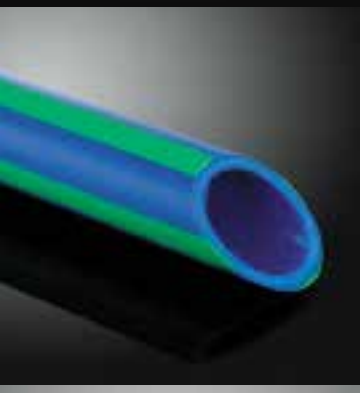
Technical Information for

aquatherm greenpipe®

pressure pipe system for potable water,
food processing, and hygienically sensitive applications

climatherm®

pressure pipe system for hydronic, compressed air,
chemical and industrial applications



aquatherm lilac

pressure pipe system for
recycled and reclaimed water systems

Table of Contents

Features

Quality Assurance

Planning

Installation Principles

Heat Fusion

Product Range

Chapter 5
Heat Fusion

Welding tools

Socket fusion

Fusion outlets

Repairs

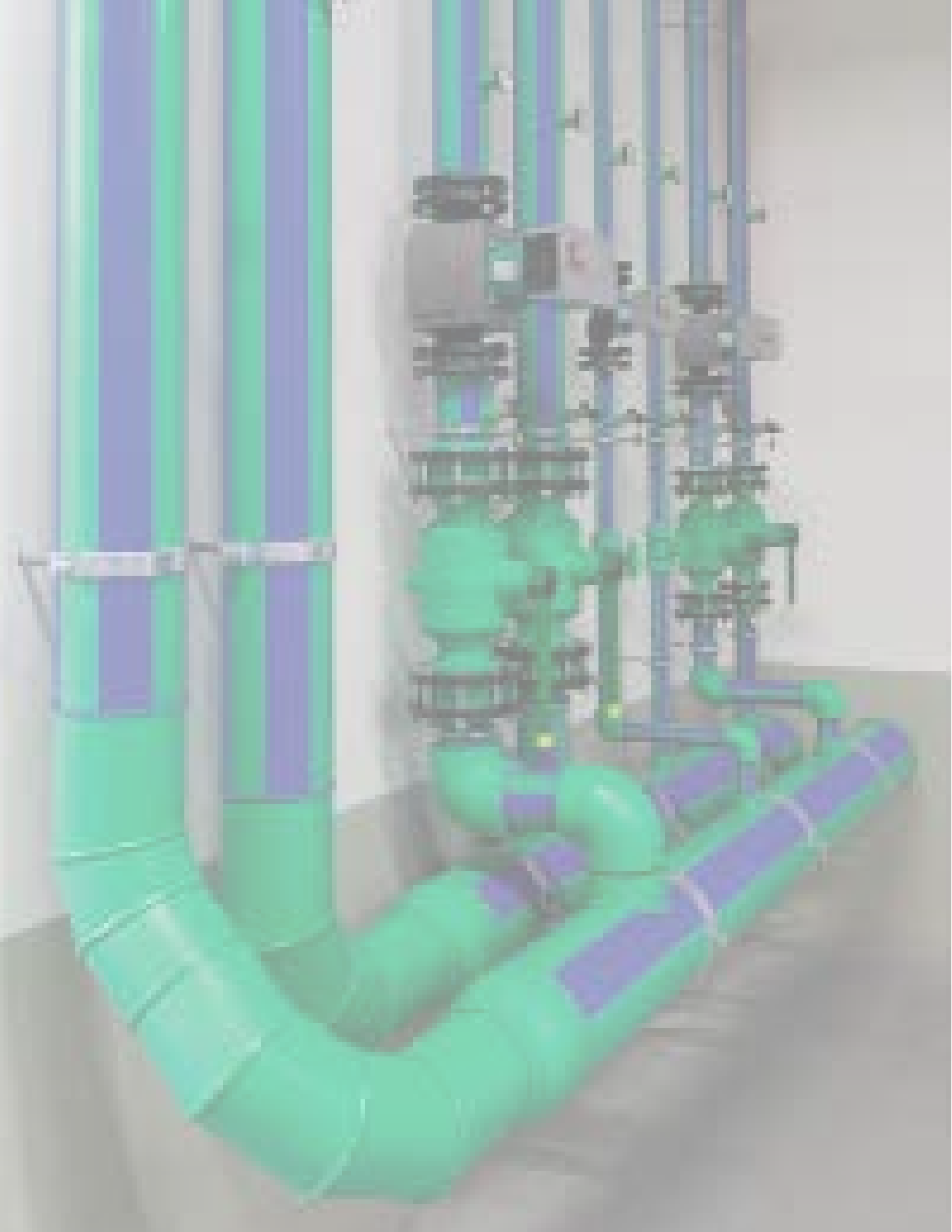
Welding jig

Welding machines

Electrofusion

Butt welding

Aquatherm Advanced



Installation training

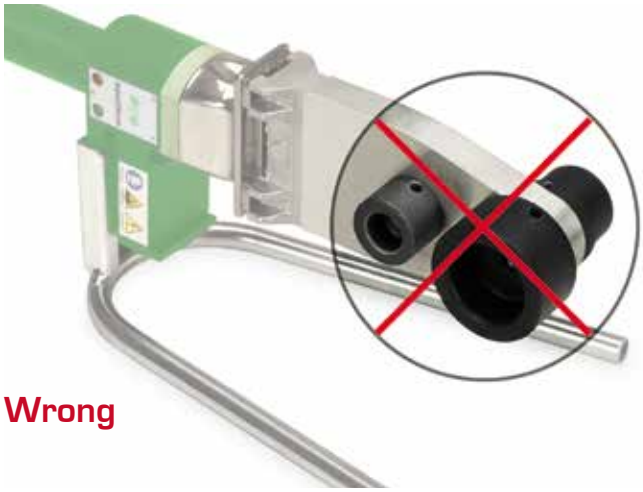
Installers need to be trained by Aquatherm in heat fusion techniques in order have their installation covered under warranty. Training is available from local Aquatherm trainers and instructors. Failure to follow proper installation procedures will also invalidate the warranty.

