

Socket fusion welding of polyethylene

Installers and installation equipment

Installation personnel should be trained and technically competent for this jointing method. Training for installers is available free of charge on request from our technical department.

The tools required for the job should be assembled and checked prior to commencing any work. When assembling longer runs or large size Polyethylene pipes, the use of guides, pipe rollers or supports, is recommended to reduce the drag forces involved.

The work crew should be equipped with equipment to enable safe handling of the pipes on site, together with appropriate hand tools. In addition, it is recommended that the following tools are used during the jointing process. Using tools designed specifically for plastic piping systems greatly improves the performance of the installation team and reduces the risk of bad joints being made.

Pipe Cutting

Item	Pipe Diameter	Part Number
Rotary Cutter	6 - 63mm	04124
Rotary Cutter	10 - 90mm	04134
Rotary Cutter	48 - 114mm	04144
Saw	Up To 75 mm	04512
Saw	Up To 100mm	04510
Saw	Up To 150mm	04517



In addition to everyday pipe fitters tools the installation of Polyethylene piping requires a fusion-welding machine of the appropriate size and type. Care should be taken to consider the advantages and disadvantages of each jointing method prior to commencement on site. In some cases, a combination of welding methods may prove to be the most cost-effective solution. Our technical department can advise on suitable jointing methods.

Details of the 'Requirements for Machines and Equipment Used for Fusion Jointing Thermoplastics' can be found in DVS 2208 Instructions Part 1.

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Preparation of the work area

Assemble the welding equipment according to the manufacturer's instructions, with due provision for safe working practices. When working outdoors, the area used for jointing must be protected from rain, snow and wind. The preferred ambient working temperature for welding is in the range of +5°C to +45°C. Protecting the fusion welding area with a tent or similar device can help maintain an even temperature in the work area.

Pipe cutting and preparation

Before cutting, pipes should be conditioned to reach the ambient working temperature under which installation and jointing will take place.

Pipe should always be cut to length using tools specifically designed for use with plastic pipe. A rotary pipe cutter with the correct blade or wheel appropriate for the pipe wall thickness is recommended, as they provide a high degree of accuracy in the finished cutting length, and also produce a square cut to the pipe. Power tools such as band saws or circular saws may also be used - however they should have blades that are specifically designed for use with plastic pipe. Handsaws with blades suitable for use with plastic pipe may be used, however it is recommended that a mitre box be used to ensure a square cut is achieved.

Once the cutting process is completed, the pipe length should be checked for accuracy, and any internal or external burrs should be removed using a deburring tool specifically designed for use with plastic pipe. Any plastic chips or swarf should also be removed from the inside of the pipe. The jointing area of the parts to be welded must be free from damage or contamination.

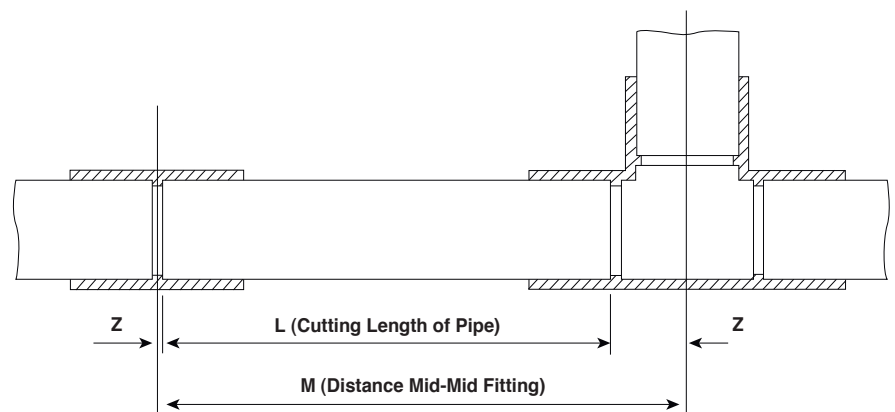
The installation of Polyethylene piping systems makes use of so-called "Z" dimension of the fitting. An explanation of the use of the "Z" dimension is shown in the following example:-

Explanation:

M = Distance mid-mid fitting

L = Cutting length of pipe

Z = Z-dimension of fitting



The Z dimension for Polyethylene pipe fittings that is used to calculate pipe cutting lengths can be found in the detailed dimensional information.

