Fusion

Part A: Mounting of the tools

1. **IMPORTANT!** Only use original fusiotherm® welding devices and fusiotherm® welding tools. They are designed with the proper temperatures and dimension for working with Aquatherm products.

2. Assemble and tighten the cold welding tools manually.

3. Before fusing a distribution block, in which two connections are fused simultaneously, the welding tools have to be placed into the respective holes as described in figures A and B.

4. All welding tools must be free from impurities. Make sure they are clean before assembling. If necessary, clean the welding tools with a coarse, non-fibrous tissue and with rubbing alcohol.

5. Place the welding tools on the welding device so that there is full surface contact between the welding tool and the heating plate. Welding tools over Ø 40 mm must always be fitted to the rear position of the heating plate.

Electric supply:

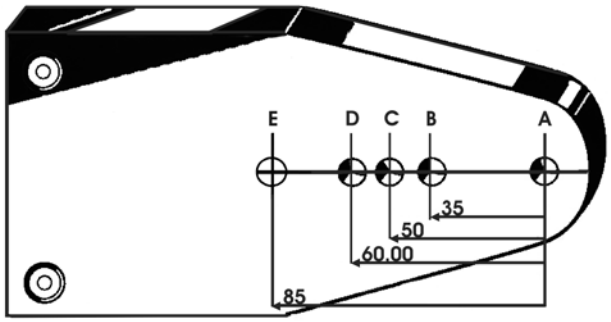
Make sure that the electrical supply used is fully compateable with the welding iron being used. Improper use of any electrical devise can cause harm to both the tool and the operator. Make sure any extension cords used are compatable with the the power imput of the welding devices.