Welding tools: Assembly

1. Use only Aquatherm approved tools and welding irons. They are designed with the proper temperatures and dimensions for working with Aquatherm products. Information on approved tools is available on Aquatherm's website or from local Aquatherm instructors and trainers.

2. Both the welding iron and the welding heads must be free of residue, dirt, oils, and other impurities before beginning fusion. Make sure they are clean before assembly. If necessary, clean the welding tools with a non-abrasive cleaning wipe. Use rubbing alcohol or a similar agent. Avoid using corrosive cleaners or cleaners that will leave a hazardous residue.

Right



Wrong

The assemblies and fusions shown in this chapter are done using the Aquatherm branded tools. Assembly and operation instructions may vary for other approved tools. Follow any additional instructions or variations given by the tool's manufacturer.

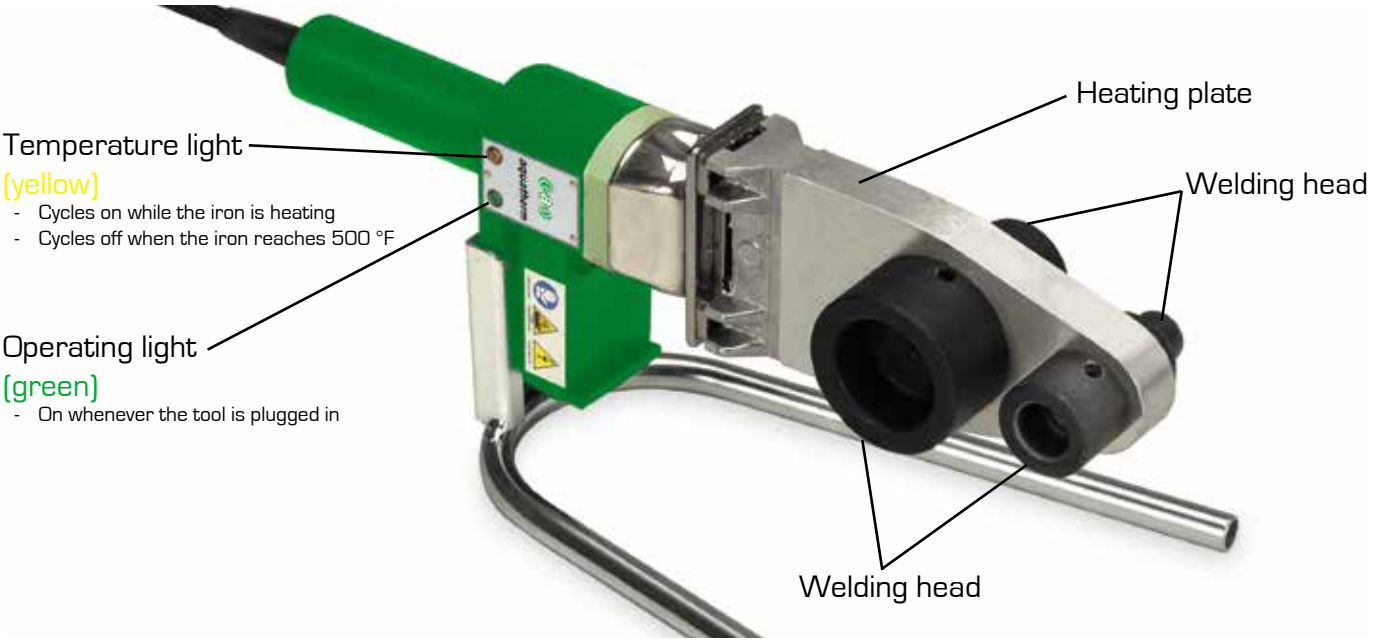
3. Before plugging in the iron, place the welding heads on the welding iron so that there will be full surface contact between the welding head and the heating plate. Welding heads over 1 ¼" (40 mm) must always be fitted to the rear position of the heating plate. Outlet welding heads should always be fitted in the rear position unless there is not enough available space around the connection.

4. Tighten the welding heads until they are almost touching the heating plate. Do not finish tightening the welding heads until the heating plate is hot. Tightening the heads completely before the iron is hot will leave impressions on the heating plate and reduce its performance over time.

5. Plug in the welding tool. Depending on the ambient temperature, it will take 10 - 30 minutes to heat up the heating plate. The tool gives a signal when it is plugged in, and gives another signal when it reaches its target temperature.

Electrical supply:

Make sure that the electrical supply used is fully compatible with the welding iron being used. Improper use of any electrical device can cause harm to both the tool and the operator. Make sure any extension cords used are compatible with the power input of the welding tools. Note that fluctuations in the power supply can cause the tool to go through longer heating cycles.



Safety precautions

By using a non-hazardous material and an emission-free joining process, Aquatherm has eliminated many of the hazards of installing a piping system. However, there will always be a certain level of risk involved in pipe installation, so it is imperative to always follow the appropriate safety precautions.

The irons are the primary concern. The surface temperature of the welding iron and heads will normally be between 450 °F (240 °C) and 500 °F (260 °C) during operation and may remain at these temperatures for as long 30 minutes after being unplugged.

When working with the welding irons, always wear the appropriate hand and arm protection to avoid the risk of burns. Protective eyewear is also recommended.

During operation, always be aware of the location of the iron. Do not leave the iron hanging loosely or allow it to brush up against flammable materials. Make sure to keep the iron clear of other people. **Always post a sign to inform those working nearby that the iron is hot and could pose a safety risk to them.**

Do not leave the iron unattended while it is plugged in. After unplugging the iron, protect it with a heat-resistant covering or place the iron back in its container. Do not allow the cord to contact the welding surfaces.

Welding tools: Heating phase

6. After the iron is hot, tighten the welding heads carefully with the hex wrench. Do not grab the welding heads with pliers or other tools that could damage the coatings.

   Make sure the welding heads are in complete contact with the heating plate.

