Jointing methods

Electrofusion

Electrofusion, the most simple and rapid jointing technique, is mainly used on construction sites for a highly efficient method of assembly for pipes, fittings and prefabricated sections.

Electrofusion couplers

The PE range includes couplers in the diameters 40 to 315 mm. The couplers are extremely suitable for applications in waste water and rainwater drainage, with the following features:

1. Injection molded with excellent dimensional accuracy and stability.
2. One welding indicator on each welding surface for checking both welding connections.
3. Centre stops easy to remove in order to use the coupler as a slide-over coupler.
4. Resistance wires fixed to the surface for an optimal heat transfer and therefore a high quality welding connection.
5. Yellow edge surrounding the welding indicators of the diameters 200, 250 and 315 mm for better visibility.

Electrofusion control box

The Akafusion control box CB315 can not only weld Akatherm electrofusion couplers in the diameter range 40 - 160 mm but also the diameters 200, 250 and 315 mm. The new techniques applied in the electronics (such as integrated circuit boards) and the case material make it a solid and reliable control box.

Multiple welding

The CB315 is capable of welding several electrofusion couplers simultaneously in the same time that is needed for producing one electrofusion weld. The combined diameters of the couplers to be joined should not exceed 200 mm. For example in the case of a 45° 75/55 mm tee, both the diameters 75 mm and the branch 50 mm can be welded at once.

Jointing procedure

1. Cut the pipe square
   The pipe ends must be cut square to ensure that the heating element in the coupler is completely covered by the pipe or fitting.

2. Mark insertion depth + 10 mm
   This is to ensure that across the full welding zone the oxidised layer will be removed.

3. Scrape pipe and mark insertion depth again
   The outer surface of the pipe (approx. 0.2 mm deep) must be scraped for the full distance that will be covered by the coupler to remove any surface ‘oxidation’.
   The insertion depth should be marked again to safeguard full insertion.

4. Clean coupler
   Before assembling the pipes into the coupler ensure that all surfaces are clean and dry.

5. Insert pipe and/or fitting up to pipe stop
   Ensure that the pipe is pushed as straight as possible into the fitting.

6. Prevent joint movement during welding

7. Prevent misalignment

8. Prevent coupler from sliding down when installed vertical pipeline

9. Prevent load on vertical pipesystem

10. Don’t weld coupler twice

Butt-welding

Butt-welding is a very economical and reliable jointing technique for making welded joints, requiring only butt-welding equipment. All Akatherm pipes and fittings can be joined by this welding method. Fittings for which a k-dimension is shown in the table can be shortened by not more than this amount. Butt-welding is extremely suitable for prefabricating pipe sections and for making special fittings.

Preparations

The following guidelines are of importance when making a proper butt-weld:
- Establish a work space where the jointing can be done without being affected by major weather conditions.
- Check the equipment functions properly. Welding equipment used on site deserves special attention.
- The fittings and or pipes need to be aligned in the welding machine. Mis-alignment can be up to 10% of the wall thickness.
- Clean the heating element before each jointing operation with a lint-free cloth and suitable cleaner (see instructions welding machine).
- Cut the pipe and/or fitting with a pipe cutter to make the end square.
- Make sure that once the pipe and/or fitting ends have been machined, they do not get dirty. Do not touch them with your hands. The surface needs to be clear of oil, grease and dirt.
- Put the pipe parts into the welding machine to facilitate a firm hold.
- Check the equipment functions properly. Butt-welding is extremely suitable for prefabricating pipe sections and for making special fittings.

Jointing methods

<table>
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<tr>
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Jointing methods

Welding process
The butt-welding of Akatherm HDPE operates according to the following steps:

Machining the surface
Both sides should be machined until they run parallel. When the machining is finished, open the carriages: the plastic shavings must be continuous and uniform in both sides to weld. Take off the milling cutter. Verify the alignment between the machined surfaces. Remove the plastic shaving. Do not dirty or touch the machined surfaces.

Preheating under pressure
Press the two ends to be jointed gradually to the heating element until a bead is created. The size of the bead is a good indication that the appropriate pressure and time is used. For pressure and bead size see the table on the next page.

Heating up with less pressure
HDPE is a good insulator, therefore at this stage it is necessary that the correct heating depth of the pipe ends is obtained. Only a small amount of pressure 0.01 N/mm² is required to maintain the contact of the pipe ends with the heating element. The heat will gradually spread through the pipe / fitting end. The size of the bead will increase a little. The time and pressure needed for this phase can be found in the table on the next page.