6. Plug in the welding device. Depending on the ambient temperature it takes 10-30 minutes to heat up the heating plate.

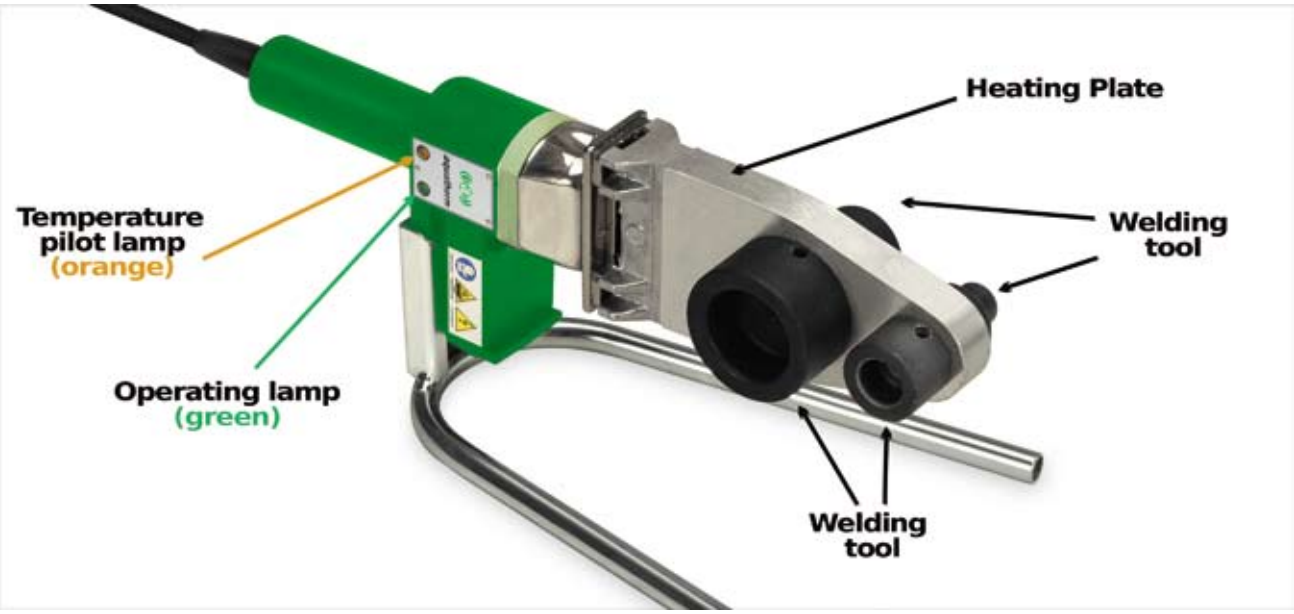
A

Art.-No.	Passage	Hole	Branch	Hole
30115	Ø 25 mm	A + E	Ø 20 mm	A + C
85123	Ø 20 mm	A + B	Ø 16 mm	A + C
85124	Ø 20 mm	A + B	Ø 16 mm	A + C

B



Fusion



Part A: Heating phase

7. During the heating phase, tighten the welding tools carefully with the Allan key.

   Take care that the tools completely contact the heating plate. Never use pliers or any other unsuitable tools, as this will damage the coating of the welding tools.

8. The temperature of 260° C is required for welding with the Fusiotherm® system. Acc. to DVS-Welding Guidelines, the temperature of the welding device has to be checked before starting the welding process. This has to be done with a fast indicating surface thermometer or alternatively with a Fusiotherm® thermocolor pencil. (see “Fusion part B, item 2”)

Part A: Handling

9. A tool change on a heated device requires another check of the welding temperature on the new tool (after heating it up).

10. If the device has been unplugged, e.g. during longer breaks, the heating process has to be restarted (see item 6).

11. After use, unplug the welding device and let it cool down. Water must never be used to cool the welding device, as this would destroy the temper of the metal.

12. Protect Fusiotherm® welding devices and tools against impurities. Burnt particles may lead to an incorrect fusion. The tools may be cleaned with Fusiotherm® cleansing cloths, Art.-No.50193.

    Always keep the welding tools dry.

13. For a perfect fusion, damaged or dirty welding tools must be replaced, as only impeccable tools guarantee a perfect connection.

14. Never attempt to open or repair a defective device. Return the defective device for repair.

15. Check the operating temperature of Fusiotherm® welding devices regularly by means of suitable measuring instruments.

Fusion

Part A: Guidelines

16. Fusion welding of joints in Fusiotherm and Climatherm piping systems must be done in accordance with the instructions in this manual. Additional information is available, and should be followed where applicable and not in conflict with these instructions:

    ASTM D 2657 - Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings

    ASTM F 1290 - Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings

Part B: Checking of devices and tools

1. Make sure the Fusiotherm® welding devices and tools comply with to the guidelines “Fusion Part A”.

2. All devices and tools must have reached the necessary operating temperature of 500°F. This should be verified with a handheld contact thermocouple (thermometer) capable of measuring temperatures up to 650°F (340°C).

Temperature control with a thermometer

Alternatively it is also possible to check the welding temperature with the Fusiotherm® temperature pencil. The application of the Fusiotherm® temperature pencil to heated surfaces enables an exact reading with a tolerance of +/-5 °C.

Application:

As soon as the temperature pilot lamp of the welding device indicates the end of the heating up period, put a chalk line on the heated external surface of the welding tool. The colour must change within 1 - 2 seconds.

If the temperature is too high, the colour will change immediately and if it is below 260 °C it will change after 3 or more seconds.

If the colour does not change within 1 - 2 seconds the temperature has to be tested again. If proper temperature cannot be reached withing 30 minutes, inspect the welding device to ensure functionality.

Temperature control by chalk

Actual color may vary

Fusion

Part B: Preparation for the fusion

3. Cut the pipe at right angles to the pipe axis. Only use fusiotherm® pipe cutters or other suitable cutting pliers. Take care that the pipe surface is free from burrs or cutting debris and remove where necessary.

4. Mark the welding depth at the end of the pipe with the enclosed pencil and template.

5. Mark the desired position of the fitting on the pipe and / or fitting. The markings on the fitting and the uninterrupted line on the pipe may be used as a guide.