7. The temperature of 500 °F (260 °C) is required for welding with the Aquatherm piping systems. The temperature of the welding head must be checked before starting the welding process. This can be done with a digital thermometer capable of measuring temperatures up to 650 °F (340 °C).

Important: If the pipe or the air around it is below 40 °F (5 °C), heating times are increased by 50%. Remember to take greater care with the pipe as it can become brittle in cold temperatures. Using power cutters on cold pipe can cause cracking and is not recommended. Use standard ratchet or wheel cutters instead. Never pre-heat the pipe beyond 100 °F (38 °C).

Welding tools: Handling

8. Changing welding heads on a heated iron requires the installer to check the temperature on the new head once it heats up.

9. If the tool has been unplugged (e.g. during longer breaks), the heating process must be restarted (see item 5).

10. After use, unplug the welding tool and let it cool down. Never use water to cool the welding device, as this will destroy the temper of the metal. Always keep the welding heads dry.

11. Protect Aquatherm welding tools and heads against impurities. Residue from previous fusions may lead to an incorrect connection. After cooling, the heads can be cleaned with a non-abrasive cloth.

12. For a proper fusion, damaged or scratched welding heads must be replaced, as only undamaged heads guarantee a perfect connection.

13. Never attempt to open or repair a defective tool. Return the defective iron to the supplier for repair.

14. Check the operating temperature of the Aquatherm welding irons regularly by means of a suitable measuring device.

Welding tools: Guidelines

15. Fusion welding of joints in Aquatherm 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.

16. Remember to use gloves when handling the iron while it is plugged in and for at least 30 minutes after unplugging it. Avoid leaving the iron exposed and unguarded, as passers-by might accidentally injure themselves. Always post a sign to inform those working nearby that the iron is hot and could pose a safety risk to them.

Socket fusion: Preparation

1. Make sure the Aquatherm welding devices and tools comply with the guidelines in “Welding tools.”

2. All devices and tools must have reached the necessary operating temperature of 500 °F (260 °C). This should be checked on the welding head, not the heating plate. This should be verified with a handheld contact or digital thermometer.

3. Cut the pipe at right angles to the pipe axis. Only use Aquatherm cutters or other suitable cutting tools. Inspect the pipe thoroughly for any cracks.

Always ensure that cutters are sharp. Cutting pipes with dull or damaged ratchet cutters can cause the pipe to crack.

Only use the cutters to cut **fusiolen® PP-R** material. It is also acceptable to use power saws with plastic-appropriate blades. 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 a pencil using the Aquatherm marking guide.

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 over short distances.

Socket fusion: Preparation

6. **If UV pipe is used, completely peel off the exterior layer first (see picture).**

   a. Only use peeling tools with undamaged peeling blades. Blunt peeling blades must be replaced. 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 UV pipe into the welding tool.

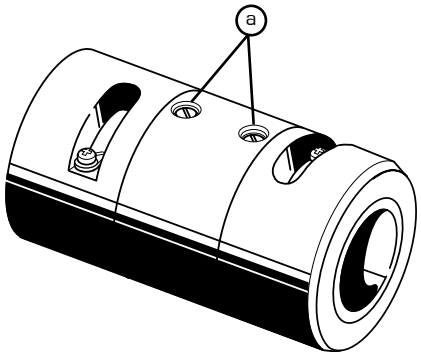
   b. Push the end of the pipe into the guide of the peeling tool. Peel off the outer layer up to the stop of the peeling tool. It is not necessary to mark the welding depth as the stop of the peeling tool indicates the correct welding depth.

   c. Before starting the fusion, check to ensure the exterior layer has been completely removed.

   d. Outer layer may also be removed using a utility knife.

Peeling off the exterior layer.

Peeling only necessary with UV-protected pipe and electrofusion sockets.



Peeling depth can be varied by turning the adjusting screw (a).

Socket fusion: Heating of pipe and fitting

7. 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.

Pipe and fittings with a dimension of 2 inches or larger are difficult to assemble accurately by hand. They can be more easily assembled using the welding jig (5.8), the bench welding machine (page 5.10), or the portable welding machine (5.11).

ATTENTION:

The heating time starts when pipe and fitting have been pushed to the correct welding depth on the welding tool.

Warning: Welding heads and heating plate are extremely hot. Always use protective hand and arm coverings to reduce the risk of serious burns.

Socket fusion welding times

Pipe diameter		Welding depth	Heating time in sec.		Welding time	Cooling time
ND (inch)	OD (mm)	inch (mm)	above 40 °F (+5 °C)	below 40 °F (+5 °C)	sec.	min.
3/8"	16	1/2" (13 mm)	5	8	4	2
1/2"	20	9/16" (14 mm)	5	8	4	2
3/4"	25	5/8" (15 mm)	7	11	4	2
1"	32	11/16" (16.5 mm)	8	12	6	4
1 1/4"	40	3/4" (18 mm)	12	18	6	4
1 1/2"	50	13/16" (20 mm)	18	27	6	4
2"	63	15/16" (24 mm)	24	36	8	6
2 1/2"	75	1" (26 mm)	30	45	8	8
3"	90	1 1/8" (29 mm)	40	60	8	8
3 1/2"	110	1 5/16" (32 mm)	50	75	10	8
4"	125	1 9/16" (40 mm)	60	90	10	8

Note: The dimensions 6" - 24" (160 mm - 630 mm) are joined by butt welding. Detailed information on butt welding can be found on pages 5.14 - 5.18

Socket fusion: Setting and alignment

8. After the heating time, quickly remove the pipe and fitting from the welding tools. Join them immediately by inserting the pipe straight into the fitting (without turning) until the marked welding depth is covered by the bead of PP-R from the fitting.

ATTENTION:

Mark the alignment of the pipe and fittings before heating. Do not push the pipe too far into the fitting, as this can reduce the internal diameter and, in an extreme case, close off the pipe.

9. 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.

10. After the cooling period, the fused joint is ready for use. As the connection cools, the PP-R from the pipe bonds perfectly to the fitting, turning them into one piece. Within minutes, the connection is ready for full system pressure.

