aquatherm greenpipe®
climatherm®

Features • Quality Assurance • Fusion • Installation Principles • Planning • Product Range

Pipe System

For Potable, Hydronic, and Industrial Applications

MADE IN GERMANY
Pipe Systems

aquatherm

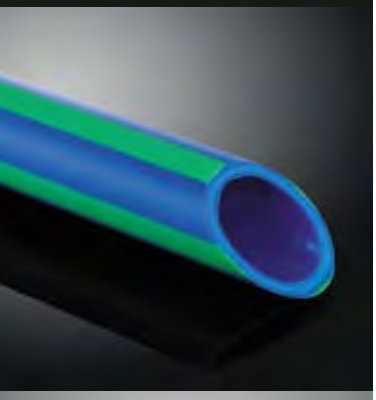
Technical Information

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



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Note: *This version of the Aquatherm catalog has been modified for distribution in Canada and the United States. The text has been translated and edited for greater clarity and the data has been converted from Metric to Imperial units. Some content has been added to address issues specific to North America. Aquatherm GmbH assumes no liability for any misprinting caused by these modifications.*

Chapter 1:
Features

aquatherm greenpipe®

climatherm®

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fusiolen® **PP-R**

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aquatherm

aquatherm greenpipe®

Advantages and fields of application

The **aquatherm greenpipe®** system is a pressure pipe system with a wide range of applications. Exceptional chemical purity and revolutionary physical strength have made **aquatherm greenpipe®** successful in over 70 countries worldwide during the last 35 years.

The **aquatherm greenpipe®** system can be used in almost every aspect of the piping industry, but is best suited for potable and food-grade applications, where the combination of chemical safety and physical durability can truly perform.

The dimensions range from ½" to 10" nominal ID.

Detailed advantages of aquatherm greenpipe® and the material fusiolen® PP-R :

- absolutely corrosion resistant
- resistant against chemicals
- reduced linear expansion by 75% for **aquatherm greenpipe®** faser-composite pipe
- environmentally friendly
- high impact resistance
- reduced pipe friction
- heat and sound insulating characteristics
- excellent welding properties
- high heat-stabilized
- less insulation may be required
- potable and food-safe
- Freeze tolerant

*Manifold construction with **aquatherm greenpipe®** reducing tees and fusion outlets.*

System components

The **aquatherm greenpipe®** system consists of:

- pipes in length and/or coils
- standard fittings (tees, elbows, etc.)
- weldable flange adapter for flange connections
- armature connections and accessories
- transition pieces from PP-R to other piping systems
- fusion outlets
- manifolds
- shut-off devices
- welding tools
- cutting tools
- auxiliaries and mountings

*Manifold construction with **aquatherm greenpipe®** faser-composite pipe and ball valves.*

climatherm®

Advantages and fields of application

The **climatherm®** pipe system is engineered specifically for applications beyond potable water installations.

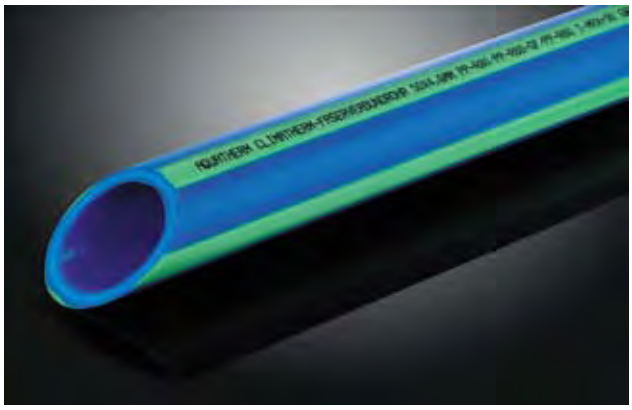
In addition to the general advantages of the **PP-R** pipe system (see 1.03) **climatherm®** offers higher volumetric flow values due to smaller wall thickness.

The dimensions range from ½" to 10" nominal ID.

The system is best suited for chilled water, hydronic heating, and various industrial applications.

Detailed advantages of climatherm® and the material fusiolen® PP-R C :

- absolutely corrosion resistant
- resistant against chemicals
- reduced linear expansion by 75% for **climatherm®** faser-composite pipe
- environmentally friendly
- high impact resistance
- reduced pipe friction
- heat and sound insulating characteristics
- excellent welding properties
- high heat-stabilized
- less insulation may be required
- increased flow rate



System components

The **climatherm®** pipe system is installed using the **aquatherm greenpipe®** fittings and consists of:

- pipes in length and/or coils
- standard fittings (tees, elbows, etc.)
- weldable flange adapter for flange connections
- armature connections and accessories
- transition pieces from PP-R to other piping systems
- fusion outlets
- manifolds
- shut-off devices
- welding tools
- cutting tools
- auxiliaries and mountings

Using the exact same tools and fittings for the **climatherm®** as for the **aquatherm greenpipe®** greatly reduces the amount of training and on-hand materials required to work with both types of installations.

The conditions, regulations and recommendations, described in chapter 3 "Fusion", chapter 4 "Installation Principles" and chapter 5 "Planning" are also valid for the **climatherm®** pipes.

The fittings used with the **climatherm®** pipe are listed in chapter 6 "Pipes and Fittings".

Comparative fields of application of aquatherm greenpipe® and climatherm®:

System recommended due to its technical advantages: ●

Application of the system is suitable: ❍

	aquatherm greenpipe	climatherm®	aquatherm® - lilac
Potable water applications	●		
Heating distribution	❍	●	
Ground source heat loops	❍	●	
Chilled water distribution	❍	●	
Swimming pools	●	●	
Chemical transport	●	●	
Recycled water and rainwater applications	❍	❍	●
Irrigation	❍	●	●
Compressed air systems	❍	●	
In-floor heating systems	❍	●	
Industrial applications	●	●	
Food processing	●		

Fields of application

aquatherm greenpipe® and climatherm® are pressurized pipe systems with many applications due to their special characteristics and versatility.

- **Hot and cold potable water systems**
  for use in residential buildings, hospitals, hotels, office and school buildings, shipbuilding, sports facilities, high-rise construction, distribution mains, and any other application where the applicable codes require a piping system with 100 psi (7 bar) pressure rating at 180°F (82°C) and materials that are safe to be used in direct contact with either food or potable water.

- **Hydronic heating and cooling distribution**
  for residential, commercial and industrial use with exceptional performance as manifolds and in boiler rooms due to the natural insulation value of the pipe walls and the convenience of fusion outlets.

- **Ground-source heat pump systems**
  and other applications where the pipe must be buried.

- **Swimming pool systems**
  and other applications where corrosive chemicals are constantly present in the water.

- **Agricultural and horticultural applications**
  where the air and soil tend to corrode other piping systems.

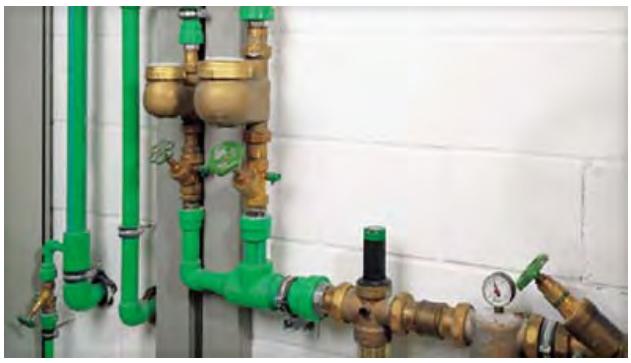
- **Compressed-air systems**
  for use in light industry, heavy industry, automotive mechanic shops, etc. because of climatherm's® phenomenal pressure rating and resistance to corrosion. Also, climatherm® and aquatherm greenpipe® will not shatter if punctured.

- **Industrial applications**
  particularly the transport of aggressive materials because aquatherm greenpipe® and climatherm® resist most types of acids.

- **Food processing**
  for applications where preserving the quality of foodstuffs is essential. aquatherm greenpipe's® **PP-R** material will never affect or leech into its medium.

- **Recycled water and rainwater applications**
  for non-potable service water, the **aquatherm lilac** pipe is ideally suited due to resistance to corrosion, scaling, and microbiological growth.

Potable water installations



From the water meter and cold water distribution to the boiler connection and hot water distribution…

…throughout the entire building as risers and mains...

... up to the last fixture, the **aquatherm greenpipe®** system offers all possibilities for a complete installation with the same non-polluting material.

Heating installations

Specially engineered transition joints and flange connections allow for safe and reliable integration of any mechanical equipment.

Flexibility and faser-composite technology drastically reduce the impact of thermal expansion.

No chemical treatments are needed for **aquatherm** piping systems, making them safe for use with any type of equipment.

Fusiolen® PP-R

All **aquatherm** pipes and fittings are made of Fusiolen® **PP-R**.

The Fusiolen® **PP-R** material is both physically and chemically resilient to the abuse that can damage other materials. It is also a low friction material, protecting it from abrasion and reducing pressure loss. The superior welding properties of Fusiolen® **PP-R** result in a permanent, leak-proof connection that is chemically indistinguishable from the rest of the pipe. This and countless other innovations have made the **aquatherm** pipe systems and the raw material Fusiolen® **PP-R** successful and respected worldwide.

Environmentally responsible

The environmentally friendly polypropylene material Fusiolen® **PP-R** is recyclable and can be ground, melted, and reutilized for various applications (e.g. motor protections, wheel linings, laundry baskets and other kinds of transport boxes). There are no harmful waste products created by the processing or disposal of Fusiolen® **PP-R.** From production that is clean (free of PVCs, leads, heavy metals, and toxins) and low in energy consumption, through its long service life, to being recyclable after serving its function, polypropylene is the green choice for piping.

Non-leaching composition

By using a material that does not interact with water or mediums, **aquatherm** ensures that chemicals from the pipe walls and fittings will never leach into drinking water or the underground water table. This makes the pipe healthier for the people using it and safer for the environment they live in.

High-temperature stabilization

The long-term heat stabilization has been increased to resist the harmful effects of peak temperatures and provide higher safety parameters.

The aquatherm advantage

Fusiolen® PP-R: A better material

- Chemically resistant
- Smell and taste neutrality
- Potable water and food-safe
- Corrosion and scaling resistant
- Environmentally friendly
- Natural insulation properties
- Not a semi-precious metal

Heat Fusion: A better connection

- Fast and simple process
- Reliable connections
- Strong, resilient joints
- Visible quality control
- No systematic weak points
- No flames or fumes

Aquatherm: A better system

- Higher flow rates
- Wider range of applications
- Exceptional impact resistance
- Reduced noise generation and water hammer
- Increased energy savings
- Completely recyclable
- Freeze tolerant
- Longer life-cycle with fewer problems

Material properties

Potable water is one of the world's most precious resources. The domestic supply system should influence the water as little as possible on its way to the consumer. The choice of the right potable water pipe system and its material is extremely important.

From the purest distilled systems to the hardest groundwater, aquatherm greenpipe® systems are suitable for all different qualities of potable water.

The environmentally friendly and hygienically enhanced potable water pipe system made from fusiolen® is biologically and chemically harmless. The extensive suitability of the **aquatherm** piping systems has been evident worldwide for over 30 years.

The **aquatherm** pipe systems hold numerous international certificates and listings, including:

- NSF, ICC, IAPMO, ASTM (USA)
- CSA, BNQ (Canada)
- DVGW, SKZ (Germany)
- AENOR (Spain)
- ÖVGW (Austria)
- WRAS (UK)
- SVGW (Switzerland)
- KIWA (Netherlands)
- SAI-Global (Australia)
- CRECEP (France)
- SII (Israel)
- SIRIM (Malaysia)
- TIN (Poland)
- LNEC (Portugal)
- SITAC (Sweden) … and many more!

These certifications testify to the high quality standard of the **aquatherm** products.

The expected service life of **aquatherm** pipes is more than 50 years. Peak temperatures of 212°F (100°C) arising from short disruptions will not cause the system to fail.

Permanent temperatures from 180°F (82°C) up to 194°F (90°C) can cause limited reduction to the service life of the pipe (see "Working pressure" tables, page 1.07).

Using **aquatherm** pipes for heating applications within the pressure and temperature conditions given in the "Working pressure" tables will yield at least the projected service life, probably longer.

Raw fusiolen PP-R granules.

Pipe labels and sizing

All **aquatherm** piping systems are manufactured based on metric units of measurement. In order to make the systems more intuitive to the North American market, **aquatherm** has converted each of its standard pipe sizes into a nominal Imperial unit, based on comparable size and flow rate. The following table gives the accepted nominal Imperial size for each metric size of pipe. Unless additional engineering allows for a downsizing of the pipe, **aquatherm** recommends using this nominal pipe sizing as an equivalent to systems made from other materials.

Manufactured Metric OD	Equivalent Imperial ID
16mm	⅜"
20mm	½"
25mm	¾"
32mm	1"
40mm	1 ¼"
50mm	1 ½"
63mm	2"
75mm	2 ½"
90mm	3"
110mm	3 ½"
125mm	4"
160mm	6"
200mm	8"
250mm	10"

Note: *The units have been converted from sizing based on OD to sizing based on ID. Metric OD will always be printed on the pipe and fittings.*

Working pressure

The following tables illustrate the permissible working pressures of the **aquatherm** piping systems based on a 50-year life cycle. The balance between working pressure and operating temperature varies based on the wall thickness of the pipe, as well as the presence of a faser-composite layer. All wall thicknesses are determined by SDR (standard dimension ratio) in which the wall thickness is a ratio of the total diameter. For example, the wall of an SDR 6 pipe is 1/6 the total diameter of the pipe.

Potable water installations

Temperature	aquatherm greenpipe® pipe SDR 11	aquatherm greenpipe® pipe SDR 7.4	aquatherm greenpipe® faser-composite pipe SDR 7.4
	Permissible working pressure (psi)		
70°F	185	295	355
105°F	135	210	255
120°F	110	175	215
140°F	95	145	175
180°F	40	100	100

SDR = Standard Dimension Ratio (diameter/wall-thickness ratio).
Working pressure is valid for all pipe sizes of the same SDR.

Hydronic and industrial applications (water only, consult aquatherm for use with other fluids)

Conditions	climatherm® faser-composite pipe SDR 11	aquatherm greenpipe® pipe SDR 7.4	aquatherm greenpipe® faser-composite pipe SDR 7.4
	Permissible working pressure (psi)		
160°F (71°C) operating, plus up to 60 days at 175°F (80°C)	105	130	160
160°F (71°C) operating, plus up to 60 days at 195°F (90°C)	70	85	110
200°F (93°C) maximum	20	35	40

SDR = Standard Dimension Ratio (diameter/wall-thickness ratio).
Working pressure is valid for all pipe sizes of the same SDR.

Compressed air pressure ratings

Aquatherm piping systems are excellently suited to compressed air applications, due to their high creep strength and non-corroding composition.

For systems with no control on the air temperature, use 50% of the system's maximum working pressure as the compressed air rating. If the air input can be kept under 100°F, use 75% of the system's maximum working pressure as the compressed air rating.

Ecology

From its beginning, **aquatherm** has always taken environmental protection seriously. Products such as the aquatherm greenpipe® system feature not only a long service life, but also excellent environmental and ecological compatibility.

Since the foundation of the company in 1973, **aquatherm** has worked hard to ensure that its products and manufacturing processes do not pollute earth's sensitive ecosystems and to develop fully recyclable materials which can be added, waste-free, to new production.

Long before environmental protection was recognized as a global issue, the aquatherm greenpipe® system fulfilled the high ecological standards which are demanded today.

For over 35 years **aquatherm** has applied its philosophy that ecological and economic interests should not be contradictory, neither during production and sales, nor in the application of the product.

The environmentally friendly raw material fusiolen® **PP-R** is used to manufacture the aquatherm greenpipe® system. To ensure its environmental compatibility, the basic material polypropylene, as well as all contained additives (color pigments and stabilizers), are extensively tested, not only by **aquatherm's** own laboratory, but also by independent researchers.

Their results show that the material fusiolen® **PP-R** and the aquatherm greenpipe® system, comply with the highest ecological standards and are thus "future-oriented."

Primary ecological advantages:

- PVC-free
- The additive share of the fusiolen® material is below 3%
- Free from heavy metals that are hazardous to human health such as Cu, Pb, Ni, and Fe
- Longer lasting
- Recyclable
- Energy efficient
- Natural insulation value
- Low-emissions

Aquatherm and LEED

There are many environmental and performance benefits that come from using **aquatherm** piping systems instead of the current industry standards. These benefits come from fusiolen® **PP-R**'s low environmental impact and lengthy service life. The United States Green Building Council and Canadian Green Building Council have established "Leadership in Environmental and Energy Design" programs to help encourage developers to make environmentally responsible choices.

The LEED program has been widely adopted by both the United States and Canada as a point system to reward engineers, architects, contractors and developers who go beyond normal measures to make their projects more environmentally friendly.

Switching from industry standard systems to **aquatherm** can help a project earn LEED credits in a variety of fields, including improved air quality, water management, and innovation in design.

Refer to the **aquatherm** LEED Reference Guide for details.

Worldwide success

This environmentally friendly and innovative pipe technology has proven itself worldwide in more than 70 countries.

In fact, fusiolen® **PP-R** is the only material approved by Greenpeace International as a future–friendly product.

System properties

Hygienic suitability

Pure drinking water is vital to our health. A piping system should transport water without degrading it in any way. The aquatherm greenpipe® system is chemically inert and does not in any way alter the quality of the water passing through it (no heavy metals or VOC's). And since the connections are made using heat fusion of the polypropylene material, there are no harmful chemicals in the water from solvent cements, glues, fluxes, or solders.

The aquatherm greenpipe® and climatherm® systems do not support the formation of mineral deposits, and are opaque, so as to not promote microbiological growth. Harmful chemicals will not leach from the pipe wall into the water. The water delivered to the faucet or appliance is always the same quality as it was when it entered the system.

Material

The aquatherm greenpipe® system meets the requirements of NSF Standard 14 and NSF Standard 61, showing that they are safe for direct contact with drinking water. In addition, the material has been tested to NSF 51 and is acceptable for direct food contact and food processing applications up to 212 °F. The piping system and materials meet the stringent requirements for strength, material quality, dimension, damage resistance, marking, and quality control of ASTM F2389 and CSA B137.11.

Fusion connections

The joining method requires no additives such as solvents, glues, or solder. The connections are made by socket, fusion outlet, butt, and electrofusion.

Potable water and food safe

The **aquatherm** piping systems are made from the same type of polypropylene used in high-purity systems, making them ideal for potable water and food-grade applications. The fusiolen® **PP-R** will never leach chemicals into its medium, keeping food and water safe for human consumption.

UV-resistance

Pipes made from fusiolen® **PP-R** and fusiolen® **PP-R C** are normally not installed where they will be subject to UV-radiation.

The aquatherm greenpipe® and climatherm® pipes come from the factory packed in UV-resistant bags, which protect the pipes until they are removed. All aquatherm greenpipe® and climatherm® pipes and fittings have UV-stabilizer to bridge transport and installation times. Maximum recommended storage time exposed to UV-radiation is 6 months.

For the application in open sunlight, **aquatherm** offers composite pipes with UV-protective layer. Faser-composite pipes with UV-protection can be ordered with Art.-No. 0670758 - 0670788 and Art.-No. 2670758 - 2670788 (see page 6.5 - 6.6).

Sound insulation

The **aquatherm** piping systems provide excellent sound dampening and insulate against the noise created by water flow and hydraulic shock. The sound generated and carried by the pipes is much less than that of other piping systems, adding to the comfort of the building's occupants.

Flame Spread Index

The Flame Spread Index gives a relative indication of how quickly a material will allow fire to move along it. Testing is done per CAN/ULC-S102.2 in Canada and ASTM E84 in the US. The aquatherm greenpipe® and climatherm® pipe systems both have an FSI of less than 25. This makes the pipes suitable for most applications, but a review of local requirements is always necessary.

Smoke Development Index

While much of the danger of a fire comes from the gas toxicity of the products of combustion, this is not a concern with aquatherm greenpipe® and climatherm®. The smoke produced by **aquatherm** piping materials is mostly water vapor, and is not dangerous to people or animals. However, the test standards used in today's codes were developed over 50 years ago and do not account for this significant difference. So while not a health issue, the SDI values for standard aquatherm greenpipe® and climatherm® are between 100 and 150. It is important to address this issue where applicable.

The SDI is normally only a concern when a pipe is exposed in a high-rise application, or when the pipe is installed in a return-air plenum. When the pipe is installed behind a gypsum wall board, SDI is not required. The required SDI requirements can be met in a number of ways:

1. **aquatherm** offers several versions of its piping systems that meet the SDI requirements. These are addressed in the next section.
2. Route piping inside of non-fire rated interior walls or conceal it behind a gypsum board finish.
3. Avoid using a return-air plenum. Return-air plenums introduce a number of health and safety issues into a building including Indoor Air Quality issues. IAQ issues include mold and dust buildup in the plenums compounded by the fact that plenums, are nearly impossible to clean. Fires can easily spread to plenums and then to the rest of the building quickly. Fires are difficult to fight once in a plenum. Therefore, for health and safety reasons, **aquatherm** recommends that air for ventilation and comfort be ducted to and from each space and return-air plenums should not be used.

Flame and smoke rated options

For applications where the code requires the pipe to meet an FSI of 25 and SDI of 50 **aquatherm** has developed and tested several solutions.

For most cases, the aquatherm greenpipe® **Advanced** and climatherm® **Advanced** are acceptable solutions. The flame rating on the thermal barrier protects the main lengths of the pipe from combustion, reducing the overall volume of smoke produced. The **aquatherm Advanced** systems are tested and listed with the pipe lengths covered and the fittings uncovered, to simplify the installation process.

It is important to remember that the fusiolen® **PP-R** is non-toxic, even during combustion. In a fully developed fire, the **aquatherm** piping systems only produce CO_2 and H_2O_{gas}, so the exposed fittings will not pose any danger to the building's occupants.

Fire stopping

Polypropylene is a combustible material and must be treated as such. Standard fire protection regulations need to be met, just as with other piping materials.

Generally, when penetrating a fire-rated assembly, fire stopping must be used to give the pipe a fire rating that matches the rating of the assembly. However, building code requirements vary greatly between areas. For information regarding fire stopping for **aquatherm** products in a particular area, please contact our technical staff by e-mail: ***technical@aquathermpipe.com***

It is critical that fire stopping issues be addressed early in the design and construction of a project.

Please contact your fire stopping system manufacturer for current listing and installation requirements. A list of manufacturers who have tested and listed their products for use with **aquatherm** piping systems can be found at: ***www.aquathermpipe.com***

Advantages

Uniformity

The system includes all necessary pipes, valves and fittings for a complete installation from the water meter up to the last tap. Mixed installations are things of the past.

Longevity

The aquatherm greenpipe® and climatherm® systems resist the scaling and corrosion that reduces the performance of other piping systems. The walls of the **PP-R** piping systems generate less friction than other systems, eliminating the abrasion that can cause pin-holing and shorten the life cycle of the pipe. The heat-fusion joints maintain the same properties as the pipe itself, so physical stresses will not damage their integrity. Overall, the **aquatherm** piping systems last longer with less maintenance than other systems, adding greater value to each installation.

Simplified installation

The aquatherm greenpipe® and climatherm® systems offer a unique and unrivaled connection process: material union by heat fusion. The short welding times speak for themselves: ½" ID - 20 mm OD = 5 sec. Fusion connections can be pressure tested or put into operation almost immediately after their fusion. There are no extended waiting times. See page 3.05 for a complete list of connection times.

Quality

All of **aquatherm's** many national and international certifications speak volumes regarding its quality and performance, but the satisfaction of **aquatherm** clients, installers, and planners says even more.

For more details regarding quality and certificates see chapter 2.

Value

By integrating industry-leading strength and reliability with stable and economic pricing, **aquatherm's** piping systems allow building owners to improve the quality of their piping systems while increasing their bottom line.

Faser-composite technology

To increase maximum operating temperatures and overall performance, **aquatherm** developed a revolutionary manufacturing method: faser-composite technology. The faser-composite material is a mixture of special fiberglass and fusiolen® **PP-R**. This material is extruded as the middle layer of the pipe. This layer allows the pipe to remain rigid at high temperatures without sacrificing any of the other benefits of the pipe.

Shatter resistant

Unlike other rigid plastics, which shatter under impact, **aquatherm's** piping systems remain flexible and resilient at normal operating temperatures. Whether hit by a high-speed projectile or struck by a slower, heavier object, **aquatherm** piping systems will not shatter. Even if brought to the breaking point, systems made from fusiolen® **PP-R** will only flatten and split, rather than throwing dangerous shrapnel. This makes the pipe extremely safe to use, even in high-risk applications.

An unmatched guarantee

As proof of **aquatherm's** demanding quality standards, all properly installed **aquatherm** pipe systems carry a 10-year warranty for pipe and fittings with a combined personal injury and property damage liability coverage of up to €13.5 million per damage event. This warranty also covers any incidental damage caused by material failure.

Note: *Warranty only valid if installed by an* **aquatherm***-trained and certified installer, using* **aquatherm***-approved tools. A final pressure test report must be submitted to verify proper installation.*

Installation types

The **aquatherm** pipe systems are applicable for all common types of installation:

Distribution network for domestic water and heating in residential buildings.

Front wall installation.

Manifold heating installation.

Concealed installation.

Surface installation.

The **aquatherm** piping systems offer the perfect method for all types of installations. The fusion connections are quick, reliable, and simple. The light-weight pipe and fittings make it possible to prefabricate assemblies.

With an extensive product range of pipe and fittings from ⅜" - 10" external diameter and more than 450 fittings, including transition fittings with NPT-threaded brass or stainless steel inserts, **aquatherm** offers ideal solutions for all fields of application.

Installation principles

All risers and distribution pipes are designed and planned as usual, but the aquatherm piping systems offer a number of advantages to reduce installation times and material costs.

1. Distribution piping with composite pipes

The increased dimensional stability of the **aquatherm greenpipe®** and **climatherm®** faser-composite piping systems allows for wider hanger spacing than other plastics (see page 4.3).

Fusion outlets (tee taps) generally replace reducing tees for branches, allowing the take-offs to be installed after the main lines. This often makes installation faster and simpler.

Because fewer fittings are needed in **aquatherm greenpipe®** or **climatherm®** systems (when compared to other piping materials), the number of connections is reduced and so is the required time for installation.

With careful planning, **aquatherm greenpipe®** and **climatherm's®** sturdy, lightweight materials are ideal for pre-fabrication, another time saver on the job site.

2. Floor distribution with distribution blocks

The distribution blocks also offer further installation options: A simple opening of a side branch by drilling (18 mm bit) enables the connection of an additional pipe.

For further information concerning installation of the **aquatherm** piping systems, see chapter 4.

Chemical resistance

Due to their special material properties, aquatherm greenpipe® and climatherm® pipes and fittings are generally chemical resistant. However aquatherm greenpipe® transition elements with brass inserts are not suitable for all media.

For industrial applications using **aquatherm** piping systems, it is advisable to use connections and valves that are strictly polypropylene (see chapter 6).

To find out if the pipe is suitable for a specific application, fill out the chemical inquiry form below and submit it to an authorized Aquatherm representative.

NOTE:
If required, threaded stainless steel inserts for aquatherm greenpipe® transition pieces are available.

*For your convenience, the following form may be photocopied and sent in by fax, or a digital version of this form is available on our web site at **www.aquathermpipe.com**.*

Inquiry for the chemical resistance of the aquatherm greenpipe® / climatherm® pipe systems

aquatherm
U.S. Technical Department
P.O. Box 777 Provo, UT 84606
Phone: (801) 805-6657
Fax: (801) 494-1053

Canada Technical Department
P.O. Box 2624 Cardston AB T0K 0K0
Phone: (403) 653-4440
Fax: (403) 770-8326

Installer:

Company: _____

Contact _____

Street _____

City/State/Zip _____

Phone _____

Fax _____

E-mail _____

Building Project:

Street _____

City _____

Place, Date / Signature

E-mail: technical@aquathermpipe.com
Web site: www.aquathermpipe.com

Field of application:

Fluid transported:

Operating temperature [°C and/or°F]: _____

Working pressure [mbar and/or psi]: _____

Service life [h/d]: _____

Concentration [%]: _____

Ambient medium:

Ambient temperature [°C and/or°F] _____

Ambient pressure [mbar and/or psi] _____

Data Sheets	enclosed	not enclosed
Fluid transported	☐	☐
Ambient medium	☐	☐

Chapter 2:
Quality Assurance

Laws, regulations and decrees

Compliance with the system standard
Quality management system

System control
Internal control

Test and acceptance of incoming goods
In-process inspection
Process control
Final inspection and testing

External control
Storage, packing, dispatch

Test certificates

aquatherm

Standards, regulations and listings

The following North American standards and listings are applicable to **aquatherm** piping systems.

- **NSF Standard 61 (C.HOT 180°F/82°C)**
  Suitable for potable water
- **NSF Standard 14**
  Certified non-toxic
- **NSF Standard 51**
  Suitable for food processing up to 212°F (100°C)
- **CFIA #A508**
  Canadian Food Inspection Agency approval #A508
- **ICC ESR-1613**
  Polypropylene pipe and fittings meet or exceed North American standards
- **DIN EN ISO 9001**
  Quality management systems: requirements
- **IPC 2006 Sec. 605**
  Water distribution
- **IPC 2006 Sec. 605**
  Water service
- **IMC 2006 Chapter 12**
  Hydronic piping
- **IRC 2006 Chapter 21**
  Hydronic piping
- **IRC 2006 Chapter 26**
  Plumbing
- **ASTM F2389**
  Standard specification for pressure rated polypropylene (PP) piping systems
- **CSA B137.11**
  Polypropylene (PP-R) pipe and fittings for pressure applications
- **CSA B214**
  Polypropylene (PP-R) pipe and fittings for hydronic applications
- **BNQ 3660-950**
  Safety of products and materials in contact with drinking water
- **ISO 15874 ff**
  Plastic pipe system for hot and cold water installation: polypropylene
- **ASTM F2023**
  Standard test method for evaluating the oxidative resistance of crosslinked polyethylene (PEX) tubing and systems to hot chlorinated water
- **ASTM D 635**
  Standard test method for rate of burning and/or extent and time of burning of plastics in a horizontal position
- **aquatherm** technical information

Compliance with the system standard

Various national and international independent authorities and institutions confirm **aquatherm's** quality standard.

aquatherm quality management system

Internal control

System control

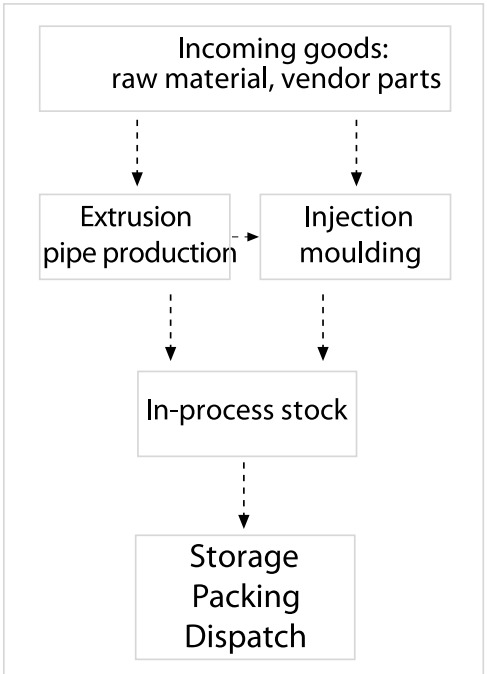
Test and acceptance →

In-process inspection
Process monitoring →

Final inspection

- dimensional control
- surface finish
- melt flow index
- impact bending test
- heat reversion test
- homogenity
- hygienical and toxicological test

→



System control

The production of a quality-controlled pipe system demands supervision, regulation, and control in all steps of the process. All results and processes have to be documented.

This requires:

- testing and acceptance of incoming goods
- process control at all stages
- in-process inspection and testing
- final inspection and testing

Relevant regulations and standards for the quality control of potable water pipe systems are established by:

- NSF
- CSA
- CFIA
- ASTM
- ICC
- IAPMO
- ISO
- DIN

These standards and guidelines detail the minimum requirements for internal control.

Conformance to these standards is verified by independent institutes in the form of internal audits and laboratory tests.

Many years of experience in the extrusion and injection moulding industries have made **aquatherm** the market leader and pioneer in manufacturing polypropylene piping systems.

This experience is reflected by demanding quality-control standards and carefully established procedures, which are meticulously documented and proven by the consistent and superior quality of **aquatherm's** products.

TÜV CERT
DIN EN ISO 9001:2000
Zertifikat: 01 100 5348

Internal control

Trained and qualified employees and a modern, well-equipped laboratory ensure that all tests are carried out and regulations are complied with in accordance with the quality-control policy, including:

- control of inspection, measuring, and test equipment
- process and production control
- receiving inspection and testing
- in-process inspection
- final inspection

All internal quality controls are documented and recorded in accordance with the quality-control policy.

To ensure consistent performance, **aquatherm** produces all of the fusiolen® **PP-R** material used in the production of its piping systems, accepting only the highest quality of raw polypropylene. By manufacturing its own resin for the extrusion process, **aquatherm** virtually eliminates the possibility of material failure.

All the metal inserts used in **aquatherm's** transition fittings are machined in the **aquatherm metal** facility, where each piece is designed and engineered to meet the exacting quality standards that **aquatherm** demands.

Test and acceptance of incoming goods

All incoming goods are subject to testing. This ensures that incoming products conform to specified requirements. Goods which have not been tested are not released for production. Goods which fail the testing in any way are rejected and returned to the supplier.

In-process inspection and testing

The quality-control standards require that tests and inspections are carried out before and during production. At the start of production all quality-relevant data is checked by the quality assurance department. Preproduction samples are tested by the laboratory technicians for:

- surface finish
- dimensional accuracy of the test samples
- data from extrusion and injection moulding machines

The goods will be released for production only if optimal test results are achieved. These tests are carried out at the beginning of each production series to ensure perfect system quality.

Process control

Ultrasonic measurement and process data recording in the field of extrusion are only two examples of **aquatherm's** extensive quality-control process.

This equipment enables constant observation and control of production.

Ultrasonic waves automatically measure and report any deviations in tolerance to the cutting device on the extrusion machine so that the sizing controls can automatically isolate a substandard product. This ensures that only perfect quality products are packed and stored.

All data received during production is analyzed in detail.

Final inspection and testing

The quality-control standards require that inspections be carried out on all finished products and tests performed on samples from every production run. The results are documented in test reports. Finished products are only released to stock when all tests and inspections conform to the prescribed procedures and specifications.

The final inspection and test includes time lapse test procedures. This enables statements regarding the usability of the products in their later field of application.

These tests are used for quality assurance during production and product development. They allow **aquatherm** to discover and remove any potential weaknesses.

The results document the system quality and optimize the manufacturing processes. The final inspection and test covers the following test procedures:

- dimensional control
- surface finish
- measurement of the melt flow index
- impact bending test
- heat reversion test
- homogeneity of the material
- internal pressure test

In addition to the tests mentioned above, daily hygiene tests in accordance with international guidelines are carried out in the company's own sensory analysis laboratory.

External control

External supervision consists of tests with a defined scope in defined intervals. The respective supervising institutions appoint authorized test organizations to carry out these tests.

The external supervision includes:

- external tests of the products
- internal audit of **aquatherm's** quality assurance system and test procedures
- calibration of the test equipment
- hygiene and toxicity tests

The results of the supervisory visits as well as external tests made on pipe and fitting samples are confirmed to **aquatherm** with test certificates.

In addition to the extensive quality-assurance testing conducted by **aquatherm** at its production facilities, independent third-party auditing is carried out by NSF International. NSF conducts four unannounced plant inspections each year, verifying the materials, processes, quality control, and piping system performance are in accordance with national and international consensus standards.

NSF is an independent, non-profit, third-party organization that certifies piping products in accordance with national and international consensus standards related to public health and safety.

Storage, packing and shipping

Upon successful release, the products are stored in suitable warehouses.

Internal instructions control the method of packing, storage and dispatch of the products. The warehouse staff ensures that the product is properly stored.

NSF International

RECOGNIZES

AQUATHERM GMBH
GERMANY

AS COMPLYING WITH NSF/ANSI 14.
PRODUCTS APPEARING IN THE NSF OFFICIAL LISTING ARE
AUTHORIZED TO BEAR THE NSF MARK.

Certification Program Accredited by the American National Standards Institute

Certification Program Accredited by the Standards Council of Canada

This certificate is the property of NSF International and must be returned upon request. To verify Certification, call 800 NSF-MARK or 734 769-8010.

April 25, 2003
Certificate# 03850 - 01

Mark L. Jost, Senior V.P., Water Systems
Water Distribution Systems

NSF International

RECOGNIZES

AQUATHERM KUNSTSTOFF EXTRUSIONS- UND SPRITZGIEßTECHNIK
GERMANY

AS COMPLYING WITH NSF/ANSI 51.
PRODUCTS APPEARING IN THE NSF OFFICIAL LISTING ARE
AUTHORIZED TO BEAR THE NSF MARK.

Certification Program Accredited by the American National Standards Institute

Certification Program Accredited by the Standards Council of Canada

This certificate is the property of NSF International and must be returned upon request. For the most current and complete information, please access NSF's website (www.nsf.org).

NSF International

RECOGNIZES

AQUATHERM GMBH
GERMANY

AS COMPLYING WITH ANSI/NSF 61.
PRODUCTS APPEARING IN THE NSF OFFICIAL LISTING ARE
AUTHORIZED TO BEAR THE NSF MARK.

NSF

Certification Program Accredited by the American National Standards Institute

Certification Program Accredited by the Standards Council of Canada

This certificate is the property of NSF International and must be returned upon request. To verify certification, call 800 NSF-MARK or (1) 734 769-8010.

May 25, 2001
Certificate# 03850 - 01

Ronald M. Coiner, General Manager
Water Distribution Systems

DVGW

DVGW Zertifizierungsstelle

Zertifikat über ein DVGW Prüfzeichen
certificate for a DVGW test mark

DW-8501AS2120

Anwendungsbereich *field of application*	Produkte der Wasserversorgung *products of water supply*
Zertifikatinhaber *owner of certificate*	aquatherm GmbH Kunststoff- Extrusions- und Spritzgießtechnik Biggen 5, D-57439 Attendorn
Vertreiber *distributor*	aquatherm GmbH Kunststoff- Extrusions- und Spritzgießtechnik Biggen 5, D-57439 Attendorn
Produktart *product category*	Verbinder und Installationssysteme: Trinkwasserinstallationssystem (8501)
Produktbezeichnung *product description*	System bestehend aus Rohren aus PP-R (80) und Verbindern aus PP-R für die Trinkwasserverwendung, PN 20
Modell *model*	FUSIOTHERM
Prüfberichte *test reports*	Mechanik: 46825/01 vom 24.01.2002 (SKZ) Hygiene: C 603/00/st vom 30.03.2000 (WHY)
Prüfgrundlagen *basis of type examination*	DVGW W 534 (01.09.1995) BGA KTW (07.01.1977)
Ablaufdatum / AZ *date of expiry / file no.*	14.02.2007 / 02-0104-WNV

07.03.2002

DVGW Deutsche Vereinigung des Gas- und Wasserfaches e.V.
Technisch-wissenschaftlicher Verein
Zertifizierungsstelle
Josef-Wirmer-Straße 1-3
D-53123 Bonn
Telefon +49 (228) 91 88-807
Telefax +49 (228) 91 88-993

DVGW

DVGW Zertifizierungsstelle

DVGW-Baumusterprüfzertifikat
DVGW type examination certificate

DW-8501AU2224

Anwendungsbereich *field of application*	Produkte der Wasserversorgung *products of water supply*
Zertifikatinhaber *owner of certificate*	aquatherm GmbH Kunststoff- Extrusions- und Spritzgießtechnik Biggen 5, D-57439 Attendorn
Vertreiber *distributor*	aquatherm GmbH Kunststoff- Extrusions- und Spritzgießtechnik Biggen 5, D-57439 Attendorn
Produktart *product category*	Installationssysteme und Systemverbinder: Trinkwasserinstallationssystem (8501)
Produktbezeichnung *product description*	System aus Kunststoffrohr PP-R 80 und Fittinge aus PP-R 80
Modell *model*	FUSIOTHERM
Prüfberichte *test reports*	Mechanikprüfung: 146703/2.1/62509 vom 22.04.2004 (SKZ) Mechanikprüfung: 146703/2.3/62512 vom 22.04.2004 (SKZ) Mechanikprüfung: 146703/2.4/62513 vom 22.04.2004 (SKZ) Mechanikprüfung: 32420/97-I vom 14.02.1997 (SKZ) Mechanikprüfung: 146603/2.1/62508 vom 02.03.2004 (SKZ) Hygieneprüfung: C-107711-03-Ko vom 03.07.2003 (WHY) Hygieneprüfung: W 1466/2001/G vom 06.07.2001 (WHY)
Prüfgrundlagen *basis of type examination*	DVGW W 534 (01.09.1995) DVGW W 544 (01.06.1999) BGA KTW (07.01.1977) DVGW W 270 (01.11.1999)
Ablaufdatum / AZ *date of expiry / file no.*	25.06.2009 / 04-0290-WNV

09.07.2004

DAT-ZE-0006/90-11

DVGW

Zertifizierungsstelle

Zertifikat über ein DVGW Prüfzeichen

certificate for a DVGW test mark

DW-8201AT2414

Anwendungsbereich *field of application*	Produkte der Wasserversorgung *products of water supply*
Zertifikatinhaber *owner of certificate*	aquatherm GmbH Kunststoff- Extrusions- und Spritzgießtechnik Biggen 5, D-57439 Attendorn
Vertreiber *distributor*	aquatherm GmbH Kunststoff- Extrusions- und Spritzgießtechnik Biggen 5, D-57439 Attendorn
Produktart *product category*	Verbundrohre für die Trinkwasserinstallation: PP/Al/PP-Rohr, Fert.-Gr. 1 (8201)
Produktbezeichnung *product description*	Verbundrohr PP-R/Al/PP-R
Modell *model*	fusiotherm Stabi-Verbundrohr
Prüfberichte *test reports*	Mechanikprüfung: 195402/2.1/50476 vom 15.01.2003 (SKZ) Hygieneprüfung: C-100297-02-Ko vom 14.10.2002 (WHY)
Prüfgrundlagen *basis of type examination*	DVGW W 542 (01.04.1997) BGA KTW (07.01.1977)
Ablaufdatum / AZ *date of expiry / file no.*	07.05.2008 / 03-0137-WNV

05.06.2003 Kos A-1/2

DAT-ZE-009/96-11

DVGW

Zertifizierungsstelle

Zertifikat über ein DVGW Prüfzeichen

certificate for a DVGW test mark

DW-8206AT2415

Anwendungsbereich *field of application*	Produkte der Wasserversorgung *products of water supply*
Zertifikatinhaber *owner of certificate*	aquatherm GmbH Kunststoff- Extrusions- und Spritzgießtechnik Biggen 5, D-57439 Attendorn
Vertreiber *distributor*	aquatherm GmbH Kunststoff- Extrusions- und Spritzgießtechnik Biggen 5, D-57439 Attendorn
Produktart *product category*	Verbundrohre für die Trinkwasserinstallation: PP/Al/PP-Rohr, Fert.-Gr. 2 (8206)
Produktbezeichnung *product description*	Verbundrohr PP-R/Al/PP-R
Modell *model*	fusiotherm Stabi-Verbundrohr
Prüfberichte *test reports*	Mechanikprüfung: 195302/W1.1/50478 vom 17.02.2003 (SKZ) Hygieneprüfung: C-100297-02-Ko vom 14.10.2002 (WHY)
Prüfgrundlagen *basis of type examination*	DVGW W 542 (01.04.1997) BGA KTW (07.01.1977)
Ablaufdatum / AZ *date of expiry / file no.*	07.05.2008 / 03-0137-WNV

05.06.2003 Kos A-1/2

DAT-ZE-009/96-11

ZERTIFIKAT

Süddeutsches Kunststoff-Zentrum

Certificate

The Süddeutsche Kunststoff-Zentrum awards the following company

Aquatherm GmbH
Kunstst.-Extrusions- u. Spritzgießtechnik
Finnentroper Straße 82
57439 Attendorn

the right to use the SKZ testing and inspection sign

A 175

for the following plastic products

Pressure pipes made of PP-R 80
Production group 1 and 2

Users of the SKZ sign are obliged to observe the required regulations for the production and testing of these products.

Würzburg, 17th August, 2000

Institute Director — *Head of the Department*

Translation for information purposes only. The German certificate is authoritative.

ZERTIFIKAT

Süddeutsches Kunststoff-Zentrum

Certificate

The Süddeutsche Kunststoff-Zentrum awards the following company

Aquatherm GmbH
Kunstst.-Extrusions- u. Spritzgießtechnik
Finnentroper Straße 82
57439 Attendorn

the right to use the SKZ testing and inspection sign

A 314

for the following plastic products

Fiber composite pipes made of PP-R 80 / PP-R 80-GF / PP-R 80
Production group 1 and 2

Users of the SKZ sign are obliged to observe the required regulations for the production and testing of these products.

Würzburg, 27th July, 2000

Institute Director — *Head of the Department*

Translation for information purposes only. The German certificate is authoritative.

Chapter 3:
Fusion

aquatherm

Part A: Basic welding tool

1. Use only **aquatherm** recommended tools and welding devices. They are designed with the proper temperatures and dimensions for working with **aquatherm** products.

2. Loosely assemble the cold welding tools by hand. Do not fully tighten the welding heads until the iron has reached its operating temperature.

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 heads on the welding device so that there is 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.