6. **If stabi-composite, UV-coated or smoke-rated pipe is used, peel off the exterior layer completely before. (see picture)**

7. Only use original fusiotherm® peeling tools with undamaged peeling blades. Blunt peeling blades must be replaced by **aquatherm** approved blades. It will be necessary to make trial peelings to ensure the correct setting of the new blade. It should not be easier than usual to push the peeled stabi-composite pipe or coated pipe into the welding tool.

8. Push the end of the pipe into the guide of the peeling tool. Peel off the outer layer up to the stop of the peeling tool. It is not necessary to mark the welding depth as the stop of the peeling tool indicates the correct welding depth.

9. Before starting the fusion, check make sure the exterior layer has been completely removed.

Cutting the pipe

Marking of the welding depth

Peeling of the aluminium-PP-composite-layer

(Not necessary on applying fusiotherm® and fusiotherm® faser-composite!)

Fusion

Pipe diameter		Welding depth		Heating time		Welding time	Cooling time
mm	inch	mm	inch	sec.DVS	below +5°C or 40°F	sec.	min.
16	⅜	13.0	0.51	5	8	4	2
20	½	14.0	0.55	5	8	4	2
25	¾	15.0	0.59	7	11	4	2
32	1	16.5	0.65	8	12	6	4
40	1 ¼	18.0	0.71	12	18	6	4
50	1 ½	20.0	0.79	18	27	6	4
63	2	24.0	0.94	24	36	8	6
75	2 ½	26.0	1.02	30	45	8	8
90	3	29.0	1.14	40	60	8	8
110	3 ½	32.5	1.28	50	75	10	8
125	4	40.0	1.57	60	90	10	8

Dimension 160, 200 + 250 mm: The dimension 160, 200 + 250 mm are joined by butt-welding. Detailed information in this chapter on page 14 + 15.

Part B: Heating of pipe and fitting

10. Push the end of the pipe, without turning, up to the marked welding depth into the welding tool.

    It is essential to observe the required heating times. Heating for too short a time can result in improper bonding. Heating for too long can result in ID restriction.

Pipes and fittings of the dimensions Ø 75 to 125 mm can only be welded with welding device Art.-No. 50141 (or with machine Art.-No. 50147). On using the **fusiotherm®** welding machine Art.-No. 50147 a separate operating instruction has to be observed.

ATTENTION:
The heating time starts when pipe and fitting have been pushed to the correct welding depth on the welding tool. NOT BEFORE!

Heat-up of the single parts

Fusion

Part B: Setting and Alignment

11. After the heating time quickly remove pipe and fitting from the welding tools. Join them immediately, and without turning, until the-marked welding depth is covered by the-bead of PP from the fitting.

    ATTENTION:

    Do not push the pipe too far into the fitting, as this would reduce the ID and in an extreme case close off the pipe.

12. The joint will remain flexible during the specified welding time. Use this time to correct the connection and adjust it to the proper angle. The correction is only restricted to the alignment of pipe and fitting. Never turn the elements or align the connection after the welding time.

13. After the cooling period the fused joint is ready for use.

    The result of the fusion is an inseparable material joining of pipe and fitting: a connection technique with security for a life-time!

Joining, fixing and...

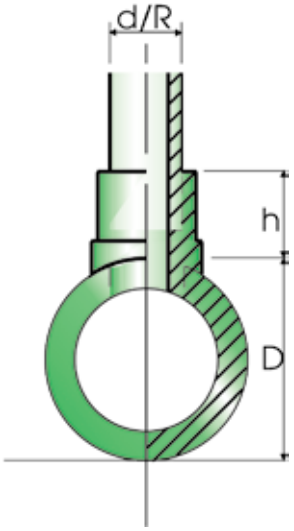
...putting the fitting in the right direction

The result: an inseparable connection!

Part C: Weld-in Saddles

Fusiotherm® weld-in saddles are available for pipe outer diameter of 40, 50, 63, 75, 90,110, 125 and 160 mm.

Weld in saddles are used for
- branch connections in existing installations
- the substitution of a tee
- branch connections in risers
- sensor wells, etc.