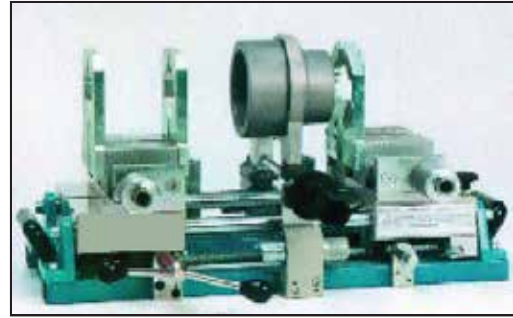
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Making a socket fusion joint - introduction

In socket fusion jointing, pipes and fittings are lap-welded together as the male pipe end is inserted into the female socket of the fitting. This process does not require any consumables, as the parts to be joined are heated to welding temperature using a single fusion tool with heating bush and heating cinnot. The pipe and fitting dimensions, as well as those of the heating tools, are in accordance with strict tolerances so that when joining force is applied after heating, a homogenous joint will result. The welding method is documented in DVS 2207 Part 1 - Polyethylene.



Hand-held socket fusion tool with optional bench mounting



Bench socket fusion tool suitable for workshop or site use

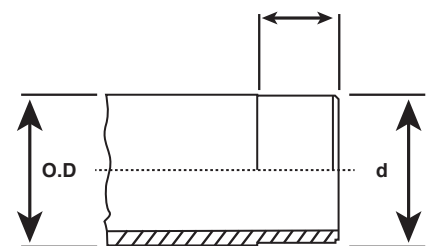
Heating element socket fusion welding may be performed using hand held tools on pipe outside diameters of up to 63mm, but for larger sizes the use of a bench mounted welding device is recommended. It is preferred, if possible, to use a bench mounted welding machine for all pipe sizes, as these devices greatly improve the joint alignment.

For successful jointing, the pipe ends must be calibrated by means of a peeling and chamfering tool. At the same time, it removes the oxidized layer that forms naturally on the outside surface of the pipe. This oxidized layer can have a detrimental effect upon the final joint strength, and it is essential that it be removed prior to welding. The tool also produces a bevel on the leading edge of the pipe, which aids entry into the socket fusion fitting during the welding process.

The calibration diameter and correct length for the peeling of the pipe ends is shown in the following table:

Calibration of Peeling Tools

Pipe O.D. (mm)	Calibration Diameter (d) (mm)	Calibration Length (L) (mm)
20	19.90 ± 0.05	14
25	24.90 ± 0.05	16
32	31.90 ± 0.05	18
40	39.85 ± 0.10	20
50	49.85 ± 0.10	23
63	62.80 ± 0.15	27
75	74.80 ± 0.15	31
90	89.80 ± 0.15	35
110	109.75 ± 0.20	41



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Making A Socket Fusion Joint - Joint Preparation

- Before heating, thoroughly inspect the heating bushes for signs of damage or contamination. Clean carefully with non-fraying paper or a clean cloth, and if necessary replace any unacceptable parts. Connect the tools to a reliable power source and switch on.
- Set the welding temperature on the fusion-welding tool to 250°C-270°C. Prior to each weld verify the temperature using a digital thermometer with surface sensor or with temple sticks (253°C for low temperature and 274°C for high temperature).
- Cut the pipe ends squarely using tool suitable for plastic pipe. A wheel-type cutter is ideal. If a saw is used, a mitre box is recommended to ensure a square cut. Power saws may be used with care.
- Remove the internal burr from the pipe, and clean up any cutting debris or swarf.
- If using a bench mounted socket fusion machine, fit the pipe and the fitting into the clamps on the machine. Bring the parts together and check that they are aligned correctly.
- Peel and chamfer the pipe end using a calibrated tool described above. Avoid touching the cleaned and prepared surface.



Preparing to peel the pipe



Peeling the pipe



The fitting is mounted in the fusion machine

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Making a socket fusion joint - completing the joint

- Position the heating element and draw the pipe and fitting onto the heating bushes. If using a hand held heating element, do not twist the parts. Hold this position for the duration of the heating time shown in the table below.
- At the end of the heating period simultaneously remove the pipe and fitting from the heating element. Immediately insert the pipe into the socket until the pipe reaches the bottom of the fitting socket (this is controlled mechanically with a bench mounted fusion machine). Take care to align the pipe and fitting correctly.
- Hold the joint in position without movement for the duration of the cooling period shown in the table below.
- When completed, inspect the joint for any visible signs of defects or contamination. A correctly made joint will have the appearance of twin parallel weld beads at the outside of the joint. The weld beads should be similar in size, and be complete around the circumference of the joint.



Heating the pipe and fitting



The heater is removed and the parts are brought together



Cooling the completed joint before handling

Do not pressurize the joint for a minimum of 1 hour.

Heating, adjusting and cooling times for Polyethylene socket fusion joints

Pipe Size O.D. (mm)	Heating Time (sec)	Adjusting Time (sec)	Cooling Time	
			Fixed (sec)	Total (min)
16	5	4	6	2
20	5	4	6	2
25	7	4	10	2
32	8	6	10	4
40	12	6	20	4
50	18	6	20	4
63	24	8	30	6
75	30	8	30	6
90	40	8	40	6
110	50	10	50	8