Electric supply:

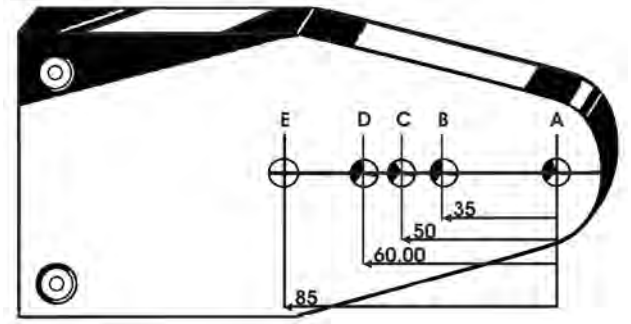
Make sure that the electrical supply used is fully compatible with the welding iron being used. Improper use of any electrical device can cause harm to both the tool and the operator. Make sure any extension cords used are compatible with the power input of the welding devices. Note that fluctuations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

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

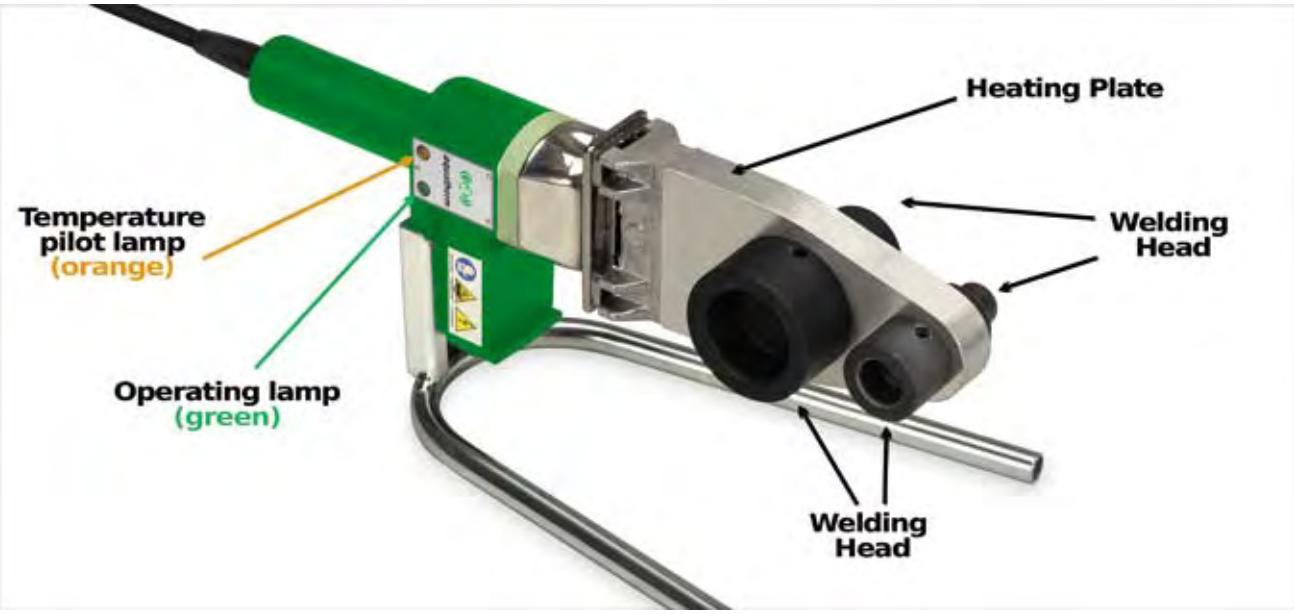
A

Art.-No.	Passage	Hole	Branch	Hole
0130115	¾" (25 mm)	A + E	½" (20 mm)	A + C
0185123	½" (20 mm)	A + B	⅜" (16 mm)	A + C
0185124	½" (20 mm)	A + B	⅜" (16 mm)	A + C

B



Fusion



Part A: Heating phase

7. During the heating phase, tighten the welding heads carefully with the hex wrench.

   Take care that the heads 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 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 fast-indicating surface thermometer or other digital thermometer.

Important: *If the pipe or the air around it is below 40°F (5°C) remember that 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).*

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 primary concern is the irons themselves. The surface temperature of the welding iron and heads will normally be between 400°F (240°C) and 500°F (260°C) during operation, and they can 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. 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.

Part A: Handling

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

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

11. After use, unplug the welding device 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.

12. Protect **aquatherm** welding devices and tools against impurities. Residue from previous fusions may lead to an incorrect connection. After cooling, the tools should be cleaned with **aquatherm** cleansing cloths, Art.-No. 0050193.

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

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

15. Check the operating temperature of the **aquatherm** welding devices regularly by means of suitable measuring instruments.

Part A: Guidelines

16. Fusion welding of joints in **aquatherm green-pipe®** 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.

- 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.

Part A: Checking devices and tools

17. Make sure the **aquatherm** welding devices and tools comply with the guidelines “Fusion Part A.”

18. 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 capable of measuring temperatures up to 650°F (340°C).

Temperature control with a thermometer.

Part B: Preparation for socket fusion

1. Cut the pipe at right angles to the pipe axis. Only use **aquatherm** cutters or other suitable cutting tools.

   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.

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

3. 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.

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

   a. Only use **aquatherm** peeling tools (Art.-No. 0050506-0050524 and Art.-No. 50558-50580) with undamaged peeling blades (Art.-No. 0050440). 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 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.

Cutting the pipe.
Recommendation: Give the pipe a slight twist while cutting.

Marking of the welding depth.

Peeling of the exterior layer.

Peeling only necessary with UV-protected pipe and electrofusion sockets (for electrofusion see 3.12)

Socket fusion welding reference

Pipe diameter		Welding depth		Heating time in sec.		Welding time	Cooling time
Nom. I.D. inch	O.D. (mm)	inch	mm	above +5°C or 40°F	below +5°C or 40°F	sec.	min.
⅜"	16	½"	13.0	5	8	4	2
½"	20	9/16"	14.0	5	8	4	2
¾"	25	⅝"	15.0	7	11	4	2
1"	32	11/16"	16.5	8	12	6	4
1 ¼"	40	¾"	18.0	12	18	6	4
1 ½"	50	13/16"	20.0	18	27	6	4
2"	63	15/16"	24.0	24	36	8	6
2 ½"	75	1"	26.0	30	45	8	8
3"	90	1 ⅛"	29.0	40	60	8	8
3 ½"	110	1 5/16"	32.5	50	75	10	8
4"	125	1 9/16"	40.0	60	90	10	8

Dimensions 6" (160 mm), 8" (200 mm) and 10" (250 mm): *The dimension 6" (160 mm), 8" (200 mm) and 10" (250 mm) are joined by butt-welding. Detailed information on butt-welding can be found on pages 3.16 - 3.18.*

Part B: 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.

Pipes and fittings of the dimensions 2 ½" (75 mm) to 4" (125 mm) can only be welded with welding device Art.-No. 0452341 (or with machine Art.-No. 0450147). When using the **aquatherm** welding machine Art.-No. 0450147, a separate operating instruction must be observed.

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

Heat-up of the single parts.

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

Part B: Setting and alignment

8. After the heating time, quickly remove 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 would reduce the ID 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.

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

Aligning the fitting.

Joining the pipe.

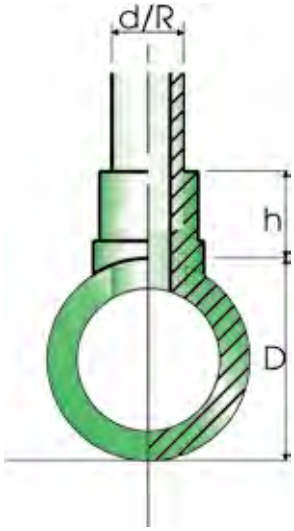
A seamless, inseparable connection.

Part C: Fusion outlets

The aquatherm greenpipe® fusion outlets are available for pipe sizes of 1 ¼” - 10” ID (40 mm - 250 mm OD).

Fusion outlets are used for:

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



Fusion

Part C: Fusion outlets

Size of Pipe / Size of Branch	⅜" 16mm	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" 160mm	8" 200mm	10" 250mm
⅜" (16 mm)	T													
½" (20 mm)	R	T	R											
¾" (25 mm)	R	R	T											
1" (32 mm)	R	R	R	T										
1 ¼" (40 mm)		R/O	R/O	R	T									
1 ½" (50 mm)		R/O	R/O	R	R	T								
2" (63 mm)		R/O	R/O	R/O	R	R	T							
2 ½" (75 mm)		R/O	R/O	R/O	R/O	R	R	T						
3" (90 mm)		O	R/O	R/O	R/O	R	R	R	T					
3 ½" (110 mm)		O	O	O	O	O	R	R	R	T				
4" (125 mm)		O	O	O	O	O	O	R	R	R	T			
6" (160 mm)		O	O	O	O	O	O	R	R			T		
8" (200 mm)		O	O	O	O	O	O	R	R	R	R		T	
10" (250 mm)		O	O	O	O	O	O	R	R	R	R			T

T= Tee available R= Reducing tee available O=Fusion outlet

Fusion outlets with threaded transitions

Pipe size	Thread size		
	½"	¾"	1"
⅜" (16 mm)	R		
½" (20 mm)	T	R	
¾" (25 mm)	R	T	
1" (32 mm)	R	R	T
1 ¼" (40 mm)	O	O	
1 ½" (50 mm)	O	O	
2" (63 mm)	O	O	
2 ½" (75 mm)	O	O	O
3" (90 mm)	O	O	O
3 ½" (110 mm)	O	O	O
4" (125 mm)	O	O	O
6" (160 mm)	O	O	O
8" (200 mm)	O	O	O
10" (250 mm)	O	O	O

*The **aquatherm** fusion outlet gives the installer greater flexibility and peace of mind.*

Fusion outlet with threaded transitions.

Part C: Fusion outlets

1. Prepare tools following the directions outlined on page 3.1 - 3.3.

2. The first step is to drill through the pipe wall at the intended outlet point by using the **aquatherm** drill bit.
   - ½"- ¾" (20-25 mm) branch: Art.-No. 0050940 / 0050941
   - 1" (32 mm) branch: Art.-No. 0050942
   - 1 ¼" (40 mm) branch: Art.-No. 0050944
   - 1 ½" (50 mm) branch: Art.-No. 0050946
   - 2" (63 mm) branch: Art.-No. 0050948

3. The welding device/outlet welding head 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 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.

6. After the welding tool has been removed, immediately insert the fusion outlet into the heated, pre-drilled hole. The fusion outlet should be pressed 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 is fitted into the sleeve on the aquatherm greenpipe® fusion outlets using conventional fusion technology.

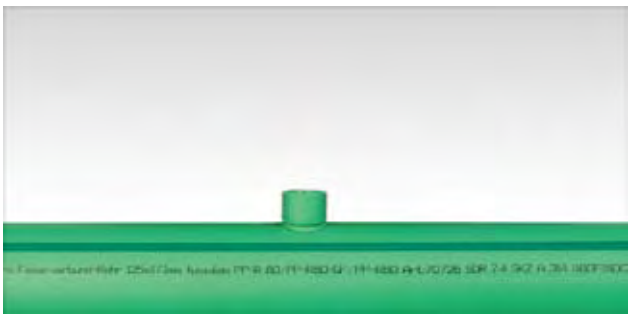
By joining the fusion outlet with the pipe's outer surface and the pipe's inner wall, the connection reaches its maximum strength.

Drilling through the pipe wall.

The welding tool is inserted into the pipe wall.

Heating-up of the pipe and fitting.

Joining.



Ready.

Part D: Manual 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 ½" - 4" ID (25 - 125 mm OD)
- one **aquatherm** welding head for each of the following diameters: 1 ½" - 4" ID (50 - 125 mm OD)
- one welding device Art.-No. 0452341
- one allen key and tool change clamp
- one installation manual

The manual welding machine was specially developed for stationary welding of pipe and fittings with an external diameter of 1 ½" to 4" (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 in sec.		Welding time	Cooling time
Nom. I.D. inch	O.D. (mm)	inch	mm	above +5°C or 40°F	below +5°C or 40°F	sec.	min.
1 ½	50	13⁄16"	20.0	18	27	6	4
2	63	15⁄16"	24.0	24	36	8	6
2 ½	75	1"	26.0	30	45	8	8
3	90	1 1⁄8"	29.0	40	60	8	8
3 ½	110	1 5⁄16"	32.5	50	75	10	8
4	125	1 9⁄16"	40.0	60	90	10	8

Dimensions 6" (160 mm), 8" (200 mm) and 10" (250 mm): *The dimension 6" (160 mm), 8" (200 mm) and 10" (250 mm) are joined by butt-welding. Detailed information on butt-welding can be found on pages 3.16-3.18.*

Part E: Electric welding jig

The **aquatherm** electric welding jig is engineered for use in fabrication shops or on the job site. Its unique clamping system acts both to move the pipe and fittings on and off the welding iron and to hold the pipe and fittings perfectly straight as the fusion connection cools.

1. Assemble the welding jig by following the instructions included in its carrying case. Improper or abusive assembly can cause the sliding clamps to jam. Ensure that all moving and sliding parts are properly lubricated.

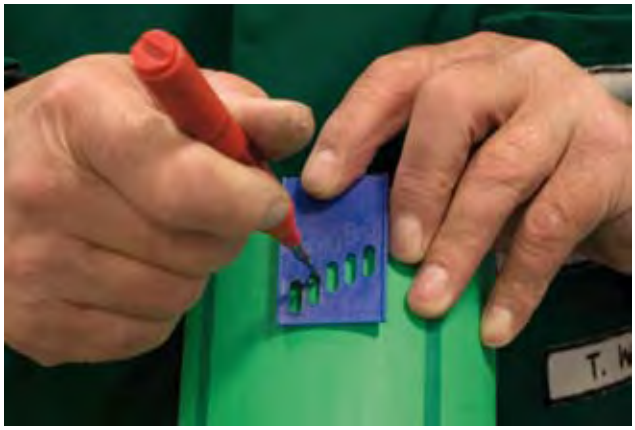
2. Prepare pipe, fittings, and welding iron as directed in parts A and B. Use the blue marking template included with the electric welding jig rather than the green one included with the welding iron.

3. Set the clamps to the proper positions for the size of pipe you will be using and lock them into place. Use the smaller knob located on the side of the clamp to adjust for tightness.

4. Secure the jig to the pipe-end being fused. It is important to secure the pipe at such a depth that it can be properly inserted into the welding tool without the clamp coming into direct contact with the welding head. This is generally ½" to 1" beyond the prescribed welding depth.

5. Secure the fitting tightly against the stop.

Electric Welding Jig.



Marking the pipe.

Setting the clamps.

Securing the jig.

Part E: Electric welding jig

6. Use the forward action of the jig to gently push the pipe and fitting onto the welding iron. If the jig's transmission begins clicking, stop and relax pressure slightly. The larger sizes of pipe and fittings often need time to heat up before they will go onto the welding tools completely. It is best to apply constant low pressure.

Positioning the iron.

7. Once the pipe and fittings have reached the proper welding depths, relax pressure slightly and begin the heating time.

Heating the pipe.

8. Once the heating time is complete, use the reverse action of the jig to pull the pipe and fitting free of the welding iron.

Removing the iron.

9. Use the forward action of the jig to push the pipe and fitting together until the double ring of **PP-R** forms. Leave clamps in place for the prescribed weld time. If the joint is being subjected to undue pressure, the clamps should be left in place for the cooling phase as well.

Completing the weld.

Part F: Electrofusion device

The **aquatherm** electrofusion device was specially developed for electrofusion sockets from ⅜” (20 mm) - 6” (160 mm).

Technical information:

- supply voltage: 110 V (nominal voltage)
- rated frequency: 50 Hz - 60 Hz
- protection class: IP 54

General and 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 (e.g. sun radiation or uncontrolled storage may cause differences in temperature) within the acceptable range of temperature (+41°F to 104°F / +5°C to 40°C).

Part F: Preparation

Carefully follow all the steps in order. 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 electro-fusion socket on the end of the pipe.
4. Peel the surface of both pipes up to the marks thoroughly with a peeling tool (use the peeling tool with the respective pipe diameter).
5. Clean again thoroughly.

Electrofusion device 3/8” (20 mm) - 6” (160 mm).

Electrofusion socket.

Peeling tool (Art.-No. 0050558-0050570, up to 75 mm) (from 3” (90 mm) - 6” (160 mm): Art.-No. 0050572 / 0050574 / 0050576 / 0050580 [without picture]).

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)
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”

Part F: Preparation

Peeling off the outer layer is essential for a proper connection. Damage of the surface such as axial grooves and 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.

Assembling the aquatherm electrofusion sockets

Avoid soiling the pipe and fix all parts securely!

1. Open the protective wrapping of the **aquatherm** 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 minutes after opening of the protective foil.

2. Push the **aquatherm** 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 **aquatherm** electrofusion sockets. Tighten the clamps (if using any).

Make sure the pipes are free from bending or the stress of their own weight within the **aquatherm** electrofusion socket. The socket is 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 sockets must be dry during installation.

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.

Completed electro fusion socket.

Part F: Fusion process

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

2. Set fusion equipment to the proper sizing.

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

4. Start and monitor the fusion process.

Do not move or stress pipe and fitting during the whole 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 strong sun-radiation need longer cooling times.

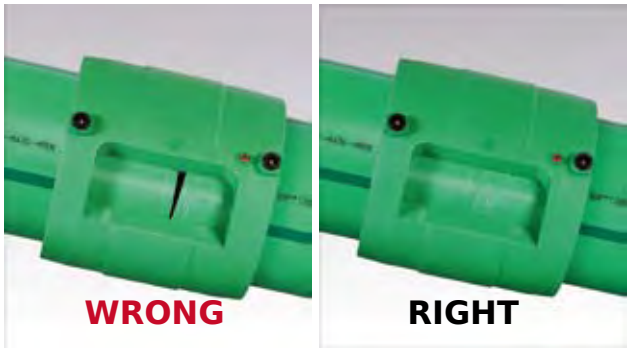
Part F: Working pressure

The **aquatherm** electrofusion sockets are rated up to 300 psi. The relation between working temperature, pressure load and service life is given in the tables “Working pressure” on page 1.7.

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

Kind of stress	Compressive stress	Minimum waiting period
Tension, bend, torsion of unpressurized pipes	N/A	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
Repeating of the welding process	N/A	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 have parallel faces. Follow the minimum welding depth exactly.

Adjust the socket diameter on the welding device. Start and control the welding process. Observe the prescribed cooling time.

Part F: Electrofusion device

For pipe repairs using a **aquatherm** electrofusion 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 free from burrs before starting the process.

Part G: 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 (Art.-No. 0050307 - 0050311) and repair pin (Art.-No. 0060600) are described on page 6.36 and 6.37. 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 made by nails or screws.

1. Assemble the repair tool, following the directions given in part A.

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: ¼" (7mm) and 7⁄16" (11mm). Using a bit that is slightly smaller than the repair tool (3⁄16" for the ¼" pin, ⅜" 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.

It is possible to repair larger holes by using a capped fusion outlet. This will allow you to patch holes up to two inches in diameter.

For larger holes or cracks, it is best to simply cut out the pipe and replace it.

Heating up.

Repair pin.

Cutting.

Part H: Butt-welding of 6” (160 mm), 8” (200 mm), and 10” (250 mm) pipes

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 6” (160 mm), 8” (200 mm) and 10” (250 mm).

The following **aquatherm** pipe series are available:

aquatherm greenpipe® SDR 11 for cold water
aquatherm greenpipe® faser-composite pipe SDR 7.4 (Pat.-No. 10018324, trademark protection no. 39926599 for green/dark green)
climatherm® faser-composite pipe SDR 11

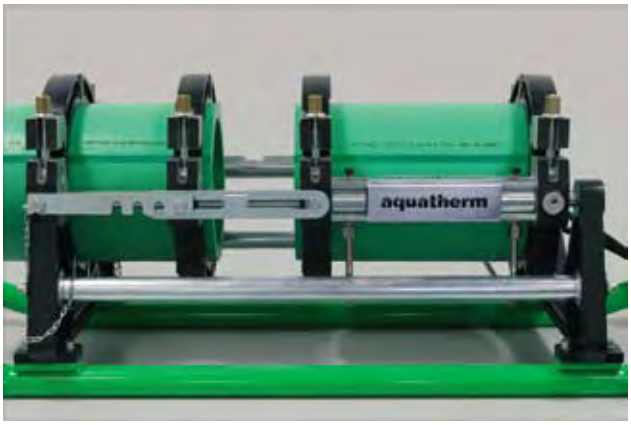
These larger sizes of pipe bring all the advantages of the aquatherm greenpipe® and climatherm® systems to much broader applications, including distribution and risers for residential and commercial applications, as well as hospital, hotels, and industrial applications.

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

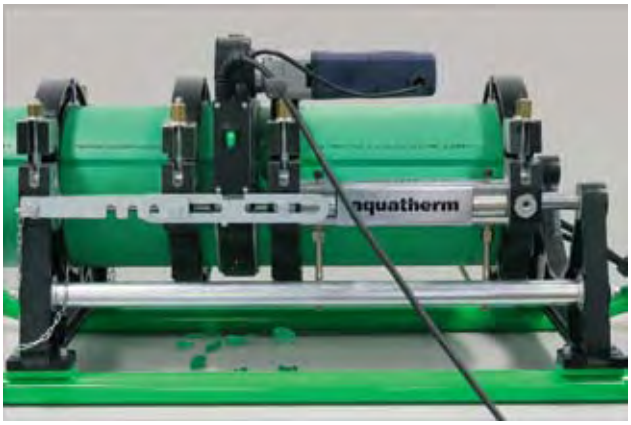
1. Protect your place of work from adverse weather conditions.
2. Check that the welding machine works properly and heat it up.
3. Cut pipes into required length.
4. Make sure pipes are aligned and fixed by means of the clamping devices.
5. Use the milling machine for planing the pipe end to make sure the welding surfaces are smooth and flat.
6. Remove the debris and clean the pipe ends with methylated spirit.
7. Clean the heating element.
8. Check that pipes match (tolerance: max. 0.1 x wall thickness).
9. Check width of gap between the two pipes to be welded (tolerance: max. 0.5 mm).
10. Plug in/turn on.
11. Check the temperature of the heating element (410°F +/- 18°F | 210°C +/- 10°C).

Before welding, the 6” (160 mm), 8” (200 mm) and 10” (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.



Planing the welding surface.

12. 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 manual of the butt-fusion machine).

13. 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 inches (mm):

Pipe Diameter	SDR 7.4	SDR 11
6” (160 mm)	0.06” (1.5 mm)	0.04” (1.0 mm)
8” (200 mm)	0.08” (2.0 mm)	0.04” (1.0 mm)
10” (250 mm)	0.08” (2.0 mm)	0.06” (1.5 mm)

14. 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.

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

16. The welded connection can now be unclamped: the welding process is finished.

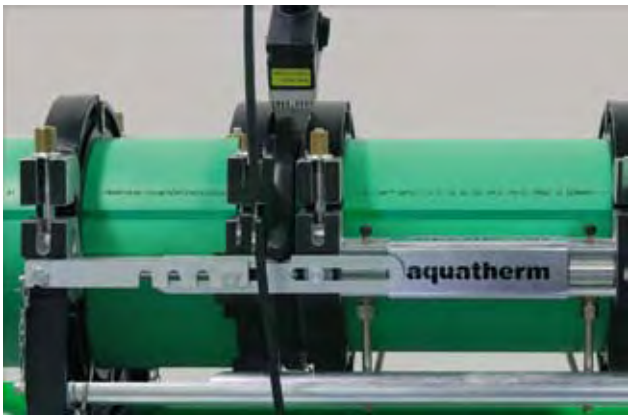
Additionally please follow the instructions given in the operating manual of the welding machine.

Important Note:

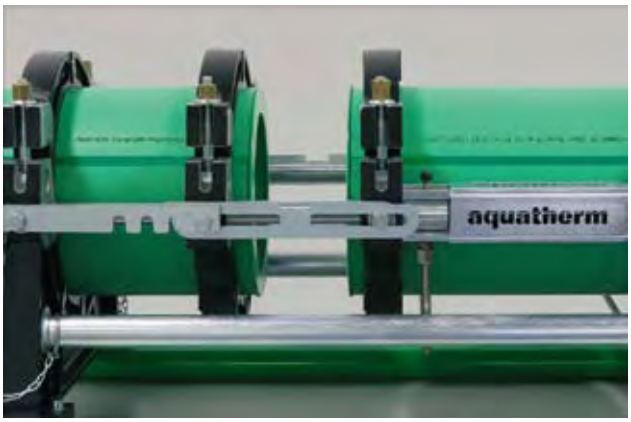
a. The welding machines must be suitable for the welding of pipes with a diameter/wall thickness ratio of up to SDR 7.4. Check with tool manufacturer to ensure that the machine is compatible with **aquatherm** products.

b. 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.

Un-clamp and work on.

Part H: Butt-welding reference

aquatherm SDR 11 piping systems butt-welding reference
fusion temperature: 410°F +/- 18°F (210°C +/-10°C)

Dimension	Adjustment		Heating		Welding (fusion)			Cooling
in. (mm)	**adjustment pressure**	**height of bead (minimum)**	**Heating time**	**Heating pressure**	**max. transition time**	**Time of pressure build-up**	**Welding pressure**	**Cooling time**
6” (160 x 14.6)	155 psi (10.7 bar)	0.039 in. (1.0 mm)	277 sec.	15.95 psi (1.1 bar)	8 sec.	13 sec.	155 psi (10.7 bar)	24 min.
8” (200 x 18.2)	240.76 psi (16.6 bar)	0.039 in. (1.0 mm)	320 sec.	24.66 psi (1.7 bar)	9 sec.	16 sec.	240 psi (16.6 bar)	29 min.
10” (250 x 22.7)	377.10 psi (26.0 bar)	0.059 in. (1.5 mm)	368 sec.	37.71 psi (2.6 bar)	10 sec.	20 sec.	377 psi (26.6 bar)	35 min.

aquatherm SDR 7.4 piping systems butt-welding reference
fusion temperature: 410°F +/- 18°F (210°C +/-10°C)

Dimension	Adjustment		Heating		Welding (fusion)			Cooling
in. (mm)	**adjustment pressure**	**height of bead (minimum)**	**Heating time**	**Heating pressure**	**max. transition time**	**Time of pressure build-up**	**Welding pressure**	**Cooling time**
6” (160 x 22.1)	221.91 psi (15.3 bar)	0.059 in. (1.5 mm)	361 sec.	21.76 psi (1.5 bar)	10 sec.	19 sec.	222 psi (15.3 bar)	34 min.
8” (200 x 18.2)	346.64 psi (23.9 bar)	0.079 in. (2.0 mm)	412 sec.	34.81 psi (2.4 bar)	11 sec.	23 sec.	347 psi (23.9 bar)	42 min.
10” (250 x 22.7)	540.99 psi (37.3 bar)	0.079 in. (2.0 mm)	466 sec.	53.66 psi (3.7 bar)	13 sec.	30 sec.	541 psi (37.3 bar)	52 min.

Part I: aquatherm Advanced Preparation for fusion

The **aquatherm greenpipe® Advanced** and **climatherm® Advanced** systems include a thermal, UV, and vapor barrier, with a thickness ranging from 5⁄16” to 5⁄8”. This barrier serves as suitable insulation in applications where building codes require the pipe the to insulated. In certain applications, the barrier can also help the piping system meet the 25/50 FSI/SDI requirements.

1. Before beginning the fusion process, the barrier covering the part of the pipe that will be fused must be removed.

2. Using the marking guide, mark the proper welding depth on the barrier. Then mark the barrier ½” to 1” further away from the end of the pipe. This second mark will help ensure that the barrier does not come into direct contact with the welding tool.

3. Make an incision lengthwise in the barrier, running from the second mark to the end of the pipe.

4. Using the second mark as a guideline, make a smooth cut around the circumference of the pipe. When finished, pull away the barrier at the end of the pipe, exposing a usable welding surface. It is important to remove enough of the barrier so that it will not be exposed to the welding tools during the fusion process.

5. Once the barrier is removed, proceed with the heat fusion as outlined on pages 3.1 – 3.6, taking care not to damage the barrier.

6. Be sure to check the newly exposed barrier for a complete seal. If the cutting or fusion processes have damaged the bond between the barrier and pipe, it is important to reseal the barrier with a suitable fire-rated tape.

Marking the insulation.

Cutting along the circumference.

Exposed welding surface.

Part I: aquatherm Advanced fusion outlet connections

When using fusion outlets on the **aquatherm greenpipe® Advanced** and **climatherm® Advanced** systems, it is important to properly remove a sufficient amount of the barrier to allow the welding tool to directly contact the pipe. It is also important to protect the barrier from the welding tool, as the heat can damage the barrier.

1. Mark the desired location of the branch on the side of the barrier. Make sure the mark is clearly visible.

2. Using the first mark as the center, make four equidistant marks on pipe, following the diameter given in table A. Two of these marks should follow the pipe lengthwise and the other two should be made crosswise. Trace the outside of these marks to form a complete circle around the first mark.

3. Using a sharp utility knife or similar tool, cut along the outside of the line. Be careful not to damage the barrier while cutting. Use a properly sized cutting guide if necessary.

4. After cutting out the entire circle, remove the barrier from the hole. Use the knife to even out the edges of the cut.

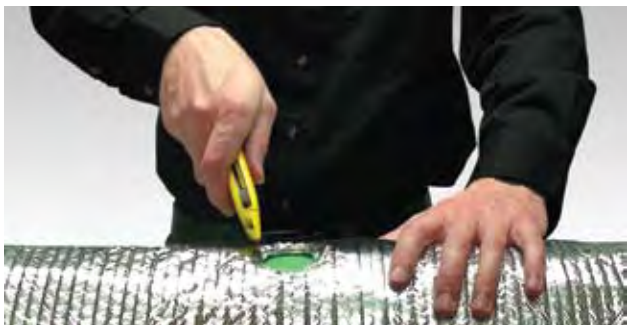
Insulation cut-away diameter

Branch size	Cut-away diameter
½" (20 mm)	1 ½"
¾" (25 mm)	1 ¾"
1" (32 mm)	2"
1 ¼" (40 mm)	2 ½"
1 ½" (50 mm)	3"
2" (63 mm)	3 ¾"

Marking the branch location.

Marking the cut-away diameter.

Cutting along the line.



Removing the insulation.

5. Re-mark the pipe in the exact center of the hole. Use the **aquatherm** drill bit to drill through the pipe wall.
   - ½"- ¾" (20-25 mm) branch: Art.-No. 0050940 / 0050941
   - 1" (32 mm) branch: Art.-No. 0050942
   - 1 ¼" (40 mm) branch: Art.-No. 0050944
   - 1 ½" (50 mm) branch: Art.-No. 0050946
   - 2" (63 mm) branch: Art.-No. 0050948

Drill through the pipe wall.

6. Insert the welding tool on the concave side of the fusion outlet head into the hole until the head is completely in contact with the outer wall of the pipe. Make sure that the welding head and heating iron never come into direct contact with the barrier. The barrier can be protected by covering it with a suitable heat-resistant covering.

Inserting welding tool.

7. Insert the fusion outlet fitting into the heating sleeve until the fusion outlet surface rests against the convex side of the welding head. (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 approximately 30 seconds in normal conditions and 45 seconds in cold weather installations.

Heating pipe and fitting.

8. Remove the welding tool and insert the fusion outlet directly into the hole. Apply pressure for at least 15 seconds. Allow the pipe and fitting to cool for approximately 10 minutes before applying load pressure.

Depending on local energy codes and the interpretations of the authority having jurisdiction, it may be necessary to insulate over the fusion outlet. Be sure to follow all applicable codes regarding proper insulation.

In certain applications, the **aquatherm Advanced** systems can be used to meet flame spread and smoke development requirements.

Welding fusion outlet into place.

Part I: aquatherm Advanced insulating instructions

For speed and convenience, many contractors install the complete **aquatherm** piping system and then cover it with insulation barrier, creating **aquatherm Advanced** on the job site. The **aquatherm Advanced** system can be installed to achieve the flame spread rating and also for thermal requirements.

Creating the **aquatherm Advanced** requires the proper sizes of insulation sheets (found on page 6.8) and the fire-rated tape (article number FT25006).

The following process should be followed to create the **aquatherm Advanced**:

1. Locate the correctly sized sheet of insulation.

2. Line up the edge of the sheet lengthwise with the pipe, making sure that the insulation will run parallel to the pipe. Verify that the marking will be facing away from the pipe.

3. Remove the paper backing from the 3/4” double sided tape and attach the insulation to the pipe. Ensure that the pipe is clean and free of debris before insulating.

4. Wrap the insulation around the pipe, then remove the paper backing from the 3/4” double sided tape and the foil tape.

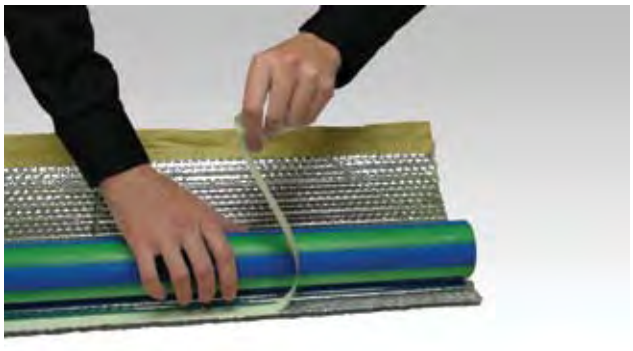
5. Once the insulation is overlapping itself, press down and rub the insulation and tape to ensure a snug smooth fit.

6. Tape the ends of the insulation to the pipe, sealing the insulation using foil tape (Art.-No. FT25006). Adjoining pieces should be installed next to each other and wrap a piece of foil tape around the full circumference.

7. If insulation is required on the fittings, use insulation that provides 1” - 1 1/2” overlap on couplings and tees. Preformed 90° and 45° elbows are available. Tee patterns are also available.

8. Ensure that all exposed edges are taped closed. The system will not perform properly if there are gaps.

Based on the certified testing, the fittings do not need to be insulated to meet smoke and flame ratings. The heat transfer comparison for insulated and uninsulated fittings can be found on pages 5.3 and 5.4. Local codes may require that the fittings be insulated.



Peel paper back from tape.

Wrap insulation and remove backing from foil tape.

Firmly press along seam to seal edges.

Tape adjoining pieces along the seam the entire circumference.

Chapter 4:
Installation Principles

Installation concepts

Support techniques

Support intervals

Installation planning

Linear expansion

Bending side
Expansion loop

Pre-stress
Bellow expansion joint

Length of bending side

Length of bending side with pre-stress

Installation in shafts

Pressure test

Flushing of pipes / Grounding
Transport and storage

Fixture connections

Distribution block plumbing and heating

agatherm

Installation concepts for aquatherm

A New Way of Thinking

The **aquatherm** piping systems offer many innovative technologies and advantages that can greatly improve the speed and ease of installation. Some of these advantages include:

- Fusion connections
- Fusion outlets
- Lightweight material
- Resilient, slightly flexible pipe & connections
- Reduced expansion and contraction

To fully utilize these advantages, a different mindset from metal or even other plastic systems is required.

A Craftsman's Pipe

As a company, **aquatherm** takes pride in the systems they manufacture and expects the same from those installing it. No matter how high the quality of the pipe and fittings, the performance of a system will always depend on how carefully and thoughtfully it is installed.

The **aquatherm** piping systems are designed to look neat and clean when installed, making it easier to expand the system and trace lines.

Planning

As with any system, the speed and accuracy of an **aquatherm** installation is improved with careful planning. Where possible, pre-measure and pre-cut all lengths of pipe, based on their intended part in the system. This will allow for a greater degree of prefabrication and a lower possibility of error.

A Pre-fab Station

Polypropylene is lighter than most other piping materials, and fusion joints adjust easily to reasonable levels of stress from being carried. To take advantage of this, many installers set up a "pre-fab" station on the job site, including a workbench, technical drawings, a welding jig or bench and the appropriate welding tools. This station is used to measure, cut, and prefabricate pipe and fittings for the installation. Use of this station ensures adequate space for tool operation.

Pre-assembly

Connections done in a shop or at the "pre-fab" station on the job site are easier and faster to assemble than connections done on pipe that is already in place. It is possible to greatly speed installation by attaching the appropriate fittings to one end of the pipe before hanging it. Identify the fittings (couplings, elbows, tees, valves) that will go with each length of pipe and fuse them together before hanging the pipe in its proper place. This will allow you to assemble as many as half your connections without any of the complications associated with in-line fusions.

Pre-fabrication

The **aquatherm** piping systems are light, strong, and somewhat flexible, making them ideal for pre-fabrication. When installing **aquatherm** pipe, identify the more complicated assemblies, such as drop 90's, flange adaptors, saddle connections, headers, etc., and assemble them in-shop or at the "pre-fab" station of the job site. Many installers will assemble whole mechanical rooms in-shop and move the entire assembly to the job site.

Support techniques

Pipe clamps for **aquatherm** pipes must be sized to match the external diameter of the plastic pipe.

Take care that the support material does not mechanically damage the surface of the pipe (**aquatherm** pipe clamps Art.-No. 0060516 - 0060654).

The ideal support material for **aquatherm** pipes are rubber-lined pipe clamps. The rubber compounds are specially made for applications with plastic pipes.

Some types of support materials are designed to allow movement and others are designed to restrict movement entirely.

It is important to distinguish whether the support material is being used as

- a fixed point or
- a sliding point

Fixed points

In principle, fixed points are used to divide the pipe into sections, restricting any uncontrolled movement of the pipe.

Fixed points have to be measured and installed in a way that the forces of expansion in **aquatherm** pipes, as well as probable additional loads, are accommodated.

When using threaded rods or threaded screws, the drop from the ceiling should be as short as possible. Swinging clamps should not be used as fixed points.

Vertical distributions can be installed using only fixed points. Faser-composite risers do not require expansion loops, provided that fixed points are located immediately before or after a branch.

To compensate for the forces arising from the linear expansion of the pipe, there must be sufficient clamps and mountings. The **aquatherm** pipe clamps meet all requirements, and based on the installation instructions that follow in this chapter are perfect for fixed point installations.

Sliding points

Sliding clamps must allow axial pipe movements without damaging the pipe.

When locating a sliding clamp, make sure that movements of the pipelines are not hindered by walls, fittings, or mechanical equipment installed next to the clamps.

Installation advice

The **aquatherm** pipe clamps are perfectly suited for both fixed point and sliding point installations.

For a fixed-point pipe hanger, a spacer is not used in the hanger except with **UV** pipe. For a sliding point hanger, the same pipe clamp is used, but with spacers provided to allow movement of the pipe.

Fastening	aquatherm greenpipe® aquatherm greenpipe® faser -composite pipe	aquatherm greenpipe® UV pipe
Sliding Point	1 spacer	2 spacers
Fixed point	no spacer	1 spacer

Support Intervals

aquatherm greenpipe® faser-composite pipe SDR 7.4 & climatherm® faser-composite pipe

Table to determine support intervals in conjunction with fluid temperature, ambient temperature at time of installation and pipe size.

Difference in temperature ΔT	Pipe diameter												
	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" 160mm	8" 200mm	10" 250mm
	Support intervals (ft)												
0°F (-17°C)	4	4.6	5.2	5.9	6.7	7.5	8	8.5	9.5	10.5	11.2	11.3	11.5
36°F(2°C)	4	4	4	4.4	5.1	5.7	6.1	6.4	7.1	7.9	8.9	9	9.2
54°F(12°C)	4	4	4	4.4	5.1	5.7	6.1	6.4	6.9	7.4	8	8.2	8.4
72°F(22°C)	4	4	4	4.1	4.8	5.4	5.7	6.1	6.6	7.1	7.7	7.9	8
90°F(32°C)	4	4	4	4.1	4.8	5.4	5.7	6.1	6.2	6.4	6.7	6.9	7.1
108°F(42°C)	4	4	4	4	4.4	5.1	5.4	5.7	5.9	6.1	6.4	6.6	6.7
126°F(52°C)	4	4	4	4	4.3	4.8	5.1	5.4	5.6	5.7	6.1	6.2	6.4

Pipe clamp distances of vertically installed pipes can be increased by 20% of the tabular values, i.e. to multiply the tabular value by 1.2.

Support Intervals

aquatherm greenpipe® SDR 11 & climatherm® pipe SDR 11

Pipe diameter												
½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" 160mm	8" 200mm	10" 250mm
Support intervals (ft)												
4	4	4	4	4	4.6	4.9	5.2	5.9	6.6	7.2	7.5	7.9

Installation planning

All fusion connections require a certain amount of space, as well as mobility, around each joint. When installing an **aquatherm** piping system, it is important to be conscious of the workspace in which each fusion will be performed. A measure of planning and foresight can greatly improve the speed and ease of an installation.

A minimum of 7” of free space around the pipe is recommended for freehand socket fusions. A minimum of 24” of free space is recommended when working with the electric welding jig or the butt fusion machine.

If a pipe must pass through an area that is difficult to access, **aquatherm** recommends prefabricating all the connections that will be in that area. Once these connections are completed, the assembled pipe and fittings can be set into place and joined to the main system with fusions done in a more accessible location.

Concealed installation with insulated piping

Concealed installations generally do not require consideration for the expansion of **aquatherm** piping systems.

In general, insulation gives enough expansion space for the pipe. In the case where the expansion is greater than the room to move in the insulation, the material absorbs any stress arising from a residual expansion.

The same applies to pipes which do not have to be insulated according to current regulations.

Embedding the pipe in concrete or plaster will negate most of the linear expansion. The compressive strain and tensile stress arising from this are no longer critical, as the extra forces are absorbed by the pipe itself. This is also true of directly buried pipe.

Linear expansion

The linear expansion of pipes depends on the difference between the installation temperature and the operating temperature:

$$\Delta T = T_{\text{operating temperature}} - T_{\text{installation temperature}}$$

Therefore cold water pipes have practically no linear expansion.

Because of the temperature-dependent expansion of the material, the linear expansion must be specially considered in case of warm water and heating installations. This requires a distinction between the types of installation:

- concealed installations with piping insulated
- installation in ducts
- open installation

aquatherm faser-composite technology

Composed of fusiolen® **PP-R** and a special faser mixture in the middle layer of the fusiolen® **PP-R** material.

The advantages:

- resistant against corrosion
- linear expansion has been reduced by 75%
- flow rate has been increased by 20% at same loading capacity due to larger inner diameter
- higher stability and carrying capacity
- higher impact strength
- easy processing: simply cut and weld

Various applications such as:

- hot and cold potable water
- food processing
- heating systems
- rainwater
- compressed air systems
- swimming pool installations
- pipelines for industrial use

Open installation

In the case of exposed installation pipes (e.g. in the basement), excellent visual characteristics and form stability are important. The **aquatherm greenpipe®** and **climatherm®** faser-composite pipes for hot water and heating systems make this possible. The coefficient (α) of linear expansion of **aquatherm greenpipe®** and **climatherm®** faser-composite pipes is only

α faser-composite = 0.035 mm/mK = 2.367•10^{-4}"/ft°F

and comparable to the linear expansion of metal pipes.

The coefficient of linear expansion of **aquatherm** piping systems without stabilizing components is

α fusiotherm= 0.150 mm/mK = 1.008•10^{-3}"/ft°F

The **aquatherm** faser-composite pipes must have enough space to expand (see page 4.06). An expansion control is required for long and straight faser-composite pipes (over 120 ft).

The **aquatherm** pipes without the stabilizing compound should have expansion control on every 30 ft of straight runs. Risers of faser-composite pipes may be installed rigidly without expansion compensation. The following formula, calculation examples, data tables and diagrams help to determine the linear expansion. The difference between working temperature and maximum or minimum installation temperature is essential for the calculation of linear expansion.

Calculation of the linear expansion

Calculation example: Linear expansion

Given and required values

Symbol	Meaning	Value	Measuring Unit
Δl	Linear expansion	?	in/ft°F
			mm/m°K
α 1	Coefficient of linear expansion **aquatherm** faser-composite pipe	2.367•10^{-4}	in/ft°F
		0.035	mm/m°K
α 2	Coefficient of linear expansion **aquatherm** pipe	1.008•10^{-3}	in/ft°F
		0.15	mm/m°K
L	Pipe length	100	ft
		30.5	m
T_W	Working temperature	160	°F
		71.0	°C
T_M	Installation temperature	60	°F
		15.6	°C
ΔT	Temperature difference between working and installation temperature ($\Delta T = T_W - T_M$)	100	°F
		38.0	°K

ΔT [°F] • ⅝ = ΔT [°K]

The linear expansion Δl is calculated according to the following formula:

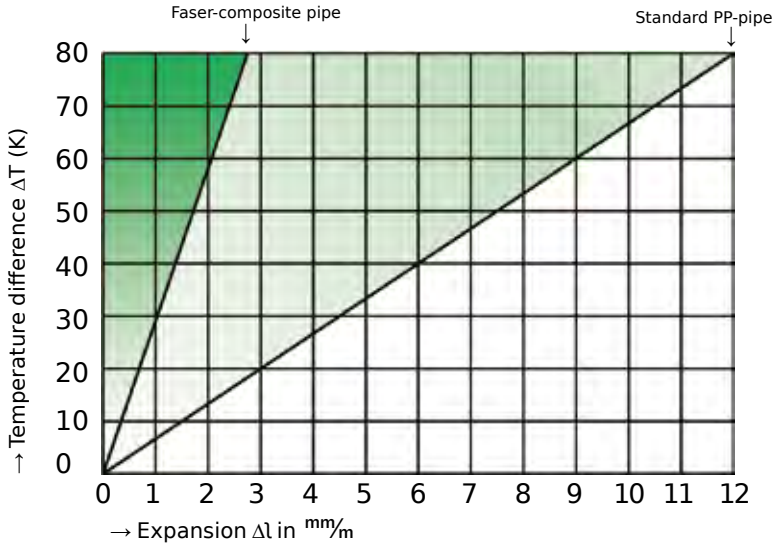
$$\Delta l = \alpha \cdot L \cdot \Delta T$$

Material: **aquatherm** faser-composite pipe
(α = 0.035 mm/mK)

$$\Delta l = 2.367 \cdot 10^{-4} \cdot 100 \text{ ft} \cdot 100°F$$

$$\Delta l = 2.4 \text{ in.}$$

Length expansion comparison: faser-composite to standard PP-pipe

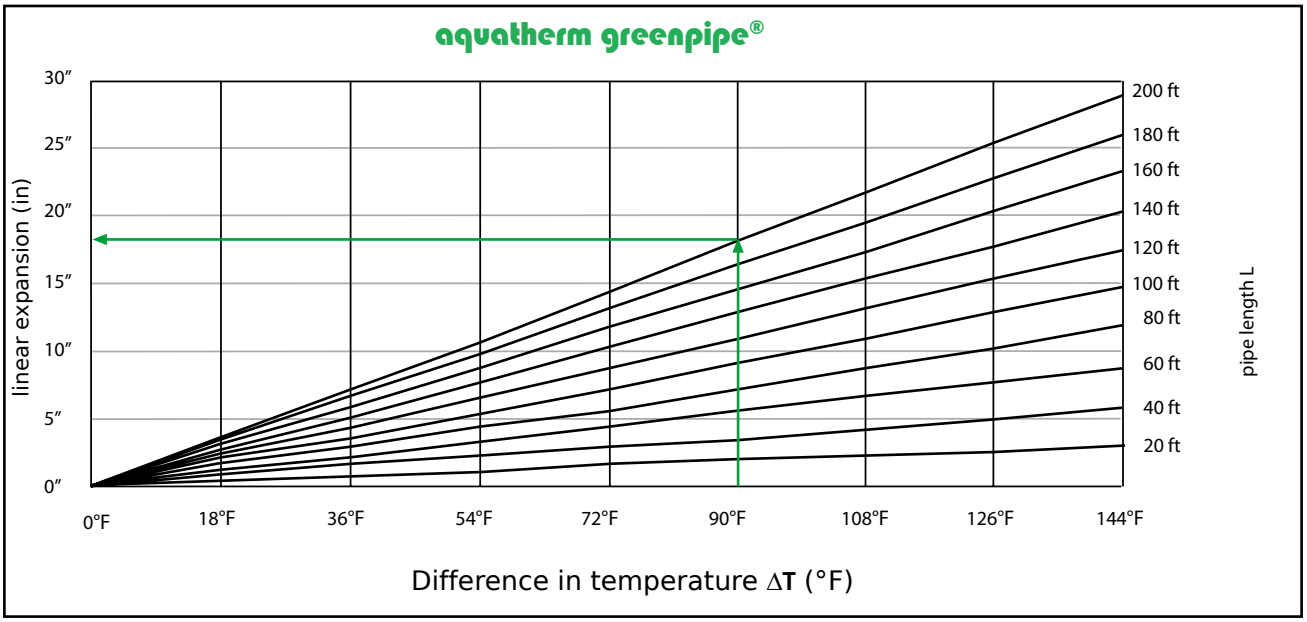


aquatherm greenpipe® (non-faser)

The linear expansion, described on the preceding pages, can be taken from the following tables and graphs.