Fusion

Part C: Weld-in Saddles

Size of Pipe / Size of Branch	16mm	20mm	25mm	32mm	40mm	50mm	63mm	75mm	90mm	110mm	125mm	160mm	200mm	250mm
	⅜"	½"	¾"	1"	1 ¼"	1 ½"	2"	2 ½"	3"	3 ½"	4"	5"	7"	9"
16mm (⅜")	T													
20mm (½")	R	T	R											
25mm (¾")	R	R	T											
32mm (1")	R	R	R	T										
40mm (1 ¼")		R/S	R/S	R	T									
50mm (1 ½")		R/S	R/S	R	R	T								
63mm (2")		R/S	R/S	R/S	R	R	T							
75mm (2 ½")		R/S	R/S	R/S	R/S	R	R	T						
90mm (3")		S	R/S	R/S	R/S	R	R	R	T					
110mm (3 ½")		S	S	S	S	S	R	R	R	T				
125mm (4")		S	S	S	S	S	S	R	R	R	T			
160mm (5")		S	S	S	S	S	S	R	R			T		
200mm (7")		S	S	S	S	S	S	R	R	R	R		T	
250mm (9")		S	S	S	S	S	S	R	R	R	R			T

T= Tee available R= Reducing Tee Available S=Saddle Available

Pipe size / Thread size	½"	¾"	1"
16mm (⅜")	R		
20mm (½")	T	R	
25mm (¾")	R	T	
32mm (1")	R	R	T
40mm (1 ¼")	S	S	
50mm (1 ½")	S	S	
63mm (2")	S	S	
75mm (2 ½")	S	S	S
90mm (3")	S	S	S
110mm (3 ½")	S	S	S
125mm (4")	S	S	S
160mm (5")	S	S	S
200mm (7")	S	S	S
250mm (9")	S	S	S

The Aquatherm saddle joint gives the installer greater flexibility and peace of mind

Fusion

Part C: Weld-in saddles

1. Before starting the welding process, check whether the **fusiotherm®** welding devices and tools comply with the requirements of “Fusion Part A”.

2. The first step is to drill through the pipe wall at the intended outlet point by using the **fusiotherm®** drill.
   - branch 20/25 mm: Art.-No. 50940/50941
   - branch 32 mm: Art.-No. 50942
   - branch 40 mm: Art.-No. 50944
   - branch 50 mm: Art.-No. 50946
   - branch 63 mm: Art.-No. 50948

3. When using **fusiotherm®** stabi-composite, UV coated, or smoke rated pipes remove the remaining exterior layer at the bore hole with the **fusiotherm®** chamfering device.

   - branch 20/25 mm: Art.-No. 50910
   - branch 32 mm: Art.-No. 50912
   - branch 40 mm: Art.-No. 50914

4. The welding device/saddle welding tool must have reached the required operating temperature of 260 °C (check with reference to “Fusion Part B, item 2”).

5. The welding surfaces have to be clean and dry.

6. Insert the heating tool on the concave side of the weld-in saddle tool into the hole drilled in the pipe wall until the tool is completely in contact with the outer wall of the pipe. Then insert the saddle fitting into the heating sleeve until the saddle surface rests against the convex side of the welding tool. (Note: Using the fitting to push the iron onto the pipe will overheat the fitting and cause a restriction in the connection.) The heating time for the pipe and fitting is generally 30 seconds.

7. After the welding tool has been removed, the weld in saddle tool is immediately inserted into the heated, drilled hole. The weld-in saddle should be pressed on the pipe for about 15 seconds. After being allowed to cool for 10 minutes the connection can be exposed to its full loading pressure. The appropriate branch pipe is fitted into the sleeve on the **fusiotherm®** weld-in saddle using conventional fusion technology.