Fusion outlets

The **aquatherm greenpipe®** fusion outlets are available for pipe sizes of 1 ¼" - 24" (40 mm - 630 mm) with outlets ranging from ½ - 8" (20 mm - 200 mm).

Fusion outlets are used for:

- branch connections in existing installations
- the substitution of a tee
- branch connections in risers
- sensor wells and other instruments

1. Prepare tools following the directions outlined in "Welding tools."

2. Drill through the pipe wall at the intended outlet point by using the Aquatherm drill bit.

3. The welding heads must have reached the required operating temperature of 500 °F (260 °C).

4. The welding surfaces must be clean and dry.

5. Insert the heating tool on the concave side of the fusion outlet head 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 fusion outlet fitting into the welding head until the saddle surface rests against the convex side of the welding tool. (Note: Do not use the fitting to push the iron onto the pipe. Doing so will overheat the fitting and cause a restriction in the connection.)

6. Heat the pipe and fitting. Refer to "Socket fusion welding times" on page 5.5, as the heating time can vary for different sizes of pipe and the ambient temperature. The connection is ready to be fused when the welding head has made a full impression on the side of the pipe and the outlet fitting has formed a bead around its edges.

7. After the welding tool has been removed, immediately insert the fusion outlet into the heated, pre-drilled hole. The fusion outlet should be held against 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 can be connected to the fusion outlet using standard socket fusion.

By joining the fusion outlet with the pipe's outer surface and the pipe's inner wall, the connection reaches its maximum strength.


Drilling through the pipe wall.


The welding tool is inserted into the pipe wall.


Heating up the pipe and fitting.


Joining.


Ready.

Repairs: Repair tool

There are several ways to repair Aquatherm piping systems. For small holes such as those produced by screws or nails, use the Aquatherm repair tool.

The necessary welding tool and repair pin are listed on page 6.40. The installation information is enclosed with the welding tool but may also be ordered separately.

The Aquatherm repair pin can be used to patch small holes and penetrations in the pipe wall. This system is especially useful for holes less than 3/8" in diameter.

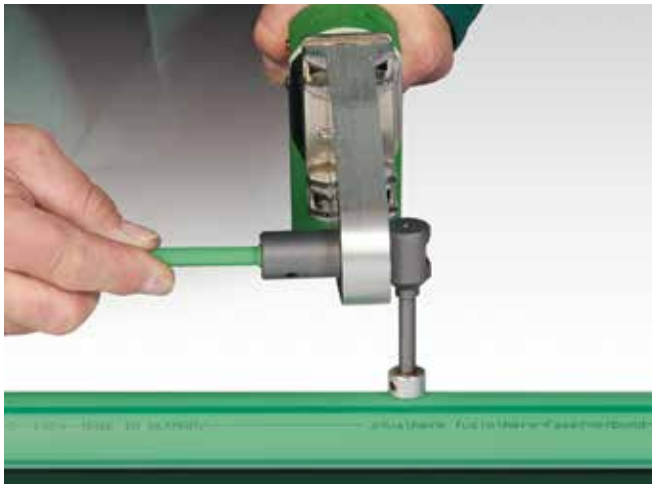
1. Assemble the repair tool, following the directions given in "Welding tools".

2. Clear the hole of any obstructions. This includes the penetrating object, any materials used to temporarily patch the hole, and any water from the pipe itself. Make sure that the water from the pipe is not in direct contact with the area being repaired.

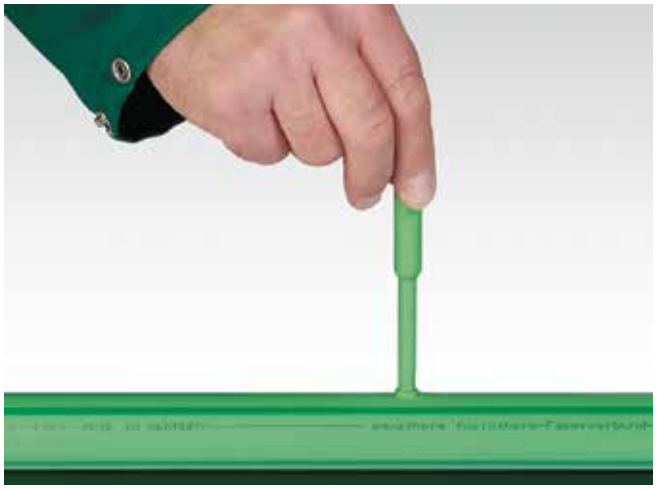
3. The repair pin comes in two sizes: 1/4" (7mm) and 7/16" (11mm). Using a bit that is slightly smaller than the repair tool (3/16" for the 1/4" pin, 3/8" for the 7/16" pin), drill out the hole to an appropriate diameter for the repair. Remove any burrs or excess material.

4. Based on the wall thickness of the pipe, mark the repair pin for the appropriate depth. Inserting the repair pin too far into the pipe can cause an obstruction.

5. Once the repair tool has reached the proper welding temperature, insert the repair head into the pre-drilled hole on the pipe. Insert the repair pin into the repair tool. Heat both the hole and the pin for 5 seconds.



6. Remove the pin from the repair tool and the repair head from the hole. Insert the repair pin into the hole and hold it in place for 15 seconds.



7. Cut away the unused portion of the repair pin. Wait at least two minutes before turning the system back on.

Repairs: Outlet repairs

For holes that are too large to be fixed using the repair tool, a fusion outlet can be used instead. Simply drill out the hole with an Aquatherm drill bit that is slightly larger than the hole itself. Then proceed to weld a matching fusion outlet into the hole, following the original directions.

Fuse a short length of pipe into the hole and cap it off. It is recommended to use a length that is long enough to be fused onto again, in the event the outlet is used as a branch or drain in the future. However, if there is no possibility of needing to expand off the repair at a future date, just use a piece long enough to fuse the cap on to.