Linear expansion ΔL (in):
aquatherm greenpipe® - α= 0.150 $^{mm}/_{mK}$ = 1.008•10^{-3}"/ft°F

Pipe length	Difference in temperature $\Delta T = T_{operating\ temperature} - T_{installation\ temperature}$							
	10°F	**20°F**	**30°F**	**40°F**	**50°F**	**60°F**	**80°F**	**100°F**
	Linear expansion ΔL (in)							
10 ft	0.1	0.2	0.3	0.4	0.5	0.6	0.8	1.0
20 ft	0.2	0.4	0.6	0.8	1.0	1.2	1.6	2.0
30 ft	0.3	0.6	0.9	1.2	1.5	1.8	2.4	3.0
40 ft	0.4	0.8	1.2	1.6	2.0	2.4	3.2	4.0
50 ft	0.5	1.0	1.5	2.0	2.5	3.0	4.0	5.0
60 ft	0.6	1.2	1.8	2.4	3.0	3.6	4.8	6.0
70 ft	0.7	1.4	2.1	2.8	3.5	4.2	5.6	7.0
80 ft	0.8	1.6	2.4	3.2	4.0	4.8	6.4	8.0
90 ft	0.9	1.8	2.7	3.6	4.5	5.4	7.2	9.0
100 ft	1.0	2.0	3.0	4.0	5.0	6.0	8.0	10.0
150 ft	1.5	3.0	4.5	6.0	7.5	9.0	12.0	14.9
200 ft	2.0	4.0	6.0	8.0	10.0	12.0	15.9	19.9

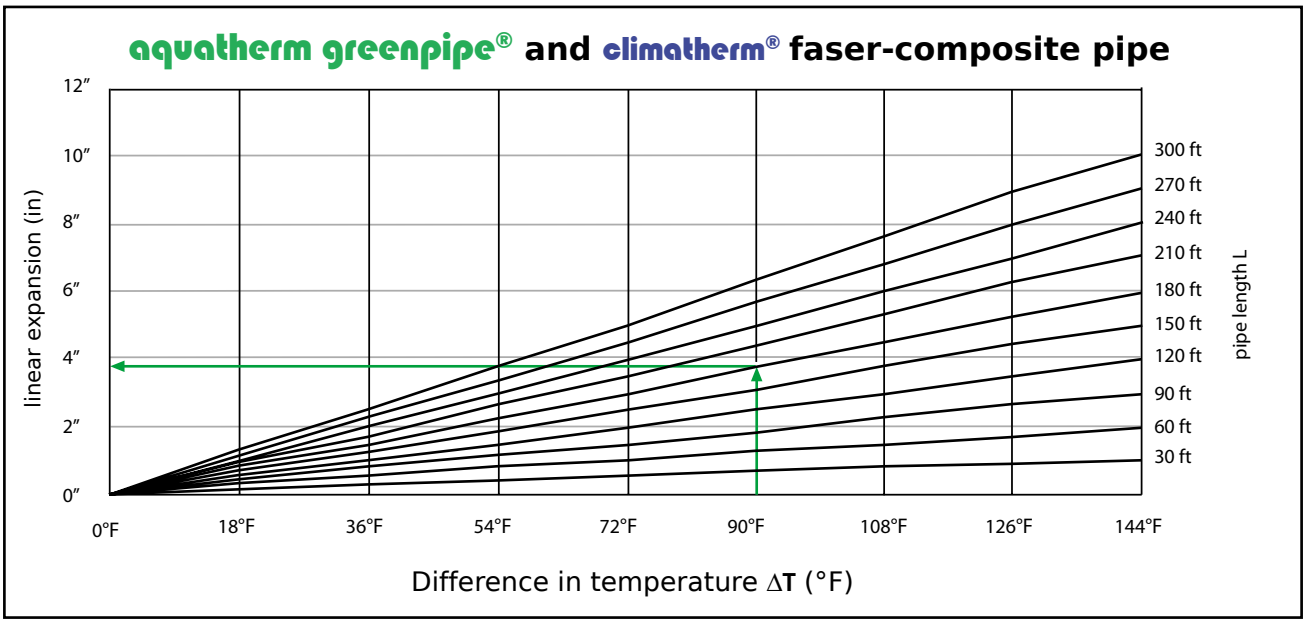


aquatherm greenpipe® faser-composite pipe
climatherm® faser-composite pipe

Due to the integration and positive bond of the different materials, the aquatherm greenpipe® and climatherm® faser-composite pipes offers much higher stability. The linear expansion is reduced to almost 1/5 the value of the standard PP-R pipes.
Linear expansion ΔL (in):

aquatherm faser-composite pipe - $\alpha = 0.035\ ^{mm}/_{mK} = 2.367 \bullet 10^{-4}$"/ft°F

Pipe length	Difference in temperature $\Delta T = T_{operating\ temperature} - T_{installation\ temperature}$							
	10°F	**20°F**	**30°F**	**40°F**	**50°F**	**60°F**	**80°F**	**100°F**
	Linear expansion ΔL (in)							
10 ft	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.2
20 ft	0.0	0.1	0.1	0.2	0.2	0.3	0.4	0.5
30 ft	0.1	0.1	0.2	0.3	0.3	0.4	0.5	0.7
40 ft	0.1	0.2	0.3	0.4	0.5	0.5	0.7	0.9
50 ft	0.1	0.2	0.3	0.5	0.6	0.7	0.9	1.1
60 ft	0.1	0.3	0.4	0.5	0.7	0.8	1.1	1.4
70 ft	0.2	0.3	0.5	0.6	0.8	1.0	1.3	1.6
80 ft	0.2	0.4	0.5	0.7	0.9	1.1	1.5	1.8
90 ft	0.2	0.4	0.6	0.8	1.0	1.2	1.6	2.1
100 ft	0.2	0.5	0.7	0.9	1.1	1.4	1.8	2.3
150 ft	0.3	0.7	1.0	1.4	1.7	2.1	2.7	3.4
200 ft	0.5	0.9	1.4	1.8	2.3	2.7	3.6	4.6



Linear expansion due to temperature difference between operating temperature and installation temperature can be addressed with different installation techniques.

Bending side

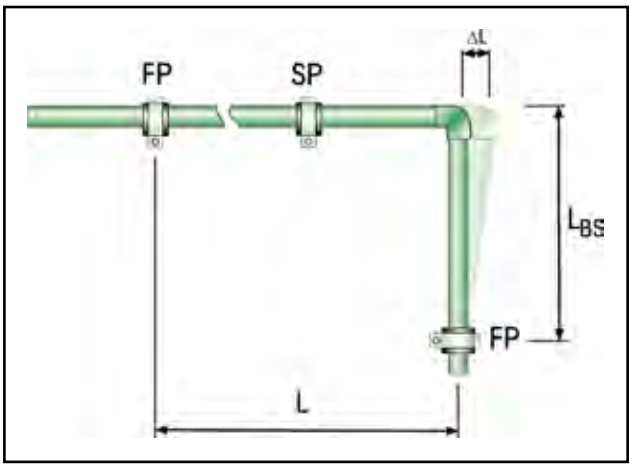
In most cases, directional changes can be used to compensate for linear expansion in pipes.

The values of the bending side can be taken directly from the tables and graphs on the following pages.

Symbol	Meaning		
L_{BS}	Length of the bending side	(in)	(mm)
K	Material specific constant	2.98	15
d	Outside diameter	(mm)	(mm)
Δl	Linear expansion	(in)	(mm)
L	Pipe Length	(ft)	(m)
FP	Fixed point		
SP	Sliding point		

Calculation of the bending side length:

$$L_{BS} = K \bullet \sqrt{d \bullet \Delta l}$$



Expansion loop

If the linear expansion cannot be compensated for by a change in direction, it may be necessary to install an expansion loop.

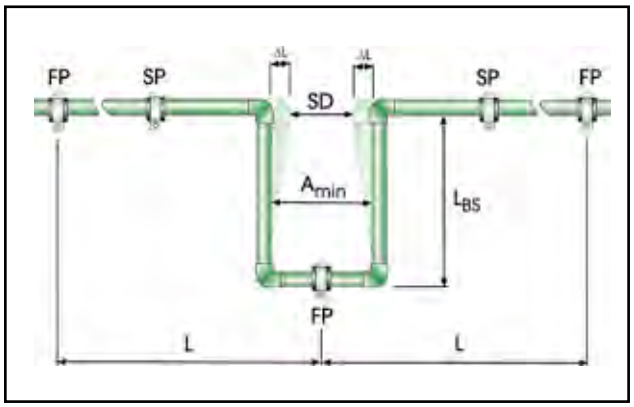
In addition to the length of the bending side L_{BS}, the width of the pipe bend A_{min} must be considered.

Symbol	Meaning	
A_{min}	Width of the expansion loop	(in)
SD	Safety distance	**6 in**

The pipe bend A_{min} is calculated according to the following formula:

$$A_{min} = 2 \bullet \Delta l + SD$$

Continuing the example from the previous page, with Δl = 1.4 in, the width of the expansion loop should be at least (2 • 1.4) + 6 = 8.8 in.



Pre-stress

Where space is limited, it is possible to shorten the total width A_{min} as well as the length of the bending side L_{BSV} by pre-stressing.

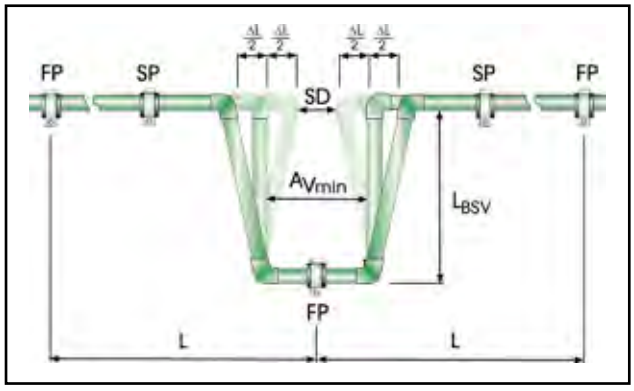
Pre-stressing during installation, if planned and carried out properly, offers a visually perfect installation, as the linear expansion is not noticeable in the operating system.

The side length L_{SV} is calculated according to the following calculation example:

Symbol	Meaning	Value	Measuring Unit
L_{BSV}	Length of pre-stress	-	in

The side length of expansion loops with pre-stress is calculated according to the following example:

$$L_{BSV} = K \bullet \sqrt{d \bullet \Delta l}$$



As noted previously, the value of K is a material constant (2.98), d is the pipe outside diameter in mm and Δl is the previously calculated thermal expansion.

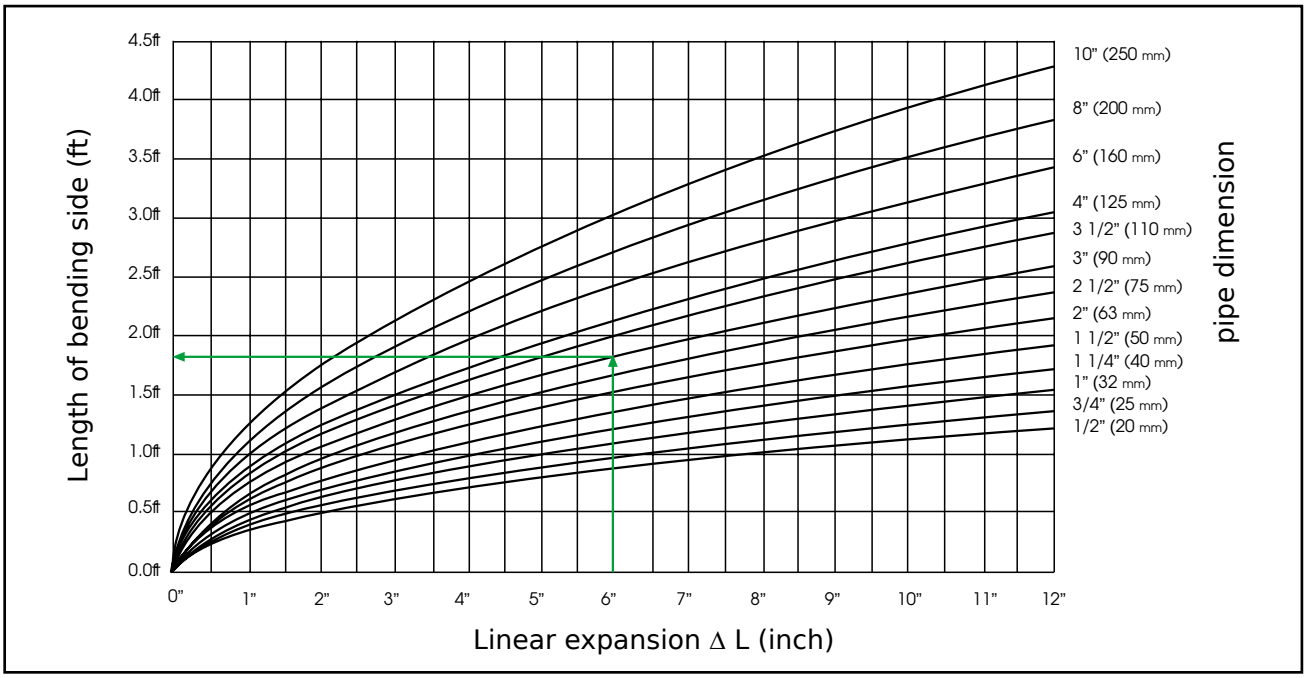
Bellow expansion joint

All bellow expansion joints designed for metal materials are unsuitable for use with **aquatherm** piping systems. When using axial expansion joints, observe the manufacturer's instructions.

The length of the bending side L_{BS} can be taken from the following tables and diagrams with consideration of the applied pipe dimensions and determined linear expansion.

Length of bending side for aquatherm greenpipe®, aquatherm greenpipe® faser-composite pipe, and climatherm® faser-composite pipe.

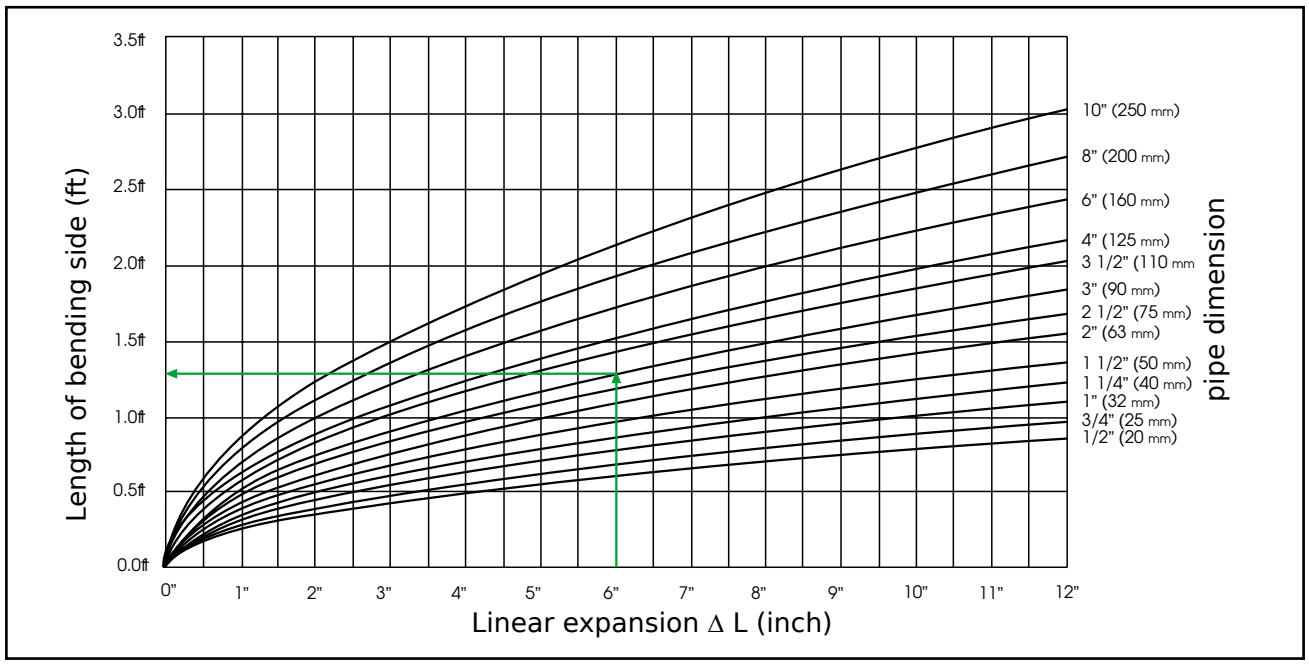
Pipe dimension in inch (mm)	Linear expansion in inches (“)											
	1”	2”	3”	4”	5”	6”	7”	8”	9”	10”	11”	12”
	Length of bending side (in)											
½” (20)	13	19	23	27	30	33	35	38	40	42	44	46
¾” (25)	15	21	26	30	34	37	40	42	45	47	50	52
1“ (32)	17	24	29	34	38	42	45	48	51	54	56	59
1¼“ (40)	19	27	33	38	42	46	50	54	57	60	63	66
1½“ (50)	21	30	37	42	47	52	56	60	64	67	70	73
2“ (63)	24	34	41	48	53	58	63	67	71	75	79	82
2½“ (75)	26	37	45	52	58	64	69	73	78	82	86	90
3“ (90)	28	40	49	57	64	70	75	80	85	90	94	99
3½“ (110)	31	44	54	63	70	77	83	89	94	99	104	109
4“ (125)	34	47	58	67	70	82	89	95	101	106	111	116
6“ (160)	38	54	66	76	85	93	100	107	114	120	126	131
8“ (200)	42	60	73	85	95	104	112	120	127	134	141	147
10“ (250)	47	67	82	95	106	116	125	134	142	150	157	164



The length of the bending side with pre-stress L_{BSV} can be taken from the following tables and diagrams with consideration of the applied pipe dimensions and determined linear expansion.

Length of bending side with pre-stress for aquatherm greenpipe®, aquatherm greenpipe® faser-composite pipe, and climatherm® faser-composite pipe.

Pipe dimension in inch (mm)	Linear expansion in inches (“)											
	1”	2”	3”	4”	5”	6”	7”	8”	9”	10”	11”	12”
	Length of bending side (in)											
½” (20)	9	13	16	19	21	23	25	27	28	30	31	33
¾” (25)	11	15	18	21	24	26	28	30	32	34	35	37
1“ (32)	12	17	21	24	27	29	32	34	36	38	40	42
1¼“ (40)	13	19	23	27	30	33	35	38	40	42	44	46
1½“ (50)	15	21	26	30	34	37	40	42	45	47	50	52
2“ (63)	17	24	29	34	38	41	45	48	51	53	56	58
2½“ (75)	18	26	32	37	41	45	49	52	55	58	61	64
3“ (90)	20	28	35	40	45	49	53	57	60	64	67	70
3½“ (110)	22	31	39	44	50	54	59	63	67	70	74	77
4“ (125)	24	34	41	47	53	58	63	67	71	75	79	82
6“ (160)	27	38	46	54	60	66	71	76	80	85	89	93
8“ (200)	30	42	52	60	67	73	79	85	90	95	99	104
10“ (250)	34	47	58	67	75	82	89	95	101	106	111	116



Installation in shafts

Due to the different linear expansion coefficients of the faser and non-faser pipes, the installation of pipe branches in risers has to be made according to the selected type of pipe.

aquatherm faser-composite pipe

The linear expansion of **aquatherm** faser-composite pipes in vertical risers can be ignored. The positioning of a fixed point directly before each take-off is sufficient.

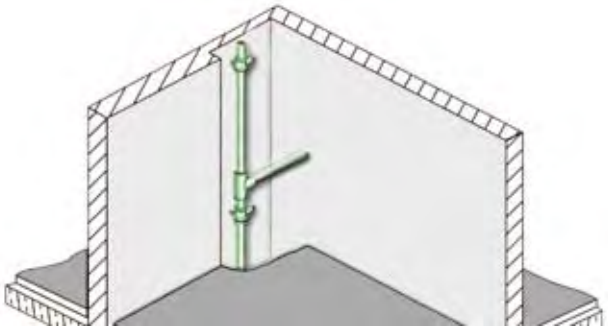
In general, it is possible to install risers rigidly, without expansion joints. This directs the expansion on the distance between the fixed points, where it becomes negligible.

It is important to maintain 10 ft. of space between two fixed points, and mid story guides may be necessary for sizes 2” and below.

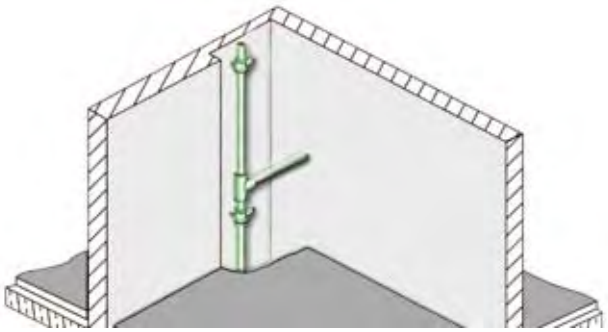
aquatherm non-faser pipe

The installation of risers using **aquatherm** pipes without faser-composite requires that branch lines be installed in such a manner as to accommodate linear expansion of the vertical riser.

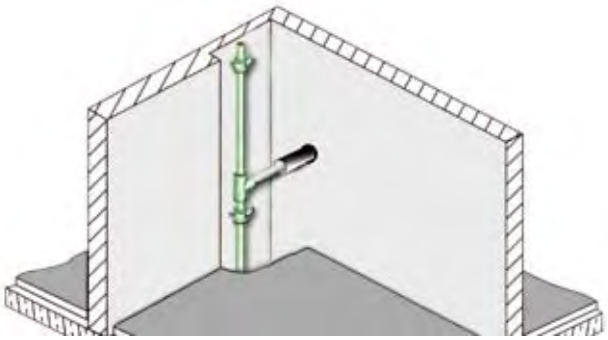
- This can be ensured by securing a proper fixing of the riser in the shaft.
- An adequately large pipe sleeve can also allow for sufficient movement of the riser.
- Also the installation of a swing joint gives the appropriate elasticity.



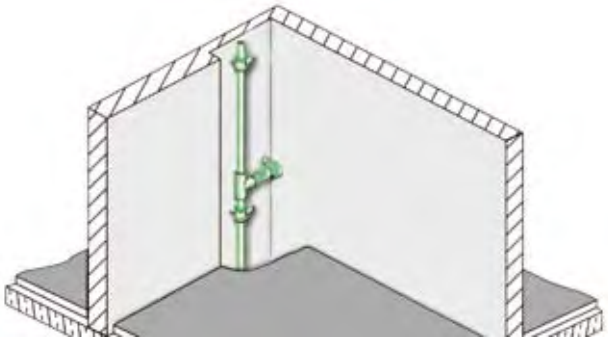
Positioning of the fixed point clamp.



Proper fixing.



Large diameter pipe liner.



Installation of a spring joint.

Pressure test / Test control

While still visible all pipelines must be hydraulically pressure tested. The test pressure must be 1.5 times of the operating pressure.

When performing the pressure test, the material properties of **aquatherm** pipes can lead to an expansion of the pipe. This influences the test results. A further influence of the test result can be caused by the coefficient of thermal expansion of **aquatherm** pipes. Different temperatures of the pipe and the test medium lead to alterations of pressure. A temperature change of 18°F corresponds to a pressure difference of 7.25 to 14.5 psi (0.5 to 1 bar). Therefore the highest possible constant temperature of the test medium must be measured during the hydraulic pressure test.

The hydraulic pressure test requires a preliminary, principal, and final test.

For the preliminary test, a test pressure of 150% of the highest possible operating pressure must be produced. This test pressure must be re-established twice within 30 minutes within a 10 minute interval. After a test time of a further 30 minutes the test pressure must not drop more than 8.7 psi (0.6 bar) and no leakage should have appeared.

The preliminary test is to be followed directly by the principal test. Test time is 2 hours. The test pressure taken from the preliminary test may not fall more than 3 psi (0.2 bar).

After completion of the preliminary and principal tests, the final test must be conducted with an alternating test pressure of 150% and 15% in a rhythm of at least 2 minutes with final intervals of 5 minutes.

Between each test phase, the pressure has to be removed.

No leakage must appear at any point of the tested installation.

Measuring of the test pressures

Measuring must be done with a manometer allowing a perfect reading of a pressure change of 1.45 psi (0.1 bar). The manometer has to be placed at the lowest point of the installation.

Test record

A record of the hydraulic pressure test must be prepared and signed by the client and contractor stating place and date (see page: 4.16)

IMPORTANT:
This test is required by the manufacturer for the validation of the aquatherm warranty. This does not supersede or replace regulations placed by the local code authority having jurisdiction.

Test should be faxed to aquatherm at:
- **801-494-1053 for the United States**
- **403-770-8326 for Canada**

Tests may also be e-mailed to:
technical@aquathermpipe.com

Example aquatherm piping system pressure test:

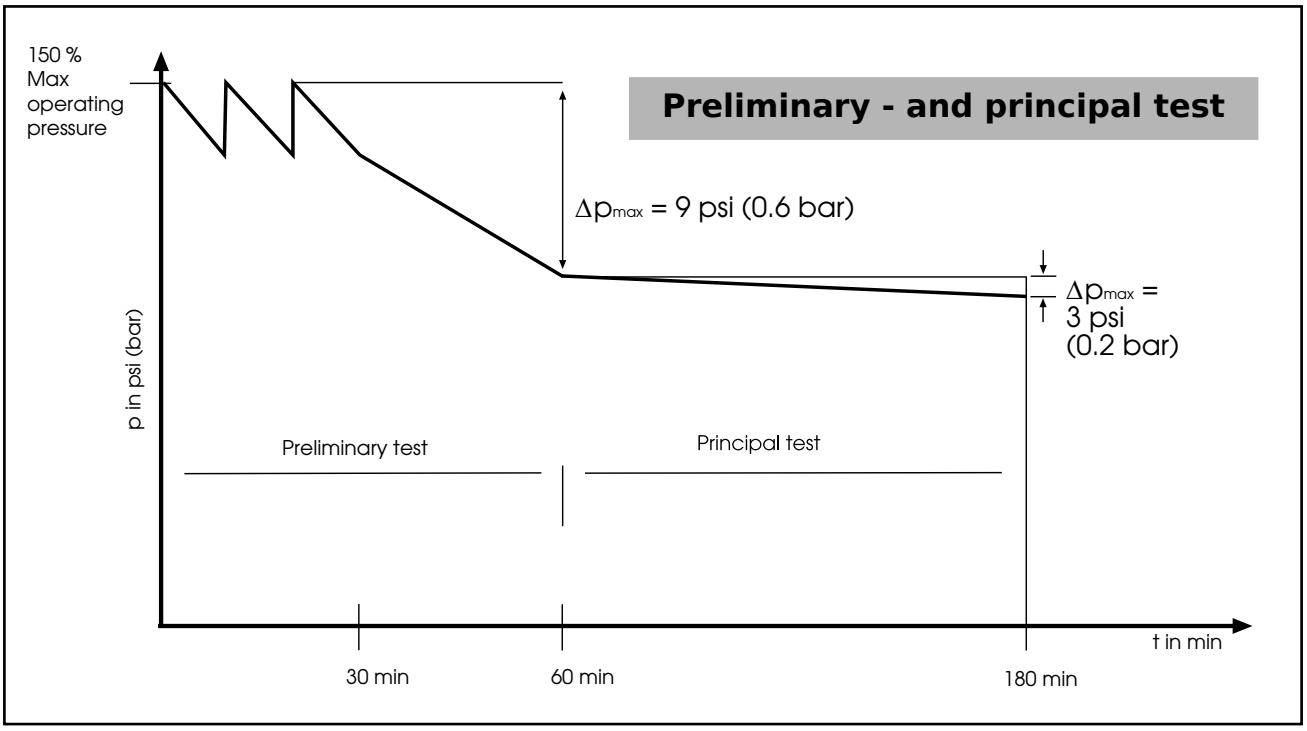
Preliminary & Principal Test:

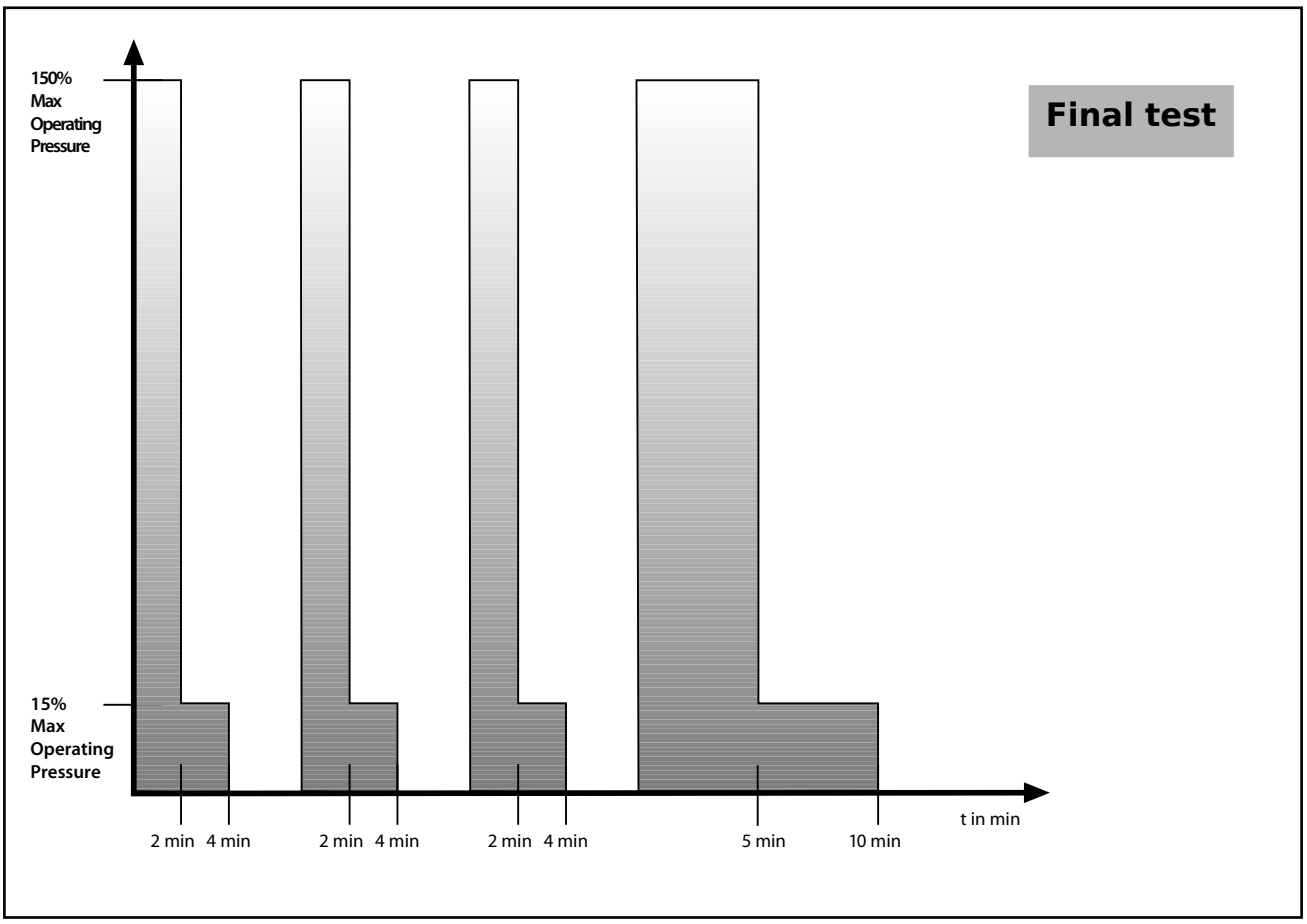
1. Bring pressure in system up to 150% of the maximum operating pressure.
2. Wait 10 minutes, then check the pressure, and if there has been any decrease due to expansion of the piping, raise pressure back to 150% of the maximum operating pressure.
3. Repeat step 2.
4. Wait 30 minutes then read pressure. Pressure must not drop more than 9 psi (0.6 bar) below 150% of the maximum operating pressure.
5. Wait 120 minutes (2 hours) then read pressure. Pressure must not drop more than 3 psi (0.2 bar) from previous reading in step 4.
6. If the system has met the requirements of steps 4 and 5, continue to the final test.

Final Test:

1. Bring pressure in system up to 150% of the maximum operating pressure (MOP) and wait 2 minutes.
2. Drop pressure to 15% MOP and wait 2 minutes.
3. Bring pressure in system up to 150% and wait 2 minutes.
4. Drop pressure to 15% MOP and wait 2 minutes.
5. Bring pressure in system up to 150% and wait 2 minutes.
6. Drop pressure to 15% MOP and wait 2 minutes.
7. Bring pressure in system up to 150% and wait 5 minutes.
8. Drop pressure to 15% MOP and wait 5 minutes.

No leakage may appear at any point of the tested installation.


Preliminary - and principal test
150 %
Max
operating
pressure
Δpmax = 9 psi (0.6 bar)
Δpmax =
3 psi
(0.2 bar)
p in psi (bar)
Preliminary test
Principal test
t in min
30 min
60 min
180 min


Final test
150%
Max
Operating
Pressure
15%
Max
Operating
Pressure
t in min
2 min
4 min
2 min
4 min
2 min
4 min
5 min
10 min

Description of the installation

Place: _____

Object: _____

_____

Pipe-lengths:
1/2” (20 mm)_____ ft/m
3/4” (25 mm)_____ ft/m
1” (32 mm)_____ ft/m
1 1/4” (40 mm)_____ ft/m
1 1/2” (50 mm)_____ ft/m
2” (63 mm)_____ ft/m
2 1/2” (75 mm)_____ ft/m
3” (90 mm)_____ ft/m
3 1/2” (110 mm)_____ ft/m
4” (125 mm)_____ ft/m
6” (160 mm)_____ ft/m
8” (200 mm)_____ ft/m
10” (250 mm)_____ ft/m

Highest point:_____ ft/m
(over manometer)

Start of the test: _____

End of the test: _____

Test period: _____

Client: _____

_____

_____

_____

Contractor: _____

_____

_____

_____

Place: _____

Date: _____

_____
Stamp / Signature

Preliminary test

150% of max. working pressure _____ psi (bar)

Pressure drop after 30 minutes: _____ psi (bar)
(max. 8.7psi / 0.6bar)

Result preliminary test: _____

Principal test

Working pressure: psi (bar) _____
(Result preliminary test)

Pressure after 2 hours: _____ psi (bar)

Result principal test: _____

Final test

1. Working pressure 150%:_____psi (bar)
at least 2 minutes, then
Working pressure 15%:_____psi (bar)
at least 2 minutes

2. Working pressure 150%:_____psi (bar)
at least 2 minutes, then
Working pressure 15%:_____psi (bar)
at least 2 minutes

3. Working pressure 150%:_____psi (bar)
at least 2 minutes, then
Working pressure 15%:_____psi (bar)
at least 2 minutes

4. Working pressure 150%:_____psi (bar)
at least 5 minutes, then
Working pressure 15%:_____psi (bar)
at least 5 minutes

Test should be faxed to **aquatherm** at:
- 801-494-1053 for the United States
- 403-770-8326 for Canada

Tests may also be e-mailed to:
technical@aquathermpipe.com

Flushing of pipes

All water systems, independent of their material, should be flushed thoroughly after their installation. The following requirements must be complied with before the installation can be put into service:

- protection of the water quality
- avoidance of corrosion damage
- avoidance of malfunctions of pumps and apparatuses
- cleanliness of the inner surface of the pipe

These requirements are met by:

- flushing with water
- flushing with air-water-mixture

The flushing medium may be determined by local codes, engineering specifications or the needs of the mechanical equipment used.

Where no requirements are established, potable water is sufficient for flushing **aquatherm** piping materials.

Grounding

Most building codes require that grounding be provided for all conductive components inside the structure. It is important to note that **aquatherm** pipes do not carry electrical currents and cannot be used to provide grounding. An alternative method of grounding is required.

Where metal pipes are replaced by PP-R pipes, the ground can not be created by the piping system. An alternative ground system must be installed.

The grounding system should be inspected by a qualified electrician.

Outdoor installation

In applications where the installed pipe will be exposed to UV-radiation (such as outdoor applications), it is recommended that aquatherm greenpipe® UV or climatherm® UV be used. This pipe is engineered with an outer coating that protects the pipe from the aging and discoloration that can occur from prolonged exposure to UV-radiation. See page 6.5 - 6.6.

Freeze protection

The **aquatherm** piping systems may be installed in applications and conditions where freezing may occur.

Generally, freezing the pipes and the water in them will not cause problems for the piping materials. However freezing may cause problems for the user, if the system is required to be operational during these freezing periods.

To avoid this, anti-freeze (glycerin or glycol) or heating cables applied externally or inside the pipe may be used to ensure the system does not freeze.

Regardless of the method chosen, all products must be used in accordance with the freeze protection system manufacturer's recommendations, the product/system listings, and shall be used in compliance with all applicable local codes.

When using any type of external heat source applied to the piping, such as heat tape or heating cables, the product must be suitable for use with plastic piping. Additionally, the heat system must be self-regulating and ensure the surface temperature of the **aquatherm** pipe and fittings will not exceed 70°C.

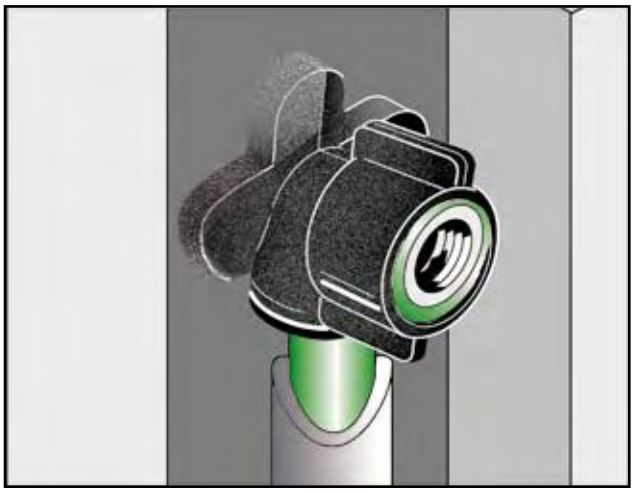
Transport and storage

The aquatherm greenpipe® and climatherm® pipes may be stored outside at any temperature. Providing a solid, flat, and level base for the pipe is very important to avoid a deformation of the pipes while in transport and storage. Improper storage of pipe can cause bowing.

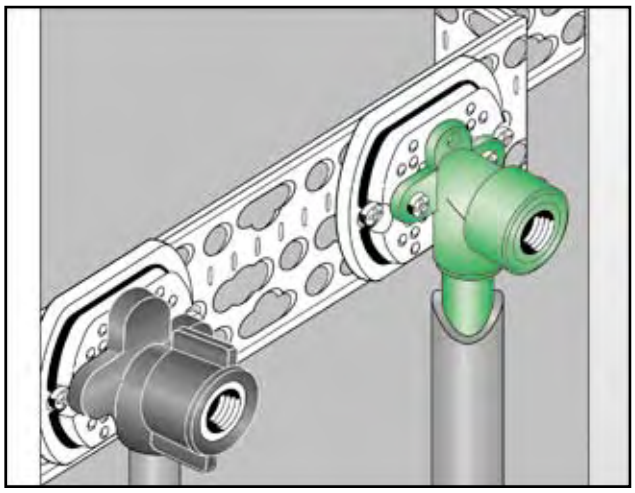
At temperatures below 0°C (32°F), it is possible to damage the pipes through strong impacts. In spite of its high impact resistance, the material must be treated with caution at low temperatures.

UV-radiation has detrimental effects on all high polymer plastics. Maximum outdoor storage time is 6 months if removed from factory-supplied UV-protected bags.

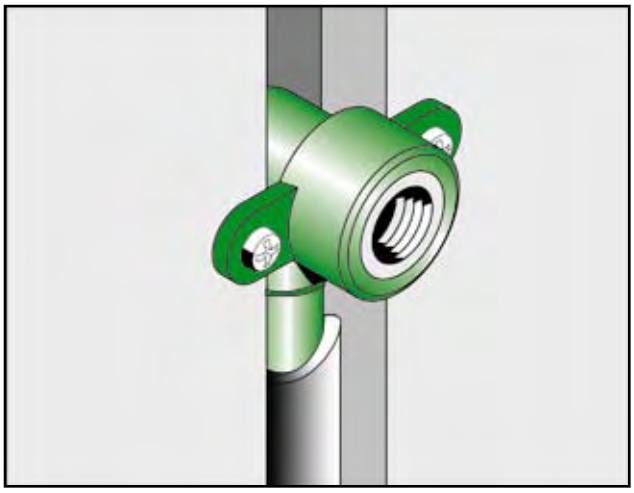
Fixture connections



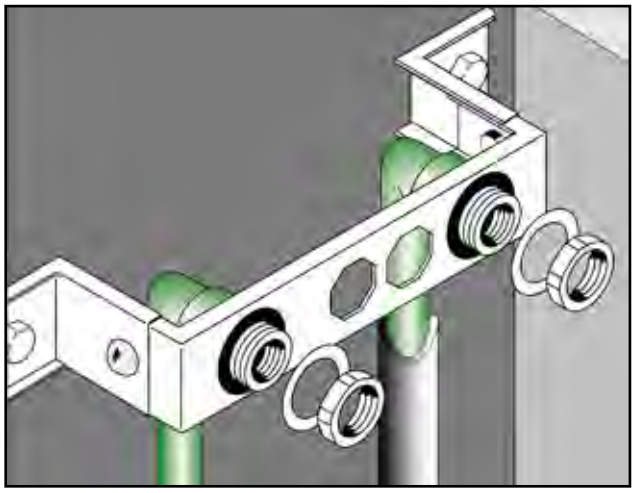
aquatherm greenpipe® connecting wall disk in sound insulating cleating, i.e. in a pipe chase or for concealed installation.



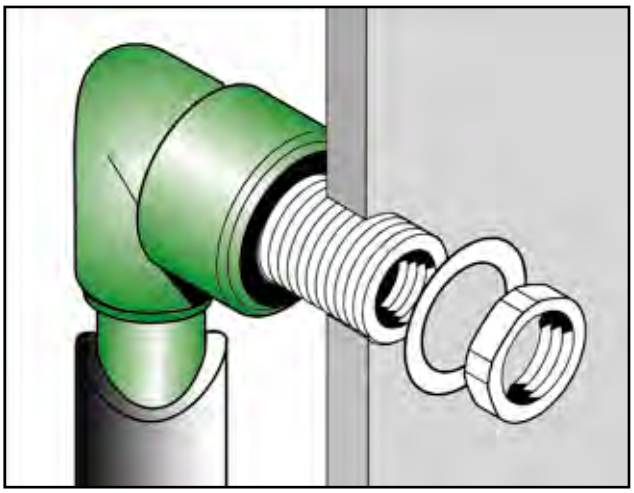
aquatherm greenpipe® wall disks for twin fixture connections with galvanized mounting plate and sound absorption plate from the fixing program (gauge for bore holes 8.7/6/3.2 in.).



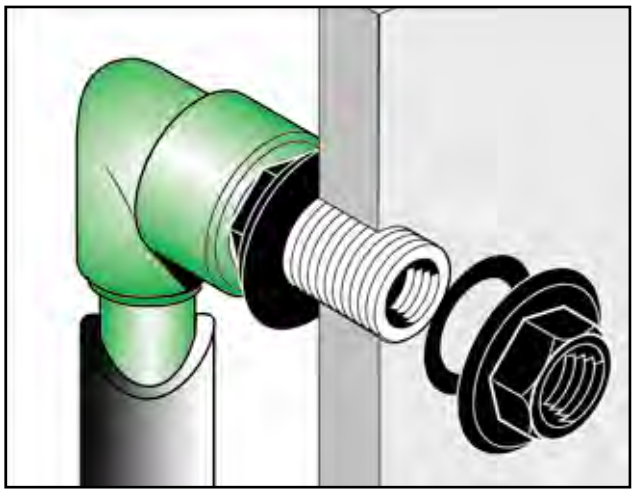
aquatherm greenpipe® cavity wall disk installed in a pipe chase.



Mounting unit twin including 2 aquatherm greenpipe® transition elbows female/male with counter nut, joint ring and curved washer.



aquatherm greenpipe® transition elbow female / male for cavity wall connection with 1” thread.



aquatherm greenpipe® cavity wall fitting joint with aquatherm greenpipe® transition elbow.

The aquatherm greenpipe® transition elbow with female/male thread can be used for flushing box connections. This transition elbow is also available with a single mounting unit.

Distribution block: example of applications

The stamped numbers 1 and 2 indicate the proper connection of the **aquatherm greenpipe®** distribution block. They provide assistance with the installation.