Change over
Remove the heating element from the jointing areas and immediately make those areas touch each other. Do not push the pipe ends abruptly onto each other. The removal of the heating element needs to be done quickly to prevent the pipe ends from cooling down. The times for changing over can be found in the table on the next page.

Welding and cooling
After the jointing areas have made contact they should be joined with a gradual increase in pressure up to the specified value. The welded components can be removed from the machine when 50% of the cooling period has elapsed, providing that this is done carefully, with no load or strain being placed on the joint. The welded components can be removed from the machine when 50% of the cooling period has elapsed, providing that this is done carefully, with no load or strain being placed on the joint. The joint must then be left undisturbed for the remainder of the cooling period.

Properties

<table>
<thead>
<tr>
<th>Diameter d₁</th>
<th>Wall thickness e</th>
<th>Preheating pressure / welding pressure (0,15 N/mm²)</th>
<th>Welding pressure (0,01 N/mm²)</th>
<th>Height welding bead</th>
<th>Heating time</th>
<th>Changeover time</th>
<th>Building-up pressure time</th>
<th>Cooling time</th>
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</table>

Welding parameters Akatherm HDPE drainage

In this table the welding parameters can be found for Akatherm HDPE. The exact regulation of the welding machine depends on its mechanical resistance. The tables provided with the machine are to be used for regulating the machine.
Jointing methods

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Both sides should be machined until they run parallel. When the machining is finished, open the carriages (the plastic shavings must be continuous and uniform in both sides to weld). Take off the milling cutter. Verify the alignment between the machined surfaces. Remove the plastic shavings. Do not dirty or touch the machined surfaces.

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Welding and cooling
After the jointing areas have made contact they should be joined with a gradual increase in pressure up to the specified value. Keep the specified welding pressure at a constant level during the cooling period. Do not cool artificially.

Welded components can be removed from the machine when 50% of the cooling period has elapsed, providing that this is done carefully, with no load or strain being placed on the joint. The joint must then be left undisturbed for the remainder of the cooling period.

Properties

In this table the welding parameters can be found for Akatherm HDPE. The exact regulation of the welding machine depends on its mechanical resistance. The tables provided with the machine are to be used for regulating the machine.
**Evaluating the butt-weld joint**

The butt-weld can be evaluated using destructive and non-destructive evaluation methods. For these evaluations special equipment has to be used. Butt-welds can easily be judged by a visual inspection making this the recommended method for a first evaluation.

The shape of the welding bead is an indication for the proper operation of the welding process. Both welding beads should have the same shape and size. The width of the welding bead should approximately be 0.5 x the height. Differences between the beads can be caused by the difference in HDPE material used in the welded components. Despite the differences in welding bead the butt can be of sufficient strength.

In the next illustration a good weld is shown with a uniform welding bead. At a visual inspection this would be classified as an “acceptable” weld.

When there is either insufficient heating up or too low welding pressure there are hardly any beads. In cases like this thick walled pipes often form shrinking cavities. The weld must be classified as “not acceptable”.

**Jointing methods**

**Properties**

**Butt-weld with big welding beads (acceptable)**

In the next illustration a cross-section of a regular, round fusion bead, free of notches or sagging is shown. Special attention should be paid to the fact that the collar value ‘K’ is greater than 0.

**Butt-weld with even welding beads (acceptable)**

**Butt-weld with mis-alignment of pipe (acceptable)**

Mis-alignment between fittings and pipe can occur for several reasons. Oval pipe ends or irregular necking of the pipe can cause an incomplete fit. If this is less than 10% of the wall thickness the weld can still be classified as “acceptable” (see next illustration).

**Jointing process:**

- Lubricate the pipe end and insert the pipe up to the marked insertion depth.
- Make joint.
- Chamfer pipe end. The pipe-end needs to be chamfered under an angle of 15°. To get an even cut and chamfer a chamfering tool should be used.
- Mark insertion depth.

**Expansion joint**

A plug-in joint is an easy to make, detachable and non-pull-tight jointing method. Expansion sockets can absorb length changes of pipes with a max. length of 5 m.

**Jointing process:**

- Cut pipe square and remove burr.
- Mark insertion depth.
- Plug in socket.
  - The pipe needs to be inserted in the plug in socket using the full insertion depth.
  - A plug-in joint is not to be used to accommodate the expansion and contraction of a pipe system.
- Chamfer pipe end. The pipe-end needs to be chamfered under an angle of 15°. To get an even cut and chamfer a chamfering tool should be used.
- Make joint.
  - Lubricate the pipe end and insert the pipe up to the marked insertion depth.