unit to the terminals on the fitting and proceed with the set-up of the welding parameters, strictly following the instructions of the welding unit.
NOTE: If there is an accidental interruption during the welding cycle, operation can only be repeated after the electrofusion joint has totally cooled (minimum 1 hour, but verifying the real cooling of the fitting). This operation can be done only once.

When the fusion cycle is completed, verify the fusion indicator coming out. The **fusion indicator** is located near to one of the terminal connections of the saddle.
WARNING: the coming out of the fusion indicator is only a confirmation that the heating cycle has been occurred, and not an indication that the welding cycle is correctly done.

cooling

Before boring the pipe, strictly respect the cooling time indicated on the saddle. Cooling time can not be less than **20 min**.
It is advisable to write with an indelible marker pen the time when the jointing will be completely cooled (i.e. if the jointing is carried out at 4.00 pm, write on the fitting 4.20 pm).

saddle boring

code 21.30: e-fusion tapping saddle
Unscrew the outlet cap. Insert the hexagonal key into the built-in cutter. Screw clockwise until the pipe perforation. This is evidenced by a great decrease in screwing force.
Tighten again for 2 turns.

Screw anticlockwise and retract the cutter back to its original position.
Remove the hexagonal key and strongly screw the cap checking the presence of the internal O-ring gasket.

code 21.20: e-fusion spigot saddle
Boring is done using approved hole-saw, with external diameter a little bit smaller than the internal branch diameter (see following table). Pay attention avoiding damages on the branch internal wall.
WARNING: Pipe boring is not allowed before welding: this can seriously compromise the jointing quality.

max external diameter of the hole-saw for spigot saddle (code 21.20)

d_n spigot saddle branch [mm]	external diameter hole-saw [mm]
20	12
25	17
32	25
40	32
50	38
63	48
90	68
110	82

accessories

Electrofusion tapping saddles with automatic flow safety system are available. This special device enters in work when the branch connection is damaged and there is a strong coming-out of fuel gas.
The safety system device stops the flow allowing the repair of the branch. At end of this maintenance operation the device working system will be restored by putting again the repaired branch connection under pressure.

automatic reading systems of welding parameters

They are universally recognized systems to “store-up” information and to allow their automatic reading and by proper systems which use the **BAR CODE INTERLEAVED 2.5** with 24 digits and control code.
The information stored in the code allow to the control unit to understand automatically the characteristics of the fitting to be welded and to work consequently, avoiding errors due to manual setting.
The code stores all information identified by the manufacturer and necessary for the electrofusion cycle: manufacturer code, type of fitting, diameter, fusion time, ohmic resistance value and its adjustment according to the ambient temperature, output voltage, cooling time, control character of correct reading, identification key.
The guarantee of correct code reading is defined by the control character. Possible differences between the fitting connected to the control unit and the code reading are shown on the machine which does not proceed in the welding cycle.

bar code

The Operator must pass the light pen over the bar code label and manually confirm if reading is correct.
We recommend to use the light pen at an approx. 45° inclination, moving it straight and continuously at constant speed from left to right side without excessive pressure.

magnetic card

The Operator inserts the magnetic card in the special scanner supplied by the fittings manufacturer. The card contains the welding parameters.
The magnetic card can also contain the recording of the welding data when required to ensure the traceability of the jointings.