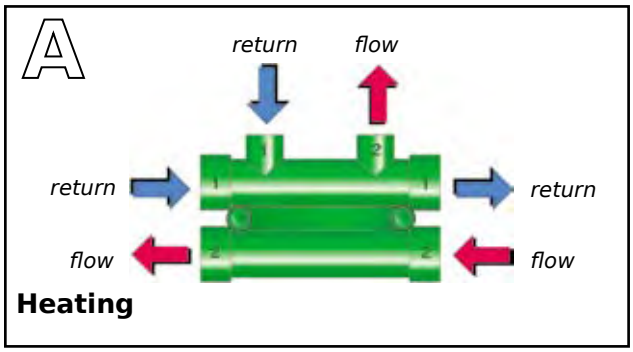
For the “heating” connection schematic (A), the return is connected to the supply channel marked 1 and the flow to supply channel marked 2. The connections can also be used in reverse.

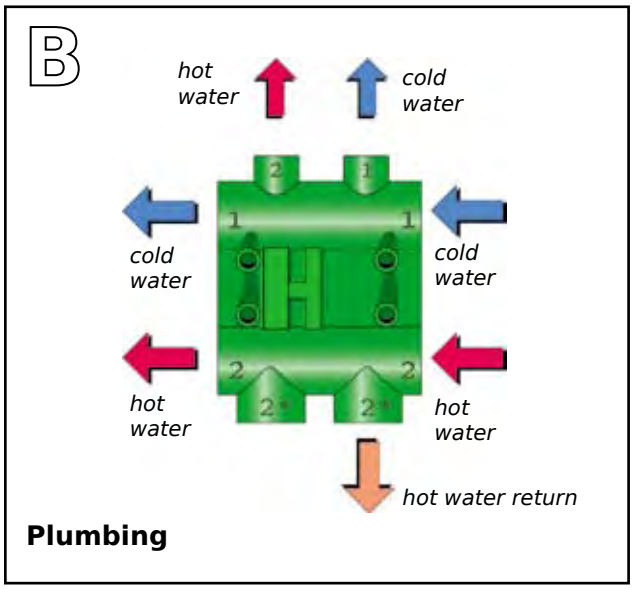
For the potable water connection schematic (B), supply channel 1 is intended for the cold water pipe and supply channel 2 for the hot water pipe connection. In factory condition, the lower outlets are closed. The connection with supply channel 2 is made by drilling out the opening (1/2” drill bit). Thus an additional pipe can be connected.

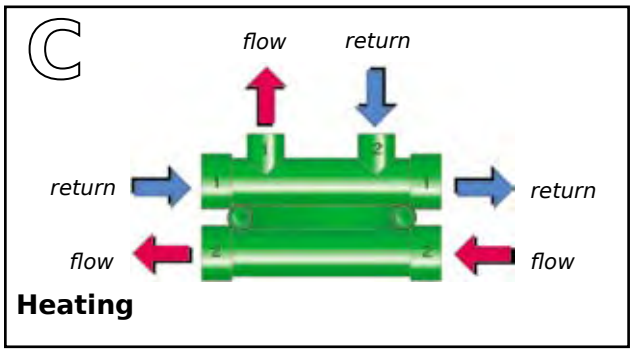
By turning the **aquatherm greenpipe®** distribution block, a mirror-image connection can be made. These schematics are presented in the illustrations C and D.

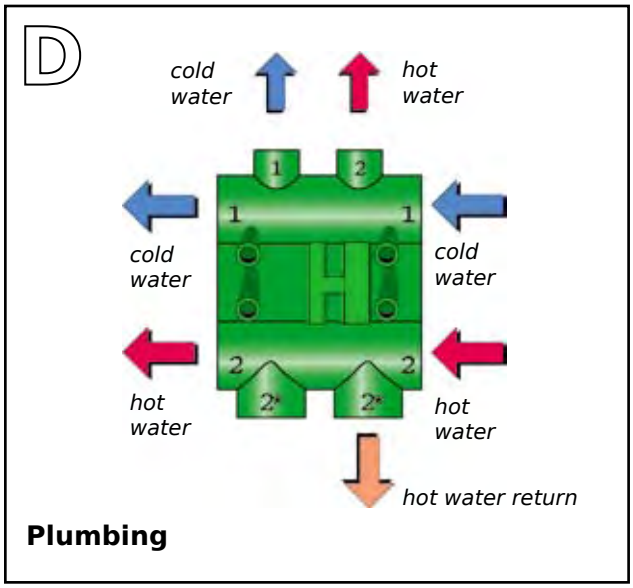
The flow and return connections of the **aquatherm greenpipe®** distribution block are installed with 1/2” (20 mm) pipes. For radiator connections, 3/8” (16 mm) pipes must be welded into the outflow sockets of the distribution block.

The **aquatherm greenpipe®** distribution block plumbing must be connected with 3/4” (25 mm) pipes. For pipe connections to the taps, 1/2” (20 mm) pipes must be welded into the outflow sockets of the distribution block.

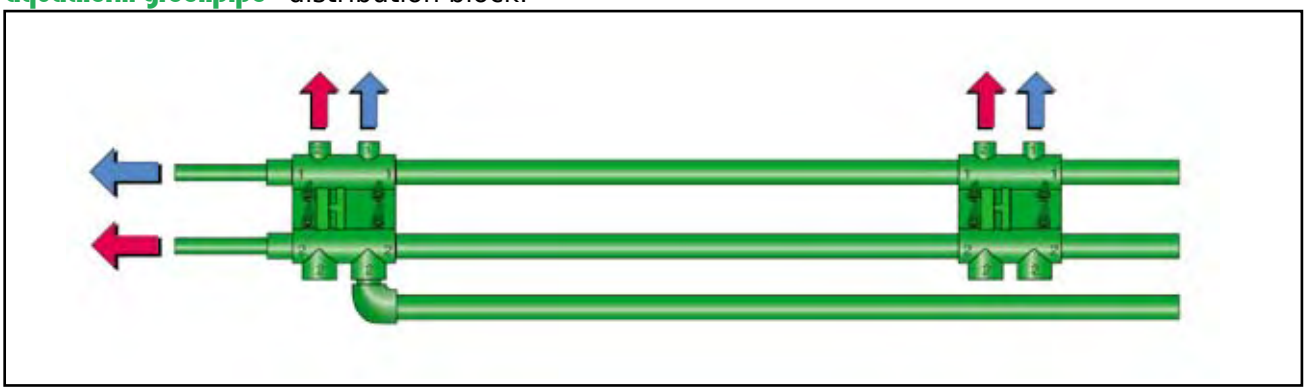




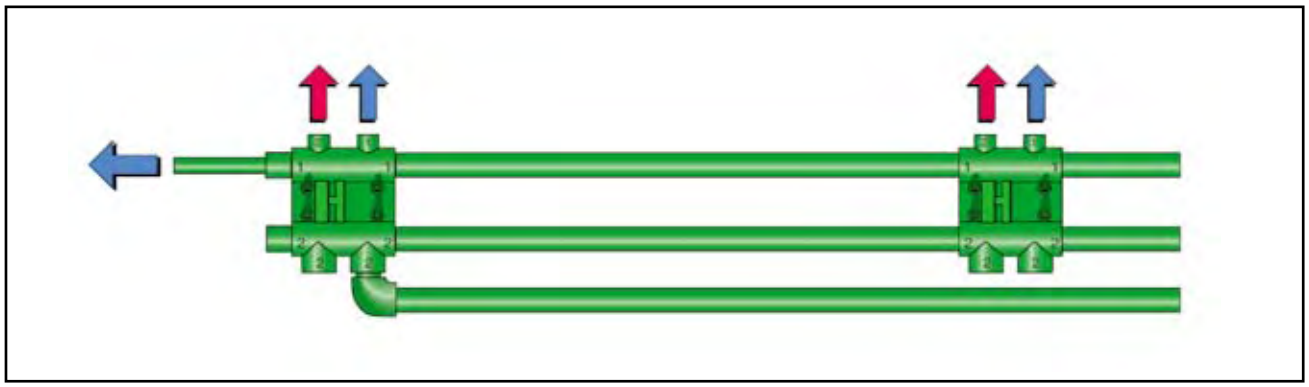




The connection pipes in the individual floors or risers are connected for hot and cold water with aquatherm greenpipe® or aquatherm greenpipe® faser-composite pipes with an external diameter of 3/4” (25 mm). The same also applies for the hot water return which can be led back from any aquatherm greenpipe® distribution block.

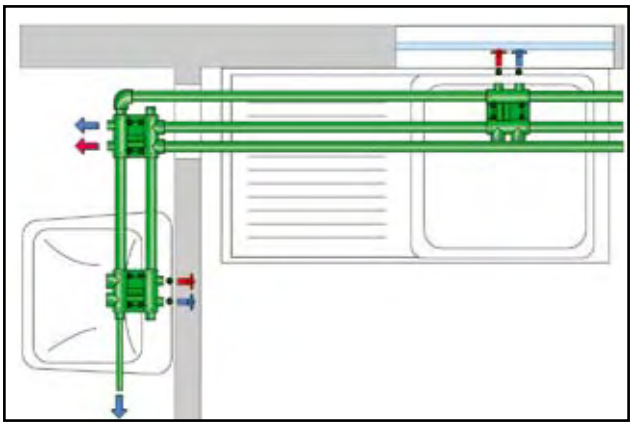


Reducers for further pipe systems can be welded directly onto the distribution block.



The supplied 3/4” (25 mm) end plug seals off a through-flow unit or, alternatively, the 3/8” (16 mm) end cap. By cutting the end of the plug, it can be used as 3/4” (25 mm) to 3/8” (16 mm) reducer or as 3/8” (16 mm) socket.

By turning the aquatherm greenpipe® distribution block and drilling out the factory-sealed outlets, it is possible to create compact connection arrangements even in areas of restricted space. This avoids the time-consuming operation of guiding under or over pipes and the associated sealing work.



Insulation for distribution block

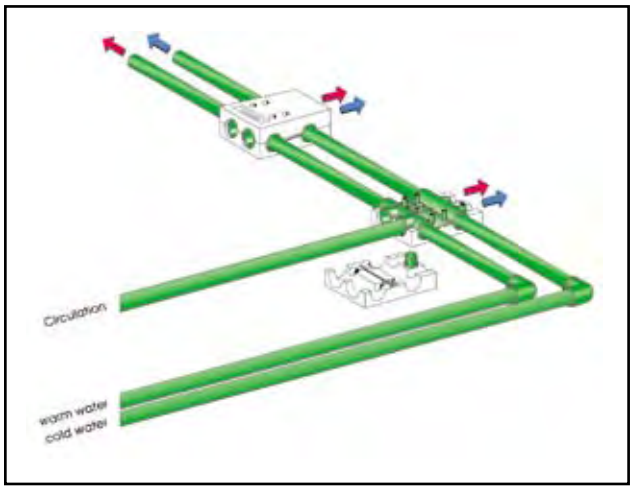
It is also possible to install the compact distribution block by using a specially adapted insulation. In this case, the junction not only avoids the crossing of pipes, but also the extra work involved in the expensive insulation of the double tee-branch.

The insulation for the aquatherm greenpipe® distribution block is made from high-quality PPO/PS rigid expanded polyurethane.

Dimensions of insulation

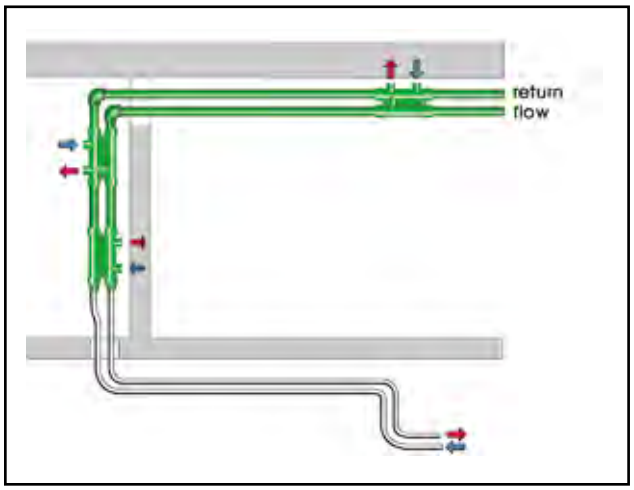
- Thermal conductivity: 0.28 $^{BTU\text{-}in}/_{hr \cdot °F \cdot ft^2}$
- Length: 7.25 in
- Width: 4.69 in
- Height: 2.76 in

The accessories (1 plug, 2 fastening plugs) are integrated in the insulation of a supply unit aquatherm greenpipe® distribution block with insulation tray (Art.-No. 30130, see picture).

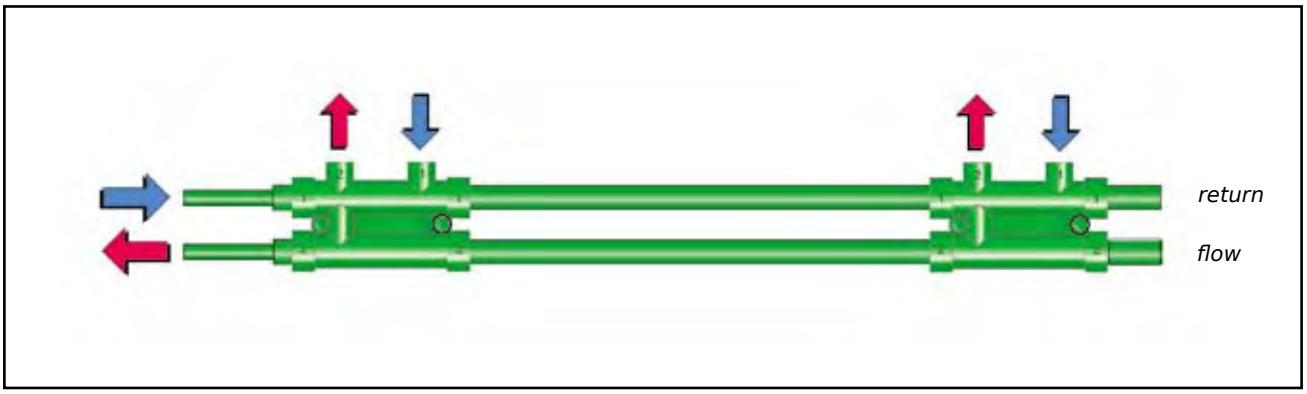


aquatherm greenpipe® distribution block

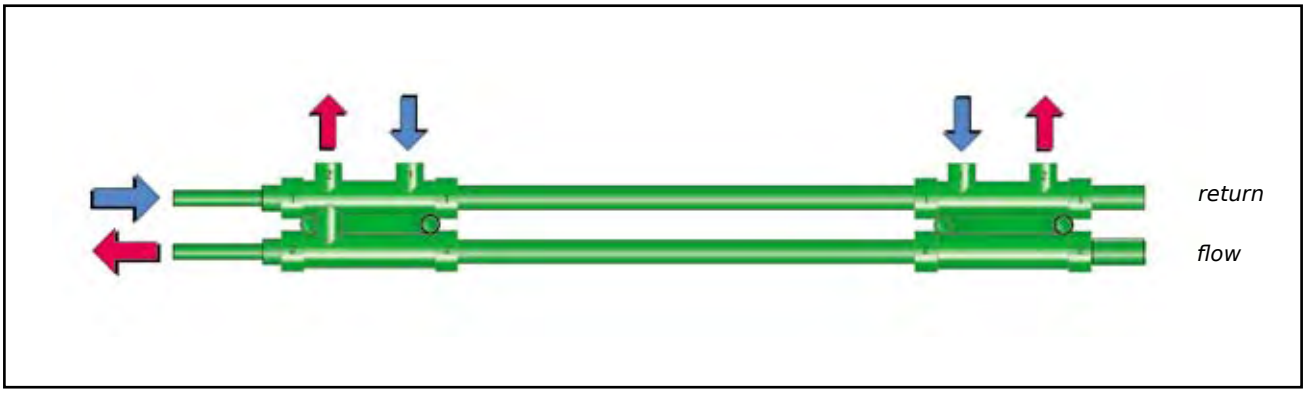
If the radiator connection is not in the immediate vicinity of the pipe connection of the distribution block, this supply can be arranged with a 3/8” (16 mm) pipe by welding-in of two reducers.



aquatherm greenpipe® distribution block: example of applications - hydronics



The flow and return connections of heating pipes to the aquatherm greenpipe® distribution block with aquatherm greenpipe® or aquatherm greenpipe® faser-composite pipes of an external diameter of 1/2” (20 mm). Used in conjunction with the **aquatherm®** connecting bend (Art.-No. 85120) and the **aquatherm®** radiator valves, the outgoing 3/8” (16 mm) pipe connections are ideal for radiator connections.



It doesn’t matter where the heating flow or return is connected to the aquatherm greenpipe® distribution block. A simple turn of the distribution block adapts it to the appropriate specification.

Chapter 5:
Planning

Planning
Flame spread and smoke development
aquatherm Advanced

Insulation calculations

Pipe sizing
Principles of calculation

Commercial water pipe sizing

Maximum flow rate
Flow velocity and head loss

Pipe friction factor and calculated flow rate

Equivalent lengths of aquatherm greenpipe® fittings

aquatherm

Planning and engineering with aquatherm

With unique advantages over both metal and other plastic systems, **aquatherm** piping systems offer new possibilities for design and application. By combining revolutionary strength and longevity with industry-leading purity and neutrality, **aquatherm** manufactures piping systems that can truly address all possible concerns for potable, food-grade, hydronic, chemical and industrial applications.

When designing with **aquatherm** piping systems, it is important to be aware of its unique features, such as the faser-composite for expansion control, the fusion connections, the impact and chemical resistance, and the sound insulation, as well as others.

In particular, the natural r-value and reduced friction factors help make the system more energy efficient. With careful planning and engineering, it is possible to exceed existing performance standards and maximize a system's efficiency.

Be sure to verify all calculations before installing an **aquatherm** piping system. The values given in this catalog are intended for general reference and are not a substitute for actual engineering.

Flame spread and smoke development

The aquatherm greenpipe® and climatherm® systems do not produce toxic by-products during combustion. In a fully developed fire, fusiolen® **PP-R** will only produce CO^2 and H_2O_{gas}. In an under-developed fire, trace amounts of CO can be produced, but this is common in all combustible materials, such as wood and paper.

Many building codes do not consider the toxicity of the smoke produced, or lack thereof, but rather focus only on the volume and opacity of the smoke. Therefore, it is important to install only pipe that meets local code requirements. These codes generally reference ASTM E84 in the United States and CSA S-102.2 in Canada and require that the installed pipe have a Flame Spread Index of 25 or less and Smoke Development Index of 50 or less.

The **aquatherm Advanced** systems are listed in both the United States and Canada as meeting the 25/50 regulations and are acceptable for installation where such codes are applicable.

aquatherm greenpipe® Advanced climatherm® Advanced

Taking convenience and versatility to a whole new level, **aquatherm Advanced** systems combine fire protection, vapor barrier, and thermal insulation into an external wrap, creating piping systems that are truly complete.

The **aquatherm Advanced** systems use an insulation wrap, providing acceptable insulation for most applications. By capitalizing on the natural insulation of the **PP-R** material, **aquatherm Advanced** is able to offer the most efficient insulation value for the application (see page 5.3). The **aquatherm Advanced** system is ideally suited for:

- heating and cooling installations
- potable hot and cold installations
- non-combustible construction

The insulation for the **aquatherm Advanced** generally meets or exceeds the heat transfer requirements for 1 1/2 inches of insulation, as given in ASHRAE and ICC energy codes. The tables on pages 5.3 and 5.4 give the approximate equivalent values.

The insulation wrap also meets an FSI of 25 and an SDI of 50, making the system safe for use in:

- return air plenums
- exposed installation in high-rise buildings
- non-combustible construction

The **aquatherm Advanced** utilizes standard aquatherm greenpipe® and climatherm® pipe lengths and fittings to simplify installation. For full instructions, see page 3.19.

Natural thermal resistance

The fusiolen® **PP-R** has a high thermal resistance value, giving a level of natural insulation to the pipe:

0.15W/mK = 1.04 Btuh/in/ft²/°F
R-value = 0.96

This, based on the thickness of the pipe wall, can offer a variety of cost and performance advantages compared to other systems.

Calculated heat loss/heat gain

In an effort to improve efficiency and save energy, most areas use building and energy codes that dictate the required amounts of insulation for a piping system. These codes must always be followed unless permission to follow the guidelines given here is expressly given.

Most energy codes are based around heat loss and heat gain for metal piping systems. The **aquatherm** piping systems are more efficient than metal systems and have much lower heat losses and heat gains. It is important to calculate the heat loss or heat gain of a system and compare it to the acceptable heat loss or heat gain for the relevant code. In most cases, a thinner amount of insulation will allow the **aquatherm** piping system to perform at an equal or higher level of efficiency than other systems under the same code.

Insulation and energy savings

The natural insulation of the pipe and fittings greatly reduces the amount of thermal energy transfer through the walls. Simply upgrading from bare metal pipe to bare **aquatherm** pipe can reduce heat loss or heat gain by as much as 50%. In most applications, this provides the same level of energy savings as a 1/4" of standard pipe insulation.

When using **aquatherm Advanced,** the energy savings are even greater. The **aquatherm Advanced** system with bare fittings is equivalent to 1" or more of standard pipe insulation, and when combined with **aquatherm Advanced** fittings, the savings are equivalent to at least 1 1/2" of standard insulation. Exact figures are given on pages 5.3 and 5.4. Always verify with local building inspectors that these figures are acceptable before beginning installation.

In many cases, an analysis of the heat loss or heat gain through the **aquatherm** pipe walls will show that less insulation is needed to reach the efficiency levels of other insulated systems. By finding the ideal thickness of insulation for a project, it is possible to maximize the savings. Excessive insulation costs more energy to produce than it will effectively save over the life of an installation and should be avoided.

Where permissible, it is recommended to use less insulation on **aquatherm** piping systems than on other systems in order to maximize overall efficiency.

Scalding

One safety concern in hot water systems is scalding from contact with the pipe walls. Exposure to bare metal pipe with hot water inside can cause serious injury. Even in an insulated system, a risk for injury can still exist at any gap in the insulation.

The natural insulation value of the **aquatherm** piping systems helps reduce the amount of insulation needed to prevent scalding and greatly reduces the risk of injury if the pipe becomes exposed.

Condensation

Water condensation on the walls of the pipe, or "sweating," is caused when the surface temperature of the pipe is lower than the dew point in the room. Adding insulation to the pipe walls will generally solve this problem, but if the vapor barrier becomes damaged, condensation can form under the insulation and ruin it.

The natural insulation of **aquatherm** piping systems helps resist condensation. In cooling applications, the surface temperature of an uninsulated **aquatherm** piping system is generally higher than other bare piping systems. This can prevent condensation from forming on the pipe, even in applications where it would normally occur.

By comparing the calculated surface temperature of the pipe with the maximum estimated dew point, it is easy to find the ideal thickness of insulation for an application. In certain installations, particularly those in controlled environments, it may be possible to do away with the insulation altogether. The table on page 5.4 gives the estimated surface temperatures for cold water systems.

Heat loss per foot SDR 11

Based on 170°F fluid temperature and 70°F room temperature (100°F ΔT)

Insulation thickness	Thermal properties	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" 160mm	8" 200mm	10" 250mm
Basic Thermal Conduit	Heat loss BTUh/FT	32.0	38.9	47.8	57.3	68.0	80.5	90.7	102.0	115.0	123.6	140.3	161.6	181.1
	Surface Temp°F	158.2	155.7	152.4	148.9	144.9	140.4	136.6	132.4	127.6	124.5	118.3	110.5	103.3
	Equivalent Insulation*	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4
Aquatherm Advance 5/16" w/ Std Fitting	Heat loss BTUh/FT	7.2	8.6	10.9	12.9	15.6	19.3	21.8	25.5	30.6	33.2	34.8	41.9	49.9
	Surface Temp°F	139.7	134.8	129.0	123.5	118.0	112.2	108.1	103.9	99.5	96.9	118.3	110.5	103.3
	Equivalent Insulation*	1.7	1.7	1.4	1.4	1.2	1.2	1.2	1.2	1.1	1.1	1.6	1.7	1.7
Aquatherm Advance 5/16" w/ Insul. Fitting	Heat loss BTUh/FT	5.7	6.6	8.3	10.0	11.9	14.7	17.1	20.0	24.0	25.3	33.1	40.0	47.8
	Surface Temp°F	79.6	80.0	80.3	80.5	80.7	80.8	80.9	80.9	80.8	80.8	80.6	79.4	78.4
	Equivalent Insulation*	3.0	3.0	2.9	2.6	1.8	1.7	1.7	1.7	1.5	1.6	1.7	1.8	1.8
Aquatherm Advance 5/8"	Heat loss BTUh/FT	4.1	4.7	5.6	6.6	7.7	9.3	10.6	12.3	14.6	16.2	19.9	24.1	29.0
	Surface Temp°F	74.4	74.6	74.9	75.1	75.2	75.4	75.5	75.6	75.7	75.7	75.7	75.2	74.7
	Equivalent Insulation*	2.6	2.5	2.4	2.3	2.2	2.2	2.1	2.1	2.0	2.0	2.0	2.1	3.0

Heat loss per foot SDR 7.4

Based on 170°F fluid temperature and 70°F room temperature (100°F ΔT)

Insulation thickness	Thermal properties	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" 160mm	8" 200mm	10" 250mm
Basic Thermal Conduit	Heat loss BTUh/FT	29.8	35.6	43.2	50.8	59.0	68.5	75.5	83.4	91.7	97.3	107.3	137.4	174.4
	Surface Temp°F	152.0	148.5	144.5	140.0	135.0	129.9	125.5	121.1	115.9	112.9	107.0	104.4	102.0
	Equivalent Insulation*	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.4
Aquatherm Advance 5/16" w/ Std Fitting	Heat loss BTUh/FT	7.0	8.3	10.5	12.3	14.8	18.1	20.3	23.6	27.9	30.1	32.1	39.8	49.3
	Surface Temp°F	135.1	129.9	123.8	118.3	112.7	107.2	103.2	99.3	95.3	93.0	88.9	84.3	80.8
	Equivalent Insulation*	1.8	1.9	1.5	1.5	1.3	1.3	1.4	1.3	1.3	1.3	1.8	1.8	1.8
Aquatherm Advance 5/16" w/ Insul. Fitting	Heat loss BTUh/FT	5.7	6.5	8.2	9.8	11.6	14.2	16.5	19.1	22.8	23.9	30.9	38.3	47.3
	Surface Temp°F	79.5	79.8	80.1	80.3	80.4	80.5	80.4	80.4	80.3	80.2	79.9	79.0	78.3
	Equivalent Insulation*	3.0	3.0	3.0	2.7	1.9	1.8	1.8	1.8	1.6	1.7	1.9	1.9	1.8
Aquatherm Advance 5/8"	Heat loss BTUh/FT	4.1	4.7	5.5	6.5	7.6	9.1	10.4	12.0	14.1	15.6	19.1	23.4	28.9
	Surface Temp°F	74.4	74.6	74.8	75.0	75.2	75.3	75.4	75.5	75.5	75.5	75.5	75.1	74.7
	Equivalent Insulation*	2.6	2.5	2.4	2.3	2.2	2.2	2.1	2.1	2.0	2.0	2.1	2.1	2.1

** Equivalent thickness in inches of Standard Insulation of Conductivity = .028 Btu·in./(h·ft2·°F) on metal pipe.*

Heat gain per foot SDR 11

Based on 45°F fluid temperature and 70°F room temperature (25°F ΔT)

Insulation thickness	Thermal properties	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" 160mm	8" 200mm	10" 250mm
Basic Thermal Conduit	Heat loss BTUh/FT	8.0	9.7	12.0	14.3	17.0	20.1	22.7	25.5	28.8	30.9	35.1	40.4	45.3
	Surface Temp°F	47.9	48.6	49.4	50.3	51.3	52.4	53.4	54.4	55.6	56.4	57.9	59.9	61.7
	Equivalent Insulation*	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4
Aquatherm Advance 5/16" w/ Std Fitting	Heat loss BTUh/FT	1.9	2.3	2.8	3.3	4.1	5.0	5.6	6.5	7.8	8.7	8.9	10.6	12.7
	Surface Temp°F	52.6	53.8	55.2	56.6	58.0	59.4	60.5	61.5	62.6	63.3	57.9	59.9	61.7
	Equivalent Insulation*	1.7	1.8	1.9	1.7	1.4	1.5	1.4	1.6	1.3	1.3	1.8	1.7	2.9
Aquatherm Advance 5/16" w/ Insul. Fitting	Heat loss BTUh/FT	1.6	1.8	2.2	2.7	3.2	3.9	4.5	5.2	6.2	6.9	8.4	10.2	12.1
	Surface Temp°F	67.6	67.5	67.4	67.4	67.3	67.3	67.3	67.3	67.3	67.3	67.4	67.6	67.9
	Equivalent Insulation*	1.9	1.9	1.8	1.7	1.6	1.6	1.6	1.5	1.5	1.5	1.6	1.6	2.9
Aquatherm Advance 5/8"	Heat loss BTUh/FT	1.0	1.2	1.4	1.6	1.9	2.3	2.7	3.1	3.6	4.0	5.0	6.0	7.3
	Surface Temp°F	68.9	68.8	68.8	68.7	68.7	68.6	68.6	68.6	68.6	68.6	68.6	68.7	68.8
	Equivalent Insulation*	2.6	2.5	2.4	2.3	2.2	2.2	2.1	2.1	2.0	2.0	2.0	2.1	3.0

Heat gain per foot SDR 7.4

Based on 45°F fluid temperature and 70°F room temperature (25°F ΔT)

Insulation thickness	Thermal properties	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" 160mm	8" 200mm	10" 250mm
Basic Thermal Conduit	Heat loss BTUh/FT	7.4	8.9	10.8	12.7	14.8	17.1	18.9	20.9	22.9	24.3	26.8	34.3	43.6
	Surface Temp°F	49.5	50.4	51.4	52.5	53.7	55.0	56.1	57.2	58.5	59.3	60.8	61.4	62.0
	Equivalent Insulation*	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.4
Aquatherm Advance 5/16" w/ Std Fitting	Heat loss BTUh/FT	1.9	2.2	2.7	3.2	3.8	4.7	5.2	6.1	7.1	7.9	8.2	10.1	12.5
	Surface Temp°F	53.7	55.0	56.5	57.9	59.3	60.7	61.7	62.7	63.7	64.3	65.3	66.4	67.3
	Equivalent Insulation*	1.7	1.9	2.0	1.8	1.5	1.6	1.5	1.7	1.5	1.4	1.9	1.8	1.6
Aquatherm Advance 5/16" w/ Insul. Fitting	Heat loss BTUh/FT	1.5	1.8	2.2	2.6	3.1	3.7	4.3	5.0	5.8	6.5	7.9	9.7	12.0
	Surface Temp°F	67.6	67.5	67.5	67.4	67.4	67.4	67.4	67.4	67.4	67.5	67.5	67.7	67.9
	Equivalent Insulation*	1.9	1.9	1.8	1.7	1.6	1.6	1.6	1.6	1.5	1.5	1.7	1.7	1.7
Aquatherm Advance 5/8"	Heat loss BTUh/FT	1.0	1.2	1.4	1.6	1.9	2.3	2.6	3.0	3.5	3.9	4.8	5.9	7.2
	Surface Temp°F	68.9	68.9	68.8	68.8	68.7	68.7	68.7	68.6	68.6	68.6	68.6	68.7	68.8
	Equivalent Insulation*	2.6	2.5	2.4	2.3	2.2	2.2	2.1	2.1	2.0	2.0	2.1	2.1	2.1

** Equivalent thickness in inches of Standard Insulation of Conductivity = .028 Btu·in./(h·ft2·°F) on metal pipe.*

Insulation on fittings

The socket fusion fittings, used from sizes ½" to 4" (20 mm - 125 mm) are external fittings, and increase the overall thickness of the pipe wall. This helps reduce heat transfer through the fittings and can eliminate the need to insulate the fittings, even in applications where the pipe walls themselves need to be insulated. The following table gives the approximate surface temperatures of the fusion fittings for both the SDR 7.4 and the SDR 11.

Surface temperature of fittings

Based on 45°F fluid temperature and 70°F room temperature.

Pipe Size	Climatherm SDR 11 (°F)	Fusiotherm SDR 7.4 (°F)
½" (20 mm)	54.27	54.48
¾" (25 mm)	54.17	55.34
1" (32 mm)	55.38	55.47
1 ¼" (40 mm)	56.18	56.73
1 ½" (50 mm)	58.41	57.58
2" (63 mm)	59.48	59.71
2 ½" (75 mm)	60.48	60.73
3" (90 mm)	61.54	61.75
3 ½" (110 mm)	62.66	62.71
4" (125 mm)	63.30	63.74

System Protection

Allowing a pump to operate for an extended period of time with zero flow passing through it can result in the pump and adjoining piping system reaching temperatures and pressures far above those recommended in by **aquatherm** (see page 1.7). These conditions will age the pipe and fittings considerably, causing them and other components to fail.

It is recommended that the designer provide a sensor system that will warn of temperatures over 180°F, or an automatic temperature and pressure relief valve at the pump discharge, or a similar preventative measure.

Pipe sizing

The recommended pipe diameter is based on the calculation of the pressure loss in the pipes.

Besides the diameter, the pressure loss depends on the length of the pipe, the pipe material, the flow rate, and the quantity and size of the fixtures to which the pipe is connected.

Due to the strength of the fused joints, as well as the minimal friction caused by the **fusiolen®** material, it is recommended that the system run at 8 ft/sec rather than the standard 3 - 5 ft/sec for metal pipe.

Principles of calculation

To determine the pipe diameter in potable water systems of buildings, there are many factors to be considered, including:

- flow speed
- required gallons per minute
- pipe friction factor of the material used
- coefficients of loss for fittings and pipe connections
- number of fixture units
- type of fixture units
- pressure loss due to apparatus (water meter, filter, softening installations, etc.)

This section includes charts on the head loss of SDR 7.4 and SDR 11 systems, as well as the estimated GPM based on a flow speed of 8 ft/s. It is important to note the differences between the SDR 7.4 and the SRD 11, as the actual ID's for both vary slightly.

Having a flow speed of 8 ft/s can sometimes allow for downsizing of the pipe when compared against other piping systems (for example, in an application where a six-inch copper pipe would have been used, a four-inch **aquatherm greenpipe®** may be sufficient). However, this is more common when using SRD 11 **climatherm®** (recommended for heating and cooling distribution and other non-potable applications) and the SDR 11 **aquatherm greenpipe®** (recommended to cold potable water systems) because the SDR 11 pipes have a higher water content per foot.

The coefficients of loss for the fittings are also included.

Commercial water pipe sizing (based on 8 f/s)

aquatherm greenpipe® SDR 11
climatherm® faser-composite pipe SDR 11

Nominal ID	Metric OD in mm	Metric ID in mm	liter/sec	GPM	Fixture Units*	
					no flush v.	w/ flush v.
½”	20	16.2	0.50	8.0	10	-
¾”	25	20.4	0.80	12.6	17	-
1”	32	26.2	1.31	20.8	31	7
1 ¼”	40	32.6	2.04	32.3	61	17
1 ½”	50	40.8	3.19	50.5	130	51
2”	63	51.4	5.06	80.2	276	156
2 ½”	75	61.4	7.22	114.4	450	334
3”	90	73.6	10.38	164.4	720	658
3 ½”	110	90.0	15.52	245.9	1307	1307
4”	125	102.2	20.01	317.0	1929	1929
6”	160	130.8	32.77	519.3	3938	3938
8”	200	163.6	51.27	812.4	10100	10100
10”	250	204.6	80.19	1270.6	15000	15000

Commercial water pipe sizing (based on 8 f/s)

aquatherm greenpipe® faser-composite pipe SDR 7.4

Nominal ID	Metric OD in mm	Metric ID in mm	liter/sec	GPM	Fixture Units*	
					no flush v.	w/ flush v.
1/2”	20	14.4	0.4	6.3	7	-
3/4”	25	18	0.6	9.8	13	-
1”	32	23.2	1.0	16.3	24	6
1 1/4”	40	29	1.6	25.5	41	9
1 1/2”	50	36.2	2.5	39.8	86	27
2”	63	45.8	4.0	63.7	193	88
2 1/2”	75	54.4	5.7	89.8	324	199
3”	90	65.4	8.2	129.8	532	418
3 1/2”	110	79.8	12.2	193.3	903	881
4”	125	90.8	15.8	250.3	1344	1344
6”	160	116.2	25.9	409.8	2782	2782
8”	200	145.2	40.4	639.9	5939	5939
10”	250	181.6	63.2	1001.0	11200	11200

**Fixture units based on ASPE Engineered Plumbing Design II, 2004, reprinted 2006. Always consult local codes to determine applicable fixture unit values.*

Flow velocity and head (friction) losses in piping

The head loss (friction pressure loss) due to the flow of water through the **aquatherm** PP-R piping is given in the following tables. The water velocity is also provided. These values are calculated from the equations below. The Hazen-Williams formula is widely used in water piping applications. It does not account for differences in fluid viscosity (different fluids) and fluid temperature. Consult your **aquatherm** representative for data using other fluids such as chemical process piping or compressed gases.

Hazen-Williams formula for pressure loss (psi / 100 ft. of pipe)

$$P_L = \frac{452}{d_i^{4.87}} \left(\frac{Q}{C} \right)^{1.85}$$

Where: PL = pressure loss, psi / 100 ft of pipe
Q = flow rate, gpm
di = inside diameter of pipe, inches
C = flow coefficient = 150 for PP-R piping

Conversion to head loss (ft of head loss per 100 ft of pipe):

HL = 2.31(PL)

Where: HL = head loss, ft / 100 ft of pipe

Calculation of flow velocity:

$$v = 0.4084 \left(\frac{Q}{d_i^2} \right)$$

Where: v = flow velocity, ft/sec

Thrust blocking

Due to the inherent strength and integrity of fused connections, thrust blocking is not required.

Pump connections

Due to fusiolen® **PP-R's** natural ability to absorb vibration, isolators are not required.

Maximum flow rate

Another consideration for the selection of the pipe diameter is the maximum permissible flow rate.

To avoid noise generation and water hammer, the calculated flow rate may not exceed the values of the table below.

Section of the installation	max. calculated flow rate at run	
	≤ 15 min. m/s	> 15 min. m/s
Connecting pipes	2	2
Service pipes: Parts with poor drag reducing passage armatures (<2.5) *	5	2
Parts with passage armatures with a higher correction value loss **	2.5	2

* *i.e. piston valves, ball cock inclined values*
** *i.e. screw-down stop globe valves*

Recommended sizing

To protect the pipe from exposure to unacceptably high temperature and pressure that could occur due to prolonged "dead heading" (pump operating at full speed with flow completely restricted), **aquatherm** recommends temperature and pressure relief valves at the discharge of 3 horse power and larger pumps.

The following tables give the head loss and flow rates of the pipe based on the pipe size and the desired GPM. Reducing head loss on the critical leg of the system can allow for downsizing on other sections of pipe.

The blue indicates the recommended sizing based on flow rate (approx. 8 f/s).

The yellow indicates the recommended size of the critical leg of the system based on head loss (avg. 3 ft /100 ft or less).

The green indicates the that recommended size of pipe for the critical leg and other sections of the system are the same.

Pipe friction factor (R) in feet of head per 100 ft. and calculated velocity (v) in feet per second based on the flow rate ($\dot{V}$)

aquatherm greenpipe® SDR 11
climatherm® faser-composite pipe SDR 11

68°F

temperature: 68°F/20°C
roughness: 0.0070 mm density: 62.32 lb/ft^3 viscosity: 1.004 x 10^{-6}m^2/s

$\dot{V}$	Dimension	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" 160mm	8" 200mm	10" 250mm
0.1 US gpm	R	0.0241	0.0083	0.0027	0.001	0.0004	0.0001	0.0001	0	0	0	0	0	0
	v	0.1	0.06	0.04	0.02	0.02	0.01	0.01	0	0	0	0	0	0
0.2 US gpm	R	0.0743	0.0255	0.008	0.0029	0.001	0.0004	0.0002	0.0001	0	0	0	0	0
	v	0.2	0.13	0.08	0.05	0.03	0.02	0.01	0.01	0.01	0.01	0	0	0
0.3 US gpm	R	0.1454	0.0496	0.0155	0.0056	0.002	0.0007	0.0003	0.0001	0.0001	0	0	0	0
	v	0.3	0.19	0.12	0.07	0.05	0.03	0.02	0.01	0.01	0.01	0	0	0
0.4 US gpm	R	0.2353	0.08	0.0249	0.009	0.0032	0.0011	0.0005	0.0002	0.0001	0	0	0	0
	v	0.4	0.25	0.15	0.1	0.06	0.04	0.03	0.02	0.01	0.01	0.01	0	0
0.5 US gpm	R	0.3427	0.1162	0.0361	0.013	0.0046	0.0016	0.0007	0.0003	0.0001	0.0001	0	0	0
	v	0.5	0.32	0.19	0.12	0.08	0.05	0.03	0.02	0.02	0.01	0.01	0	0
0.6 US gpm	R	0.4668	0.158	0.0489	0.0176	0.0062	0.0021	0.0009	0.0004	0.0002	0.0001	0	0	0
	v	0.6	0.38	0.23	0.15	0.09	0.06	0.04	0.03	0.02	0.02	0.01	0.01	0
0.7 US gpm	R	0.6069	0.205	0.0633	0.0228	0.008	0.0027	0.0012	0.0005	0.0002	0.0001	0	0	0
	v	0.7	0.44	0.27	0.17	0.11	0.07	0.05	0.03	0.02	0.02	0.01	0.01	0
0.8 US gpm	R	0.7624	0.2572	0.0793	0.0285	0.01	0.0034	0.0015	0.0006	0.0003	0.0001	0	0	0
	v	0.8	0.51	0.31	0.2	0.13	0.08	0.06	0.04	0.03	0.02	0.01	0.01	0.01
0.9 US gpm	R	0.933	0.3143	0.0968	0.0347	0.0121	0.0041	0.0018	0.0008	0.0003	0.0002	0.0001	0	0
	v	0.9	0.57	0.35	0.22	0.14	0.09	0.06	0.04	0.03	0.02	0.01	0.01	0.01
1.0 US gpm	R	1.1182	0.3762	0.1157	0.0415	0.0145	0.0049	0.0021	0.0009	0.0004	0.0002	0.0001	0	0
	v	1	0.63	0.38	0.25	0.16	0.1	0.07	0.05	0.03	0.03	0.02	0.01	0.01
2.0 US gpm	R	3.7238	1.2427	0.3793	0.1349	0.0468	0.0158	0.0069	0.0029	0.0011	0.0006	0.0002	0.0001	0.0000
	v	2.0100	1.2700	0.7700	0.5000	0.3200	0.2000	0.1400	0.1000	0.0700	0.0500	0.0300	0.0200	0.0100
3.0 US gpm	R	7.5972	2.5224	0.7660	0.2715	0.0938	0.0315	0.0136	0.0058	0.0023	0.0012	0.0004	0.0001	0.0000
	v	3.0100	1.9000	1.1500	0.7400	0.4700	0.3000	0.2100	0.1500	0.1000	0.0800	0.0500	0.0300	0.0200
4.0 US gpm	R	12.6536	4.1847	1.2662	0.4474	0.1543	0.0517	0.0223	0.0095	0.0037	0.0020	0.0006	0.0002	0.0001
	v	4.0200	2.5300	1.5400	0.9900	0.6300	0.4000	0.2800	0.1900	0.1300	0.1000	0.0600	0.0400	0.0300
5.0 US gpm	R	18.84	6.21	1.87	0.66	0.23	0.08	0.03	0.01	0.01	0.00	0.00	0.00	0.00
	v	5.02	3.17	1.92	1.24	0.79	0.50	0.35	0.24	0.16	0.13	0.08	0.05	0.03
6.0 US gpm	R	26.13	8.59	2.58	0.91	0.31	0.10	0.04	0.02	0.01	0.00	0.00	0.00	0.00
	v	6.03	3.80	2.30	1.49	0.95	0.60	0.42	0.29	0.20	0.15	0.09	0.06	0.04

$\dot{V}$ = flow rate (US gpm) | R = feet of head per 100 ft | v = velocity (ft/sec)

Pipe friction factor (R) in feet of head per 100 ft. and calculated velocity (v) in feet per second based on the flow rate ($\dot{V}$)

aquatherm greenpipe® SDR 11
climatherm® faser-composite pipe SDR 11

68°F

temperature: 68°F/20°C
roughness: 0.0070 mm density: 62.32 lb/ft³ viscosity: 1.004 x 10^{-6} m²/s