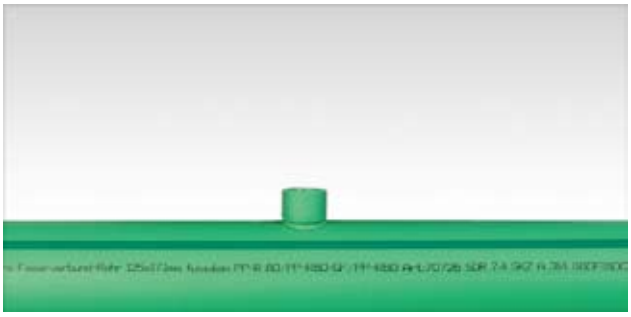
By fusing the weld-in saddle with the pipe outer surface and the pipe inner wall the connection reaches it’s maximum strength.

Drilling through the pipe wall

The welding tool is inserted into the pipe wall ...

...heating-up of the pipe and fitting.

Joining



Ready!

Fusion

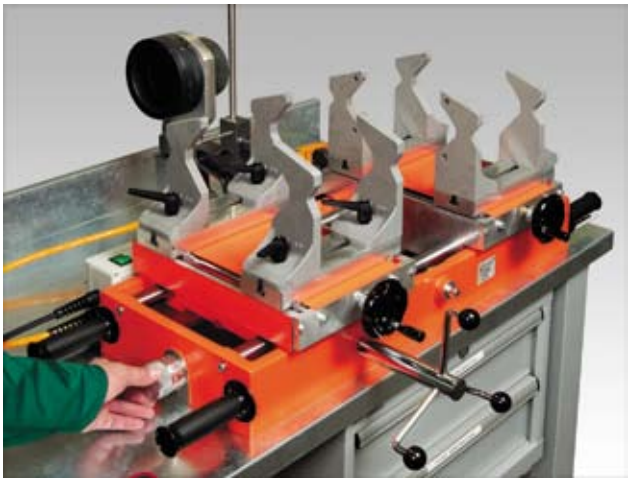
Part D:
fusiotherm® welding machine

One wooden transport box for the welding machine includes:

- One machine body with assembly points for the remaining parts
- One set clamping jaws composed of 8 two-part jaws bars for pipes and fittings, outer diameter 25, 32, 40, 50, 63, 75, 90, 110, 125 mm
- One fusiotherm® welding tool for each of the following diameters: 50, 63, 75, 90, 110, 125 mm
- One welding device Art.-No.: 50341
- One Allan key and tool change clamp
- One fusiotherm® temperature pencil
- One Installation manual

The fusiotherm® welding machine was specially developed for stationary welding of pipe and fittings with an external diameter of 50 to 125 mm. This machine is equipped with a hand crank to facilitate a precise pre-assembly of complicated installation parts.

(The necessary operating instructions are enclosed.)



Pipe diameter		Welding depth		Heating time		Welding time	Cooling time
mm	inch	mm	inch	sec.DVS	below +5°C or 40°F	sec.	min.
50	1 ½	20.0	0.79	18	27	6	4
63	2	24.0	0.94	24	36	8	6
75	2 ½	26.0	1.02	30	45	8	8
90	3	29.0	1.14	40	60	8	8
110	3 ½	32.5	1.28	50	75	10	8
125	4	40.0	1.57	60	90	10	8

Dimension 160, 200 + 250 mm: The dimension 160, 200 + 250 mm are joined by butt-welding. Detailed information in this chapter on page 14 + 15.

Fusion

Part E: Fusiotherm® electrofusion device

The Fusiotherm®-electrofusion device was specially developed for electrofusion sockets from Ø 20 - 160 mm.

Technical information:

- supply voltage: 230 V (nominal voltage)
- nominal capacity: 2.800 VA, 80 % ED
- rated frequency: 50 Hz - 60 Hz
- protection class: IP 54

General and inspection

Cleanliness is - besides correct workmanship - the most important precondition for a proper fusion. To help keep the sockets clean, do not unwrap them until you are ready to install them.

The pipe surface must also be clean and undamaged. Deformed pipe ends must be cut off.

All parts of the system to be fused as well the temperature sensors shall have the same temperature (e.g. sun radiation or uncontrolled storage may cause differences in temperature!) within the acceptable range of temperature (e.g. +5 °C to 40 °C according to DVS 2207).

Preparation

Follow carefully the order of working steps! Preparation is one of the most important steps of the electrofusion process!