Aquatherm welding machines: Bench welding machine

The Aquatherm welding machine is intended for stationary assembly of 1 ½" to 4" pipe using socket connections. The machine works best on a bench for pre-fabrication and is a valuable part of any shop or assembly station. The welding machine helps create precise, accurate connections quickly and consistently.

The Aquatherm bench welding machine comes with a wooden case, a machine slide with metal body, clamping jaws (1 ½" – 4"), welding heads (1 ½" – 4"), 2 heating plates, and pipe support with rollers.

Instructions

1. Check the welding machine. The temperature lamp blinks after reaching the appropriate welding temperature (500 °F).
2. Align the clamping jaws.
3. Lock the fitting into the clamping jaws.
4. Place the pipe loosely in the other clamping jaws. Set the welding depth with the adjusting knob.

5. Push in the calibration knob and turn the crank as far as it will go. This will slide the pipe to the proper depth.
6. Once the pipe is against the fitting, secure it with the clamping jaws. Then turn the crank back and pull out the calibration knob.
7. Follow the welding time according to the socket fusion welding times table. Lower the welding iron into place and push the fitting and pipe slowly as far as they will go onto the heads.
8. The heating time starts when pipe and fitting are completely pushed onto the heads. When the heating time is complete, return the slide, raise the welding iron, and quickly join the pipe and fitting.

More detailed information is available in the operating manuals enclosed with the units.

Aquatherm welding machines: Portable welding machine

The Aquatherm portable welding machine is designed to be used on the job site and can be clamped onto available surfaces. The portable machine can also be used in a shop.

The Aquatherm portable welding machine comes with a built-in heating plate, a machine slide with light metal body, clamping jaws (1 ½" – 4"), and a mounting clamp.

1. Before plugging in the portable welding machine, make sure that it is securely clamped to a stable surface. The surface will need to support the weight of the machine as well as the pipe and fitting. The clamp needs to be tight enough so that the machine cannot slide or wobble during operation.

2. Check the welding machine. The temperature lamp blinks after reaching the appropriate welding temperature (500 °F). Align the clamping jaws. Set the welding depth with the adjusting knob.

3. Lock the fitting into the clamping jaws.

4. Place the pipe loosely in the other clamping jaws.

5. Push in the calibration knob and turn the crank as far as it will go. This will slide the pipe to the proper depth.

6. Once the pipe is against the fitting, secure it with the clamping jaws. Then turn the crank back and pull out the calibration knob.

7. Follow the welding time according to the socket fusion welding times table. Lower the welding iron into place and slowly push the fitting and pipe as far as they will go onto the heads.

8. The heating time starts when pipe and fitting are completely pushed onto the heads. When heating time is complete, return the slide, raise the welding iron, and quickly join the pipe and fitting.

More detailed information can be accessed in the operating manuals enclosed with the units.

Socket fusion welding times (1 ¼" - 4")

Pipe diameter		Welding depth	Heating time in sec.		Welding time	Cooling time
ND (inch)	OD (mm)	inch (mm)	above 40 °F (+5 °C)	below +5 °C or 40 °F	sec.	min.
1 ¼"	40	¾" (18 mm)	12	18	6	4
1 ½"	50	13/16" (20 mm)	18	27	6	4
2"	63	15/16" (24 mm)	24	36	8	6
2 ½"	75	1" (26 mm)	30	45	8	8
3"	90	1 1/8" (29 mm)	40	60	8	8
3 ½"	110	1 5/16" (32 mm)	50	75	10	8
4"	125	1 9/16" (40 mm)	60	90	10	8

Note: The dimensions 6" - 24" (160 mm - 630 mm) are joined by butt welding. Detailed information on butt welding can be found on pages 5.14 - 5.18.

Electrofusion: Tool

The Aquatherm electrofusion tool was specially developed for electrofusion sockets from ½" (20 mm) - 6" (160 mm).

General inspection

Besides proper workmanship, cleanliness is the most important condition 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. Rougher deformed pipe ends must be cut off.

All parts of the system being fused must have the same temperature within the range of 41 °F to 104 °F (5 °C to 40 °C). Note that sun radiation or uncontrolled storage may cause differences in temperature.

Electrofusion: Preparing the pipe

Peeling off the outer layer is essential for a proper connection. Damage of the surface such as axial grooves or scratches is not acceptable in the fusion zone. Avoid touching peeled surfaces and protect them against dirt and grease. Start the fusion process within 30 minutes after peeling.

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 electrofusion socket on the end of the pipe.

4. Peel the surface of both pipes up to the marks with a peeling tool. Use the peeling tool that matches the pipe diameter being fused.

5. Clean the pipe again thoroughly, removing any burrs and smoothing the surface of the pipe.

Electrofusion: Preparing the fitting

6. Open the protective wrapping of the Aquatherm electrofusion socket. Clean the inside of the fitting carefully with Aquatherm® cleaning wipes or a coarse, non-abrasive cloth and rubbing alcohol. Assemble the fitting within 30 minutes of removing the protective foil.

Welding depth for electrofusion													
Size	½" (20 mm)	¾" (25 mm)	1" (32 mm)	1 ¼" (40 mm)	1 ½" (50 mm)	2" (63 mm)	2 ½" (75 mm)	3" (90 mm)	3 ½ (110 mm)	4" (125 mm)	6" (160 mm)	8" (200 mm)	10" (250 mm)
Depth	1 ⅜"	1 ½"	1 ⁹⁄₁₆"	1 ¹³⁄₁₆"	2"	2 ⁵⁄₁₆"	2 ⁹⁄₁₆"	2 ⅞"	3 ³⁄₁₆"	3 ⅜"	3 ¹¹⁄₁₆"	4 ⅛"	5"

7. Push the Aquatherm electrofusion sockets onto the end of the pipe up to the marked depth. Use pressing clamps if necessary.

8. Push the other prepared pipe end into the Aquatherm electrofusion socket. Tighten the clamps (if using any).

9. Make sure the pipes are free from bending or the stress of their own weight within the Aquatherm electrofusion socket. The socket should be movable at both pipe ends after assembling. The air gap must 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 socket must be dry during installation.