$\dot{V}$	Dimension	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" 160mm	8" 200mm	10" 250mm
7.0 US gpm	R	34.50	11.31	3.40	1.19	0.41	0.14	0.06	0.02	0.01	0.01	0.00	0.00	0.00
	v	7.03	4.43	2.69	1.74	1.11	0.70	0.49	0.34	0.23	0.18	0.11	0.07	0.04
8.0 US gpm	R	43.93	14.37	4.31	1.51	0.52	0.17	0.07	0.03	0.01	0.01	0.00	0.00	0.00
	v	8.03	5.07	3.07	1.98	1.27	0.80	0.56	0.39	0.26	0.20	0.12	0.08	0.05
9.0 US gpm	R	54.40	17.76	5.31	1.86	0.64	0.21	0.09	0.04	0.01	0.01	0.00	0.00	0.00
	v	9.04	5.70	3.46	2.23	1.42	0.90	0.63	0.44	0.29	0.23	0.14	0.09	0.06
10.0 US gpm	R	65.90	21.47	6.41	2.24	0.77	0.25	0.11	0.05	0.02	0.01	0.00	0.00	0.00
	v	10.04	6.33	3.84	2.48	1.58	1.00	0.70	0.49	0.33	0.25	0.15	0.10	0.06
11.0 US gpm	R	78.43	25.51	7.60	2.66	0.91	0.30	0.13	0.05	0.02	0.01	0.00	0.00	0.00
	v	11.05	6.97	4.22	2.73	1.74	1.10	0.77	0.54	0.36	0.28	0.17	0.11	0.07
12.0 US gpm	R	91.9771	29.8589	8.8851	3.1011	1.0573	0.3506	0.1503	0.0634	0.0244	0.0134	0.0042	0.0014	0.0005
	v	12.05	7.6	4.61	2.98	1.9	1.2	0.84	0.58	0.39	0.3	0.18	0.12	0.08
13.0 US gpm	R	106.5307	34.5278	10.2595	3.5771	1.2185	0.4038	0.1729	0.073	0.0281	0.0154	0.0048	0.0017	0.0006
	v	13.05	8.23	4.99	3.22	2.06	1.3	0.91	0.63	0.42	0.33	0.2	0.13	0.08
14.0 US gpm	R	122.0882	39.5098	11.7238	4.0836	1.3898	0.4602	0.197	0.0831	0.0319	0.0175	0.0054	0.0019	0.0007
	v	14.06	8.87	5.38	3.47	2.22	1.4	0.98	0.68	0.46	0.35	0.22	0.14	0.09
15.0 US gpm	R	138.6446	44.8029	13.2769	4.6202	1.5712	0.5199	0.2224	0.0938	0.036	0.0197	0.0061	0.0021	0.0007
	v	15.06	9.5	5.76	3.72	2.37	1.5	1.05	0.73	0.49	0.38	0.23	0.15	0.09
16.0 US gpm	R	156.1957	50.405	14.9184	5.1867	1.7625	0.5827	0.2492	0.105	0.0403	0.022	0.0068	0.0024	0.0008
	v	16.07	10.13	6.14	3.97	2.53	1.6	1.12	0.78	0.52	0.4	0.25	0.16	0.1
17.0 US gpm	R	174.7379	56.3146	16.6474	5.7829	1.9636	0.6488	0.2773	0.1168	0.0448	0.0245	0.0076	0.0026	0.0009
	v	17.07	10.77	6.53	4.22	2.69	1.7	1.19	0.83	0.55	0.43	0.26	0.17	0.11
18.0 US gpm	R	194.2678	62.5301	18.4635	6.4084	2.1744	0.718	0.3068	0.1292	0.0496	0.0271	0.0084	0.0029	0.001
	v	18.08	11.4	6.91	4.46	2.85	1.8	1.26	0.88	0.59	0.45	0.28	0.18	0.11
19.0 US gpm	R	214.7826	69.0503	20.3661	7.0631	2.3949	0.7904	0.3376	0.1421	0.0545	0.0298	0.0092	0.0032	0.0011
	v	19.08	12.03	7.29	4.71	3.01	1.9	1.33	0.92	0.62	0.48	0.29	0.19	0.12
20.0 US gpm	R	236.2796	75.8737	22.3547	7.7467	2.625	0.8658	0.3697	0.1555	0.0596	0.0326	0.0101	0.0035	0.0012
	v	20.08	12.67	7.68	4.96	3.17	2	1.4	0.97	0.65	0.5	0.31	0.2	0.13
22.0 US gpm	R	282.2117	90.4265	26.5883	9.2003	3.1136	1.0259	0.4377	0.184	0.0705	0.0385	0.0119	0.0041	0.0014
	v	22.09	13.93	8.45	5.46	3.48	2.19	1.54	1.07	0.72	0.56	0.34	0.22	0.14

$\dot{V}$ = flow rate (US gpm) | R = feet of head per 100 ft | v = velocity (ft/sec)

Pipe friction factor (R) in feet of head per 100 ft. and calculated velocity (v) in feet per second based on the flow rate ($\dot{V}$)

aquatherm greenpipe® SDR 11
climatherm® faser-composite pipe SDR 11

68°F

temperature: 68°F/20°C
roughness: 0.0070 mm density: 62.32 lb/ft³ viscosity: 1.004 x 10^{-6} m²/s

$\dot{V}$	Dimension	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" 160mm	8" 200mm	10" 250mm
24.0 US gpm	R	332.0482	106.1809	31.1613	10.7677	3.6398	1.198	0.5108	0.2146	0.0822	0.0448	0.0139	0.0048	0.0017
	v	24.1	15.2	9.21	5.95	3.8	2.39	1.68	1.17	0.78	0.61	0.37	0.24	0.15
26.0 US gpm	R	385.7761	123.1302	36.0708	12.4478	4.203	1.3821	0.5889	0.2473	0.0946	0.0516	0.0159	0.0055	0.0019
	v	26.11	16.47	9.98	6.45	4.12	2.59	1.82	1.26	0.85	0.66	0.4	0.26	0.16
28.0 US gpm	R	443.3849	141.2692	41.3148	14.2397	4.8029	1.5779	0.6719	0.282	0.1078	0.0588	0.0182	0.0063	0.0022
	v	28.12	17.73	10.75	6.94	4.43	2.79	1.96	1.36	0.91	0.71	0.43	0.28	0.18
30.0 US gpm	R	504.8655	160.5932	46.891	16.1424	5.4391	1.7854	0.7598	0.3188	0.1218	0.0664	0.0205	0.0071	0.0024
	v	30.13	19	11.52	7.44	4.75	2.99	2.1	1.46	0.98	0.76	0.46	0.3	0.19
32.0 US gpm	R	570.2104	181.0981	52.7978	18.1553	6.1114	2.0044	0.8526	0.3575	0.1365	0.0744	0.023	0.0079	0.0027
	v	32.13	20.27	12.29	7.94	5.07	3.19	2.24	1.56	1.04	0.81	0.49	0.32	0.2
34.0 US gpm	R	639.413	202.7804	59.0337	20.2776	6.8194	2.2348	0.9501	0.3982	0.152	0.0828	0.0255	0.0088	0.003
	v	34.14	21.53	13.05	8.43	5.38	3.39	2.38	1.65	1.11	0.86	0.52	0.33	0.21
36.0 US gpm	R	712.4678	225.6371	65.5972	22.5086	7.563	2.4766	1.0523	0.4409	0.1682	0.0916	0.0282	0.0097	0.0034
	v	36.15	22.8	13.82	8.93	5.7	3.59	2.52	1.75	1.17	0.91	0.55	0.35	0.23
38.0 US gpm	R	789.3701	249.6654	72.4872	24.8479	8.3418	2.7296	1.1593	0.4855	0.1852	0.1008	0.0311	0.0107	0.0037
	v	38.16	24.06	14.59	9.42	6.02	3.79	2.66	1.85	1.24	0.96	0.59	0.37	0.24
40.0 US gpm	R	870.1156	274.863	79.7024	27.2949	9.1556	2.9938	1.2709	0.532	0.2028	0.1104	0.034	0.0117	0.004
	v	40.17	25.33	15.36	9.92	6.33	3.99	2.8	1.95	1.3	1.01	0.62	0.39	0.25
45.0 US gpm	R	1088.770	342.9592	99.1572	33.8807	11.3423	3.7026	1.5701	0.6566	0.2501	0.1361	0.0419	0.0144	0.005
	v	45.19	28.5	17.28	11.16	7.12	4.49	3.15	2.19	1.46	1.14	0.69	0.44	0.28
50.0 US gpm	R	1331.377	418.3232	120.6258	41.1306	13.7442	4.4797	1.8977	0.7929	0.3018	0.1641	0.0504	0.0173	0.006
	v	50.21	31.66	19.2	12.4	7.92	4.99	3.5	2.43	1.63	1.26	0.77	0.49	0.31
55.0 US gpm	R	1597.903	500.9338	144.0975	49.0393	16.359	5.3242	2.2533	0.9407	0.3578	0.1945	0.0597	0.0205	0.0071
	v	55.23	34.83	21.12	13.64	8.71	5.49	3.84	2.68	1.79	1.39	0.85	0.54	0.35
60.0 US gpm	R	1888.319	590.7742	169.5637	57.6028	19.1849	6.2353	2.6366	1.0998	0.418	0.2271	0.0697	0.0239	0.0082
	v	60.25	38	23.04	14.88	9.5	5.99	4.19	2.92	1.95	1.51	0.92	0.59	0.38
65.0 US gpm	R	2202.608	687.8313	197.0173	66.8172	22.2203	7.2125	3.0472	1.2702	0.4824	0.262	0.0803	0.0276	0.0095
	v	65.27	41.16	24.96	16.12	10.29	6.48	4.54	3.16	2.11	1.64	1	0.64	0.41
70.0 US gpm	R	2540.751	792.0942	226.4524	76.6797	25.4638	8.255	3.4849	1.4516	0.5509	0.2991	0.0916	0.0314	0.0108
	v	70.3	44.33	26.88	17.36	11.08	6.98	4.89	3.41	2.28	1.77	1.08	0.69	0.44

$\dot{V}$ = flow rate (US gpm) | R = feet of head per 100 ft | v = velocity (ft/sec)

Pipe friction factor (R) in feet of head per 100 ft. and calculated velocity (v) in feet per second based on the flow rate ($\dot{V}$)

aquatherm greenpipe® SDR 11
climatherm® faser-composite pipe SDR 11

68°F

temperature: 68°F/20°C
roughness: 0.0070 mm density: 62.32 lb/ft³ viscosity: 1.004 x 10^{-6} m²/s

$\dot{V}$	Dimension	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" 160mm	8" 200mm	10" 250mm
75.0 US gpm	R	2902.737	903.554	257.864	87.1876	28.9142	9.3625	3.9494	1.644	0.6235	0.3384	0.1036	0.0355	0.0122
	v	75.32	47.5	28.79	18.6	11.87	7.48	5.24	3.65	2.44	1.89	1.16	0.74	0.47
80.0 US gpm	R	3288.556	1022.203	291.2479	98.3387	32.5703	10.5345	4.4406	1.8472	0.7002	0.3799	0.1163	0.0398	0.0137
	v	80.34	50.66	30.71	19.84	12.67	7.98	5.59	3.89	2.6	2.02	1.23	0.79	0.5
85.0 US gpm	R	3698.198	1148.036	326.6006	110.1308	36.4313	11.7706	4.9581	2.0612	0.7808	0.4235	0.1295	0.0444	0.0152
	v	85.36	53.83	32.63	21.08	13.46	8.48	5.94	4.14	2.77	2.14	1.31	0.84	0.54
90.0 US gpm	R	4131.657	1281.048	363.9188	122.5624	40.4962	13.0703	5.5019	2.2859	0.8655	0.4693	0.1435	0.0491	0.0169
	v	90.38	57	34.55	22.32	14.25	8.98	6.29	4.38	2.93	2.27	1.39	0.89	0.57
95.0 US gpm	R	4588.927	1421.233	403.1999	135.6318	44.7645	14.4335	6.0718	2.5213	0.9541	0.5171	0.158	0.0541	0.0186
	v	95.4	60.16	36.47	23.56	15.04	9.48	6.64	4.62	3.09	2.4	1.46	0.94	0.6
100.0 US gpm	R	5070.003	1568.589	444.4415	149.3378	49.2353	15.8598	6.6675	2.7671	1.0466	0.5671	0.1732	0.0592	0.0203
	v	100.42	63.33	38.39	24.8	15.83	9.98	6.99	4.87	3.25	2.52	1.54	0.98	0.63
110.0 US gpm	R	6103.557	1884.799	532.7983	178.6547	58.7822	18.9006	7.9364	3.2903	1.2432	0.6733	0.2054	0.0702	0.0241
	v	110.46	69.66	42.23	27.28	17.42	10.97	7.69	5.35	3.58	2.78	1.69	1.08	0.69
120.0 US gpm	R	7232.291	2229.655	628.9753	210.5046	69.1329	22.1907	9.3074	3.8548	1.4551	0.7877	0.2401	0.082	0.0281
	v	120.51	75.99	46.07	29.76	19	11.97	8.39	5.84	3.9	3.03	1.85	1.18	0.76
130.0 US gpm	R	8456.187	2603.143	732.9616	244.8811	80.2836	25.7287	10.7798	4.4605	1.6823	0.9102	0.2772	0.0946	0.0324
	v	130.55	82.33	49.91	32.24	20.58	12.97	9.09	6.32	4.23	3.28	2	1.28	0.82
140.0 US gpm	R	9775.229	3005.250	844.7484	281.7784	92.2315	29.5131	12.3528	5.1068	1.9244	1.0407	0.3168	0.1081	0.037
	v	140.59	88.66	53.75	34.72	22.16	13.97	9.79	6.81	4.56	3.53	2.16	1.38	0.88
150.0 US gpm	R		3435.965	964.3286	321.1922	104.9739	33.5427	14.0258	5.7935	2.1814	1.1792	0.3586	0.1223	0.0418
	v		94.99	57.59	37.2	23.75	14.96	10.49	7.3	4.88	3.78	2.31	1.48	0.94
160.0 US gpm	R		3895.280	1091.696	363.1184	118.5088	37.8164	15.7983	6.5203	2.4532	1.3255	0.4029	0.1373	0.0469
	v		101.33	61.43	39.68	25.33	15.96	11.19	7.78	5.21	4.04	2.46	1.58	1.01
170.0 US gpm	R		4383.190	1226.846	407.5539	132.8343	42.3333	17.6697	7.2869	2.7396	1.4797	0.4494	0.1531	0.0523
	v		107.66	65.27	42.16	26.91	16.96	11.88	8.27	5.53	4.29	2.62	1.67	1.07
180.0 US gpm	R			1369.775	454.4958	147.9487	47.0925	19.6397	8.0932	3.0406	1.6416	0.4983	0.1696	0.0579
	v			69.11	44.64	28.5	17.96	12.58	8.76	5.86	4.54	2.77	1.77	1.13
190.0 US gpm	R			1520.479	503.9418	163.8505	52.0935	21.7077	8.939	3.356	1.8113	0.5494	0.187	0.0638
	v			72.95	47.12	30.08	18.95	13.28	9.24	6.18	4.79	2.93	1.87	1.2

$\dot{V}$ = flow rate (US gpm) | R = feet of head per 100 ft | v = velocity (ft/sec)

Pipe friction factor (R) in feet of head per 100 ft. and calculated velocity (v) in feet per second based on the flow rate ($\dot{V}$)

aquatherm greenpipe® SDR 11
climatherm® faser-composite pipe SDR 11

68°F

temperature: 68°F/20°C
roughness: 0.0070 mm density: 62.32 lb/ft³ viscosity: 1.004 x 10^{-6} m²/s

$\dot{V}$	Dimension	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" 160mm	8" 200mm	10" 250mm
200.0 US gpm	R			1678.956	555.8898	180.5386	57.3354	23.8735	9.8239	3.6858	1.9885	0.6028	0.205	0.07
	v			76.79	49.6	31.66	19.95	13.98	9.73	6.51	5.05	3.08	1.97	1.26
220.0 US gpm	R			2019.215	667.2847	216.2692	68.5399	28.4969	11.7109	4.3882	2.3658	0.7164	0.2435	0.083
	v			84.47	54.56	34.83	21.95	15.38	10.7	7.16	5.55	3.39	2.17	1.39
240.0 US gpm	R			2390.538	788.6686	255.1327	80.7021	33.5078	13.7529	5.1472	2.7732	0.8389	0.2849	0.0971
	v			92.14	59.52	38	23.94	16.78	11.68	7.81	6.06	3.7	2.36	1.51
260.0 US gpm	R				920.0321	297.1233	93.8186	38.9041	15.949	5.9624	3.2104	0.9701	0.3292	0.1121
	v				64.48	41.16	25.94	18.18	12.65	8.46	6.56	4.01	2.56	1.64
280.0 US gpm	R				1061.368	342.236	107.8866	44.6842	18.2982	6.8333	3.6772	1.1101	0.3764	0.1281
	v				69.44	44.33	27.93	19.57	13.62	9.11	7.07	4.31	2.76	1.76
300.0 US gpm	R				1212.670	390.4667	122.9037	50.8467	20.7999	7.7596	4.1733	1.2587	0.4265	0.1451
	v				74.39	47.5	29.93	20.97	14.6	9.76	7.57	4.62	2.95	1.89
320.0 US gpm	R				1373.934	441.8121	138.8681	57.3904	23.4533	8.7409	4.6985	1.4158	0.4794	0.163
	v				79.35	50.66	31.92	22.37	15.57	10.41	8.07	4.93	3.15	2.01
340.0 US gpm	R				1545.155	496.2694	155.7779	64.3143	26.2578	9.777	5.2527	1.5814	0.5352	0.1819
	v				84.31	53.83	33.92	23.77	16.54	11.06	8.58	5.24	3.35	2.14
360.0 US gpm	R				1726.331	553.8362	173.6318	71.6175	29.213	10.8675	5.8357	1.7555	0.5937	0.2017
	v				89.27	57	35.91	25.17	17.51	11.71	9.08	5.55	3.54	2.27
380.0 US gpm	R					614.5105	192.4283	79.299	32.3183	12.0124	6.4473	1.938	0.655	0.2224
	v					60.16	37.91	26.56	18.49	12.36	9.59	5.85	3.74	2.39
400.0 US gpm	R					678.2905	212.1665	87.3583	35.5733	13.2113	7.0875	2.1287	0.7191	0.244
	v					63.33	39.9	27.96	19.46	13.01	10.09	6.16	3.94	2.52
450.0 US gpm	R					851.3186	265.6252	109.1549	44.3636	16.4438	8.8119	2.6418	0.8912	0.3021
	v					71.24	44.89	31.46	21.89	14.64	11.35	6.93	4.43	2.83
500.0 US gpm	R					1043.729	324.9506	133.3001	54.0825	20.0104	10.7123	3.2061	1.0802	0.3658
	v					79.16	49.88	34.95	24.33	16.27	12.62	7.7	4.92	3.15
550.0 US gpm	R					1255.510	390.1333	159.7875	64.7261	23.909	12.7872	3.821	1.2859	0.435
	v					87.08	54.86	38.45	26.76	17.9	13.88	8.47	5.42	3.46
600.0 US gpm	R					1486.651	461.166	188.6121	76.2912	28.1379	15.0357	4.4861	1.508	0.5097
	v					94.99	59.85	41.94	29.19	19.52	15.14	9.24	5.91	3.78

$\dot{V}$ = flow rate (US gpm) | R = feet of head per 100 ft | v = velocity (ft/sec)

Pipe friction factor (R) in feet of head per 100 ft. and calculated velocity (v) in feet per second based on the flow rate ($\dot{V}$)

aquatherm greenpipe® SDR 11
climatherm® faser-composite pipe SDR 11

68°F

temperature: 68°F/20°C
roughness: 0.0070 mm density: 62.32 lb/ft³ viscosity: 1.004 x 10^{-6} m²/s

$\dot{V}$	Dimension	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" 160mm	8" 200mm	10" 250mm
650.0 US gpm	R					1737.143	538.0432	219.7699	88.7752	32.6957	17.4566	5.2011	1.7465	0.5898
	v					102.91	64.84	45.44	31.62	21.15	16.4	10.01	6.4	4.09
700.0 US gpm	R					2006.982	620.7603	253.2576	102.176	37.5812	20.0493	5.9655	2.0012	0.6752
	v					110.82	69.83	48.93	34.06	22.78	17.66	10.78	6.89	4.41
750.0 US gpm	R					2296.162	709.3139	289.0726	116.4917	42.7932	22.813	6.7791	2.2719	0.766
	v					118.74	74.82	52.43	36.49	24.4	18.92	11.55	7.39	4.72
800.0 US gpm	R					2604.680	803.7009	327.2127	131.721	48.331	25.7471	7.6417	2.5586	0.862
	v					126.66	79.8	55.93	38.92	26.03	20.19	12.32	7.88	5.04
850.0 US gpm	R					2932.533	903.919	367.676	147.8624	54.1938	28.8511	8.5529	2.8612	0.9633
	v					134.57	84.79	59.42	41.35	27.66	21.45	13.09	8.37	5.35
900.0 US gpm	R						1009.966	410.461	164.915	60.3809	32.1245	9.5127	3.1796	1.0697
	v						89.78	62.92	43.79	29.28	22.71	13.86	8.86	5.67
950.0 US gpm	R						1121.840	455.5663	182.8777	66.8916	35.567	10.5208	3.5136	1.1813
	v						94.77	66.41	46.22	30.91	23.97	14.63	9.35	5.98
1000.0 US gpm	R						1239.541	502.9909	201.7497	73.7256	39.1781	11.5771	3.8633	1.298
	v						99.75	69.91	48.65	32.54	25.23	15.4	9.85	6.3
1050.0 US gpm	R						1363.066	552.7336	221.5304	80.8822	42.9576	12.6814	4.2286	1.4198
	v						104.74	73.4	51.08	34.16	26.49	16.17	10.34	6.61
1100.0 US gpm	R						1492.415	604.7938	242.219	88.3612	46.9051	13.8335	4.6093	1.5467
	v						109.73	76.9	53.52	35.79	27.76	16.94	10.83	6.93
1150.0 US gpm	R						1627.587	659.1706	263.815	96.1621	51.0203	15.0335	5.0055	1.6786
	v						114.72	80.39	55.95	37.42	29.02	17.71	11.32	7.24
1200.0 US gpm	R						1768.582	715.8634	286.3179	104.2847	55.3032	16.281	5.4171	1.8156
	v						119.71	83.89	58.38	39.04	30.28	18.49	11.82	7.55
1250.0 US gpm	R						1915.397	774.8717	309.7274	112.7286	59.7533	17.5761	5.844	1.9576
	v						124.69	87.38	60.82	40.67	31.54	19.26	12.31	7.87
1300.0 US gpm	R						2068.033	836.1948	334.0429	121.4936	64.3705	18.9186	6.2863	2.1045
	v						129.68	90.88	63.25	42.3	32.8	20.03	12.8	8.18
1350.0 US gpm	R						2226.490	899.8325	359.2641	130.5793	69.1547	20.3085	6.7438	2.2565
	v						134.67	94.37	65.68	43.92	34.06	20.8	13.29	8.5

$\dot{V}$ = flow rate (US gpm) | R = feet of head per 100 ft | v = velocity (ft/sec)

Pipe friction factor (R) in feet of head per 100 ft. and calculated velocity (v) in feet per second based on the flow rate ($\dot{V}$)

aquatherm greenpipe® SDR 11
climatherm® faser-composite pipe SDR 11

68°F

temperature: 68°F/20°C
roughness: 0.0070 mm density: 62.32 lb/ft³ viscosity: 1.004 x 10^{-6} m²/s

$\dot{V}$	Dimension	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" 160mm	8" 200mm	10" 250mm
1400.0 US gpm	R						2390.767	965.7843	385.3908	139.9857	74.1057	21.7456	7.2165	2.4134
	v						139.66	97.87	68.11	45.55	35.33	21.57	13.79	8.81
1450.0 US gpm	R						2560.863	1034.049	412.4226	149.7125	79.2233	23.2299	7.7044	2.5752
	v						144.64	101.37	70.55	47.18	36.59	22.34	14.28	9.13
1500.0 US gpm	R						2736.778	1104.628	440.3593	159.7595	84.5074	24.7613	8.2074	2.742
	v						149.63	104.86	72.98	48.8	37.85	23.11	14.77	9.44
1550.0 US gpm	R							1177.520	469.2007	170.1265	89.9579	26.3398	8.7256	2.9136
	v							108.36	75.41	50.43	39.11	23.88	15.26	9.76
1600.0 US gpm	R							1252.725	498.9465	180.8135	95.5746	27.9653	9.2588	3.0902
	v							111.85	77.84	52.06	40.37	24.65	15.75	10.07
1650.0 US gpm	R							1330.243	529.5965	191.8202	101.3575	29.6377	9.8072	3.2716
	v							115.35	80.28	53.69	41.63	25.42	16.25	10.39

$\dot{V}$ = flow rate (US gpm) | R = feet of head per 100 ft | v = velocity (ft/sec)

Pipe friction factor (R) in feet of head per 100 ft. and calculated velocity (v) in feet per second based on the flow rate ($\dot{V}$)

aquatherm greenpipe® faser-composite pipe SDR 7.4

68°F

temperature: 68°F/20°C
roughness: 0.0070 mm density: 62.32 lb/ft³ viscosity: 1.004 x 10^{-6} m²/s

$\dot{V}$	Dimension	⅜" 16mm	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" 160mm	8" 200mm	10" 250mm
0.1 US gpm	R	0.1126	0.0415	0.0148	0.0046	0.0017	0.0006	0.0002	0.0001	0	0	0	0	0	0
	v	0.2	0.13	0.08	0.05	0.03	0.02	0.01	0.01	0.01	0	0	0	0	0
0.2 US gpm	R	0.3523	0.1285	0.0455	0.014	0.005	0.0018	0.0006	0.0003	0.0001	0	0	0	0	0
	v	0.39	0.25	0.16	0.1	0.06	0.04	0.03	0.02	0.01	0.01	0.01	0	0	0
0.3 US gpm	R	0.6947	0.2522	0.0889	0.0273	0.0097	0.0035	0.0012	0.0005	0.0002	0.0001	0.0001	0	0	0
	v	0.59	0.38	0.24	0.15	0.09	0.06	0.04	0.03	0.02	0.01	0.01	0.01	0	0
0.4 US gpm	R	1.13	0.4088	0.1436	0.0439	0.0155	0.0055	0.0019	0.0008	0.0004	0.0001	0.0001	0	0	0
	v	0.78	0.51	0.33	0.2	0.13	0.08	0.05	0.04	0.02	0.02	0.01	0.01	0.01	0
0.5 US gpm	R	1.6524	0.5963	0.209	0.0637	0.0225	0.008	0.0027	0.0012	0.0005	0.0002	0.0001	0	0	0
	v	0.98	0.64	0.41	0.24	0.16	0.1	0.06	0.04	0.03	0.02	0.02	0.01	0.01	0
0.6 US gpm	R	2.258	0.8131	0.2844	0.0864	0.0304	0.0108	0.0036	0.0016	0.0007	0.0003	0.0002	0	0	0
	v	1.18	0.76	0.49	0.29	0.19	0.12	0.08	0.05	0.04	0.02	0.02	0.01	0.01	0
0.7 US gpm	R	2.9435	1.0581	0.3694	0.112	0.0394	0.014	0.0047	0.0021	0.0009	0.0004	0.0002	0.0001	0	0
	v	1.37	0.89	0.57	0.34	0.22	0.14	0.09	0.06	0.04	0.03	0.02	0.01	0.01	0.01
0.8 US gpm	R	3.7067	1.3304	0.4638	0.1404	0.0493	0.0174	0.0058	0.0026	0.0011	0.0004	0.0002	0.0001	0	0
	v	1.57	1.02	0.65	0.39	0.25	0.16	0.1	0.07	0.05	0.03	0.03	0.02	0.01	0.01
0.9 US gpm	R	4.5456	1.6291	0.5672	0.1715	0.0601	0.0213	0.0071	0.0032	0.0013	0.0005	0.0003	0.0001	0	0
	v	1.76	1.14	0.73	0.44	0.28	0.18	0.11	0.08	0.06	0.04	0.03	0.02	0.01	0.01
1.0 US gpm	R	5.4585	1.9538	0.6794	0.2052	0.0718	0.0254	0.0084	0.0038	0.0016	0.0006	0.0003	0.0001	0	0
	v	1.96	1.27	0.81	0.49	0.31	0.2	0.13	0.09	0.06	0.04	0.03	0.02	0.01	0.01
2.0 US gpm	R	18.4253	6.5356	2.2538	0.6748	0.2346	0.0823	0.0272	0.0121	0.0051	0.0020	0.0011	0.0003	0.0001	0.0000
	v	3.9200	2.5400	1.6300	0.9800	0.6300	0.4000	0.2500	0.1800	0.1200	0.0800	0.0600	0.0400	0.0300	0.0200
3.0 US gpm	R	37.9310	13.3728	4.5870	1.3662	0.4729	0.1653	0.0543	0.0241	0.0101	0.0040	0.0022	0.0007	0.0002	0.0001
	v	5.8800	3.8100	2.4400	1.4700	0.9400	0.6000	0.3800	0.2700	0.1800	0.1200	0.1000	0.0600	0.0400	0.0200
4.0 US gpm	R	63.6256	22.3244	7.6256	2.2622	0.7806	0.2721	0.0892	0.0395	0.0166	0.0065	0.0035	0.0011	0.0004	0.0001
	v	7.8300	5.0800	3.2500	1.9600	1.2500	0.8000	0.5000	0.3600	0.2500	0.1700	0.1300	0.0800	0.0500	0.0300
5.0 US gpm	R	95.32	33.31	11.34	3.35	1.15	0.40	0.13	0.06	0.02	0.01	0.01	0.00	0.00	0.00
	v	9.79	6.35	4.07	2.45	1.57	1.01	0.63	0.45	0.31	0.21	0.16	0.10	0.06	0.04
6.0 US gpm	R	132.88	46.27	15.70	4.63	1.59	0.55	0.18	0.08	0.03	0.01	0.01	0.00	0.00	0.00
	v	11.75	7.63	4.88	2.94	1.88	1.21	0.75	0.53	0.37	0.25	0.19	0.12	0.08	0.05

$\dot{V}$ = flow rate (US gpm) | R = feet of head per 100 ft | v = velocity (ft/sec)

Pipe friction factor (R) in feet of head per 100 ft. and calculated velocity (v) in feet per second based on the flow rate ($\dot{V}$)

aquatherm greenpipe® faser-composite pipe SDR 7.4

68°F

temperature: 68°F/20°C
roughness: 0.0070 mm density: 62.32 lb/ft³ viscosity: 1.004 x 10^{-6} m²/s

$\dot{V}$	Dimension	⅜" 16mm	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" 160mm	8" 200mm	10" 250mm
7.0 US gpm	R	176.23	61.18	20.71	6.09	2.09	0.72	0.24	0.10	0.04	0.02	0.01	0.00	0.00	0.00
	v	13.71	8.90	5.69	3.43	2.19	1.41	0.88	0.62	0.43	0.29	0.22	0.14	0.09	0.06
8.0 US gpm	R	225.30	78.00	26.33	7.73	2.64	0.92	0.30	0.13	0.05	0.02	0.01	0.00	0.00	0.00
	v	15.67	10.17	6.51	3.92	2.51	1.61	1.01	0.71	0.49	0.33	0.26	0.16	0.10	0.06
9.0 US gpm	R	280.06	96.71	32.58	9.54	3.26	1.13	0.37	0.16	0.07	0.03	0.01	0.00	0.00	0.00
	v	17.63	11.44	7.32	4.41	2.82	1.81	1.13	0.80	0.55	0.37	0.29	0.18	0.11	0.07
10.0 US gpm	R	340.45	117.30	39.43	11.52	3.93	1.36	0.44	0.19	0.08	0.03	0.02	0.01	0.00	0.00
	v	19.59	12.71	8.13	4.90	3.13	2.01	1.26	0.89	0.62	0.41	0.32	0.20	0.13	0.08
11.0 US gpm	R	406.46	139.74	46.89	13.68	4.66	1.61	0.52	0.23	0.10	0.04	0.02	0.01	0.00	0.00
	v	21.54	13.98	8.95	5.39	3.45	2.21	1.38	0.98	0.68	0.46	0.35	0.21	0.14	0.09
12 US gpm	R	478.07	164.04	54.94	16.00	5.45	1.88	0.61	0.27	0.11	0.04	0.02	0.01	0.00	0.00
	v	23.50	15.25	9.76	5.88	3.76	2.41	1.51	1.07	0.74	0.50	0.38	0.23	0.15	0.10
13.0 US gpm	R	555.24	190.17	63.58	18.48	6.28	2.16	0.70	0.31	0.13	0.05	0.03	0.01	0.00	0.00
	v	25.46	16.52	10.57	6.37	4.07	2.61	1.63	1.16	0.80	0.54	0.42	0.25	0.16	0.11
14.0 US gpm	R	637.98	218.13	72.81	21.14	7.18	2.47	0.80	0.35	0.15	0.06	0.03	0.01	0.00	0.00
	v	27.42	17.79	11.39	6.86	4.39	2.82	1.76	1.25	0.86	0.58	0.45	0.27	0.18	0.11
15.0 US gpm	R	726.25	247.92	82.63	23.95	8.12	2.79	0.90	0.40	0.16	0.06	0.03	0.01	0.00	0.00
	v	29.38	19.06	12.20	7.34	4.70	3.02	1.88	1.34	0.92	0.62	0.48	0.29	0.19	0.12
16.0 US gpm	R	820.07	279.52	93.03	26.93	9.13	3.13	1.01	0.44	0.18	0.07	0.04	0.01	0.00	0.00
	v	31.34	20.34	13.01	7.83	5.01	3.22	2.01	1.42	0.99	0.66	0.51	0.31	0.20	0.13
17.0 US gpm	R	919.40	312.93	104.01	30.06	10.18	3.49	1.13	0.49	0.21	0.08	0.04	0.01	0.00	0.00
	v	33.30	21.61	13.83	8.32	5.33	3.42	2.14	1.51	1.05	0.70	0.54	0.33	0.21	0.14
18.0 US gpm	R	1024.25	348.15	115.57	33.36	11.28	3.87	1.25	0.55	0.23	0.09	0.05	0.01	0.01	0.00
	v	35.25	22.88	14.64	8.81	5.64	3.62	2.26	1.60	1.11	0.74	0.58	0.35	0.23	0.15
19.0 US gpm	R	1134.61	385.17	127.70	36.82	12.44	4.26	1.37	0.60	0.25	0.10	0.05	0.02	0.01	0.00
	v	37.21	24.15	15.45	9.30	5.95	3.82	2.39	1.69	1.17	0.79	0.61	0.37	0.24	0.15
20.0 US gpm	R	1250.48	423.99	140.40	40.43	13.65	4.67	1.51	0.66	0.27	0.11	0.06	0.02	0.01	0.00
	v	39.17	25.42	16.27	9.79	6.27	4.02	2.51	1.78	1.23	0.83	0.64	0.39	0.25	0.16
22.0 US gpm	R	1498.69	507.02	167.52	48.14	16.23	5.54	1.79	0.78	0.32	0.13	0.07	0.02	0.01	0.00
	v	43.09	27.96	17.90	10.77	6.89	4.42	2.76	1.96	1.36	0.91	0.70	0.43	0.28	0.18
$\dot{V}$ = flow rate (US gpm)					R = feet of head per 100 ft						v = velocity (ft/sec)				

Pipe friction factor (R) in feet of head per 100 ft. and calculated velocity (v) in feet per second based on the flow rate ($\dot{V}$)

aquatherm greenpipe® faser-composite pipe SDR 7.4

68°F

temperature: 68°F/20°C

roughness: 0.0070 mm density: 62.32 lb/ft³ viscosity: 1.004 x 10^{-6} m²/s

$\dot{V}$	Dimension	⅜" 16mm	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" 160mm	8" 200mm	10" 250mm
24.0 US gpm	R	1768.86	597.21	196.92	56.46	19.00	6.49	2.09	0.91	0.38	0.15	0.08	0.02	0.01	0.00
	v	47.01	30.50	19.52	11.75	7.52	4.83	3.02	2.14	1.48	0.99	0.77	0.47	0.30	0.19
26.0 US gpm	R	2060.96	694.54	228.58	65.41	21.98	7.49	2.41	1.05	0.44	0.17	0.09	0.03	0.01	0.00
	v	50.92	33.05	21.15	12.73	8.15	5.23	3.27	2.32	1.60	1.08	0.83	0.51	0.33	0.21
28.0 US gpm	R	2374.96	799.00	262.50	74.98	25.16	8.57	2.75	1.20	0.50	0.19	0.10	0.03	0.01	0.00
	v	54.84	35.59	22.78	13.71	8.77	5.63	3.52	2.49	1.73	1.16	0.90	0.55	0.35	0.23
30.0 US gpm	R	2710.86	910.58	298.67	85.17	28.54	9.71	3.11	1.36	0.56	0.22	0.12	0.04	0.01	0.00
	v	58.76	38.13	24.40	14.69	9.40	6.03	3.77	2.67	1.85	1.24	0.96	0.59	0.38	0.24
32.0 US gpm	R	3068.62	1029.27	337.09	95.96	32.12	10.91	3.50	1.53	0.63	0.24	0.13	0.04	0.01	0.01
	v	62.67	40.67	26.03	15.67	10.03	6.44	4.02	2.85	1.97	1.32	1.02	0.62	0.40	0.26
34.0 US gpm	R	3448.25	1155.06	377.74	107.37	35.90	12.18	3.90	1.70	0.70	0.27	0.15	0.04	0.02	0.01
	v	66.59	43.21	27.66	16.65	10.65	6.84	4.27	3.03	2.09	1.41	1.09	0.66	0.43	0.28
36.0 US gpm	R	3849.74	1287.95	420.63	119.39	39.87	13.52	4.32	1.88	0.78	0.30	0.16	0.05	0.02	0.01
	v	70.51	45.75	29.28	17.63	11.28	7.24	4.52	3.21	2.22	1.49	1.15	0.70	0.45	0.29
38.0 US gpm	R	4273.06	1427.92	465.75	132.01	44.04	14.91	4.77	2.08	0.86	0.33	0.18	0.05	0.02	0.01
	v	74.43	48.30	30.91	18.61	11.91	7.64	4.77	3.38	2.34	1.57	1.21	0.74	0.48	0.31
40.0 US gpm	R	4718.22	1574.97	513.10	145.24	48.40	16.38	5.23	2.28	0.94	0.36	0.19	0.06	0.02	0.01
	v	78.34	50.84	32.54	19.59	12.53	8.04	5.03	3.56	2.46	1.66	1.28	0.78	0.50	0.32
45.0 US gpm	R	5926.62	1973.56	641.21	180.94	60.14	20.31	6.47	2.82	1.16	0.45	0.24	0.07	0.03	0.01
	v	88.14	57.19	36.60	22.03	14.10	9.05	5.65	4.01	2.77	1.86	1.44	0.88	0.56	0.30
50 US gpm	R	7271.379	2416.316	783.190	220.390	73.0923	24.6322	7.8355	3.4047	1.3999	0.5375	0.2892	0.0888	0.0306	0.0109
	v	97.93	63.55	40.67	24.48	15.67	10.06	6.28	4.45	3.08	2.07	1.6	0.98	0.63	0.4
55 US gpm	R		2903.213	939.0158	263.5802	87.2342	29.3441	9.3191	4.0452	1.6618	0.6375	0.3429	0.1052	0.0363	0.0129
	v		69.90	44.74	26.93	17.24	11.06	6.91	4.9	3.39	2.28	1.76	1.07	0.69	0.45
60.0 US gpm	R		3434.214	1108.664	310.4936	102.5631	34.4414	10.921	4.7361	1.9439	0.7451	0.4006	0.1228	0.0423	0.015
	v		76.26	48.8	29.38	18.8	12.07	7.54	5.34	3.7	2.48	1.92	1.17	0.75	0.49
65.0 US gpm	R		4009.295	1292.119	361.1212	119.0738	39.9216	12.6403	5.4767	2.246	0.8603	0.4623	0.1416	0.0487	0.0173
	v		82.61	52.87	31.83	20.37	13.07	8.17	5.79	4.01	2.69	2.08	1.27	0.81	0.53
70.0 US gpm	R		4628.439	1489.367	415.4549	136.7618	45.7824	14.476	6.2667	2.568	0.9829	0.5279	0.1616	0.0556	0.0197
	v		88.97	56.94	34.28	21.94	14.08	8.79	6.23	4.31	2.9	2.24	1.37	0.88	0.57

$\dot{V}$ = flow rate (US gpm) | R = feet of head per 100 ft | v = velocity (ft/sec)

Pipe friction factor (R) in feet of head per 100 ft. and calculated velocity (v) in feet per second based on the flow rate ($\dot{V}$)

aquatherm greenpipe® faser-composite pipe SDR 7.4

68°F

temperature: 68°F/20°C
roughness: 0.0070 mm density: 62.32 lb/ft³ viscosity: 1.004 x 10^{-6} m²/s

$\dot{V}$	Dimension	⅜" 16mm	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" 160mm	8" 200mm	10" 250mm
75.0 US gpm	R		5291.630	1700.396	473.4878	155.6236	52.0222	16.4273	7.1056	2.9095	1.1129	0.5975	0.1827	0.0628	0.0223
	v		95.32	61.01	36.72	23.5	15.08	9.42	6.68	4.62	3.1	2.4	1.46	0.94	0.61
80.0 US gpm	R		5998.857	1925.198	535.2145	175.6557	58.6392	18.4936	7.9931	3.2706	1.2501	0.671	0.2051	0.0705	0.025
	v		101.68	65.07	39.17	25.07	16.09	10.05	7.12	4.93	3.31	2.56	1.56	1	0.65
85.0 US gpm	R		6750.111	2163.766	600.6301	196.8555	65.632	20.6742	8.9288	3.6509	1.3946	0.7483	0.2285	0.0785	0.0278
	v		108.03	69.14	41.62	26.64	17.09	10.68	7.57	5.24	3.52	2.72	1.66	1.06	0.69
90.0 US gpm	R		7545.383	2416.093	669.7305	219.2205	72.9994	22.9685	9.9126	4.0505	1.5463	0.8293	0.2532	0.0869	0.0308
	v		114.39	73.21	44.07	28.2	18.1	11.31	8.01	5.55	3.72	2.88	1.76	1.13	0.73
95.0 US gpm	R		8384.667	2682.173	742.5123	242.7487	80.7403	25.3762	10.944	4.4691	1.7051	0.9142	0.2789	0.0958	0.0339
	v		120.74	77.27	46.52	29.77	19.11	11.94	8.46	5.85	3.93	3.04	1.85	1.19	0.77
100.0 US gpm	R		9267.958	2962.003	818.9724	267.4382	88.8536	27.8966	12.0229	4.9066	1.871	1.0028	0.3058	0.1049	0.0371
	v		127.10	81.34	48.96	31.34	20.11	12.56	8.91	6.16	4.14	3.2	1.95	1.25	0.81
110.0 US gpm	R		11166.54	3562.897	982.9173	320.2946	106.1942	33.2743	14.3223	5.8381	2.2238	1.1912	0.3629	0.1244	0.044
	v		139.81	89.48	53.86	34.47	22.12	13.82	9.8	6.78	4.55	3.52	2.15	1.38	0.89
120.0 US gpm	R		13241.11	4218.750	1161.548	377.7787	125.0151	39.0987	16.8091	6.8441	2.6043	1.3942	0.4243	0.1454	0.0513
	v		152.52	97.61	58.76	37.6	24.13	15.08	10.69	7.39	4.97	3.84	2.34	1.5	0.97
130.0 US gpm	R		15491.63	4929.542	1354.850	439.8816	145.311	45.3674	19.4821	7.9241	3.0123	1.6118	0.4901	0.1678	0.0592
	v		165.23	105.74	63.65	40.74	26.14	16.33	11.58	8.01	5.38	4.16	2.54	1.63	1.05
140.0 US gpm	R		17918.10	5695.261	1562.815	506.5962	167.078	52.0783	22.3401	9.0775	3.4476	1.8437	0.5601	0.1917	0.0676
	v		177.93	113.88	68.55	43.87	28.16	17.59	12.47	8.63	5.79	4.48	2.73	1.75	1.13
150 US gpm	R			6515.895	1785.432	577.9166	190.3124	59.2298	25.3821	10.3037	3.9098	2.0899	0.6344	0.217	0.0765
	v			122.01	73.45	47.01	30.17	18.85	13.36	9.24	6.21	4.79	2.93	1.88	1.21
160.0 US gpm	R			7391.435	2022.695	653.8378	215.0113	66.8201	28.6073	11.6023	4.3989	2.3502	0.7129	0.2437	0.0859
	v			130.15	78.34	50.14	32.18	20.1	14.25	9.86	6.62	5.11	3.12	2	1.3
170.0 US gpm	R			8321.874	2274.598	734.3557	241.172	74.848	32.0149	12.973	4.9146	2.6245	0.7955	0.2718	0.0957
	v			138.28	83.24	53.27	34.19	21.36	15.14	10.47	7.04	5.43	3.32	2.13	1.38
180 US gpm	R				2541.137	819.4668	268.7924	83.3124	35.6042	14.4153	5.4567	2.9127	0.8823	0.3012	0.106
	v				88.14	56.41	36.2	22.62	16.03	11.09	7.45	5.75	3.51	2.25	1.46
190.0 US gpm	R				2822.307	909.1682	297.8706	92.2121	39.3746	15.929	6.0252	3.2148	0.9731	0.3321	0.1169
	v				93.03	59.54	38.21	23.87	16.92	11.71	7.86	6.07	3.71	2.38	1.54

$\dot{V}$ = flow rate (US gpm) | R = feet of head per 100 ft | v = velocity (ft/sec)

Pipe friction factor (R) in feet of head per 100 ft. and calculated velocity (v) in feet per second based on the flow rate ($\dot{V}$)

aquatherm greenpipe® faser-composite pipe SDR 7.4

68°F

temperature: 68°F/20°C
roughness: 0.0070 mm density: 62.32 lb/ft³ viscosity: 1.004 x 10^{-6} m²/s