1. Cut the ends of the pipes squarely and deburr them thoroughly
2. Clean and dry the ends of the pipes at the necessary length
3. Mark the depth of Fusiotherm® electro-fusionsocket on the end of the pipe
4. Peel the surface of both pipes up to the marks thoroughly with a peeling tool (use the Fusiotherm® peeling tool with the respective pipe diameter)
5. Clean again thoroughly

Fusiotherm® electrofusion device Ø 20-160 mm

Fusiotherm® electrofusion socket

Fusiotherm® peeling tool (Art.-No. 50558-70, up to 75 mm) (from 90-160 mm: Art.-No. 50572/50574/50576/ 50580 (without picture))

Welding depth to 160 mm (5”)											
Ø	20(½-)	25 (¾-)	32 (1”)	40 (1 ¼-)	50 (1 ½-)	63 (2”)	75 (2 ½-)	90 (3”)	110 (3 ½-)	125 (4”)	160 (5”)
depth	1.38”	1.54”	1.57”	1.81”	2.00”	2.32”	2.56”	2.87”	3.15”	3.39”	3.66”

Fusion

Part E: Fusiotherm® electrofusion device

Without complete peeling of the fusion surface, a perfect connection cannot be guaranteed. Damages of the surface like axial grooves and scratches are not acceptable in the fusion zone. Avoid touching peeled surfaces and protect them against dirt and grease. Start the fusion process within 30 mins after peeling.

Assembling the Fusiotherm® electrofusion sockets

Avoid soiling the pipe and fix all parts securely!

1. Open the protective wrapping of the Fusiotherm® electrofusion sockets (cut with knife along the edge of the bore), leaving the rest of the foil intact. Clean the inside of the fitting carefully with aquatherm® cleaning wipes. Assemble the fitting within 30 mins after opening of the protective foil.

2. Push the Fusiotherm® electrofusion sockets on the clean and dry end of the pipe (up to the marked depth). Use pressing clamps if necessary.

3. Remove the protective foil completely and push the other prepared pipe end into the Fusiotherm® electrofusion sockets. Tighten the clamps (if using any).

Leave the pipes, free from bending stress or own weight, within the Fusiotherm® electrofusion socket. The socket is movable at both pipe ends after assembling. The air gap has to be even around the circumference. A stressed or displaced connection can cause an unacceptable melt-flow and a defective connection while joining. The pipe ends and electrofusion sockets have to be dry when installed.

Cut, peel and clean the pipes to be welded carefully

Clean the inner surface of the electrofusion socket

Push the electrofusion socket onto the pipe end

Fusion

Part E: Fusiotherm® electrofusion device

Fusion process

1. Position the fitting with even air gap around the circumference.

2. Regulate fusion equipment for the right fusion parameter.

3. Compare the indications of the fusion equipment with the parameters of the label.

4. Start and monitor the fusion process.

Do not move or stress pipe and fitting during the whole fusion process and cooling time. Cooling time and pressure test A fused pipe-joint must not be moved (no release of the clamps) or stressed before complete cooling. The minimum required cooling time is marked on each Fusiotherm®-electrofusion socket. Ambient temperatures of more than 25 °C or strong sun-radiation need longer cooling times.

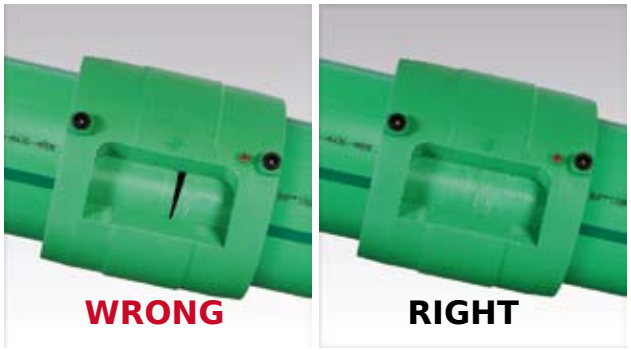
Working pressure

Fusiotherm® electrofusion sockets correspond to the pressure of PN 20. The relation between working temperature, pressure load and service life is given in the tables “Permissible working pressure.”