RIGHT

WRONG

Electrofusion: Fusion process

10. Position the fitting with even spacing around the circumference.

11. Set fusion equipment to the proper sizing.

12. Compare the settings of the fusion equipment with the parameters of the label for accuracy.

13. Start and monitor the fusion process.

14. Do not move or stress pipe and fitting during the fusion process and cooling time. The 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 Aquatherm electrofusion socket. Ambient temperatures of more than 77 °F (25 °C) or connections in direct sunlight need longer cooling times. The Aquatherm electrofusion sockets are rated up to 300 psi.

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

Electrofusion: Repairs

For pipe repairs using an Aquatherm electrofusion socket, cut a section of pipe equal to 3 or 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 the welding depth of the electrofusion 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. Complete the fusions as previously directed.

Butt welding: 6” - 24” pipe

For joining larger pipe sizes, Aquatherm recommends using butt fusion. Butt fusion is a process that joins the ends of the pipe directly to each other, or to the ends of the fittings. This process is done using a system of hydraulic clamps and a heating plate.

Instructions for the process are given below. Training for butt fusion is available through Aquatherm’s authorized trainers and instructors.

Butt welding: Preparation

1. Protect your workstation from adverse weather conditions. Rain, snow, and mud can damage the machine and cause improper connections.

2. Clean the heating element with rubbing alcohol and a non-abrasive cloth.

3. Plug in the machine and turn it on.

Inspect the welding machine and heating iron.

4. Check that the welding machine works properly. Turn on the heating plate and verify that it heats up. The plate should reach a temperature of approximately 400 °F (200 °C). Verify with an infrared temperature gun.

5. Cut the pipes as squarely and smoothly as possible to the required length. Ensure that there are no cracks in the pipe.

The parts to be welded are fixed.

6. Make sure the pipes are aligned and properly supported.

7. Calculate drag pressure. Drag pressure is the minimum force needed to close the machine. Add drag pressure to all other pressures, as if it were “0” on the gauge.

8. Calculate adjustment/fusion pressure. This varies from machine to machine based on its mechanical advantage. Adjustment pressure can be calculated from the operator’s manual of the machine. This catalog also contains some pressures for reference.

9. Set the adjustment pressure.

Planing the welding surface.

10. Use the facing machine for planing the pipe end to make sure the welding surfaces are smooth and flat.

11. Remove the debris and clean the pipe ends with rubbing alcohol if necessary.

12. Check that the pipe walls match. Do not butt weld SDR 11 pipe and fittings to SDR 7.4 pipe and fittings. Use flanges to transition.

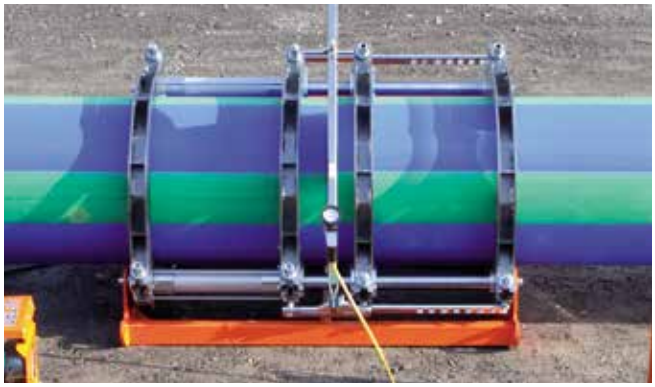
13. Use the machine to push the ends of the pipe against each other. Check for gaps. There cannot be any visible gaps.

Positioning the heating iron.

14. Check the temperature of the heating element. It should be between 390 and 430 °F (200 °C - 220 °C).

Butt welding: Fusion

15. After the heating element has been positioned, push the pipes onto the heating plate with a specified pressure.



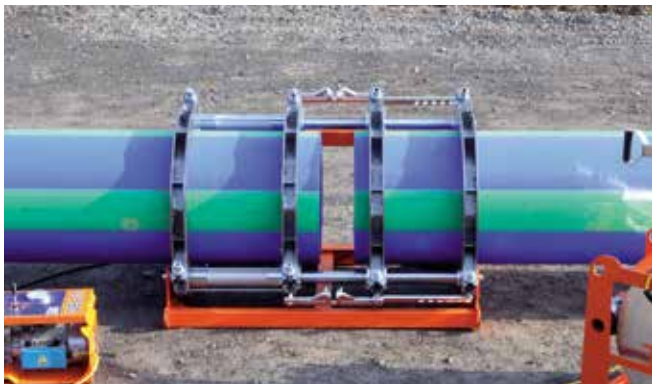
Heating-up the pipe ends.

16. **Standard procedure:** After reaching the specified bead height (see table), reduce the pressure to 10% or less of the adjustment pressure (plus drag). This process marks the beginning of the heating time. This time allows the pipe ends to reach the proper welding temperature.

17. **Shift procedure:** When using a manifold block controller, rather than leaving positive pressure on the gauge, lock the carriage in place with the pipe against the iron. This will prevent the machine from over-melting the pipe during this process. Begin the heating time and continue fusion as normal.

Specified Bead Height in Inches (mm):

Size	SDR 7.4	SDR 11	SDR 17.6
6" (160 mm)	0.06" (1.5 mm)	0.04" (1.0 mm)	0.04" (1.0 mm)
8" (200 mm)	0.08" (2.0 mm)	0.04" (1.0 mm)	0.04" (1.0 mm)
10" (250 mm)	0.08" (2.0 mm)	0.06" (1.5 mm)	0.04" (1.0 mm)
12" (315 mm)	0.1" (2.5 mm)	0.08" (2.0 mm)	0.04" (1.0 mm)
14" (355 mm)	0.1" (2.5 mm)	0.08" (2.0 mm)	0.06" (1.5 mm)
16" (400 mm)	-	0.08" (2.0 mm)	0.06" (1.5 mm)
18" (450 mm)	-	0.1" (2.5 mm)	0.06" (1.5 mm)
20" (500 mm)	-	-	0.08" (2.0 mm)
22" (560 mm)	-	-	0.08" (2.0 mm)
24" (630 mm)	-	-	0.08" (2.0 mm)



Open the clamps and remove heating element.