$\dot{V}$	Dimension	⅜" 16mm	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" 160mm	8" 200mm	10" 250mm
200 US gpm	R				3118.105	1003.457	328.4048	101.5462	43.3255	17.5138	6.6198	3.5306	1.068	0.3643	0.1281
	v				97.93	62.67	40.22	25.13	17.81	12.32	8.28	6.39	3.9	2.5	1.62
220.0 US gpm	R				3753.574	1205.790	393.8358	121.5146	51.7672	20.8955	7.8871	4.2032	1.2698	0.4327	0.1521
	v				107.72	68.94	44.24	27.64	19.59	13.56	9.1	7.03	4.29	2.75	1.78
240.0 US gpm	R				4447.527	1426.451	465.0755	143.2119	60.9257	24.5586	9.2577	4.93	1.4876	0.5065	0.1779
	v				117.51	75.21	48.27	30.15	21.37	14.79	9.93	7.67	4.68	3	1.94
260 US gpm	R					1665.430	542.1163	166.6336	70.7983	28.5015	10.7309	5.7105	1.7212	0.5855	0.2055
	v					81.48	52.29	32.67	23.15	16.02	10.76	8.31	5.07	3.25	2.11
280.0 US gpm	R					1922.717	624.952	191.7759	81.3825	32.723	12.3059	6.5444	1.9703	0.6697	0.2349
	v					87.74	56.31	35.18	24.94	17.25	11.59	8.95	5.47	3.5	2.27
300.0 US gpm	R					2198.306	713.5774	218.6357	92.6765	37.2218	13.9823	7.4312	2.235	0.7591	0.2661
	v					94.01	60.33	37.69	26.72	18.49	12.42	9.59	5.86	3.75	2.43
320.0 US gpm	R					2492.191	807.9885	247.2103	104.6785	41.9969	15.7596	8.3706	2.5151	0.8536	0.2991
	v					100.28	64.36	40.2	28.5	19.72	13.24	10.23	6.25	4	2.59
340.0 US gpm	R					2804.368	908.1818	277.4975	117.387	47.0476	17.6372	9.3624	2.8104	0.9532	0.3338
	v					106.55	68.38	42.72	30.28	20.95	14.07	10.87	6.64	4.25	2.75
360.0 US gpm	R					3134.833	1014.154	309.4954	130.8007	52.373	19.6147	10.4064	3.1209	1.0578	0.3702
	v					112.81	72.4	45.23	32.06	22.18	14.9	11.51	7.03	4.5	2.92
380 US gpm	R						1125.904	343.2024	144.9185	57.9725	21.6919	11.5023	3.4465	1.1674	0.4083
	v						76.42	47.74	33.84	23.41	15.73	12.15	7.42	4.75	3.08
400.0 US gpm	R						1243.428	378.6169	159.7394	63.8454	23.8684	12.6498	3.7871	1.2819	0.4482
	v						80.45	50.26	35.62	24.65	16.55	12.79	7.81	5	3.24
450.0 US gpm	R						1562.493	474.6165	199.8625	79.7208	29.7423	15.7437	4.7038	1.5899	0.5552
	v						90.50	56.54	40.07	27.73	18.62	14.38	8.78	5.63	3.64
500.0 US gpm	R						1917.619	581.2658	244.364	97.2952	36.2311	19.157	5.7129	1.9283	0.6726
	v						100.56	62.82	44.53	30.81	20.69	15.98	9.76	6.25	4.05
550.0 US gpm	R						2308.791	698.5533	293.2354	116.563	43.3319	22.8878	6.8136	2.2968	0.8003
	v						110.61	69.1	48.98	33.89	22.76	17.58	10.74	6.88	4.45
600.0 US gpm	R						2735.996	826.4704	346.4703	137.52	51.0422	26.9344	8.0051	2.6951	0.9381
	v						120.67	75.38	53.43	36.97	24.83	19.18	11.71	7.5	4.86

$\dot{V}$ = flow rate (US gpm) | R = feet of head per 100 ft | v = velocity (ft/sec)

Pipe friction factor (R) in feet of head per 100 ft. and calculated velocity (v) in feet per second based on the flow rate ($\dot{V}$)

aquatherm greenpipe® faser-composite pipe SDR 7.4

68°F

temperature: 68°F/20°C

roughness: 0.0070 mm density: 62.32 lb/ft³ viscosity: 1.004 x 10^{-6} m²/s

$\dot{V}$	Dimension	⅜" 16mm	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" 160mm	8" 200mm	10" 250mm
650.0 US gpm	R						3199.227	965.0104	404.0636	160.1627	59.3598	31.2954	9.2868	3.123	1.086
	v						130.72	81.67	57.89	40.05	26.9	20.78	12.69	8.13	5.26
700.0 US gpm	R						3698.478	1114.168	466.0111	184.4883	68.283	35.9696	10.6583	3.5802	1.2439
	v						140.78	87.95	62.34	43.13	28.97	22.38	13.66	8.75	5.67
750.0 US gpm	R						4233.743	1273.939	532.3097	210.4944	77.8105	40.9559	12.1191	4.0666	1.4117
	v						150.83	94.23	66.79	46.21	31.04	23.97	14.64	9.38	6.07
800.0 US gpm	R						4805.018	1444.320	602.9566	238.1791	87.9409	46.2537	13.6688	4.5819	1.5893
	v						160.89	100.51	71.24	49.29	33.11	25.57	15.61	10	6.48
850.0 US gpm	R						5412.300	1625.309	677.9496	267.5407	98.6732	51.862	15.307	5.1261	1.7767
	v						170.95	106.79	75.7	52.37	35.18	27.17	16.59	10.63	6.88
900 US gpm	R							1816.903	757.2868	298.5779	110.0065	57.7802	17.0334	5.6989	1.9737
	v							113.08	80.15	55.46	37.25	28.77	17.57	11.25	7.29
950.0 US gpm	R							2019.101	840.9667	331.2894	121.94	64.0078	18.8479	6.3003	2.1804
	v							119.36	84.6	58.54	39.32	30.37	18.54	11.88	7.69
1000.0 US gpm	R							2231.900	928.9879	365.6742	134.473	70.5442	20.75	6.9302	2.3967
	v							125.64	89.06	61.62	41.39	31.97	19.52	12.5	8.1
1050.0 US gpm	R							2455.300	1021.349	401.7314	147.6049	77.3891	22.7397	7.5883	2.6225
	v							131.92	93.51	64.7	43.46	33.56	20.49	13.13	8.5
1100.0 US gpm	R							2689.299	1118.049	439.4603	161.3351	84.5419	24.8166	8.2748	2.8578
	v							138.20	97.96	67.78	45.52	35.16	21.47	13.75	8.91
1150.0 US gpm	R							2933.896	1219.088	478.8602	175.6632	92.0024	26.9807	8.9894	3.1026
	v							144.49	102.41	70.86	47.59	36.76	22.45	14.38	9.31
1200.0 US gpm	R							3189.092	1324.465	519.9305	190.5888	99.7703	29.2318	9.732	3.3568
	v							150.77	106.87	73.94	49.66	38.36	23.42	15	9.72
1250.0 US gpm	R							3454.884	1434.178	562.6706	206.1114	107.8451	31.5696	10.5027	3.6204
	v							157.05	111.32	77.02	51.73	39.96	24.4	15.63	10.12
1300.0 US gpm	R							3731.272	1548.228	607.0801	222.2307	116.2267	33.9941	11.3013	3.8934
	v							163.33	115.77	80.1	53.8	41.56	25.37	16.25	10.53
1350.0 US gpm	R							4018.256	1666.614	653.1586	238.9465	124.9149	36.5052	12.1278	4.1757
	v							169.61	120.22	83.18	55.87	43.15	26.35	16.88	10.93

$\dot{V}$ = flow rate (US gpm) | R = feet of head per 100 ft | v = velocity (ft/sec)

Pipe friction factor (R) in feet of head per 100 ft. and calculated velocity (v) in feet per second based on the flow rate ($\dot{V}$)

aquatherm greenpipe® faser-composite pipe SDR 7.4

68°F

temperature: 68°F/20°C

roughness: 0.0070 mm density: 62.32 lb/ft³ viscosity: 1.004 x 10^{-6} m²/s

$\dot{V}$	Dimension	⅜" 16mm	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" 160mm	8" 200mm	10" 250mm
1400.0 US gpm	R							4315.835	1789.336	700.9057	256.2584	133.9094	39.1026	12.9821	4.4673
	v							175.90	124.68	86.26	57.94	44.75	27.33	17.5	11.34
1450.0 US gpm	R							4624.009	1916.392	750.3211	274.1663	143.21	41.7864	13.8641	4.7682
	v							182.18	129.13	89.34	60.01	46.35	28.3	18.13	11.74
1500.0 US gpm	R							4942.778	2047.784	801.4044	292.6697	152.8165	44.5564	14.7739	5.0784
	v							188.46	133.58	92.43	62.08	47.95	29.28	18.75	12.15
1550 US gpm	R								2183.509	854.1555	311.7687	162.7289	47.4125	15.7113	5.3978
	v								138.04	95.51	64.15	49.55	30.25	19.38	12.55
1600.0 US gpm	R								2323.569	908.574	331.4629	172.9469	50.3547	16.6764	5.7264
	v								142.49	98.59	66.22	51.15	31.23	20	12.96
1650.0 US gpm	R								2467.963	964.6598	351.7522	183.4703	53.3828	17.669	6.0642
	v								146.94	101.67	68.29	52.74	32.21	20.63	13.36

$\dot{V}$ = flow rate (US gpm) | R = feet of head per 100 ft | v = velocity (ft/sec)

Pipe friction factor (R) in mbar per meter and calculated velocity (v) in meters per second based on the flow rate ($\dot{V}$)

aquatherm greenpipe® SDR 11
climatherm® faser-composite pipe SDR 11

20°C

temperature: 20°C/68°F
roughness: 0.0070 mm density: 1 kg/l viscosity: 1.004 x 10^{-6} m^2/s

$\dot{V}$		Dimen-sion	20 mm	25 mm	32 mm	40 mm	50 mm	63 mm	75 mm	90 mm	110 mm	125 mm	160 mm
0.01 l/s	0.6 l/m	R	0.05	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		v	0.05	0.03	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
0.02 l/s	1.2 l/m	R	0.16	0.05	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		v	0.10	0.06	0.04	0.02	0.02	0.01	0.01	0.00	0.00	0.00	0.00
0.03 l/s	1.8 l/m	R	0.31	0.10	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		v	0.15	0.09	0.06	0.04	0.02	0.01	0.01	0.01	0.00	0.00	0.00
0.04 l/s	2.4 l/m	R	0.50	0.17	0.05	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00
		v	0.19	0.12	0.07	0.05	0.03	0.02	0.01	0.01	0.01	0.00	0.00
0.05 l/s	3 l/m	R	0.74	0.25	0.08	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00
		v	0.24	0.15	0.09	0.06	0.04	0.02	0.02	0.01	0.01	0.01	0.00
0.06 l/s	3.6 l/m	R	1.01	0.34	0.10	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.00
		v	0.29	0.18	0.11	0.07	0.05	0.03	0.02	0.01	0.01	0.01	0.00
0.07 l/s	4.2 l/m	R	1.31	0.44	0.14	0.05	0.02	0.01	0.00	0.00	0.00	0.00	0.00
		v	0.34	0.21	0.13	0.08	0.05	0.03	0.02	0.02	0.01	0.01	0.01
0.08 l/s	4.8 l/m	R	1.65	0.55	0.17	0.06	0.02	0.01	0.00	0.00	0.00	0.00	0.00
		v	0.39	0.24	0.15	0.10	0.06	0.04	0.03	0.02	0.01	0.01	0.01
0.09 l/s	5.4 l/m	R	2.03	0.68	0.21	0.07	0.03	0.01	0.00	0.00	0.00	0.00	0.00
		v	0.44	0.28	0.17	0.11	0.07	0.04	0.03	0.02	0.01	0.01	0.01
0.1 l/s	6 l/m	R	2.43	0.81	0.25	0.09	0.03	0.01	0.00	0.00	0.00	0.00	0.00
		v	0.49	0.31	0.19	0.12	0.08	0.05	0.03	0.02	0.02	0.01	0.01
0.12 l/s	7.2 l/m	R	3.35	1.12	0.34	0.12	0.04	0.01	0.01	0.00	0.00	0.00	0.00
		v	0.58	0.37	0.22	0.14	0.09	0.06	0.04	0.03	0.02	0.01	0.01
0.16 l/s	9.6 l/m	R	5.54	1.84	0.56	0.20	0.07	0.02	0.01	0.00	0.00	0.00	0.00
		v	0.78	0.49	0.30	0.19	0.12	0.08	0.05	0.04	0.03	0.02	0.01
0.18 l/s	10.8 l/m	R	6.82	2.27	0.69	0.24	0.08	0.03	0.01	0.01	0.00	0.00	0.00
		v	0.87	0.55	0.33	0.22	0.14	0.09	0.06	0.04	0.03	0.02	0.01
0.2 l/s	12 l/m	R	8.22	2.73	0.83	0.29	0.10	0.03	0.01	0.01	0.00	0.00	0.00
		v	0.97	0.61	0.37	0.24	0.15	0.10	0.07	0.05	0.03	0.02	0.01
0.3 l/s	18 l/m	R	16.90	5.57	1.68	0.59	0.20	0.07	0.03	0.01	0.00	0.00	0.00
		v	1.46	0.92	0.56	0.36	0.23	0.14	0.10	0.07	0.05	0.04	0.02

$\dot{V}$ = flow rate (l/s) | R = pressure drop (mbar/m) | v = velocity (m/s)

Pipe friction factor (R) in mbar per meter and calculated velocity (v) in meters per second based on the flow rate ($\dot{V}$)

aquatherm greenpipe® SDR 11
climatherm® faser-composite pipe SDR 11

20°C

temperature: 20°C/68°F
roughness: 0.0070 mm density: 1 kg/l viscosity: 1.004 x 10^{-6} m^2/s

$\dot{V}$		Dimen-sion	20 mm	25 mm	32 mm	40 mm	50 mm	63 mm	75 mm	90 mm	110 mm	125 mm	160 mm
0.4 l/s	24 l/m	R	28.31	9.30	2.80	0.98	0.34	0.11	0.05	0.02	0.01	0.00	0.00
		v	1.94	1.22	0.74	0.48	0.31	0.19	0.14	0.09	0.06	0.05	0.03
0.5 l/s	30 l/m	R	42.36	13.86	4.15	1.46	0.50	0.17	0.07	0.03	0.01	0.01	0.00
		v	2.43	1.53	0.93	0.60	0.38	0.24	0.17	0.12	0.08	0.06	0.04
0.6 l/s	36 l/m	R	58.99	19.24	5.75	2.01	0.69	0.23	0.10	0.04	0.02	0.01	0.00
		v	2.91	1.84	1.11	0.72	0.46	0.29	0.20	0.14	0.09	0.07	0.04
0.7 l/s	42 l/m	R	78.16	25.41	7.57	2.65	0.90	0.30	0.13	0.05	0.02	0.01	0.00
		v	3.40	2.14	1.30	0.84	0.54	0.34	0.24	0.16	0.11	0.09	0.05
0.8 l/s	48 l/m	R	99.83	32.37	9.62	3.36	1.14	0.38	0.16	0.07	0.03	0.01	0.00
		v	3.88	2.45	1.48	0.96	0.61	0.39	0.27	0.19	0.13	0.10	0.06
0.9 l/s	54 l/m	R	123.97	40.10	11.90	4.14	1.41	0.47	0.20	0.08	0.03	0.02	0.01
		v	4.37	2.75	1.67	1.08	0.69	0.43	0.30	0.21	0.14	0.11	0.07
1 l/s	60 l/m	R	150.58	48.60	14.39	5.00	1.70	0.56	0.24	0.10	0.04	0.02	0.01
		v	4.85	3.06	1.85	1.20	0.76	0.48	0.34	0.24	0.16	0.12	0.07
1.2 l/s	72 l/m	R	211.10	67.87	20.02	6.94	2.35	0.78	0.33	0.14	0.05	0.03	0.01
		v	5.82	3.67	2.23	1.44	0.92	0.58	0.41	0.28	0.19	0.15	0.09
1.4 l/s	84 l/m	R	281.32	90.12	26.49	9.17	3.10	1.02	0.44	0.18	0.07	0.04	0.01
		v	6.79	4.28	2.60	1.68	1.07	0.67	0.47	0.33	0.22	0.17	0.10
1.6 l/s	96 l/m	R	361.15	115.34	33.81	11.67	3.94	1.30	0.55	0.23	0.09	0.05	0.01
		v	7.76	4.90	2.97	1.92	1.22	0.77	0.54	0.38	0.25	0.20	0.12
1.8 l/s	108 l/m	R	450.55	143.49	41.95	14.45	4.87	1.60	0.68	0.29	0.11	0.06	0.02
		v	8.73	5.51	3.34	2.16	1.38	0.87	0.61	0.42	0.28	0.22	0.13
2 l/s	120 l/m	R	549.50	174.56	50.90	17.51	5.89	1.93	0.82	0.34	0.13	0.07	0.02
		v	9.70	6.12	3.71	2.40	1.53	0.96	0.68	0.47	0.31	0.24	0.15
2.2 l/s	132 l/m	R	657.95	208.53	60.67	20.83	7.00	2.29	0.98	0.41	0.16	0.08	0.03
		v	10.67	6.73	4.08	2.64	1.68	1.06	0.74	0.52	0.35	0.27	0.16
2.4 l/s	144 l/m	R	775.89	245.39	71.25	24.42	8.20	2.68	1.14	0.48	0.18	0.10	0.03
		v	11.64	7.34	4.45	2.88	1.84	1.16	0.81	0.56	0.38	0.29	0.18
2.6 l/s	156 l/m	R	903.30	285.14	82.62	28.28	9.48	3.10	1.32	0.55	0.21	0.11	0.04
		v	12.61	7.95	4.82	3.11	1.99	1.25	0.88	0.61	0.41	0.32	0.19

$\dot{V}$ = flow rate (l/s) | R = pressure drop (mbar/m) | v = velocity (m/s)

Pipe friction factor (R) in mbar per meter and calculated velocity (v) in meters per second based on the flow rate ($\dot{V}$)

aquatherm greenpipe® SDR 11
climatherm® faser-composite pipe SDR 11

20°C

temperature: 20°C/68°F
roughness: 0.0070 mm density: 1 kg/l viscosity: 1.004 x 10^{-6} m^2/s

$\dot{V}$		Dimen-sion	20 mm	25 mm	32 mm	40 mm	50 mm	63 mm	75 mm	90 mm	110 mm	125 mm	160 mm
2.8 l/s	168 l/m	R	1040.16	327.76	94.79	32.40	10.85	3.54	1.50	0.63	0.24	0.13	0.04
		v	13.58	8.57	5.19	3.35	2.14	1.35	0.95	0.66	0.44	0.34	0.21
3 l/s	180 l/m	R	1186.48	373.24	107.76	36.78	12.30	4.01	1.70	0.71	0.27	0.15	0.05
		v	14.55	9.18	5.56	3.59	2.29	1.45	1.01	0.71	0.47	0.37	0.22
3.2 l/s	192 l/m	R	1342.23	421.59	121.52	41.42	13.84	4.51	1.91	0.80	0.30	0.17	0.05
		v	15.52	9.79	5.94	3.83	2.45	1.54	1.08	0.75	0.50	0.39	0.24
3.4 l/s	204 l/m	R	1507.41	472.79	136.07	46.33	15.46	5.03	2.13	0.89	0.34	0.18	0.06
		v	16.50	10.40	6.31	4.07	2.60	1.64	1.15	0.80	0.53	0.41	0.25
3.6 l/s	216 l/m	R	1682.01	526.85	151.41	51.49	17.16	5.58	2.36	0.99	0.37	0.20	0.06
		v	17.47	11.01	6.68	4.31	2.75	1.73	1.22	0.85	0.57	0.44	0.27
3.8 l/s	228 l/m	R	1866.03	583.75	167.53	56.91	18.95	6.16	2.60	1.09	0.41	0.22	0.07
		v	18.44	11.63	7.05	4.55	2.91	1.83	1.28	0.89	0.60	0.46	0.28
4 l/s	240 l/m	R	2059.46	643.50	184.44	62.58	20.82	6.76	2.86	1.19	0.45	0.25	0.08
		v	19.41	12.24	7.42	4.79	3.06	1.93	1.35	0.94	0.63	0.49	0.30
4.2 l/s	252 l/m	R	2262.30	706.09	202.12	68.51	22.77	7.39	3.12	1.30	0.49	0.27	0.08
		v	20.38	12.85	7.79	5.03	3.21	2.02	1.42	0.99	0.66	0.51	0.31
4.4 l/s	264 l/m	R	2474.55	771.52	220.59	74.70	24.81	8.04	3.40	1.41	0.54	0.29	0.09
		v	21.35	13.46	8.16	5.27	3.37	2.12	1.49	1.03	0.69	0.54	0.33
4.6 l/s	276 l/m	R	2696.19	839.79	239.84	81.14	26.92	8.72	3.68	1.53	0.58	0.32	0.10
		v	22.32	14.07	8.53	5.51	3.52	2.22	1.55	1.08	0.72	0.56	0.34
4.8 l/s	288 l/m	R	2927.24	910.89	259.86	87.84	29.12	9.43	3.98	1.65	0.63	0.34	0.10
		v	23.29	14.69	8.90	5.75	3.67	2.31	1.62	1.13	0.75	0.59	0.36
5 l/s	300 l/m	R	3167.68	984.83	280.67	94.79	31.40	10.16	4.28	1.78	0.68	0.37	0.11
		v	24.26	15.30	9.27	5.99	3.82	2.41	1.69	1.18	0.79	0.61	0.37
5.2 l/s	312 l/m	R	3417.51	1061.60	302.25	101.99	33.76	10.91	4.60	1.91	0.72	0.39	0.12
		v	25.23	15.91	9.65	6.23	3.98	2.51	1.76	1.22	0.82	0.63	0.39
5.4 l/s	324 l/m	R	3676.74	1141.21	324.60	109.44	36.20	11.69	4.93	2.05	0.78	0.42	0.13
		v	26.20	16.52	10.02	6.47	4.13	2.60	1.82	1.27	0.85	0.66	0.40
5.6 l/s	336 l/m	R	3945.36	1223.64	347.73	117.15	38.72	12.50	5.26	2.19	0.83	0.45	0.14
		v	27.17	17.13	10.39	6.71	4.28	2.70	1.89	1.32	0.88	0.68	0.42

$\dot{V}$ = flow rate (l/s) | R = pressure drop (mbar/m) | v = velocity (m/s)

Pipe friction factor (R) in mbar per meter and calculated velocity (v) in meters per second based on the flow rate ($\dot{V}$)

aquatherm greenpipe® SDR 11
climatherm® faser-composite pipe SDR 11

20°C

temperature: 20°C/68°F
roughness: 0.0070 mm density: 1 kg/l viscosity: 1.004 x 10^{-6} m^2/s

$\dot{V}$		Dimen-sion	20 mm	25 mm	32 mm	40 mm	50 mm	63 mm	75 mm	90 mm	110 mm	125 mm	160 mm
5.8 l/s	348 l/m	R	4223.36	1308.90	371.63	125.10	41.32	13.33	5.61	2.33	0.88	0.48	0.15
		v	28.14	17.75	10.76	6.95	4.44	2.80	1.96	1.36	0.91	0.71	0.43
6 l/s	360 l/m	R	4510.76	1396.99	396.31	133.31	44.00	14.19	5.97	2.48	0.94	0.51	0.16
		v	29.11	18.36	11.13	7.19	4.59	2.89	2.03	1.41	0.94	0.73	0.45
6.2 l/s	372 l/m	R	4807.54	1487.91	421.76	141.77	46.76	15.07	6.34	2.63	0.99	0.54	0.16
		v	30.08	18.97	11.50	7.43	4.74	2.99	2.09	1.46	0.97	0.76	0.46
6.4 l/s	384 l/m	R	5113.71	1581.66	447.99	150.48	49.60	15.97	6.71	2.79	1.05	0.57	0.17
		v	31.05	19.58	11.87	7.67	4.90	3.08	2.16	1.50	1.01	0.78	0.48
6.6 l/s	396 l/m	R	5429.26	1678.23	474.98	159.44	52.52	16.90	7.10	2.95	1.11	0.60	0.18
		v	32.02	20.19	12.24	7.91	5.05	3.18	2.23	1.55	1.04	0.80	0.49
6.8 l/s	408 l/m	R	5754.19	1777.62	502.75	168.65	55.52	17.86	7.50	3.11	1.18	0.64	0.19
		v	32.99	20.80	12.61	8.15	5.20	3.28	2.30	1.60	1.07	0.83	0.51
7 l/s	420 l/m	R	6088.51	1879.84	531.29	178.11	58.59	18.84	7.91	3.28	1.24	0.67	0.20
		v	33.96	21.42	12.98	8.39	5.35	3.37	2.36	1.65	1.10	0.85	0.52
7.5 l/s	450 l/m	R	6965.36	2147.74	606.00	202.86	66.63	21.39	8.97	3.72	1.40	0.76	0.23
		v	36.39	22.95	13.91	8.99	5.74	3.61	2.53	1.76	1.18	0.91	0.56
8 l/s	480 l/m	R	7900.83	2433.28	685.53	229.16	75.17	24.10	10.10	4.18	1.58	0.85	0.26
		v	38.81	24.48	14.84	9.58	6.12	3.86	2.70	1.88	1.26	0.98	0.60
9 l/s	540 l/m	R	9947.63	3057.26	859.00	286.42	93.71	29.98	12.54	5.18	1.95	1.06	0.32
		v	43.66	27.54	16.69	10.78	6.88	4.34	3.04	2.12	1.41	1.10	0.67
10 l/s	600 l/m	R		3751.74	1051.68	349.88	114.21	36.45	15.23	6.29	2.37	1.28	0.39
		v		30.59	18.55	11.98	7.65	4.82	3.38	2.35	1.57	1.22	0.74
12 l/s	720 l/m	R		5352.08	1494.56	495.34	161.05	51.20	21.34	8.79	3.30	1.78	0.54
		v		36.71	22.26	14.38	9.18	5.78	4.05	2.82	1.89	1.46	0.89
14 l/s	840 l/m	R		7234.15	2014.06	665.47	215.64	68.33	28.40	11.67	4.37	2.36	0.71
		v		42.83	25.97	16.77	10.71	6.75	4.73	3.29	2.20	1.71	1.04
16 l/s	960 l/m	R			2610.11	860.21	277.95	87.81	36.43	14.94	5.59	3.01	0.91
		v			29.68	19.17	12.24	7.71	5.40	3.76	2.52	1.95	1.19
18 l/s	1080 l/m	R			3282.66	1079.54	347.96	109.65	45.40	18.59	6.94	3.73	1.13
		v			33.39	21.56	13.77	8.67	6.08	4.23	2.83	2.19	1.34

$\dot{V}$ = flow rate (l/s) | R = pressure drop (mbar/m) | v = velocity (m/s)

Pipe friction factor (R) in mbar per meter and calculated velocity (v) in meters per second based on the flow rate ($\dot{V}$)

aquatherm greenpipe® SDR 11
climatherm® faser-composite pipe SDR 11

20°C

temperature: 20°C/68°F
roughness: 0.0070 mm density: 1 kg/l viscosity: 1.004 x 10^{-6} m^2/s

$\dot{V}$		Dimen-sion	20 mm	25 mm	32 mm	40 mm	50 mm	63 mm	75 mm	90 mm	110 mm	125 mm	160 mm
20 l/s	1200 l/m	R			4031.69	1323.42	425.65	133.82	55.31	22.61	8.43	4.53	1.37
		v			37.10	23.96	15.30	9.64	6.75	4.70	3.14	2.44	1.49
22 l/s	1320 l/m	R			4857.17	1591.85	511.01	160.32	66.16	27.00	10.05	5.40	1.62
		v			40.81	26.36	16.83	10.60	7.43	5.17	3.46	2.68	1.64
24 l/s	1440 l/m	R			5759.09	1884.80	604.03	189.14	77.94	31.77	11.81	6.34	1.90
		v			44.52	28.75	18.36	11.57	8.11	5.64	3.77	2.93	1.79
26 l/s	1560 l/m	R				2202.27	704.71	220.29	90.66	36.90	13.70	7.35	2.21
		v				31.15	19.89	12.53	8.78	6.11	4.09	3.17	1.93
28 l/s	1680 l/m	R				2544.25	813.03	253.75	104.30	42.40	15.72	8.42	2.53
		v				33.55	21.42	13.49	9.46	6.58	4.40	3.41	2.08
30 l/s	1800 l/m	R				2910.74	928.99	289.53	118.87	48.27	17.87	9.57	2.87
		v				35.94	22.95	14.46	10.13	7.05	4.72	3.66	2.23
32 l/s	1920 l/m	R				3301.73	1052.60	327.62	134.36	54.50	20.16	10.79	3.23
		v				38.34	24.48	15.42	10.81	7.52	5.03	3.90	2.38
34 l/s	2040 l/m	R				3717.22	1183.84	368.01	150.78	61.10	22.58	12.08	3.61
		v				40.73	26.01	16.39	11.48	7.99	5.34	4.14	2.53
36 l/s	2160 l/m	R				4157.20	1322.72	410.72	168.12	68.06	25.12	13.43	4.01
		v				43.13	27.54	17.35	12.16	8.46	5.66	4.39	2.68
38 l/s	2280 l/m	R					1469.23	455.73	186.38	75.38	27.80	14.85	4.43
		v					29.07	18.31	12.83	8.93	5.97	4.63	2.83
40 l/s	2400 l/m	R					1623.37	503.04	205.56	83.07	30.61	16.35	4.87
		v					30.59	19.28	13.51	9.40	6.29	4.88	2.98
42 l/s	2520 l/m	R					1785.14	552.66	225.65	91.12	33.54	17.90	5.33
		v					32.12	20.24	14.18	9.87	6.60	5.12	3.13
44 l/s	2640 l/m	R					1954.54	604.58	246.67	99.52	36.61	19.53	5.81
		v					33.65	21.20	14.86	10.34	6.92	5.36	3.27
46 l/s	2760 l/m	R					2131.56	658.80	268.61	108.29	39.80	21.22	6.31
		v					35.18	22.17	15.54	10.81	7.23	5.61	3.42
48 l/s	2880 l/m	R					2316.21	715.32	291.46	117.42	43.12	22.99	6.83
		v					36.71	23.13	16.21	11.28	7.55	5.85	3.57

$\dot{V}$ = flow rate (l/s) | R = pressure drop (mbar/m) | v = velocity (m/s)

Pipe friction factor (R) in mbar per meter and calculated velocity (v) in meters per second based on the flow rate ($\dot{V}$)

aquatherm greenpipe® SDR 11
climatherm® faser-composite pipe SDR 11

20°C

temperature: 20°C/68°F
roughness: 0.0070 mm density: 1 kg/l viscosity: 1.004 x 10^{-6} m^2/s

$\dot{V}$		Dimen-sion	20 mm	25 mm	32 mm	40 mm	50 mm	63 mm	75 mm	90 mm	110 mm	125 mm	160 mm
50 l/s	3000 l/m	R					2508.48	774.14	315.22	126.91	46.58	24.81	7.37
		v					38.24	24.10	16.89	11.75	7.86	6.10	3.72
52 l/s	3120 l/m	R					2708.38	835.27	339.91	136.76	50.15	26.71	7.92
		v					39.77	25.06	17.56	12.22	8.17	6.34	3.87
54 l/s	3240 l/m	R					2915.90	898.68	365.51	146.97	53.86	28.67	8.50
		v					41.30	26.02	18.24	12.69	8.49	6.58	4.02
56 l/s	3360 l/m	R					3131.04	964.40	392.02	157.54	57.70	30.70	9.09
		v					42.83	26.99	18.91	13.16	8.80	6.83	4.17
58 l/s	3480 l/m	R					3353.80	1032.42	419.45	168.47	61.66	32.80	9.71
		v					44.36	27.95	19.59	13.63	9.12	7.07	4.32
60 l/s	3600 l/m	R						1102.73	447.80	179.76	65.75	34.96	10.34
		v						28.92	20.26	14.10	9.43	7.31	4.47
62 l/s	3720 l/m	R						1175.34	477.06	191.40	69.97	37.19	10.99
		v						29.88	20.94	14.57	9.75	7.56	4.61
64 l/s	3840 l/m	R						1250.25	507.23	203.41	74.31	39.48	11.66
		v						30.84	21.61	15.04	10.06	7.80	4.76
66 l/s	3960 l/m	R						1327.46	538.32	215.77	78.78	41.84	12.35
		v						31.81	22.29	15.51	10.37	8.05	4.91
68 l/s	4080 l/m	R						1406.96	570.32	228.49	83.38	44.27	13.06
		v						32.77	22.97	15.98	10.69	8.29	5.06
70 l/s	4200 l/m	R						1488.75	603.24	241.56	88.11	46.77	13.79
		v						33.74	23.64	16.45	11.00	8.53	5.21
72 l/s	4320 l/m	R						1572.85	637.07	255.00	92.96	49.33	14.54
		v						34.70	24.32	16.92	11.32	8.78	5.36
74 l/s	4440 l/m	R						1659.23	671.81	268.79	97.94	51.95	15.30
		v						35.66	24.99	17.39	11.63	9.02	5.51
76 l/s	4560 l/m	R						1747.92	707.46	282.94	103.05	54.64	16.09
		v						36.63	25.67	17.86	11.95	9.26	5.66
78 l/s	4680 l/m	R						1838.90	744.03	297.45	108.28	57.40	16.89
		v						37.59	26.34	18.33	12.26	9.51	5.80

$\dot{V}$ = flow rate (l/s) | R = pressure drop (mbar/m) | v = velocity (m/s)

Pipe friction factor (R) in mbar per meter and calculated velocity (v) in meters per second based on the flow rate ($\dot{V}$)

20°C

aquatherm greenpipe® faser-composite pipe SDR 7.4

temperature: 20°C/68°F
roughness: 0.0070 mm density: 1 kg/l viscosity: 1.004 x 10^{-6} m^2/s

$\dot{V}$		Dimension	16 mm	20 mm	25 mm	32 mm	40 mm	50 mm	63 mm	75 mm	90 mm	110 mm	125 mm	160 mm
0.01 l/s	0.60 l/m	R	0.24	0.09	0.03	0.01	0	0	0	0	0	0	0	0
		v	0.09	0.06	0.04	0.02	0.02	0.01	0.01	0	0	0	0	0
0.02 l/s	1.20 l/m	R	0.75	0.27	0.1	0.03	0.01	0	0	0	0	0	0	0
		v	0.19	0.12	0.08	0.05	0.03	0.02	0.01	0.01	0.01	0	0	0
0.03 l/s	1.80 l/m	R	1.49	0.54	0.19	0.06	0.02	0.01	0	0	0	0	0	0
		v	0.28	0.18	0.12	0.07	0.05	0.03	0.02	0.01	0.01	0.01	0	0
0.04 l/s	2.40 l/m	R	2.43	0.88	0.31	0.09	0.03	0.01	0	0	0	0	0	0
		v	0.38	0.25	0.16	0.09	0.06	0.04	0.02	0.02	0.01	0.01	0.01	0
0.05 l/s	3.00 l/m	R	3.58	1.28	0.45	0.14	0.05	0.02	0.01	0	0	0	0	0
		v	0.47	0.31	0.2	0.12	0.08	0.05	0.03	0.02	0.01	0.01	0.01	0
0.06 l/s	3.60 l/m	R	4.91	1.76	0.61	0.18	0.06	0.02	0.01	0	0	0	0	0
		v	0.57	0.37	0.24	0.14	0.09	0.06	0.04	0.03	0.02	0.01	0.01	0.01
0.07 l/s	4.20 l/m	R	6.42	2.29	0.8	0.24	0.08	0.03	0.01	0	0	0	0	0
		v	0.66	0.43	0.28	0.17	0.11	0.07	0.04	0.03	0.02	0.01	0.01	0.01
0.08 l/s	4.80 l/m	R	8.1	2.89	1	0.3	0.11	0.04	0.01	0.01	0	0	0	0
		v	0.76	0.49	0.31	0.19	0.12	0.08	0.05	0.03	0.02	0.02	0.01	0.01
0.09 l/s	5.40 l/m	R	9.96	3.55	1.23	0.37	0.13	0.05	0.02	0.01	0	0	0	0
		v	0.85	0.55	0.35	0.21	0.14	0.09	0.05	0.04	0.03	0.02	0.01	0.01
0.10 l/s	6.00 l/m	R	11.99	4.27	1.48	0.44	0.15	0.05	0.02	0.01	0	0	0	0
		v	0.95	0.61	0.39	0.24	0.15	0.1	0.06	0.04	0.03	0.02	0.02	0.01
0.12 l/s	7.20 l/m	R	16.5400	5.8700	2.0300	0.6100	0.2100	0.0700	0.0200	0.0100	0.0000	0.0000	0.0000	0
		v	1.1400	0.7400	0.4700	0.2800	0.1800	0.1200	0.0700	0.0500	0.0400	0.0200	0.0200	0.01
0.16 l/s	9.60 l/m	R	27.5600	9.7400	3.3500	1.0000	0.3500	0.1200	0.0400	0.0200	0.0100	0.0000	0.0000	0
		v	1.5100	0.9800	0.6300	0.3800	0.2400	0.1600	0.1000	0.0700	0.0500	0.0300	0.0200	0.02
0.18 l/s	10.8 l/m	R	34.0100	12.0000	4.1200	1.2300	0.4300	0.1500	0.0500	0.0200	0.0100	0.0000	0.0000	0
		v	1.7000	1.1100	0.7100	0.4300	0.2700	0.1700	0.1100	0.0800	0.0500	0.0400	0.0300	0.02
0.20 l/s	12.0 l/m	R	41.07	14.47	4.96	1.48	0.51	0.18	0.06	0.03	0.01	0.00	0.00	0
		v	1.89	1.23	0.79	0.47	0.30	0.19	0.12	0.09	0.06	0.04	0.03	0.02
0.30 l/s	18.0 l/m	R	85.35	29.85	10.17	3.01	1.04	0.36	0.12	0.05	0.02	0.01	0.00	0
		v	2.84	1.84	1.18	0.71	0.45	0.29	0.18	0.13	0.09	0.06	0.05	0.03

$\dot{V}$ = flow rate (l/s) | R = pressure drop (mbar/m) | v = velocity (m/s)

Pipe friction factor (R) in mbar per meter and calculated velocity (v) in meters per second based on the flow rate ($\dot{V}$)

aquatherm greenpipe® faser-composite pipe SDR 7.4

20°C

temperature: 20°C/68°F
roughness: 0.0070 mm density: 1 kg/l viscosity: 1.004 x 10^{-6} m^2/s

$\dot{V}$		Dimension	16 mm	20 mm	25 mm	32 mm	40 mm	50 mm	63 mm	75 mm	90 mm	110 mm	125 mm	160 mm
0.40 l/s	24.0 l/m	R	144.17	50.15	17.00	5.01	1.72	0.60	0.19	0.09	0.04	0.01	0.01	0
		v	3.78	2.46	1.57	0.95	0.61	0.39	0.24	0.17	0.12	0.08	0.06	0.04
0.50 l/s	30.0 l/m	R	217.21	75.21	25.40	7.45	2.55	0.88	0.29	0.13	0.05	0.02	0.01	0
		v	4.73	3.07	1.96	1.18	0.76	0.49	0.30	0.22	0.15	0.10	0.08	0.05
0.60 l/s	36.0 l/m	R	304.25	104.94	35.31	10.33	3.53	1.22	0.40	0.17	0.07	0.03	0.02	0
		v	5.68	3.68	2.36	1.42	0.91	0.58	0.36	0.26	0.18	0.12	0.09	0.06
0.70 l/s	42.0 l/m	R	405.16	139.27	46.72	13.62	4.64	1.60	0.52	0.23	0.10	0.04	0.02	0.01
		v	6.62	4.30	2.75	1.66	1.06	0.68	0.42	0.30	0.21	0.14	0.11	0.07
0.80 l/s	48.0 l/m	R	519.85	178.15	59.60	17.33	5.90	2.03	0.66	0.29	0.12	0.05	0.03	0.01
		v	7.57	4.91	3.14	1.89	1.21	0.78	0.49	0.34	0.24	0.16	0.12	0.08
0.90 l/s	54.0 l/m	R	648.25	221.55	73.92	21.45	7.28	2.5	0.81	0.36	0.15	0.06	0.03	0.01
		v	8.52	5.53	3.54	2.13	1.36	0.87	0.55	0.39	0.27	0.18	0.14	0.08
1.00 l/s	60.0 l/m	R	790.3	269.43	89.69	25.97	8.8	3.02	0.98	0.43	0.18	0.07	0.04	0.01
		v	9.46	6.14	3.93	2.37	1.51	0.97	0.61	0.43	0.3	0.2	0.15	0.09
1.20 l/s	72.0 l/m	R	1115.23	378.58	125.51	36.19	12.23	4.19	1.35	0.59	0.25	0.09	0.05	0.02
		v	11.35	7.37	4.72	2.84	1.82	1.17	0.73	0.52	0.36	0.24	0.19	0.11
1.40 l/s	84.0 l/m	R	1494.4	505.47	166.98	47.97	16.17	5.52	1.78	0.78	0.32	0.12	0.07	0.02
		v	13.25	8.6	5.5	3.31	2.12	1.36	0.85	0.6	0.42	0.28	0.22	0.13
1.60 l/s	96.0 l/m	R	1927.68	650	214.05	61.29	20.61	7.03	2.26	0.99	0.41	0.16	0.09	0.03
		v	15.14	9.82	6.29	3.78	2.42	1.55	0.97	0.69	0.48	0.32	0.25	0.15
1.80 l/s	108 l/m	R	2414.97	812.11	266.69	76.14	25.55	8.69	2.79	1.22	0.5	0.19	0.1	0.03
		v	17.03	11.05	7.07	4.26	2.73	1.75	1.09	0.77	0.54	0.36	0.28	0.17
2.00 l/s	120 l/m	R	2956.18	991.77	324.88	92.51	30.97	10.52	3.37	1.47	0.61	0.23	0.13	0.04
		v	18.92	12.28	7.86	4.73	3.03	1.94	1.21	0.86	0.6	0.4	0.31	0.19
2.20 l/s	132 l/m	R	3551.28	1188.92	388.58	110.38	36.89	12.51	4	1.75	0.72	0.28	0.15	0.05
		v	20.82	13.51	8.65	5.2	3.33	2.14	1.34	0.95	0.65	0.44	0.34	0.21
2.40 l/s	144 l/m	R	4200.22	1403.55	457.79	129.75	43.28	14.66	4.68	2.04	0.84	0.32	0.17	0.05
		v	22.71	14.74	9.43	5.68	3.63	2.33	1.46	1.03	0.71	0.48	0.37	0.23
2.60 l/s	156 l/m	R	4902.97	1635.62	532.49	150.61	50.15	16.96	5.41	2.36	0.97	0.37	0.2	0.06
		v	24.6	15.96	10.22	6.15	3.94	2.53	1.58	1.12	0.77	0.52	0.4	0.25

$\dot{V}$ = flow rate (l/s) | R = pressure drop (mbar/m) | v = velocity (m/s)

Pipe friction factor (R) in mbar per meter and calculated velocity (v) in meters per second based on the flow rate ($\dot{V}$)

aquatherm greenpipe® faser-composite pipe SDR 7.4

20°C

temperature: 20°C/68°F
roughness: 0.0070 mm density: 1 kg/l viscosity: 1.004 x 10^{-6} m^2/s

$\dot{V}$		Dimension	16 mm	20 mm	25 mm	32 mm	40 mm	50 mm	63 mm	75 mm	90 mm	110 mm	125 mm	160 mm
2.80 l/s	168 l/m	R	5659.51	1885.14	612.68	172.95	57.51	19.42	6.19	2.69	1.11	0.43	0.23	0.07
		v	26.49	17.19	11	6.62	4.24	2.72	1.7	1.2	0.83	0.56	0.43	0.26
3.00 l/s	180 l/m	R	6469.83	2152.07	698.33	196.77	65.33	22.04	7.02	3.05	1.25	0.48	0.26	0.08
		v	28.39	18.42	11.79	7.1	4.54	2.91	1.82	1.29	0.89	0.6	0.46	0.28
3.20 l/s	192 l/m	R	7333.9	2436.42	789.45	222.07	73.63	24.81	7.89	3.43	1.41	0.54	0.29	0.09
		v	30.28	19.65	12.58	7.57	4.84	3.11	1.94	1.38	0.95	0.64	0.49	0.3
3.40 l/s	204 l/m	R	8251.71	2738.16	886.03	248.84	82.39	27.73	8.81	3.82	1.57	0.6	0.32	0.1
		v	32.17	20.88	13.36	8.04	5.15	3.3	2.06	1.46	1.01	0.68	0.53	0.32
3.60 l/s	216 l/m	R	9223.26	3057.3	988.06	277.08	91.63	30.8	9.78	4.24	1.74	0.67	0.36	0.11
		v	34.06	22.1	14.15	8.52	5.45	3.5	2.19	1.55	1.07	0.72	0.56	0.34
3.80 l/s	228 l/m	R	10248.54	3393.82	1095.53	306.79	101.33	34.02	10.79	4.68	1.92	0.74	0.4	0.12
		v	35.96	23.33	14.93	8.99	5.75	3.69	2.31	1.63	1.13	0.76	0.59	0.36
4.00 l/s	240 l/m	R	11327.55	3747.73	1208.45	337.96	111.5	37.4	11.85	5.13	2.11	0.81	0.43	0.13
		v	37.85	24.56	15.72	9.46	6.06	3.89	2.43	1.72	1.19	0.8	0.62	0.38
4.20 l/s	252 l/m	R	12460.26	4119.01	1326.81	370.59	122.13	40.93	12.95	5.61	2.3	0.88	0.47	0.14
		v	39.74	25.79	16.5	9.94	6.36	4.08	2.55	1.81	1.25	0.84	0.65	0.4
4.4 l/s	264 l/m	R	13646.69	4507.66	1450.61	404.68	133.23	44.6	14.1	6.11	2.5	0.96	0.51	0.16
		v	41.63	27.02	17.29	10.41	6.66	4.28	2.67	1.89	1.31	0.88	0.68	0.41
4.60 l/s	276 l/m	R	14886.82	4913.68	1579.84	440.23	144.79	48.43	15.3	6.62	2.71	1.04	0.56	0.17
		v	43.53	28.25	18.08	10.88	6.96	4.47	2.79	1.98	1.37	0.92	0.71	0.43
4.80 l/s	288 l/m	R	16180.66	5337.07	1714.51	477.24	156.81	52.4	16.54	7.15	2.93	1.12	0.6	0.18
		v	45.42	29.47	18.86	11.35	7.27	4.66	2.91	2.07	1.43	0.96	0.74	0.45
5 l/s	300 l/m	R		5777.81	1854.6	515.71	169.29	56.53	17.83	7.71	3.15	1.21	0.65	0.2
		v		30.70	19.65	11.83	7.57	4.86	3.03	2.15	1.49	1	0.77	0.47
5.2 l/s	312 l/m	R		6235.92	2000.12	555.63	182.23	60.8	19.16	8.28	3.39	1.29	0.69	0.21
		v		31.93	20.43	12.3	7.87	5.05	3.16	2.24	1.55	1.04	0.8	0.49
5.40 l/s	324 l/m	R		6711.39	2151.07	597	195.64	65.22	20.54	8.87	3.63	1.39	0.74	0.23
		v		33.16	21.22	12.77	8.18	5.25	3.28	2.32	1.61	1.08	0.83	0.51
5.60 l/s	336 l/m	R		7204.21	2307.44	639.83	209.5	69.78	21.96	9.48	3.87	1.48	0.79	0.24
		v		34.39	22.01	13.25	8.48	5.44	3.4	2.41	1.67	1.12	0.86	0.53

$\dot{V}$ = flow rate (l/s) | R = pressure drop (mbar/m) | v = velocity (m/s)