For further information concerning electrofusion socket and details about the Fusiotherm® electrofusion device read the enclosed operating instructions.

Kind of stress	Compressive stress	Minimum waiting period
Tension, bend, torsion of unpressurized pipes		20 minutes
Test - or wroking pressure of pipes pressurized	up to 0.1 bar (1.5 psi) 0.1 upto 1 bar (1.5-14.5 psi) over 1 bar	20 minutes 60 minutes 120 minutes
Prpeating of the welding process		60 minutes

Push the second pipe - also peeled and cleaned - into the socket



For a stable welding result it is important that both pipe ends inside the electrofusion socket are with parallel faces! Follow the minimum welding depth - absolutely!

Adjust the socket diameter on the welding device. Start and control welding process. Keep the cooling time. Finished!

Fusion

Part E: Electrofusion Device

Pipe repairs with fusiotherm® electro socket Cut squarely 3-4 lengths of a fitting out of the defective pipe on either side of the defect. Fit the new pipe into this gap. Prepare the ends of the existing pipe including marking of the half length of the fitting.

Peel the new piece of pipe on both sides to the proper depth.

Unwrap two fittings and carefully move the fittings over both ends of the repair pipe.

Place the repair-pipe into the gap and move the fittings until they are aligned with the markings on the existing pipes.

Use clamps as needed. Align the pipes carefully before starting the fusion process. Take care that joint is stree free before starting the process.

Part F: Repair

Damaged pipes may be repaired - as already mentioned - by means of

- fusion (see Part B)
- electro socket fusion (see Part E).

In addition to this the fusiotherm® program offers the possibility of the

- repair pin.

The necessary welding tool (Art.-No. 50307/11) and repair pin (Art.-No. 60600) are described on page 6.15 and 6.36. The installation information is enclosed with the welding tool, but may also be ordered separately.

Heating up

Repair pin

Cutting

Fusion

Butt-welding of pipe dimension 160, 200 and 250 mm

Due to the increasing demand for Aquatherm's revolutionary products in larger and more ambitious projects, aquatherm now offers its well-known plastic pipe systems in dimensions of 160, 200 and 250 mm (5', 7' and 9' ID).

The following **aquatherm** pipes series are available:
fusiotherm® pipe SDR 11 for cold water
fusiotherm® faser-composite pipe SDR 7.4 (Pat.-No. 10018324, trademark protection no. 39926599 for green/dark green)
climatherm faser-composite pipe SDR 11

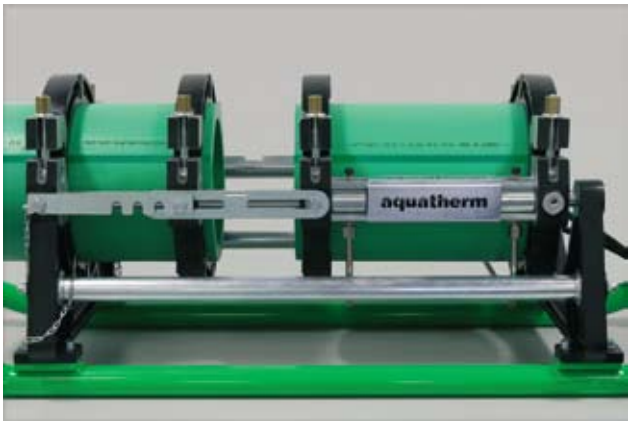
These larger sizes of pipe bring all the advantages of the Fusiotherm and Climatherm systems to much broader applications, including distribution and risers for residential and commercial applications, as well as hosipital, hotels, and industrial applications.