18. When heating time is complete, slide the pipe ends apart, remove the heating element quickly, and join the pipes by pushing both sides together.

19. Fuse the pipes using the full welding pressure and allow them to cool while still under pressure. The welding pressure is the same as the adjustment/fusion pressure.

20. The welded connection can now be un-clamped.

These instructions are given as general guidelines. Specifications can vary by machine. Follow variations given in the operating manual of the welding machine.

The welding machines must be suitable for planing and fusing pipes with a wall thickness of SDR 7.4. Check with tool manufacturer to ensure that the machine is compatible with Aquatherm products. Specifically, Aquatherm pipes use metric clamps.

For hydraulically operated welding machines, the real pressure must be calculated in consideration of the hydraulic piston area. This value can be taken from the machine's operating manual.

Join the pipes and cool under pressure.

Butt welding: Fusion times

The following table gives the times for the heating phase, welding phase, and cooling phase of a butt fusion. The heating, welding, and cooling times are based on the size and SDR of the pipe. These values do not change from one welding machine to the next. However, each machine will have a different gauge pressure for adjustment and welding, based on the mechanical advantage of that machine. That value should be calculated using the machine's operator manual. The next page includes that value from some of the commonly available machines for quick reference.

Dimension		Heating	Welding (Fusion)		Cooling
ND in (OD mm)	SDR	Heating Time	Max. Transition Time	Time of Pressure Build-up	Cooling Time
6" (160 x 9.1)	17.6	3 min. 24 sec.	6 sec.	9 sec.	15 min.
6" (160 x 14.6)	11	4 min. 37 sec.	8 sec.	13 sec.	24 min.
6" (160 x 21.9)	7.4	6 min. 1 sec.	10 sec.	19 sec.	34 min.
8" (200 x 11.4)	17.6	3 min. 57 sec.	7 sec.	11 sec.	19 min.
8" (200 x 18.2)	11	5 min. 20 sec.	9 sec.	16 sec.	29 min.
8" (200 x 27.4)	7.4	6 min. 52 sec.	11 sec.	23 sec.	42 min.
10" (250 x 14.2)	17.6	4 min. 32 sec.	8 sec.	13 sec.	23 min.
10" (250 x 22.7)	11	6 min. 8 sec.	10 sec.	20 sec.	35 min.
10" (250 x 34.2)	7.4	7 min. 46 sec.	13 sec.	30 sec.	52 min.
12" (315 x 17.9)	17.6	5 min. 17 sec.	9 sec.	16 sec.	28 min.
12" (315 x 28.6)	11	7 min.	12 sec.	24 sec.	44 min.
12" (315 x 43.1)	7.4	8 min. 40 sec.	15 sec.	37 sec.	62 min.
14" (355 x 20.1)	17.6	5 min. 41 sec.	9 sec.	18 sec.	32 min.
14" (355 x 32.2)	11	7 min. 28 sec.	13 sec.	28 sec.	48 min.
14" (355 x 48.0)	7.4	9 min. 25 sec.	17 sec.	42 sec.	70 min.
16" (400 x 22.7)	17.6	6 min. 7 sec.	10 sec.	20 sec.	35 min.
16" (400 x 36.3)	11	8 min.	14 sec.	31 sec.	54 min.
18" (450 x 25.5)	17.6	6 min. 35 sec.	11 sec.	22 sec.	39 min.
18" (450 x 40.9)	11	8 min. 28 sec.	15 sec.	36 sec.	59 min.
20" (500 x 28.4)	17.6	6 min. 59 sec.	12 sec	24 sec	43 min.
22" (560 x 31.7)	17.6	7 min. 24 sec.	12 sec.	27 sec.	48 min.
24" (630 x 35.7)	17.6	7 min. 55 sec.	14 sec.	31 sec.	53 min.

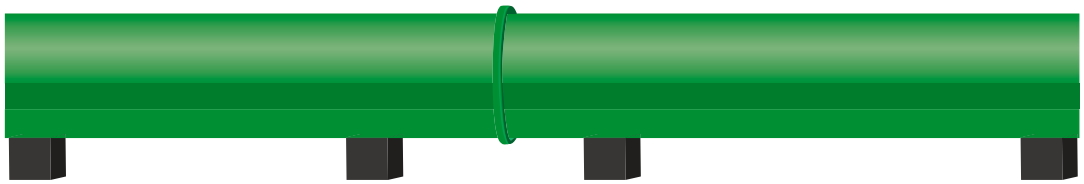
Butt welding: Adjustment/welding pressures

The follow table gives the adjustment/welding pressures of butt welding machines commonly used with Aquatherm pipe. A more complete list can be found in the Aquatherm Installer manual. This data is based on information from the respective manufacturers of these tools at the time of this catalog's printing and may not be complete or current with the manufacturer's product specifications. In the event of discrepancy between this table the operator's manual for the welding machine, the operator's manual should be considered correct. The interfacial pressure for Aquatherm's PP-R pipe is 1 bar, or 14.5 psi.