Pipe friction factor (R) in mbar per meter and calculated velocity (v) in meters per second based on the flow rate ($\dot{V}$)

aquatherm greenpipe® faser-composite pipe SDR 7.4

20°C

temperature: 20°C/68°F

roughness: 0.0070 mm density: 1 kg/l viscosity: 1.004 x 10^{-6} m^2/s

$\dot{V}$		Dimension	16 mm	20 mm	25 mm	32 mm	40 mm	50 mm	63 mm	75 mm	90 mm	110 mm	125 mm	160 mm
5.80 l/s	348 l/m	R		7714.39	2469.24	684.11	223.82	74.5	23.43	10.11	4.13	1.58	0.85	0.26
		v		35.61	22.79	13.72	8.78	5.64	3.52	2.5	1.73	1.16	0.9	0.55
6.00 l/s	360 l/m	R		8241.92	2636.46	729.84	238.6	79.36	24.94	10.76	4.39	1.68	0.9	0.27
		v		36.84	23.58	14.19	9.08	5.83	3.64	2.58	1.79	1.2	0.93	0.57
6.2 l/s	372 l/m	R		8786.80	2809.1	777.02	253.84	84.37	26.5	11.42	4.66	1.78	0.95	0.29
		v		38.07	24.36	14.67	9.39	6.02	3.76	2.67	1.85	1.24	0.96	0.58
6.40 l/s	384 l/m	R		9349.04	2987.16	825.65	269.53	89.52	28.1	12.11	4.94	1.88	1.01	0.31
		v		39.30	25.15	15.14	9.69	6.22	3.88	2.75	1.91	1.28	0.99	0.6
6.60 l/s	396 l/m	R		9928.62	3170.64	875.73	285.68	94.82	29.74	12.81	5.23	1.99	1.07	0.33
		v		40.53	25.94	15.61	9.99	6.41	4.01	2.84	1.96	1.32	1.02	0.62
6.80 l/s	408 l/m	R		10525.55	3359.54	927.25	302.29	100.27	31.43	13.53	5.52	2.1	1.13	0.34
		v		41.75	26.72	16.09	10.29	6.61	4.13	2.93	2.02	1.36	1.05	0.64
7.00 l/s	420 l/m	R		11139.83	3553.86	980.23	319.36	105.86	33.16	14.27	5.82	2.22	1.19	0.36
		v		42.98	27.51	16.56	10.6	6.8	4.25	3.01	2.08	1.4	1.08	0.66
7.50 l/s	450 l/m	R		12751.43	4063.35	1119	364.01	120.49	37.69	16.21	6.6	2.51	1.34	0.41
		v		46.05	29.47	17.74	11.35	7.29	4.55	3.23	2.23	1.5	1.16	0.71
8.00 l/s	480 l/m	R		14471.43	4606.69	1266.81	411.52	136.02	42.49	18.25	7.43	2.82	1.51	0.46
		v		49.12	31.44	18.92	12.11	7.77	4.86	3.44	2.38	1.6	1.24	0.75
9.00 l/s	540 l/m	R		18236.63	5794.9	1589.53	515.05	169.8	52.9	22.69	9.22	3.5	1.87	0.57
		v		55.26	35.37	21.29	13.63	8.74	5.46	3.87	2.68	1.8	1.39	0.85
10 l/s	600 l/m	R			7118.43	1948.35	629.93	207.19	64.4	27.58	11.19	4.24	2.27	0.69
		v			39.30	23.66	15.14	9.72	6.07	4.3	2.98	2	1.54	0.94
12.0 l/s	720 l/m	R			10171.36	2774.23	893.66	292.78	90.64	38.7	15.66	5.92	3.16	0.96
		v			47.16	28.39	18.17	11.66	7.28	5.16	3.57	2.4	1.85	1.13
14.0 l/s	840 l/m	R			13765.32	3744.31	1202.62	392.73	121.15	51.6	20.83	7.86	4.19	1.27
		v			55.02	33.12	21.2	13.6	8.5	6.02	4.17	2.8	2.16	1.32
16 l/s	960 l/m	R				4858.51	1556.75	506.99	155.92	66.27	26.69	10.05	5.35	1.61
		v				37.85	24.22	15.55	9.71	6.88	4.76	3.2	2.47	1.51
18.0 l/s	1080 l/m	R				6116.78	1956	635.54	194.94	82.7	33.24	12.5	6.65	2
		v				42.58	27.25	17.49	10.93	7.74	5.36	3.6	2.78	1.7

$\dot{V}$ = flow rate (l/s) | R = pressure drop (mbar/m) | v = velocity (m/s)

Pipe friction factor (R) in mbar per meter and calculated velocity (v) in meters per second based on the flow rate ($\dot{V}$)

aquatherm greenpipe® faser-composite pipe SDR 7.4

20°C

temperature: 20°C/68°F
roughness: 0.0070 mm density: 1 kg/l viscosity: 1.004 x 10^{-6} m^2/s

$\dot{V}$		Dimension	16 mm	20 mm	25 mm	32 mm	40 mm	50 mm	63 mm	75 mm	90 mm	110 mm	125 mm	160 mm
20.0 l/s	1200 l/m	R				7519.10	2400.35	778.35	238.19	100.87	40.48	15.19	8.07	2.43
		v				47.31	30.28	19.43	12.14	8.6	5.95	4	3.09	1.89
22.0 l/s	1320 l/m	R				9065.44	2889.78	935.41	285.66	120.79	48.39	18.13	9.62	2.89
		v				52.04	33.31	21.38	13.35	9.47	6.55	4.4	3.4	2.07
24.0 l/s	1440 l/m	R				10755.78	3424.28	1106.72	337.35	142.44	56.98	21.32	11.31	3.39
		v				56.77	36.34	23.32	14.57	10.33	7.14	4.8	3.71	2.26
26 l/s	1560 l/m	R					4003.83	1292.25	393.24	165.83	66.25	24.75	13.11	3.92
		v					39.36	25.26	15.78	11.19	7.74	5.2	4.02	2.45
28.0 l/s	1680 l/m	R					4628.43	1492.01	453.33	190.94	76.18	28.43	15.05	4.5
		v					42.39	27.21	17	12.05	8.34	5.6	4.32	2.64
30.0 l/s	1800 l/m	R					5298.07	1705.99	517.63	217.78	86.79	32.35	17.11	5.11
		v					45.42	29.15	18.21	12.91	8.93	6	4.63	2.83
32.0 l/s	1920 l/m	R					6012.75	1934.18	586.12	246.35	98.06	36.51	19.3	5.75
		v					48.45	31.09	19.42	13.77	9.53	6.4	4.94	3.02
34.0 l/s	2040 l/m	R					6772.46	2176.59	658.81	276.64	110	40.91	21.61	6.44
		v					51.47	33.03	20.64	14.63	10.12	6.8	5.25	3.21
36.0 l/s	2160 l/m	R					7577.20	2433.21	735.69	308.65	122.61	45.55	24.05	7.15
		v					54.50	34.98	21.85	15.49	10.72	7.2	5.56	3.39
38 l/s	2280 l/m	R						2704.03	816.76	342.38	135.89	50.43	26.61	7.91
		v						36.92	23.07	16.35	11.31	7.6	5.87	3.58
40.0 l/s	2400 l/m	R						2989.06	902.01	377.83	149.83	55.55	29.3	8.7
		v						38.86	24.28	17.21	11.91	8	6.18	3.77
42.0 l/s	2520 l/m	R						3288.29	991.46	414.99	164.43	60.91	32.11	9.52
		v						40.81	25.49	18.07	12.5	8.4	6.49	3.96
44.0 l/s	2640 l/m	R						3601.72	1085.09	453.87	179.69	66.51	35.04	10.38
		v						42.75	26.71	18.93	13.1	8.8	6.8	4.15
46.0 l/s	2760 l/m	R						3929.35	1182.9	494.47	195.62	72.35	38.09	11.28
		v						44.69	27.92	19.79	13.69	9.2	7.1	4.34
48.0 l/s	2880 l/m	R						4271.18	1284.9	536.78	212.21	78.43	41.27	12.21
		v						46.64	29.14	20.65	14.29	9.6	7.41	4.53

$\dot{V}$ = flow rate (l/s) | R = pressure drop (mbar/m) | v = velocity (m/s)

Pipe friction factor (R) in mbar per meter and calculated velocity (v) in meters per second based on the flow rate ($\dot{V}$)

aquatherm greenpipe® faser-composite pipe SDR 7.4

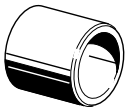
20°C

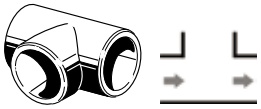
temperature: 20°C/68°F
roughness: 0.0070 mm density: 1 kg/l viscosity: 1.004 x 10^{-6} m^2/s

$\dot{V}$		Dimension	16 mm	20 mm	25 mm	32 mm	40 mm	50 mm	63 mm	75 mm	90 mm	110 mm	125 mm	160 mm
50.0 l/s	3000 l/m	R						4627.22	1391.08	580.81	229.47	84.74	44.57	13.17
		v						48.58	30.35	21.51	14.88	10	7.72	4.71
52.0 l/s	3120 l/m	R						4997.44	1501.45	626.55	247.38	91.29	48	14.18
		v						50.52	31.56	22.37	15.48	10.4	8.03	4.9
54.0 l/s	3240 l/m	R						5381.87	1616	674	265.95	98.08	51.54	15.21
		v						52.47	32.78	23.23	16.07	10.8	8.34	5.09
56 l/s	3360 l/m	R						5780.49	1734.73	723.17	285.19	105.1	55.21	16.28
		v						54.41	33.99	24.09	16.67	11.2	8.65	5.28
58.0 l/s	3480 l/m	R						6193.31	1857.64	774.05	305.08	112.36	59	17.39
		v						56.35	35.21	24.95	17.27	11.6	8.96	5.47
60 l/s	3600 l/m	R							1984.73	826.64	325.64	119.86	62.91	18.53
		v							36.42	25.81	17.86	12	9.27	5.66
62.0 l/s	3720 l/m	R							2116.00	880.94	346.85	127.59	66.95	19.7
		v							37.63	26.67	18.46	12.4	9.57	5.85
64.0 l/s	3840 l/m	R							2251.45	936.96	368.73	135.56	71.1	20.91
		v							38.85	27.54	19.05	12.8	9.88	6.04
66.0 l/s	3960 l/m	R							2391.08	994.68	391.26	143.77	75.38	22.15
		v							40.06	28.4	19.65	13.2	10.19	6.22
68.0 l/s	4080 l/m	R							2534.89	1054.12	414.46	152.21	79.78	23.43
		v							41.28	29.26	20.24	13.6	10.5	6.41
70.0 l/s	4200 l/m	R							2682.88	1115.27	438.31	160.89	84.3	24.74
		v							42.49	30.12	20.84	14	10.81	6.6
72.0 l/s	4320 l/m	R							2835.05	1178.12	462.82	169.8	88.94	26.09
		v							43.70	30.98	21.43	14.4	11.12	6.79
74.0 l/s	4440 l/m	R							2991.40	1242.69	487.99	178.95	93.7	27.47
		v							44.92	31.84	22.03	14.8	11.43	6.98
76.0 l/s	4560 l/m	R							3151.92	1308.97	513.82	188.34	98.59	28.88
		v							46.13	32.7	22.62	15.2	11.74	7.17
78.0 l/s	4680 l/m	R							3316.63	1376.96	540.31	197.96	103.59	30.33
		v							47.35	33.56	23.22	15.6	12.05	7.36

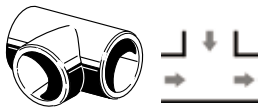
$\dot{V}$ = flow rate (l/s) | R = pressure drop (mbar/m) | v = velocity (m/s)

Equivalent lengths of aquatherm greenpipe® fittings (ft)

Socket	⅜" 16mm	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm
	0.4	0.5	0.7	0.9	1.1	1.4	1.7
	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm			
	2.1	2.5	3.0	4.2			

Tee	⅜" 16mm	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm
	0.4	0.5	0.7	0.9	1.1	1.4	1.7
	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" SDR 7.4 160mm	8" SDR 7.4 200mm	10" SDR 7.4 250mm
	2.1	2.5	3.0	4.2	4.8	6.0	7.4
	6" SDR 11 160mm	8" SDR 11 200mm	10" SDR 11 250mm				
	5.4	6.7	8.4				

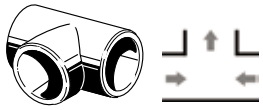
Tee *(Separation of flow)*	⅜" 16mm	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm
	2.1	2.6	3.3	4.2	5.2	6.6	8.3
	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" SDR 7.4 160mm	8" SDR 7.4 200mm	10" SDR 7.4 250mm
	9.8	11.8	14.4	20.1	22.9	28.6	35.7
	6" SDR 11 160mm	8" SDR 11 200mm	10" SDR 11 250mm				
	25.8	32.2	40.3				

Tee *(Conjunction of flow)*	⅜" 16mm	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm
	1.4	1.7	2.2	2.8	3.5	4.4	5.5
	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" SDR 7.4 160mm	8" SDR 7.4 200mm	10" SDR 7.4 250mm
	6.6	7.9	9.6	13.4	15.2	19.1	23.8
	6" SDR 11 160mm	8" SDR 11 200mm	10" SDR 11 250mm				
	17.2	21.5	26.8				

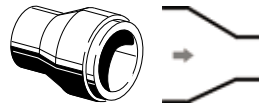
(➡ = flow direction)

Equivalent lengths of aquatherm greenpipe® fittings (ft)

Tee *(Counter current in case of separation of flow)*	⅜" 16mm	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm
	3.1	3.9	4.9	6.3	7.9	9.9	12.4
	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" SDR 7.4 160mm	8" SDR 7.4 200mm	10" SDR 7.4 250mm
	14.8	17.7	21.7	30.2	34.3	42.9	53.6
	6" SDR 11 160mm	8" SDR 11 200mm	10" SDR 11 250mm				
	38.7	48.3	60.4				

Tee *(Counter current in case of conjunction of flow)*	⅜" 16mm	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm
	5.2	6.5	8.2	10.4	13.1	16.4	20.7
	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" SDR 7.4 160mm	8" SDR 7.4 200mm	10" SDR 7.4 250mm
	24.6	29.5	36.1	50.3	57.2	71.5	89.3
	6" SDR 11 160mm	8" SDR 11 200mm	10" SDR 11 250mm				
	64.4	80.5	100.7				

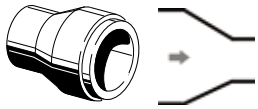
Bushing *(by 1 dimension)*	⅜" 16mm	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm
		0.9	1.1	1.4	1.7	2.2	2.8
	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" SDR 7.4 160mm	8" SDR 7.4 200mm	10" SDR 7.4 250mm
	3.3	3.9	4.8	6.7	7.6	9.5	11.9
	6" SDR 11 160mm	8" SDR 11 200mm	10" SDR 11 250mm				
	8.6	10.7	13.4				

Bushing *(by 2 dimensions)*	⅜" 16mm	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm
			1.4	1.7	2.2	2.7	3.4
	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" SDR 7.4 160mm	8" SDR 7.4 200mm	10" SDR 7.4 250mm
	4.1	4.9	6.0	8.4	9.5	11.9	14.9
	6" SDR 11 160mm	8" SDR 11 200mm	10" SDR 11 250mm				
	10.7	13.4	16.8				

(➡ = flow direction)

Equivalent lengths of aquatherm greenpipe® fittings (ft)

Bushing *(by 3 dimensions)*	⅜" 16mm	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm
				2.1	2.6	3.3	4.1
	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" SDR 7.4 160mm	8" SDR 7.4 200mm	10" SDR 7.4 250mm
	4.9	5.9	7.2	10.1	11.4	14.3	17.9
	6" SDR 11 160mm	8" SDR 11 200mm	10" SDR 11 250mm				
	12.9	16.1	20.1				

Bushing *(by 4 dimensions)*	⅜" 16mm	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm
					3.1	3.8	4.8
	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" SDR 7.4 160mm	8" SDR 7.4 200mm	10" SDR 7.4 250mm
	5.7	6.9	8.4	11.7	13.3	16.7	20.8
	6" SDR 11 160mm	8" SDR 11 200mm	10" SDR 11 250mm				
	15.0	18.8	23.5				

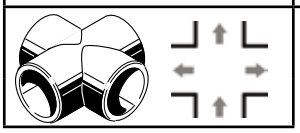
Bushing *(by 5 dimensions)*	⅜" 16mm	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm
						4.4	5.5
	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" SDR 7.4 160mm	8" SDR 7.4 200mm	10" SDR 7.4 250mm
	6.6	7.9	9.6	13.4	15.2	19.1	23.8
	6" SDR 11 160mm	8" SDR 11 200mm	10" SDR 11 250mm				
	17.2	21.5	26.8				

Bushing *(by 6 dimensions)*	⅜" 16mm	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm
							6.2
	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" SDR 7.4 160mm	8" SDR 7.4 200mm	10" SDR 7.4 250mm
	7.4	8.9	10.8	15.1	17.2	21.4	26.8
	6" SDR 11 160mm	8" SDR 11 200mm	10" SDR 11 250mm				
	19.3	24.2	30.2				

(➡ = flow direction)

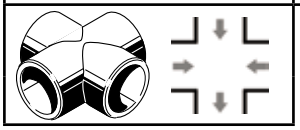
Equivalent lengths of aquatherm greenpipe® fittings (ft)

Cross
(Separation of flow)



⅜" 16mm	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm
3.7	4.5	5.7	7.3	9.2

Cross
(Conjunction of flow)

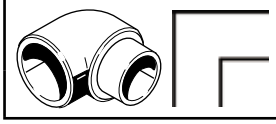


⅜" 16mm	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm
6.4	8.0	10.1	12.9	16.1

Elbow 90°

⅜" 16mm	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm
1.3	1.6	2.0	2.6	3.3	4.1	5.2
2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" SDR 7.4 160mm	8" SDR 7.4 200mm	10" SDR 7.4 250mm
6.2	7.4	9.0	12.6	14.3	17.9	22.3
6" SDR 11 160mm	8" SDR 11 200mm	10" SDR 11 250mm				
25.7	32.2	40.3				

Elbow 90°
(male / female)



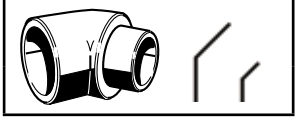
⅜" 16mm	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm
1.3	1.6	2.0	2.6	3.3

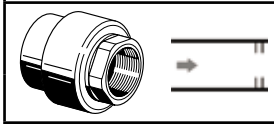
Elbow 45°

⅜" 16mm	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm
0.7	0.9	1.1	1.4	1.7	2.2	2.8
2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" SDR 7.4 160mm	8" SDR 7.4 200mm	10" SDR 7.4 250mm
3.3	3.9	4.8	6.7	7.6	9.5	11.9
6" SDR 11 160mm	8" SDR 11 200mm	10" SDR 11 250mm				
10.7	13.4	16.8				

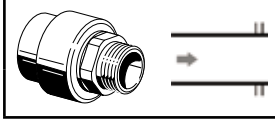
(➡ = flow direction)

Equivalent lengths of aquatherm greenpipe® fittings (ft)

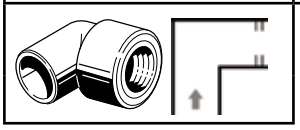
Elbow 45° (male / female)	3/8" 16mm	1/2" 20mm	3/4" 25mm	1" 32mm	1 1/4" 40mm
	0.7	0.9	1.1	1.4	1.7

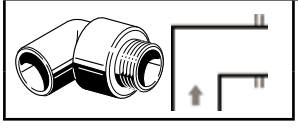
Transition (female thread)	3/8" 16mm	1/2" 20mm	3/4" 25mm	1" 32mm	1 1/4" 40mm	1 1/2" 50mm	2" 63mm
	0.9	1.1	1.4	1.7	2.2	2.7	3.4

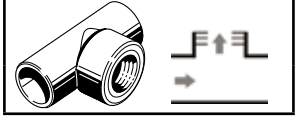
2 1/2" 75mm
4.1

Transition (male thread)	3/8" 16mm	1/2" 20mm	3/4" 25mm	1" 32mm	1 1/4" 40mm	1 1/2" 50mm	2" 63mm
	1.2	1.5	1.9	2.4	3.1	3.8	4.8

2 1/2" 75mm	3" 90mm	3 1/2" 110mm
5.7	6.9	8.4

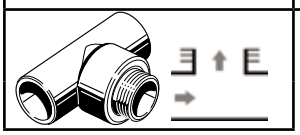
Elbow (female thread)	3/8" 16mm	1/2" 20mm	3/4" 25mm	1" 32mm
	1.5	1.9	2.4	3.0

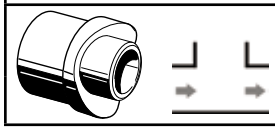
Elbow (male thread)	3/8" 16mm	1/2" 20mm	3/4" 25mm	1" 32mm
	1.7	2.2	2.7	3.5

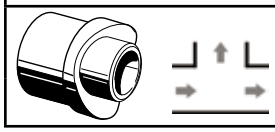
Tee (female thread)	3/8" 16mm	1/2" 20mm	3/4" 25mm	1" 32mm
	2.8	3.5	4.4	5.6

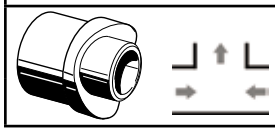
(➡ = flow direction)

Equivalent lengths of aquatherm greenpipe® fittings (ft)

Tee *(male thread)*		½" 20mm
		3.9

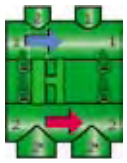
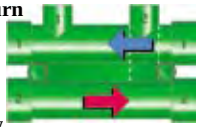
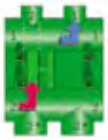
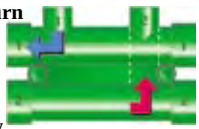
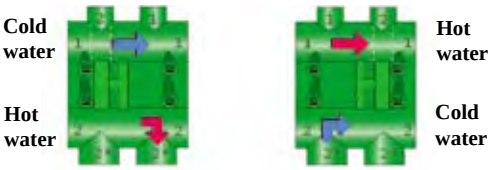
Fusion outlet	⅜" 16mm	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm
	0.4	0.5	0.7	0.9	1.1	1.4	1.7
	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" 160mm	8" 200mm	10" 250mm
	2.1	2.5	3.0	4.2	5.4	6.7	8.4

Fusion outlet *(separation of flow)*	⅜" 16mm	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm
	0.9	1.1	1.4	1.7	2.2	2.7	3.4
	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" 160mm	8" 200mm	10" 250mm
	4.1	4.9	6.0	8.4	10.7	13.4	16.8

Fusion outlet *(Counter current in case of conjunction of flow)*	⅜" 16mm	½" 20mm	¾" 25mm	1" 32mm	1 ¼" 40mm	1 ½" 50mm	2" 63mm
	1.7	2.2	2.7	3.5	4.4	5.5	6.9
	2 ½" 75mm	3" 90mm	3 ½" 110mm	4" 125mm	6" 160mm	8" 200mm	10" 250mm
	8.2	9.8	12.0	16.8	21.5	26.8	33.6

(➡ = flow direction)

Equivalent lengths of aquatherm greenpipe® fittings (ft) - distribution block

Picture	Comment	Picture	Comment	Equivalent Length
Potable water installation Cold water Hot water 	Reduced ¾"(25 mm) passage for separation of flow	Heating installation Return Flow 	Reduced ½" (20 mm) passage for separation of flow	2.0
	¾"(25 mm) passage for separation of flow		½" (20 mm) passage for separation of flow	0.5
Potable water installation Cold water Hot water 	½" (20 mm) passage for separation of flow	Heating installation Return Flow 	⅜" (16 mm) branch for separation of flow	1.6
	½" (20 mm) branch for conjunction of flow		⅜" (16 mm) branch in case of conjunction of flow	3.2
	Reduced ½"(20 mm) passage for separation of flow		⅜" (16 mm) branch for separation of flow	4.4
Potable water installation Cold water Hot water Hot water return 			¾"(25 mm) branch for separation of flow	2.4
			⅜" (16 mm) branch for conjunction of flow	1.6

Chapter 6:
Pipes and Fittings

aquatherm greenpipe® faser-composite pipe SDR 7.4

aquatherm greenpipe® SDR 11

climatherm® faser-composite pipe SDR 11 / 7.4

aquatherm greenpipe® SDR 7.4

aquatherm greenpipe® faser-composite pipe SDR 7.4 UV

climatherm® faser-composite pipe SDR 11 UV

aquatherm® - lilac pipe SDR 11

aquatherm Advanced

Accessories

Fittings

Flanges

Couplings

Mounting devices

Threaded connections

Transition pieces

Distributors

Valves

Tools

aquatherm

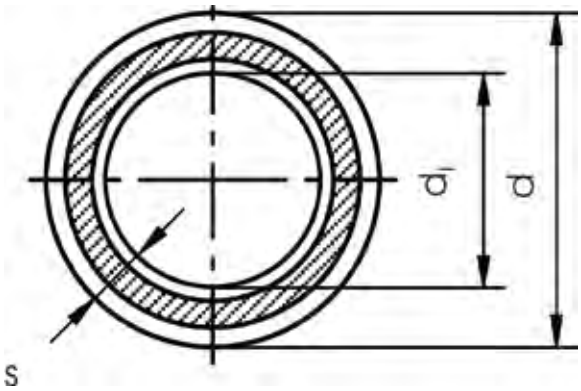
aquatherm greenpipe®

faser-composite pipe SDR 7.4

Material: fusiolen® PP-R faser-composite

In accordance with:

- NSF-14
- NSF-51
- NSF-61
- CSA-B137.11
- ICC AC 122
- ICC ESR 1613
- ASTM F 2389
- CFIA #A508



NSF System Certification:
Including fittings, connection pieces, and connection techniques.

Fields of Application:
For high temperature, moderate pressure systems, particularly domestic hot water systems.

Pipe *			Diameter **	Wall thickness	Internal diameter	Water capacity	Weight ***
Art.-No.	Dimension Nom. I.D. -- O.D.	Packing unit	d (mm)	s (mm)	d_i (mm)	gal/ft	lb/ft
0670708	1/2" -- 20 X 2.8 mm	25	20	2.8	14.4	0.0131	0.106
0670710	3/4" -- 25 X 3.5 mm	25	25	3.5	18	0.024	0.165
0670712	1" -- 32 X 4.4 mm	10	32	4.4	23.2	0.0340	0.265
0670714	1.25" -- 40 X 5.5 mm	10	40	5.5	29	0.0531	0.412
0670716	1.5" -- 50 X 6.9 mm	5	50	6.9	36.2	0.0828	0.642
0670718	2" -- 63 X 8.6 mm	5	63	8.6	45.8	0.1325	1.008
0670720	2.5" -- 75 X 10.3 mm	5	75	10.3	54.4	0.1870	1.435
0670722	3" -- 90 X 12.3 mm	3	90	12.3	65.4	0.2703	2.055
0670724	3.5" -- 110 X 15.1 mm	2	110	15.1	79.8	0.4023	3.075
0670726	4" -- 125 X 17.1 mm	1	125	17.1	90.8	0.521	3.959
0670730	6" -- 160 X 21.9 mm	1	160	21.9	116.2	0.854	6.409
0670734	8" -- 200 X 27.4 mm	1	200	27.4	145.2	1.333	10.114
0670738	10" -- 250 x 34.2 mm	1	250	34.2	181.6	2.084	15.777

** Pipes come in standard 13 ft lengths (4 m).*

*** To calculate exact dimensions of the pipe in imperial inches, divide measurement by 25.4.*

**** To calculate the weight of the pipe in kg/m, multiply the measurement by 1.5.*

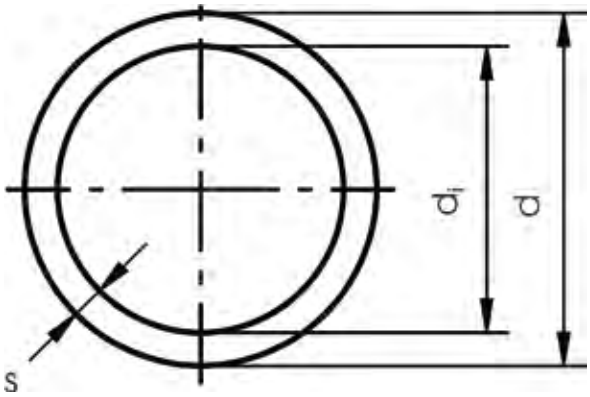
aquatherm greenpipe® pipe SDR 11

Material: fusiolen® PP-R

Pipe series: SDR 11 / S 5

In accordance with:

- NSF-14
- NSF-51
- NSF-61
- CSA-B137.11
- ICC AC 122
- ICC ESR 1613
- ASTM F 2389
- CFIA #A508



NSF System Certification:
Including fittings, connection pieces, and connection techniques.

Fields of Application:
Potable water, preferably domestic cold. Low pressure installations, such as rainwater, well-casings, food processing, etc.

Pipe *			Diameter **	Wall thickness	Internal diameter	Water capacity	Weight ***
Art.-No.	Dimension Nom. I.D. -- O.D.	Packing unit	d (mm)	s (mm)	d_i (mm)	gal/ft	lb/ft
0610208	1/2" -- 20 X 1.9 mm	25	20	1.9	16.2	0.017	0.073
0610210	3/4" -- 25 X 2.3 mm	25	25	2.3	20.4	0.026	0.111
0610212	1" -- 32 X 2.9 mm	10	32	2.9	26.2	0.043	0.178
0610214	1.25" -- 40 X 3.7 mm	10	40	3.7	32.6	0.067	0.279
0610216	1.5" -- 50 X 4.6 mm	5	50	4.6	40.8	0.105	0.433
0610218	2" -- 63 X 5.8 mm	5	63	5.8	51.4	0.167	0.682
0610220	2.5" -- 75 X 6.8 mm	5	75	6.8	61.4	0.237	0.951
0610222	3" -- 90 X 8.2 mm	3	90	8.2	73.6	0.343	1.374
0610224	3.5" -- 110 X 10 mm	2	110	10.0	90.0	0.512	2.107
0610226	4" -- 125 X 11.4 mm	1	125	11.4	102.2	0.661	2.639
0610230	6" -- 160 X 14.6 mm	1	160	14.6	130.8	1.082	4.311
0610234	8" -- 200 X 18.2 mm	1	200	18.2	163.6	1.692	6.713
0610238	10" -- 250 X 22.7 mm	1	250	22.7	204.6	2.646	10.442
The following items are supplied in coils:							
0610308	1/2" -- 20 X 1.9 mm	25	20	1.9	16.2	0.017	0.726
0610310	3/4" -- 25 X 2.3 mm	25	25	2.3	20.4	0.026	0.106
0610312	1" -- 32 X 3.9 mm	12.5	32	2.9	26.2	0.043	0.173

** Pipes come in standard 13 ft lengths (4 m).*

*** To calculate exact dimensions of the pipe in imperial inches, divide measurement by 25.4.*

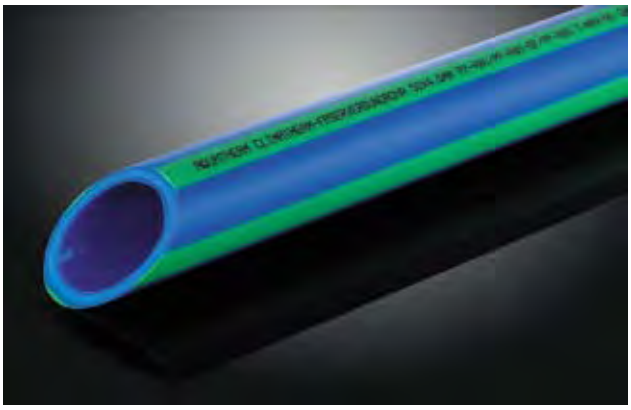
**** To calculate the weight of the pipe in kg/m, multiply the measurement by 1.5.*

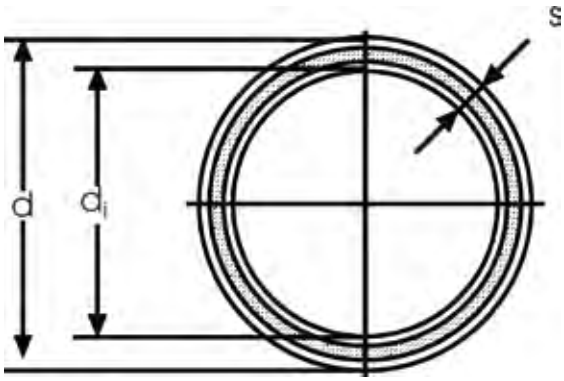
climatherm® faser-composite pipe SDR 11

Material: fusiolen® PP-R C-GF

Pipe series:
Art.-Nr. 2070708/2070710 = **SDR 7.4**
Art.-Nr. 2070112-2070138 = **SDR 11**

In accordance with:
- NSF-14
- CSA-B137.11
- ICC AC 122
- ICC ESR 1613
- ASTM F 2389





NSF System Certification:
Including fittings, connection pieces, and connection techniques.

Fields of Application:
Same applications as the standard climatherm®, but with higher operating temperatures and greater variations in operating temperature.

Pipe *			Diameter **	Wall thickness	Internal diameter	Water capacity	Weight ***
Art.-No.	Dimension Nom. I.D. -- O.D.	Packing unit	d (mm)	s (mm)	d_i (mm)	gal/ft	lb/ft
2670708	1/2" -- 20 X 2.8 mm SDR7.4	25	20	2.8	14.4	0.017	0.107
2670710	3/4" -- 25 X 3.5 mm SDR7.4	25	25	3.5	18	0.026	0.167
2670112	1" -- 32 X 4.4 mm SDR11	10	32	2.9	26.2	0.043	0.189
2670114	1.25" -- 40 X 3.7 mm SDR11	10	40	3.7	32.6	0.067	0.292
2670116	1.5" -- 50 X 4.6 mm SDR11	5	50	4.6	40.8	0.105	0.454
2670118	2" -- 63 X 5.8 mm SDR11	5	63	5.8	51.4	0.167	0.716
2670120	2.5" -- 75 X 6.8 mm SDR11	5	75	6.8	61.4	0.237	0.996
2670122	3" -- 90 X 8.2 mm SDR11	3	90	8.2	73.6	0.343	1.441
2670124	3.5" -- 110 X 10 mm SDR11	2	110	10	90	0.512	2.134
2670126	4" -- 125 X 11.4 mm SDR11	1	125	11.4	102.2	0.661	2.767
2670130	6" -- 160 X 14.6 mm SDR11	1	160	14.6	130.8	1.082	4.521
2670134	8" -- 200 X 18.2 mm SDR11	1	200	18.2	163.6	1.692	7.042
2670138	10" -- 250 X 22.7 mm SDR11	1	250	22.7	204.6	2.646	10.953
	The following items are supplied in coils (non-faser)						
2610308	1/2" -- 20 x 1.9 mm SDR11	25	20	1.9	16.2	0.017	0.107
2610310	3/4" -- 25 x 2.3 mm SDR11	25	25	2.3	20.4	0.026	0.164
2610312	1" -- 32 X 2.9 mm SDR11	12.5	32	2.9	26.2	0.043	0.261

** Pipes come in standard 13 ft lengths (4 m).*

*** To calculate exact dimensions of the pipe in imperial inches, divide measurement by 25.4*

**** To calculate the weight of the pipe in kg/m, multiply the measurement by 1.5.*

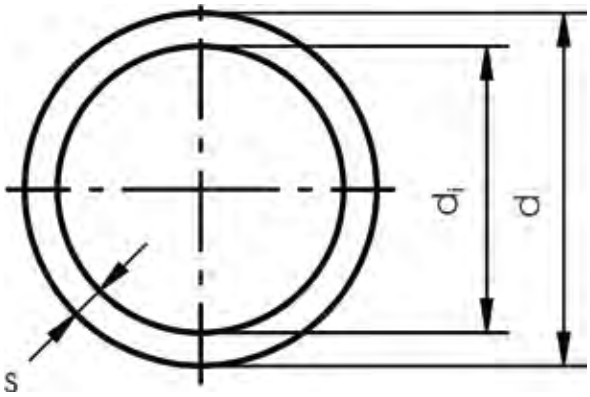
aquatherm greenpipe® pipe SDR 7.4

Material: fusiolen® PP-R

Pipe series: SDR 7.4 / S 2.5

In accordance with:

- NSF-14
- NSF-51
- NSF-61
- CSA-B137.11
- ICC AC 122
- ICC ESR 1613
- ASTM F 2389
- CFIA #A508



NSF System Certification:
Including fittings, connection pieces, and connection techniques.

Fields of Application:
Moderate pressures with minimal temperature changes. Domestic cold water, food processing, compressed gases, etc.

Pipe *			Diameter **	Wall thickness	Internal diameter	Water capacity	Weight ***
Art.-No.	Dimension Nom. I.D. -- O.D.	Packing unit	d (mm)	s (mm)	d_i (mm)	gal/ft	lb/ft
0610806	3/8" -- 16 X 2.2 mm	25	16	2.2	11.6	0.0085	0.065
0610808	1/2" -- 20 X 2.8 mm	25	20	2.8	14.4	0.0131	0.100
0610810	3/4" -- 25 X 3.5 mm	25	25	3.5	18	0.024	0.156
0610812	1" -- 32 X 4.4 mm	10	32	4.4	23.2	0.0340	0.250
0610814	1.25" -- 40 X 5.5 mm	10	40	5.5	29	0.0531	0.388
0610816	1.5" -- 50 X 6.9 mm	5	50	6.9	36.2	0.0828	0.605
0610818	2" -- 63 X 8.6 mm	5	63	8.6	45.8	0.1325	0.952
0610820	2.5" -- 75 X 10.3 mm	5	75	10.3	54.4	0.1870	1.354
0610822	3" -- 90 X 12.3 mm	3	90	12.3	65.4	0.2703	1.939
0610824	3.5" -- 110 X 15.1 mm	2	110	15.1	79.8	0.4023	2.902
The following items are supplied in coils:							
0610906	3/8" -- 16 X 2.2 mm	25	16	2.2	11.6	0.0085	0.065
0610908	1/2" -- 20 X 2.8 mm	25	20	2.8	14.4	0.0131	0.100

** Pipes come in standard 13 ft lengths (4 m).*

*** To calculate exact dimensions of the pipe in imperial inches, divide measurement by 25.4.*

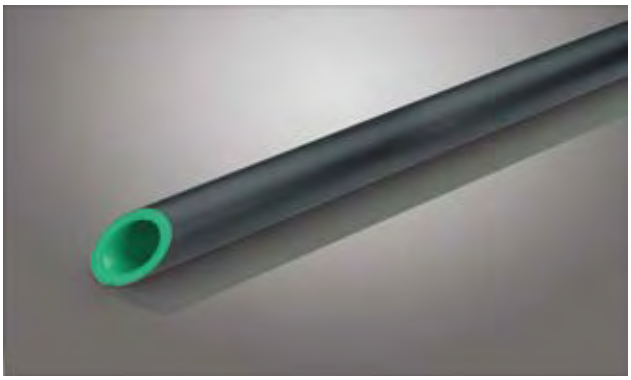
**** To calculate the weight of the pipe in kg/m, multiply the measurement by 1.5.*

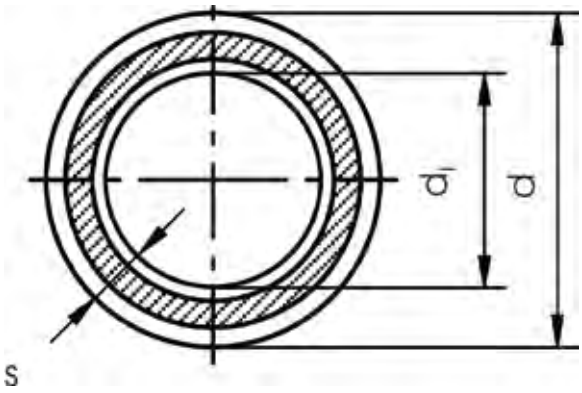
aquatherm greenpipe® UV faser-composite pipe SDR 7.4

Material: fusiolen® PP-R faser-composite

In accordance with:

- NSF-14
- NSF-51
- NSF-61
- CSA-B137.11
- ICC AC 122
- ICC ESR 1613
- ASTM F 2389
- CFIA #A508





NSF System Certification:
Including fittings, connection pieces and connection techniques.

Fields of Application:
All the same applications as the standard aquatherm greenpipe® SDR 7.4 faser-composite, but for installations where the pipe is exposed to UV radiation.

Pipe *			Diameter **	Wall thickness	Internal diameter	Water capacity	Weight ***
Art.-No.	Dimension Nom. I.D. -- O.D.	Packing unit	d (mm)	s (mm)	d_i (mm)	gal/ft	lb/ft
0670758	1/2" -- 20 X 2.8 mm	25	20	2.8	14.4	0.013	0.138
0670760	3/4" -- 25 X 3.5 mm	25	25	3.5	18	0.024	0.206
0670762	1" -- 32 X 4.4 mm	10	32	4.4	23.2	0.034	0.318
0670764	1.25" -- 40 X 5.5 mm	10	40	5.5	29	0.053	0.476
0670766	1.5" -- 50 X 6.9 mm	5	50	6.9	36.2	0.083	0.720
0670768	2" -- 63 X 8.6 mm	5	63	8.6	45.8	0.133	1.102
0670770	2.5" -- 75 X 10.3 mm	5	75	10.3	54.4	0.187	1.533
0670772	3" -- 90 X 12.3 mm	3	90	12.3	65.4	0.270	2.207
0670774	3.5" -- 110 X 15.1 mm	2	110	15.1	79.8	0.402	3.306
0670776	4" -- 125 X 17.1 mm	1	125	17.1	90.8	0.521	4.185
0670780	6" -- 160 X 21.9 mm	1	160	21.9	113.2	0.810	6.807
0670784	8" -- 200 X 27 mm	1	200	27.4	141.8	1.271	10.592
0670788	10" -- 250 x 33.8 mm	1	250	34.2	177.6	1.994	16.482

** Pipes come in standard 13 ft lengths (4 m).*

*** To calculate exact dimensions of the pipe in imperial inches, divide measurement by 25.4.*

**** To calculate the weight of the pipe in kg/m, multiply the measurement by 1.5.*

climatherm® UV faser-composite pipe SDR 11

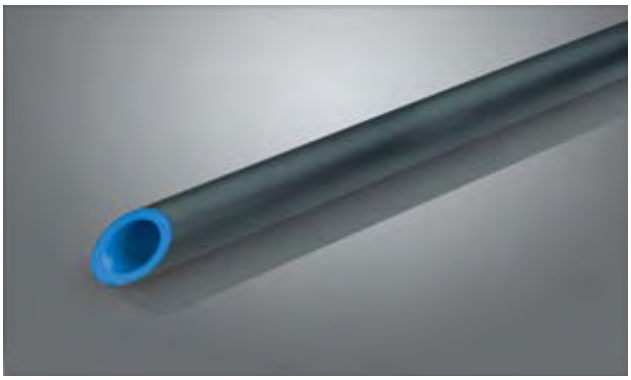
Material: fusiolen® PP-R C-GF

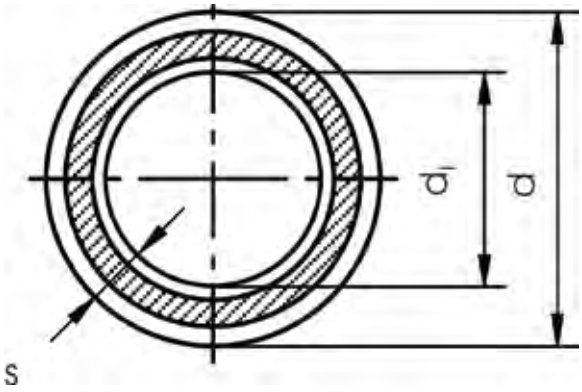
Pipe series:
Art.-Nr. 2070708/2070710 = **SDR 7.4**
Art.-Nr. 2070112-2070138 = **SDR 11**

In accordance with:
- NSF-14
- CSA-B137.11
- ICC AC 122
- ICC ESR 1613
- ASTM F 2389

NSF System Certification:
Including fittings, connection pieces and connection techniques.

Fields of Application:
All the same applications as the standard climatherm® SDR 11 faser-composite, but for installations where the pipe is exposed to UV radiation.





Pipe *			Diameter **	Wall thickness	Internal diameter	Water capacity	Weight ***
Art.-No.	Dimension Nom. I.D. -- O.D.	Packing unit	d (mm)	s (mm)	d_i (mm)	gal/ft	lb/ft
2670758	1/2" -- 20 X 2.8 mm SDR7.4	25	20	2.8	14.4	0.013	0.142
2670760	3/4" -- 25 X 3.5 mm SDR7.4	25	25	3.5	18.0	0.020	0.212
2670162	1" -- 32 X 4.4 mm SDR11	10	32	2.9	26.2	0.043	0.249
2670164	1.25" -- 40 X 5.5 mm SDR11	10	40	3.7	32.6	0.067	0.370
2670166	1.5" -- 50 X 6.9 mm SDR11	5	50	4.6	40.8	0.105	0.551
2670168	2" -- 63 X 8.6 mm SDR11	5	63	5.8	51.4	0.167	0.841
2670170	2.5" -- 75 X 10.3 mm SDR11	5	75	6.8	61.4	0.238	1.141
2670172	3" -- 90 X 12.3 mm SDR11	3	90	8.2	73.6	0.342	1.659
2670174	3.5" -- 110 X 15.1 mm SDR11	2	110	10.0	90.0	0.512	2.464
2670176	4" -- 125 X 17.1 mm SDR11	1	125	11.4	102.2	0.660	3.123
2670180	6" -- 160 X 14.6 mm SDR11	1	160	14.6	130.8	1.032	4.876
2670184	8" -- 200 X 18.2 mm SDR11	1	200	18.2	163.6	1.622	7.542
2670188	10" -- 250 X 22.7 mm SDR11	1	250	22.7	204.6	2.544	11.692

** Pipes come in standard 13 ft lengths (4 m).*

*** To calculate exact dimensions of the pipe in imperial inches, divide measurement by 25.4.*

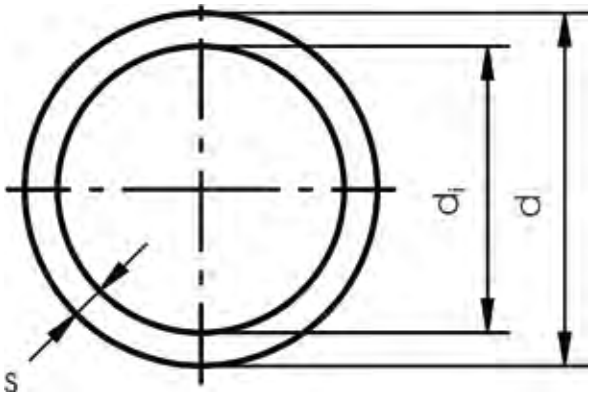
**** To calculate the weight of the pipe in kg/m, multiply the measurement by 1.5.*

aquatherm® - lilac SDR 11
for recycled / reclaimed water

Material: fusiolen® PP-R

Pipe series:
Art.-Nr. 9010808/9010810 = **SDR 7.4**
Art.-Nr. 9010212-9010238 = **SDR 11**

In accordance with:
- NSF-14
- CSA B 137.11



Fields of Application:
For rainwater and reclaimed water systems.