Pipes and fittings are fused, as explained below, by butt welding:

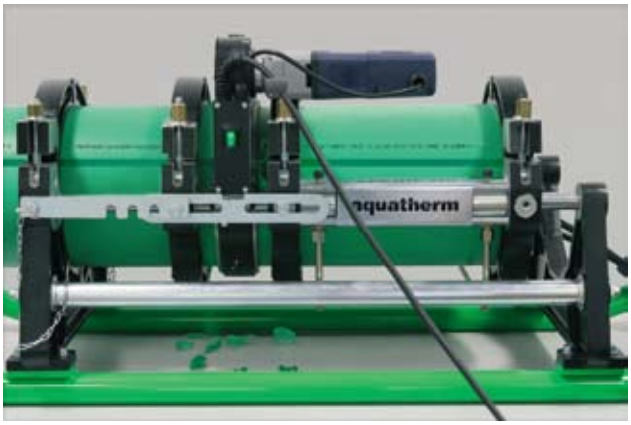
1. Protect your place of work from weather influences
2. Check that the welding machine works properly and heat it up
3. Cut pipes into required length
4. Make sure pipes are aligned and fixed by means of the clamping devices
5. Use the milling machine for planing the pipe end to make sure the welding surfaces are smooth and flat
6. Remove the debris and clean the pipe ends with methylated spirit
7. Check that pipes match (tolerance: max. 0.1 x wall thickness)
8. Check width of gap between the two pipes to be welded (tolerance: max. 0.5 mm)
9. Check the temperature of the heating element (210° C +/- 10° C)
10. Clean the heating element

Before welding, the 160, 200 or 250 mm pipes are cut into the required lengths

Check performance of the welding machine and heat it up



The parts to be welded are fixed and aligned respectively, the milling machine is used



Fusion

11. After the heating element has been positioned, the pipes are pushed onto the heating plate with a specified pressure (exact pressures and temperatures based on pipe thickness should be included in the operators manuel of the butt-fusion machine).

12. After reaching the specified bead height (see table) the pressure is reduced. This process marks the beginning of the heating time. This time is for heating up the pipe ends to the proper welding temperature.

    Specified bead height in mm (“):

Pipe Diameter	SDR 7.4	SDR 11
160 (5”)	1.5 (0.06”)	1.0 (0.04”)
200 (7”)	2.0 (0.08”)	1.0 (0.04”)
250 (9”)	2.0 (0.08”)	1.5 (0.06”)

13. When heating time is complete, slide the pipe ends apart, remove the heating element quickly and join the pipes by putting both parts of the clamp together.

14. The pipes are fused with the required welding pressure and cooled down under pressure.

15. The welded connection can be unclamped - the welding process is finished.

Additionally please follow the instructions given in the operating manual of the welding machine and observe guideline DVS 2207, part 11.

Important Note

1.) The welding machines have to be suitable for the welding of pipes with a diameter/wall thickness ratio of up to SDR 7.4

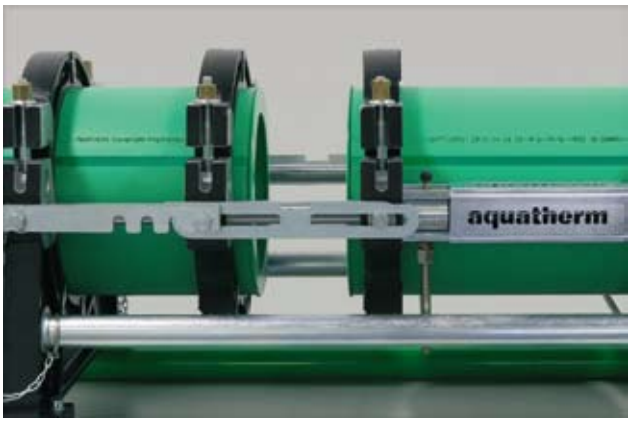
aquatherm recommends the following suitable welding machines for butt welding:

Company Ritmo: DELTA „DRAGON“250
Company Rothenberger: ROWELD P 250 B
Company Widos: WIDOS 4001/4002

2.) For hydraulically operated welding machines, the real manometer pressure has to be calculated in consideration of the hydraulic piston area.

This value can be taken from the respective operating manuals.

Positioning of heating element



Divide the machine slide, remove heating element

Join the pipes, cool down under pressure

Unclamp and work on...