Dimension			Ritmo						McElroy						Widos		
ND in (OD mm)	SDR	Rothenburger 250/315	Delta Dragon 160	Delta Dragon 250B	Delta Dragon 315B	Delta Dragon 355B	Delta Dragon 500	Delta Dragon 630	28 Low Force	28 High Force	412, 618, T500 (Med)	412 & 618 High Force	824 & 1236 Med Force	824 & 1236 High Force	WI 4900	WI 5100 & 5500	WI 6100
		Adjustment Pressure (psi)															
6" (160 x 9.1)	17.6	102	247	102	87	44	-	-	60	21	17	9	-	-	116	-	-
6" (160 x 14.6)	11	160	392	160	145	73	-	-	93	33	26	13	-	-	174	-	-
6" (160 x 21.9)	7.4	218	551	218	203	102	-	-	132	47	37	19	-	-	247	-	-
8" (200 x 11.4)	17.6	160	-	160	145	73	-	-	94	33	26	13	10	5	174	73	-
8" (200 x 18.2)	11	247	-	261	232	102	-	-	145	51	40	21	16	8	261	116	-
8" (200 x 27.4)	7.4	348	-	363	319	160	-	-	207	73	58	29	23	12	344	160	-
10" (250 x 14.2)	17.6	247	-	261	232	102	-	-	-	-	41	21	16	8	261	116	-
10" (250 x 22.7)	11	377	-	406	348	160	-	-	-	-	63	32	25	13	406	174	-
10" (250 x 34.2)	7.4	537	-	566	508	232	-	-	-	-	90	46	35	18	580	247	-
12" (315 x 17.9)	17.6	392	-	-	263	174	-	-	-	-	65	33	25	13	421	174	145
12" (315 x 28.6)	11	595	-	-	566	261	-	-	-	-	100	51	39	20	640	276	218
12" (315 x 43.1)	7.4	856	-	-	798	377	-	-	-	-	141	72	55	29	-	-	-
14" (355 x 20.1)	17.6	-	-	-	-	218	-	73	-	-	82	42	32	17	-	218	189
14" (355 x 32.2)	11	-	-	-	-	334	-	102	-	-	126	65	50	26	-	348	276
14" (355 x 48.0)	7.4	-	-	-	-	479	-	160	-	-	179	91	70	37	-	-	-
16" (400 x 22.7)	17.6	-	-	-	-	-	174	87	-	-	104	53	41	21	-	290	232
16" (400 x 36.3)	11	-	-	-	-	-	276	131	-	-	161	82	63	33	-	435	348
18" (450 x 25.5)	17.6	-	-	-	-	-	218	116	-	-	132	67	52	27	-	363	290
18" (450 x 40.9)	11	-	-	-	-	-	334	174	-	-	203	104	80	42	-	551	450
20" (500 x 28.4)	17.6	-	-	-	-	-	276	145	-	-	163	-	64	33	-	435	363
22" (560 x 31.7)	17.6	-	-	-	-	-	-	174	-	-	-	-	80	42	-	-	450
24" (630 x 35.7)	17.6	-	-	-	-	-	-	218	-	-	-	-	101	53	-	-	566

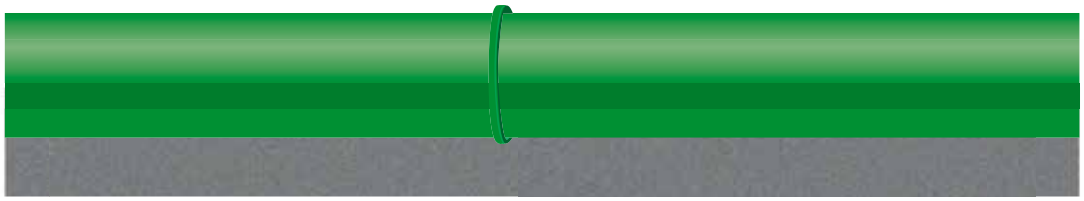
Reducing cooling times

Cooling times for butt welded connections can be reduced by 50% if the joint is properly supported for the remainder of the cooling time. For example, the cooling time for 6" SDR 11 pipe can be reduced from 24 minutes to 12 minutes if the joint is not subjected to any undue stress for the remaining 12 minutes. The following images show proper and improper support for the pipe.



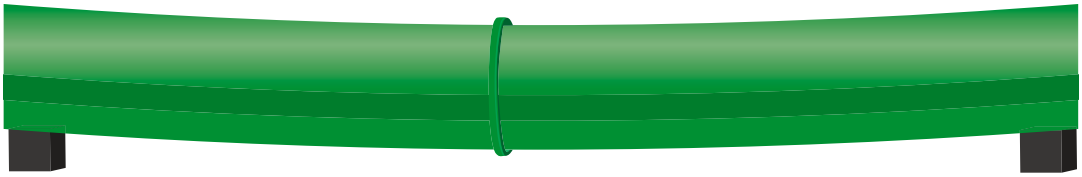
Correct

Whether on hangers or blocks, the pipe should be supported on either side of the connection, as well as further down the line.



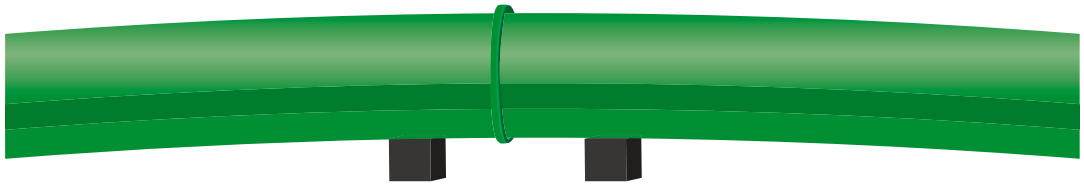
Correct

The pipe can also lay flat on the ground or a similar level surface.



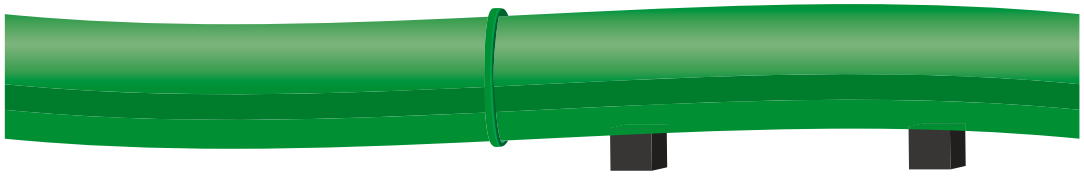
Incorrect

Failure to support the pipe near the connection can result in undue stress on the bottom of the joint.



Incorrect

Failure to support the pipe further away from the connection can result in undue stress at the top of the joint.



Incorrect

Failure to support the pipe on both sides of the connection can cause undue stress across the joint.