Pipe *			Diameter **	Wall thickness	Internal diameter	Water capacity	Weight ***
Art.-No.	Dimension Nom. I.D. -- O.D.	Packing unit	d (mm)	s (mm)	d_i (mm)	gal/ft	lb/ft
9010808	1/2" -- 20 X 2.8 mm SDR7.4	25	20	2.8	14.4	0.013	0.099
9010810	3/4" -- 25 X 3.5 mm SDR7.4	25	25	3.5	18.0	0.020	0.155
9010212	1" -- 32 X 4.4 mm SDR11	10	32	2.9	26.2	0.043	0.175
9010214	1.25" -- 40 X 3.7 mm SDR11	10	40	3.7	32.6	0.067	0.277
9010216	1.5" -- 50 X 4.6 mm SDR11	5	50	4.6	40.8	0.105	0.429
9010218	2" -- 63 X 5.8 mm SDR11	5	63	5.8	51.4	0.167	0.679
9010220	2.5" -- 75 X 6.8 mm SDR11	5	75	6.8	61.4	0.238	0.947
9010222	3" -- 90 X 8.2 mm SDR11	3	90	8.2	73.6	0.342	1.364
9010224	3.5" -- 110 X 10 mm SDR11	2	110	10.0	90.0	0.512	2.023
9010226	4" -- 125 X 11.4 mm SDR11	1	125	11.4	102.2	0.660	2.627
9010230	6" -- 160 X 14.6 mm SDR11	1	160	14.6	130.8	1.081	4.287
9010234	8" -- 200 X 18.2 mm SDR11	1	200	18.2	163.6	1.692	6.686
9010238	10" -- 250 X 22.7 mm SDR11	1	250	22.7	204.6	2.646	10.416

** Pipes come in standard 13 ft lengths (4 m).*

*** To calculate exact dimensions of the pipe in imperial inches, divide measurement by 25.4.*

**** To calculate the weight of the pipe in kg/m, multiply the measurement by 1.5.*

aquatherm Advanced

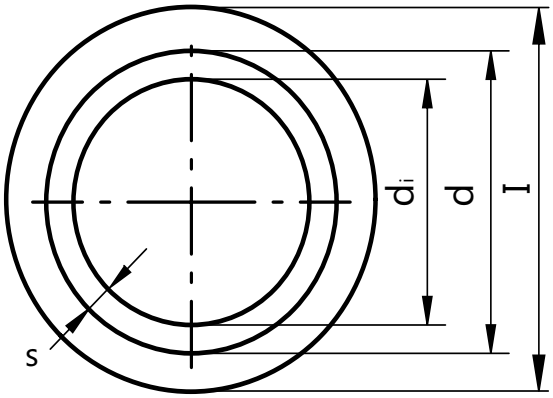
Compatable with:
aquatherm greenpipe® pipe SDR 11
aquatherm greenpipe® faser-composite pipe SDR 7.4
climatherm® faser-composite pipe SDR 11

In accordance with:
- NSF-14
- NSF-51*
- NSF-61*
- CSA-B137.11
- ICC 1613
- ICC AC 122
- ASTM F 2389
- CFIA #A508*

* aquatherm greenpipe® *only*

System Components:
Sheets of fire-resistant insulation and tape. Intended for use with a complete Aquatherm piping system.

Fields of Application:
Intended for use in applications where energy codes require insulation on the pipe.



The values for d, d_i and s correspond to the values given for each piping system. The value for I is found by adding twice the insulation thickness to d for any size of pipe.

aquatherm Advanced wrap *(pipe sold seperately)*

Art.-No.	Dimension Nom. I.D. -- O.D.	Wrap Dimensions	Lengths / package	Insulation Wall
AA0610208	1/2” -- 20 mm	5.50” x 36”	172	5/16”
AA0610210	3/4” -- 25 mm	6.00” x 36”	160	5/16”
AA0610212	1” -- 32 mm	6.50” x 36”	144	5/16”
AA0610214	1.25” -- 40 mm	7.50” x 36”	116	5/16”
AA0610216	1.5” -- 50 mm	9.00” x 36”	104	5/16”
AA0610218	2” -- 63 mm	10.50” x 36”	116	5/16”
AA0610220	2.5” -- 75 mm	12.00” x 36”	104	5/16”
AA0610222	3” -- 90 mm	14.00” x 36”	96	5/16”
AA0610224	3.5” -- 110 mm	16.75” x 36”	96	5/16”
AA0610226	4” -- 125 mm	18.50” x 36”	48	5/16”
AA0610230	6” -- 160 mm	22.50” x 36”	48	5/16”
AA0610234	8” -- 200 mm	25.75” x 36”	48	5/16”
AA0610238	10” -- 250 mm	33.25” x 36”	48	5/16”

Foil tape *required for* **aquatherm *Advanced*** *installations*

Art.-No.	Dimension Nom. I.D. -- O.D.	Total Linear Feet	Packing unit	lb per case
FT25006	(6) Rolls 2” X 150’ Foil Tape	900	6 per case	8

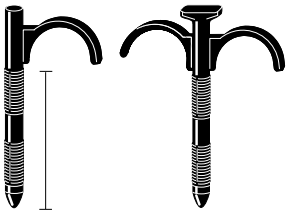
Pricing and packing is per case of 6. Rolls not sold individually.

6

Accessories

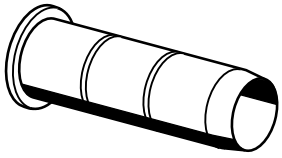
Pipe fastening strap *suitable for 3/8" - 1" (16 - 32mm) pipe*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0060604	Single -- 1 3/8" (45 mm)	50	1		0.011
0060606	Single -- 2.5" (75 mm)	50	1		0.015
0060608	Double -- 1 3/8" (45mm)	50	1		0.017
0060610	Double -- 2.5" (75 mm)	50	1		0.019



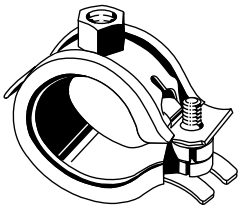
aquatherm pipe support

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0085110	3/8" -- 16 X 2.2 mm - 11.4 mm	10	1		0.011
0010186	3/8" -- 16 X 2.7 mm - 10.4 mm	10	1		0.011



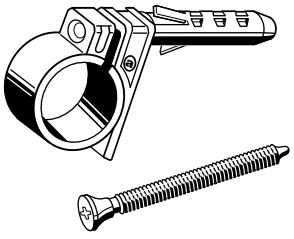
Pipe clamps *for* **aquatherm** *pipes*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0060516	3/8" -- 16mm	50	1		0.099
0060520	1/2" -- 20 mm	50	1		0.105
0060525	3/4" -- 25 mm	50	1		0.112
0060532	1" -- 32 mm	50	1		0.132
0060540	1.25" -- 40 mm	50	1		0.147
0060550	1.5" -- 50 mm	50	1		0.174
0060563	2" -- 63 mm	25	1		0.200
0060575	2.5" -- 75 mm	25	1		0.231
0060590	3" -- 90 mm	25	1		0.282
0060594	3.5" -- 110 mm	25	1		0.341
0060595	4" -- 125 mm	25	1		0.467
0060597	6" -- 160 mm	25	1		0.753
0060650	8" -- 200 mm	1	1		-
0060654	10" -- 250 mm	1	1		-



Plastic pipe clamps *for* **aquatherm** pipe

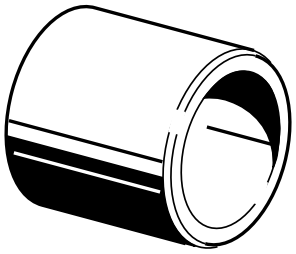
Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0060616	3/8" -- 16 mm	1	1		0.015
0060620	1/2" -- 20 mm	1	1		0.017
0060625	3/4" -- 25 mm	1	1		0.035



Fittings

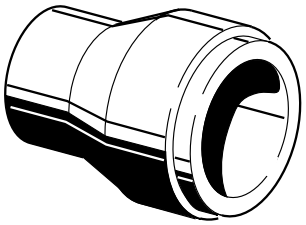
aquatherm greenpipe® coupling

Art.-No.	Dimension Nom. I.D. -- O.D.	Packing unit	Price Unit	Price	lb/pc
0111006	3/8” -- 16 mm	10	1		0.018
0111008	1/2” -- 20 mm	10	1		0.024
0111010	3/4” -- 25 mm	10	1		0.040
0111012	1” -- 32 mm	5	1		0.060
0111014	1.25” -- 40 mm	5	1		0.095
0111016	1.5” -- 50 mm	5	1		0.192
0111018	2” -- 63 mm	1	1		0.276
0111020	2.5” -- 75 mm	1	1		0.459
0111022	3” -- 90 mm	1	1		0.732
0111024	3.5” -- 110 mm	1	1		1.305
0111026	4” -- 125 mm	1	1		1.784



aquatherm greenpipe® bushing

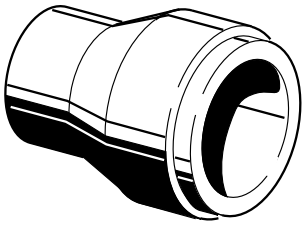
Art.-No.	Dimension Nom. I.D. -- O.D.	Packing unit	Price unit	Price	lb/pc
0111109	3/8” to 1/2” -- 16 to 20 mm	10	1		0.0198
0111110	3/8” to 3/4” -- 16 to 25 mm	10	1		0.0265
0111112	3/4” to 1/2” -- 25 to 20 mm	10	1		0.0287
0111114	1” to 1/2” -- 32 to 20 mm	5	1		0.0353
0111116	1” to 3/4” -- 32 to 25 mm	5	1		0.0463
0111118	1.25” to 1/2” -- 40 to 20 mm	5	1		0.0573
0111120	1.25” to 3/4” -- 40 to 25 mm	5	1		0.0750
0111122	1.25” to 1” -- 40 to 32 mm	5	1		0.0772
0111124	1.5” to 1/2” -- 50 to 20 mm	5	1		0.0970
0111126	1.5” to 3/4” -- 50 to 25 mm	5	1		0.0926
0111128	1.5” to 1” -- 50 to 32 mm	5	1		0.1146
0111130	1.5” to 1.25” -- 50 to 40 mm	5	1		0.1257
0111131	2” to 1/2” -- 63 to 20 mm	1	1		0.1631
0111132	2” to 3/4” -- 63 to 25 mm	1	1		0.1521
0111134	2” to 1” -- 63 to 32 mm	1	1		0.1852
0111136	2” to 1.25” -- 63 to 40 mm	1	1		0.2028
0111138	2” to 1.5” -- 63 to 50 mm	1	1		0.2557
0111143	2.5” to 1/2” -- 75 to 20 mm	1	1		0.2425
0111144	2.5” to 3/4” -- 75 to 25 mm	1	1		0.2403
0111145	2.5” to 1” -- 75 to 32 mm	1	1		0.2888
0111139	2.5” to 1.25” -- 75 to 40 mm	1	1		0.2910
0111140	2.5” to 1.5” -- 75 to 50 mm	1	1		0.3439
0111142	2.5” to 2” -- 75 to 63 mm	1	1		0.4012
0111151	3” to 1.5” -- 90 to 50 mm	1	1		0.4564
0111152	3” to 2” -- 90 to 63 mm	1	1		0.5379
0111153	3” to 2.5” -- 90 to 75 mm	1	1		0.6349
0111155	3.5” to 2” -- 110 to 63 mm	1	1		0.7694
0111157	3.5” to 2.5” -- 110 to 75 mm	1	1		0.8907
0111159	3.5” to 3” -- 110 to 90 mm	1	1		1.1707
0111161	4” to 2.5” -- 125 to 75 mm	1	1		1.1707
0111163	4” to 3” -- 125 to 90 mm	1	1		1.1707
0111165	4” to 3.5” -- 125 to 110 mm	1	1		1.8056



Fittings

aquatherm greenpipe® reducer

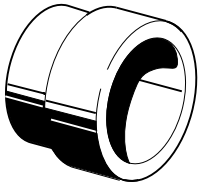
Art.-No.	Dimension Nom. I.D. -- O.D.	Packing unit	Price unit	Price	lb/pc
0111176	6" to 4" – 160 to 125 mm (SDR 7.4)*	1	1		1.7946
0111177	6" to 4 " – 160 to 125 mm (SDR 11)*	1	1		2.1605
0111184	8" to 6" – 200 to 160 mm (SDR 7.4)*	1	1		3.4613
0111185	8" to 6" – 200 to 160 mm (SDR 11)*	1	1		2.5794
0111190	10" to 8" – 250 to 200 mm (SDR 7.4)*	1	1		7.0768
0111191	10" to 8" – 250 to 200 mm (SDR 11)*	1	1		5.1368



** Indicates reducers that are butt welded to the pipes.*

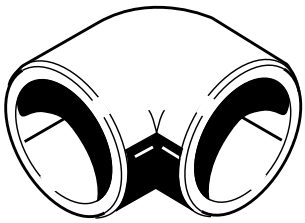
aquatherm greenpipe® reducing coupling *female/female*

Art.-No.	Dimension Nom. I.D. -- O.D.	Packing unit	Price unit	Price	lb/pc
0111238	2" to 1.5" -- 63 to 50 mm	1	1		0.258
0111242	2.5" to 2" -- 75 to 63 mm	1	1		0.399
0111253	3" to 2.5" -- 90 to 75 mm	1	1		0.628



aquatherm greenpipe® elbow 90°

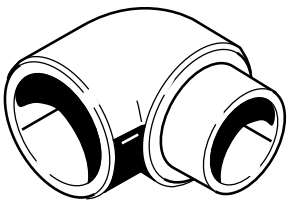
Art.-No.	Dimension Nom. I.D. -- O.D.	Packing unit	Price unit	Price	lb/pc
0112106	3/8" -- 16 mm	10	1		0.024
0112108	1/2" -- 20 mm	10	1		0.040
0112110	3/4" -- 25 mm	10	1		0.055
0112112	1" -- 32 mm	5	1		0.090
0112114	1.25" -- 40 mm	5	1		0.157
0112116	1.5" -- 50 mm	5	1		0.355
0112118	2" -- 63 mm	1	1		0.611
0112120	2.5" -- 75 mm	1	1		0.985
0112122	3" -- 90 mm	1	1		1.768
0112124	3.5" -- 110 mm	1	1		3.113
0112126	4" -- 125 mm	1	1		4.330
0112130	6'' -- 160 mm (SDR 7.4)*	1	1		5.739
0112131	6" -- 160 mm (SDR 11)*	1	1		4.319
0112134	8" -- 200 mm (SDR 7.4)*	1	1		25.772
0112135	8" -- 200 mm (SDR 11)*	1	1		17.946
0112138	10" -- 250 mm (SDR 7.4)*	1	1		57.320
0112139	10" -- 250 mm (SDR 11)*	1	1		39.683



** Indicates elbows that are butt welded to the pipes.*

aquatherm greenpipe® street 90° *female/male*

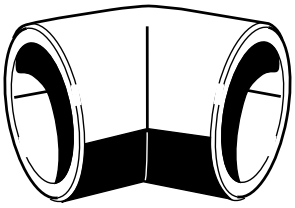
Art.-No.	Dimension Nom. I.D. -- O.D.	Packing unit	Price unit	Price	lb/pc
0112306	3/8" -- 16 mm	10	1		0.024
0112308	1/2" -- 20 mm	10	1		0.040
0112310	3/4" -- 25 mm	10	1		0.055
0112312	1" -- 32 mm	5	1		0.090
0112314	1.25" -- 40 mm	5	1		0.157



Fittings

aquatherm greenpipe® elbow 45°

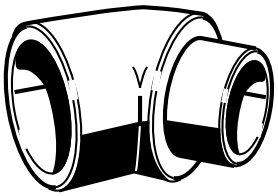
Art.-No.	Dimension Nom. I.D. -- O.D.	Packing unit	Price unit	Price	lb/pc
0112506	3/8" -- 16 mm	10	1		0.020
0112508	1/2" -- 20 mm	10	1		0.031
0112510	3/4" -- 25 mm	10	1		0.042
0112512	1" -- 32 mm	5	1		0.077
0112514	1.25" -- 40 mm	5	1		0.119
0112516	1.5" -- 50 mm	5	1		0.254
0112518	2" -- 63 mm	1	1		0.487
0112520	2.5" -- 75 mm	1	1		0.756
0112522	3" -- 90 mm	1	1		1.230
0112524	3.5" -- 110 mm	1	1		2.194
0112526	4" -- 125 mm	1	1		2.818
0112530	6" -- 160 mm (SDR 7.4)*	1	1		4.184
0112531	6" -- 160 mm (SDR 11)*	1	1		3.034
0112534	8" -- 200 mm (SDR 7.4)*	1	1		18.034
0112535	8" -- 200 mm (SDR 11)*	1	1		12.655
0112538	10" -- 250 mm (SDR 7.4)*	1	1		16.173
0112539	10" -- 250 mm (SDR 11)*	1	1		28.660



** Indicates reducers that are butt welded to the pipes.*

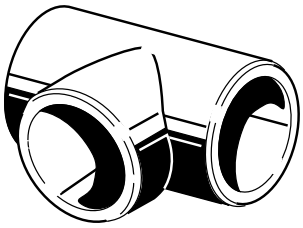
aquatherm greenpipe® street 45° *female/male*

Art.-No.	Dimension Nom. I.D. -- O.D.	Packing unit	Price unit	Price	lb/pc
0112708	1/2" -- 20 mm	10	1		0.031
0112710	3/4" -- 25 mm	10	1		0.040
0112712	1" -- 32 mm	5	1		0.079
0112714	1.25" -- 40 mm	5	1		0.126



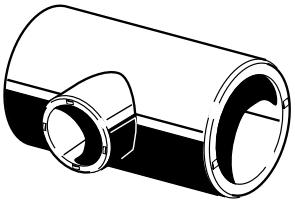
aquatherm greenpipe® tee

Art.-No.	Dimension Nom. I.D. -- O.D.	Packing unit	Price unit	Price	lb/pc
0113106	3/8" -- 16 mm	10	1		0.033
0113108	1/2" -- 20 mm	10	1		0.053
0113110	3/4" -- 25 mm	10	1		0.073
0113112	1" -- 32 mm	5	1		0.134
0113114	1.25" -- 40 mm	5	1		0.196
0113116	1.5" -- 50 mm	5	1		0.452
0113118	2" -- 63 mm	1	1		0.811
0113120	2.5" -- 75 mm	1	1		1.226
0113122	3" -- 90 mm	1	1		2.134
0113124	3.5" -- 110 mm	1	1		3.788
0113126	4" -- 125 mm	1	1		5.889
0113130	6" -- 160 mm (SDR 7.4)*	1	1		8.051
0113131	6" -- 160 mm (SDR 11)*	1	1		6.111
0113134	8" -- 200 mm (SDR 7.4)*	1	1		8.051
0113135	8" -- 200 mm (SDR 11)*	1	1		15.146
0113138	10" -- 250 mm (SDR 7.4)*	1	1		48.502
0113139	10" -- 250 mm (SDR 11)*	1	1		35.274



Fittings

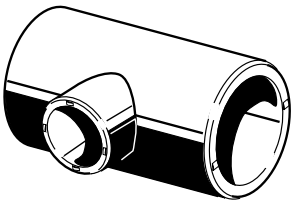
aquatherm greenpipe® reducing tee



Art.-No.	Dimension Nom. I.D. -- O.D.	Packing unit	Price unit	Price	lb/pc
0113506	1/2" X 3/8" X 3/8" – 20 X 16 X 16 mm	10	1		0.057
0113508	1/2" X 1/2" X 3/8" – 20 X 20 X 16 mm	10	1		0.055
0113510	1/2" X 3/8" X 1/2" – 20 X 16 X 20 mm	10	1		0.055
0113511	1/2" X 1/2" X 3/4" – 20 X 20 X 25 mm	10	1		0.090
0113512	3/4" X 3/8" X 3/8" – 25 X 16 X 16 mm	10	1		0.095
0113514	3/4" X 1/2" X 3/8"– 25 X 20 X 16 mm	10	1		0.090
0113516	3/4" X 3/4" X 3/8" – 25 X 25 X 16 mm	10	1		0.084
0113520	3/4" X 1/2" X 1/2" – 25 X 20 X 20 mm	10	1		0.088
0113522	3/4" X 3/4" X 1/2" – 25 X 25 X 20 mm	10	1		0.079
0113528	1" X 1" X 3/8" – 32 X 32 X 16 mm	5	1		0.121
0113532	1" X 1/2" X 1/2" – 32 X 20 X 20 mm	5	1		0.181
0113534	1" X 1" X 1/2" – 32 X 32 X 20 mm	5	1		0.117
0113538	1" X 3/4" x 3/4" – 32 X 25 X 25 mm	5	1		0.134
0113540	1" X 1" X 3/4" – 32 X 32 X 25 mm	5	1		0.141
0113542	1.25" X 1.25" X 1/2" – 40 X 40 X 20 mm	5	1		0.203
0113544	1.25" X 1.25" X 3/4 " – 40 X 40 X 25 mm	5	1		0.196
0113546	1.25" X 1.25" X 1" – 40 X 40 X 32 mm	5	1		0.234
0113547	1.5" X 1.5" X 1/2" – 50 X 50 X 20 mm	5	1		0.406
0113548	1.5" X 1.5" X 3/4" – 50 X 50 X 25 mm	5	1		0.423
0113550	1.5" X 1.5" X 1" – 50 X 50 X 32 mm	5	1		0.406
0113551	1.5" X 1.5" X 1.25" – 50 X 50 X 40 mm	5	1		0.494
0113552	2" X 2" X 1/2" – 63 X 63 X 20 mm	1	1		0.736
0113554	2" X 2" X 3/4" – 63 X 63 X 25 mm	1	1		0.747
0113556	2" X 2" X 1" – 63 X 63 x 32 mm	1	1		0.736
0113558	2" x 2" X 1.25" – 63 X 63 X 40 mm	1	1		0.734
0113560	2" X 2" X 1.5" – 63 X 63 x 50 mm	1	1		0.882
0113561	2.5" X 2.5" X 1/2" – 75 X 75 X 20 mm	1	1		1.184
0113562	2.5" X 2.5" X 3/4" – 75 X 75 X 25 mm	1	1		1.162
0113564	2.5" X 2.5" X 1" – 75 X 75 X 32 mm	1	1		1.155
0113566	2.5" X 2.5" X 1.25" – 75 X 75 X 40 mm	1	1		1.184
0113568	2.5" X 2.5" X 1.5" – 75 X 75 X 50 mm	1	1		1.153
0113570	2.5" X 2.5" X 2" – 75 X 75 X 63 mm	1	1		1.213
0113576	3" X 3" X 1" – 90 X 90 X 32 mm	1	1		1.989
0113578	3" X 3" X 1.25" – 90 X 90 X 40 mm	1	1		1.967
0113580	3" X 3" X 1.5" -- 90 X 90 X 50 mm	1	1		2.218
0113582	3" x3" x 2" – 90 X 90 X 63 mm	1	1		2.017
0113584	3" X 3" X 2.5" – 90 X 90 X 75 mm	1	1		2.293
0113586	3.5" X 3.5" X 2" – 110 X 110 X 63 mm	1	1		3.688
0113588	3.5" X 3.5" X 2.5" – 110 X 110 X 75 mm	1	1		3.587
0113590	3.5" X 3.5" X 2.5" – 110 X 110 X 90 mm	1	1		3.631
0113592	4" X 4" X 2.5" – 125 X 125 X 75 mm	1	1		3.585
0113594	4" X 4" X 3" – 125 X 125 X 90 mm	1	1		3.631
0113596	4" X 4" X 3.5" – 125 X 125 X 110 mm	1	1		5.794

Fittings

aquatherm greenpipe® reducing tee

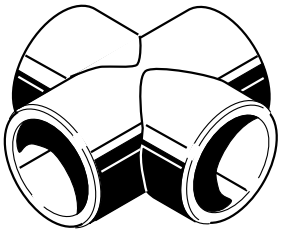


Art.-No.	Dimension Nom. I.D. -- O.D.	Packing unit	Price unit	Price	lb/pc
0113600	6” X 6” X 2.5” -- 160 x 160 x 75 mm (SDR 7.4)	1	1		9.731
0113601	6” X 6” X 2.5” -- 160 x 160 x 75 mm (SDR 11)	1	1		6.923
0113602	6” X 6” X 3” -- 160 x 160 x 90 mm (SDR 7.4)	1	1		9.954
0113603	6” X 6” X 3” -- 160 x 160 x 90 mm (SDR 11)	1	1		7.002
0113608	8” X 8” X 2.5” -- 200 x 200 x 75 mm (SDR 7.4)	1	1		15.675
0113609	8” X 8” X 2.5” -- 200 x 200 x 75 mm (SDR 11)	1	1		11.649
0113610	8” X 8” X 3” -- 200 x 200 x 90 mm (SDR 7.4)	1	1		16.623
0113611	8” X 8” X 3” -- 200 x 200 x 90 mm (SDR 11)	1	1		11.393
0113612	8” X 8” X 3.5” -- 200 x 200 x 110 mm (SDR 7.4)	1	1		16.149
0113613	8” X 8” X 3.5” -- 200 x 200 x 110 mm (SDR 11)	1	1		12.452
0113614	8” X 8” X 4” -- 200 x 200 x 125 mm (SDR 7.4)	1	1		16.854
0113615	8” X 8” X 4” -- 200 x 200 x 125 mm (SDR 11)	1	1		12.756
0113624	10” X 10” X 2.5” -- 250 x 250 x 75 mm (SDR 7.4)	1	1		36.850
0113625	10” X 10” X 2.5” -- 250 x 250 x 75 mm (SDR 11)	1	1		26.455
0113626	10” X 10” X 3” -- 250 x 250 x 90 mm (SDR 7.4)	1	1		37.002
0113627	10” X 10” X 3” -- 250 x 250 x 90 mm (SDR 11)	1	1		26.455
0113628	10” X 10” X 3.5” -- 250 x 250 x 110 mm (SDR 7.4)	1	1		37.002
0113629	10” X 10” X 3.5” -- 250 x 250 x 110 mm (SDR 11)	1	1		28.660
0113630	10” X 10” X 4” -- 250 x 250 x 125 mm (SDR 7.4)	1	1		37.615
0113631	10” X 10” X 4” -- 250 x 250 x 125 mm (SDR 11)	1	1		26.455

Fittings

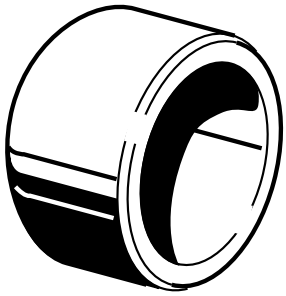
aquatherm greenpipe® cross

Art.-No.	Dimension Nom. I.D. -- O.D.	Packing unit	Price unit	Price	lb/pc
0113708	1/2” -- 20 mm	10	1		0.057
0113710	3/4” -- 25 mm	10	1		0.079
0113712	1” -- 32 mm	5	1		0.148
0113714	1.25” -- 40 mm	5	1		0.231



aquatherm greenpipe® end cap

Art.-No.	Dimension Nom. I.D. -- O.D.	Packing unit	Price unit	Price	lb/pc
0114106	3/8” -- 16 mm	10	1		0.020
0114108	1/2” -- 20 mm	10	1		0.024
0114110	3/4” -- 25 mm	10	1		0.020
0114112	1” -- 32 mm	5	1		0.051
0114114	1.25” -- 40 mm	5	1		0.093
0114116	1.5” -- 50 mm	5	1		0.174
0114118	2” -- 63 mm	1	1		0.320
0114120	2.5” -- 75 mm	1	1		0.529
0114122	3” -- 90 mm	1	1		0.836
0114124	3.5” -- 110 mm	1	1		1.360
0114126	4” -- 125 mm	1	1		1.889
0114130	6” -- 160 mm (SDR 7.4)	1	1		1.889
0114131	6” -- 160 mm (SDR 11)	1	1		1.658
0114134	8” -- 200 mm (SDR 7.4)	1	1		3.064
0114135	8” -- 200 mm (SDR 11)	1	1		2.205
0114138	10” -- 250 mm (SDR 7.4)	1	1		5.622
0114139	10” -- 250 mm (SDR 11)	1	1		4.431



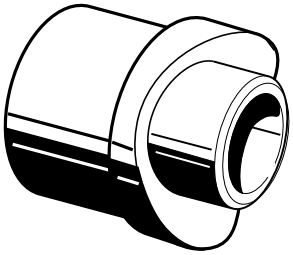
aquatherm greenpipe® cross-over

Art.-No.	Dimension Nom. I.D. -- O.D.	Packing unit	Price unit	Price	lb/pc
0116106	3/8” -- 16 mm	10	1		0.086
0116108	1/2” -- 20 mm	10	1		0.143
0116110	3/4” -- 25 mm	10	1		0.212
0116112	1” -- 32 mm	5	1		0.340

Fittings

aquatherm greenpipe® fusion outlet

Art.-No.	Dimension Nom. I.D. -- O.D. (Pipe X Saddle)	Packing unit	Price unit	Price	lb/pc
0115156	1.25” X 1/2” -- 40 X 20 mm	5	1		0.033
0115158	1.25” X 3/4” -- 40 X 25 mm	5	1		0.037
0115160	1.5” X 1/2” -- 50 X 20 mm	5	1		0.040
0115162	1.5” X 3/4” -- 50 X 25 mm	5	1		0.042
0115164	2 X 1/2” -- 63 X 20 mm	5	1		0.040
0115166	2” X 3/4” -- 63 X 25 mm	5	1		0.042
0115168	2” X 1” -- 63 X 32 mm	5	1		0.057
0115170	2.5” X 1/2” -- 75 X 20 mm	5	1		0.040
0115172	2.5” X 3/4” -- 75 X 25 mm	5	1		0.042
0115174	2.5” X 1” -- 75 X 32 mm	5	1		0.060
0115175	2.5” X 1.25” -- 75 X 40 mm	5	1		0.106
0115176	3” X 1/2” -- 90 X 20 mm	5	1		0.042
0115178	3” X 3/4’’ -- 90 X 25 mm	5	1		0.042
0115180	3” X 1” -- 90 X 32 mm	5	1		0.060
0115181	3” X 1.25” -- 90 X 40 mm	5	1		0.106
0115182	3.5” X 1/2” -- 110 X 20 mm	5	1		0.042
0115184	3.5” X 3/4” -- 110 X 25 mm	5	1		0.044
0115186	3.5” X 1” -- 110 X 32 mm	5	1		0.062
0115188	3.5” X 1.25” -- 110 X 40 mm	5	1		0.108
0115189	3.5” X 1.5” -- 110 X 50 mm	5	1		0.064
0115190	4” X 1/2” -- 125 X 20 mm	5	1		0.042
0115192	4” X 3/4” -- 125 X 25 mm	5	1		0.046
0115194	4” X 1” -- 125 X 32 mm	5	1		0.066
0115196	4” X 1.25” -- 125 X 40 mm	5	1		0.112
0115197	4” X 1.5” -- 125 X 50 mm	5	1		0.064
0115198	4” X 2’’ -- 125 X 63 mm	5	1		0.064
0115206	6” X 1/2” -- 160 X 20 mm	5	1		0.055
0115208	6” X 3/4” -- 160 X 25 mm	5	1		0.057
0115210	6” X 1” -- 160 X 32 mm	5	1		0.075
0115212	6” X 1.25” -- 160 X 40 mm	5	1		0.126
0115214	6” X 1.5” -- 160 X 50 mm	5	1		0.119
0115216	6” X 2” -- 160 X 63 mm	5	1		-
0115228	8-10” X 1/2” -- 200-250/20 mm	5	1		-
0115229	8-10” X 3/4” -- 200-250/25 mm	5	1		-
0115230	8-10” X 1” -- 200-250/32 mm	5	1		-
0115231	8” X 1.25” -- 200/40 mm	5	1		-
0115232	8” X 1.5” -- 200/50 mm	5	1		-
0115233	8” X 2” -- 200/63 mm	5	1		-
0115251	10” X 1.25” -- 250/40 mm	5	1		-
0115252	10” X 1.5” -- 250/50 mm	5	1		-
0115253	10” X 2” -- 250/63 mm	5	1		-



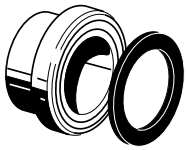
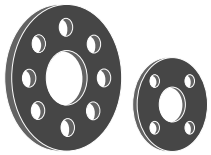
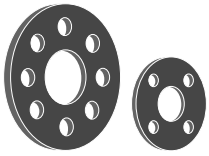
With weld-on surface and additional weld-in socket for fusion with the inner pipe wall.

The necessary welding tools for aquatherm greenpipe® fusion outlets are described on page 6.40:

- Welding tools Art.-No. 0050614 - 0050640
- The **aquatherm** drill bit Art.-No. 0050940 - 0050948

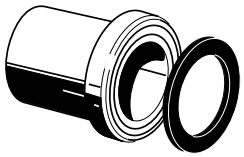
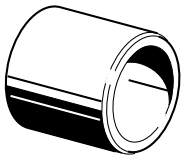
Flanges

aquatherm greenpipe® flange adapter
aquatherm flange ring

aquatherm Dimension Nom. ID. -- O.D.	nominal flange size	Flange adapter		Flange ring American bolt pattern			Flange ring European bolt pattern	
		Art. No.	lb/pc	Art. No.	Number of bolt holes	lb/pc	Art. No.	lb/pc
1" -- 32 mm	1.25”	0115512	0.068	3315712	4	2.73	0115712	1.010
1.25" -- 40 mm	1.5”	0115514	0.097	3315714	4	2.73	0115714	1.561
1.5" -- 50 mm	1.5”	0115516	0.134	3315716	4	3.52	0115716	1.715
2" -- 63 mm	2”	0115518	0.220	3315718	4	4.42	0115718	2.006
2.5" -- 75 mm	2.5”	0115520	0.315	3315720	4	7.22	0115720	2.557
3" -- 90 mm	3”	0115522	0.556	3315722	4	8.32	0115722	3.064
3.5" -- 110 mm	3.5”	0115524	0.721	-	-	-	0115724	3.289
4" -- 125 mm	4”	0115527	2.888	See Table Below			0115726	3.289
4” -- 125 mm	6”	0115527	2.888	3315730	8	15.14	-	-
6" -- 160 mm SDR 7.4	6”	0115530	2.564	3315730	8	15.14	0115730	7.998
6" -- 160 mm SDR 11	6”	0115531	2.103	3315730	8	15.14	0115730	7.998
8" -- 200 mm SDR 7.4	8”	0115534	4.409	3315734	8	22.79	0115734	10.472
8" -- 200 mm SDR 11	8”	0115535	4.409	3315734	8	22.79	0115734	10.472
10" -- 250 mm SDR 7.4	10”	0115538	4.409	3315738	12	33.20	0115738	15.644
10" -- 250 mm SDR 11	10”	0115539	4.409	3315738	12	33.20	0115738	15.644

All flange adaptors and flange rings are sold separately and in a single packing unit.

aquatherm Dimension Nom. ID. -- O.D.	nominal flange size	Flange adapter connects to coupling		Flange ring American bolt pattern		
		Art. No.	lb/pc	Art. No.	Number of bolt holes	lb/pc
4” -- 125 mm	4”	0115526	0.068	3315726	8	11.22

Art-No. 0115526 (pictured left) must be paired with a coupling Art.-No 0111026 (pictured above, sold separately)

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aquatherm greenpipe® pump flange adapter ring *American bolt pattern*

Art.-No.	Dimension Nom. I.D. -- O.D.	Packing unit	Price unit	Price	lb/pc
5515172	3/4” x 1” -- 25 x 32 mm	1	1		-
5515714	1.25” x 1” -- 40 x 32 mm	1	1		-

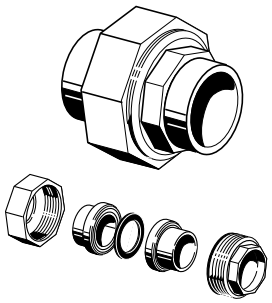
Art.-No. 5515714 was designed to be compatible with Grundfos Pump Model UP395 and and may or may not be fully compatible with other models.

Couplings

aquatherm greenpipe® union with brass nut

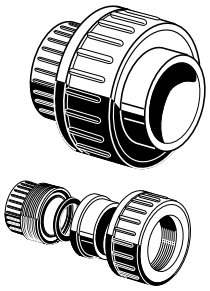
Art.-No.	Dimension Nom. I.D. -- O.D.	Packing unit	Price unit	Price	lb/pc
0115812	1” -- 32 mm	1	1		1.098
0115814	1.25” -- 40 mm	1	1		1.856
0115816	1.5” -- 50 mm	1	1		2.083
0115818	2” -- 63 mm	1	1		3.397
0115820	2.5” -- 75 mm	1	1		4.497

Brass coupling screw with two PP-R flange adapters including washer.



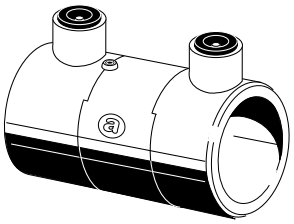
aquatherm greenpipe® union with PP-R nut

Art.-No.	Dimension Nom. I.D. -- O.D.	Packing unit	Price unit	Price	lb/pc
0115838	1/2” -- 20 mm	10	1		0.079
0115840	3/4” -- 25 mm	10	1		0.130
0115842	1” -- 32 mm	5	1		0.194
0115844	1.25” -- 40 mm	5	1		0.295
0115846	1.5” -- 50 mm	5	1		0.373
0115848	2” -- 63 mm	1	1		0.644
0115850	2.5” -- 75 mm	1	1		-



aquatherm greenpipe® electrofusion socket

Art.-No.	Dimension Nom. I.D. -- O.D.	Packing unit	Price unit	Price	lb/pc
0117208	1/2” -- 20 mm	1	1		0.097
0117210	3/4” -- 25 mm	1	1		0.117
0117212	1” -- 32 mm	1	1		0.159
0117214	1.25” -- 40 mm	1	1		0.216
0117216	1.5” -- 50 mm	1	1		0.306
0117218	2” -- 63 mm	1	1		0.496
0117220	2.5” -- 75 mm	1	1		0.754
0117222	3” -- 90 mm	1	1		1.089
0117224	3.5” -- 110 mm	1	1		1.797
0117226	4” -- 125 mm	1	1		2.410
0117230	6” -- 160 mm	1	1		3.900



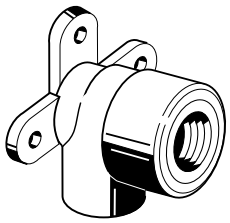
Tool:
aquatherm greenpipe® electrofusion device (Art.-No. 50175)

aquatherm greenpipe® peeling tool (Art.-No. 0050558 - 0050580)required

Mounting Devices

aquatherm greenpipe® back plate elbow *threaded*

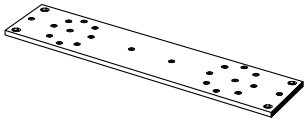
Brass Art.-No. (NPT)	Stainless Steel Art.-No. (ISO)	Dimension	Packing unit	Price unit	lb/pc
0120106	-	(3/8" -- 16 mm) X 1/2" F	10	1	0.187
0120108	920108	(1/2" -- 20 mm) X 1/2" F	10	1	0.187
0120110	920110	(1/2" -- 20 mm) X 3/4" F	10	1	0.245
0120112	920112	(3/4" -- 25 mm) X 3/4" F	10	1	0.245
0120113	920113	(3/4" -- 25 mm) X 1/2" F	10	1	0.201



Mounting plate *galvanized; to fix back plate elbows as double connection*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0060010	8.7/5.9/3.2 in 220/150/80 mm	1	1		0.487

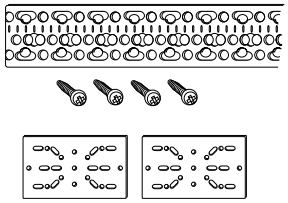
not suitable for connection with sound insulation plate (Art.-No. 0079080)



Mounting rail *galvanized; to fix back plate elbows including 2 fixing plates and 4 screws*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0079090	length = 22" -- 560 mm	1	1		1.162

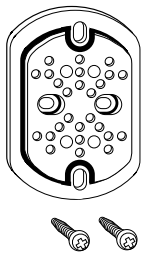
not suitable for connection with sound insulation plate (Art.-No. 0079080)



Sound insulation plate *for aquatherm greenpipe® back plate elbow*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0079080		2	1		0.249

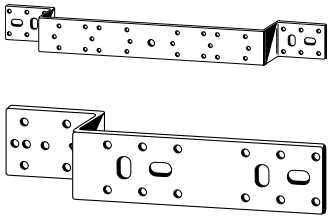
including two screws each



Mounting Rail *(double and single)*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0079095	double	2	1		0.908
0079096	single	2	1		-

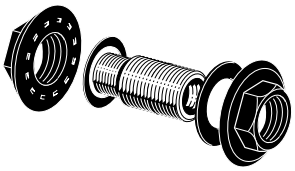
galvanized, for fixing of back plate elbows



Threaded Connections

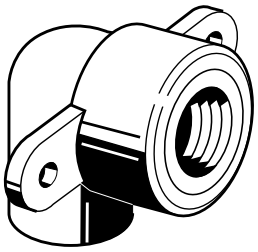
aquatherm dry construction wall fitting ISO

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0120114	1/2”	10	1		0.277



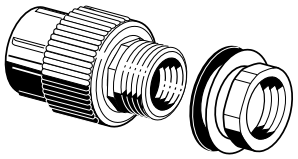
aquatherm greenpipe® wing back 90˚ elbow

Brass Art.-No. (NPT)	Stainless Steel Art.-No. (ISO)	Dimension	Packing unit	Price unit	lb/pc
0120156	-	16 mm x 1/2” F	10	1	0.185
0120158	920158	20 mm x 1/2” F	10	1	0.179



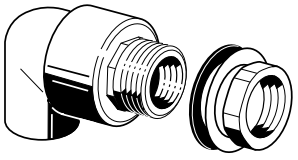
aquatherm greenpipe® ISO transition piece *with counternut, gasket and tension washer*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0120204	20 mm x 1/2” F x 3/4” M	10	1		0.450



aquatherm greenpipe® ISO transition elbow *with counternut, gasket and tension washer*

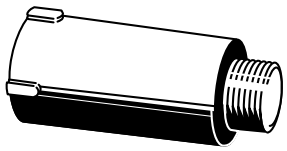
Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0120206	16 mm x 1/2” F x 3/4” M	1	1		0.437
0120208	20 mm x 1/2” F x 3/4” M	1	1		0.441
0120209	25 mm x 1/2” F x 3/4” M	1	1		0.454



Threaded Connections

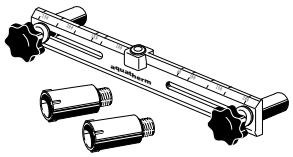
aquatherm greenpipe® ISO plug for pressure tests *with gasket*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0050708	1/2” M	1	1		0.046
0050710	3/4” M	1	1		0.059



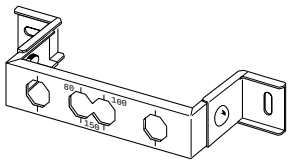
aquatherm assembling jig

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0050700	-	1	1		-



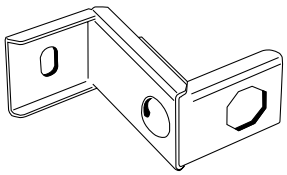
Mounting unit *twin*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0060110	3.2/4/5.9 in 80/100/150 mm	1	1		1.415



Mounting unit *single*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0060115	-	1	1		0.606

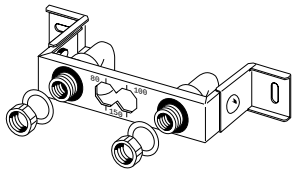


Threaded Connections

Mounting unit *with* aquatherm greenpipe® *ISO transition elbow (Art.-No. 20208)*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0060150	-	1	1		2.301

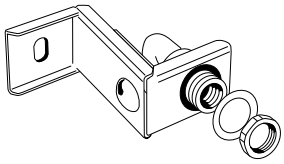
with counternut, gasket and tension washer



Mounting unit *with 1* aquatherm greenpipe® *ISO transition elbow (Art.-No. 0120208)*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0060155	-	1	1		1.166

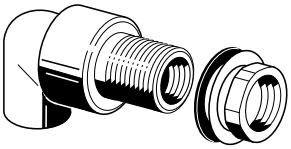
with counternut, gasket and tension washer



aquatherm greenpipe® **ISO transition elbow** *for dry construction*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0120210	20 mm x 1/2” F x 3/4” M	10	1		0.487

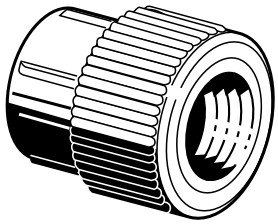
with 30 mm thread, counternut, gasket and tension washer



Transition Pieces

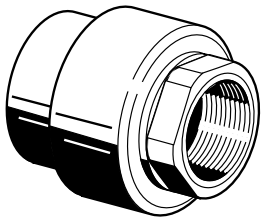
aquatherm greenpipe® transition piece *round*

Brass Art.-No. (NPT)	Stainless Steel Art.-No. (ISO)	Dimension Pipe (Nom. I.D. -- O.D.) X Thread Type	Packing unit	Price unit	lb/pc
0121006	-	(3/8" -- 16mm) X 1/2" F	10	1	0.156
0121008	921008	(1/2" -- 20mm) X 1/2" F	10	1	0.154
0121010	921010	(1/2" -- 20mm) X 3/4" F	10	1	0.198
0121011	921011	(3/4" -- 25mm) X 1/2" F	10	1	0.156
0121012	921012	(3/4" -- 25mm) X 3/4" F	10	1	0.189
0121013	921013	(1" -- 32mm) X 3/4" F	5	1	0.205



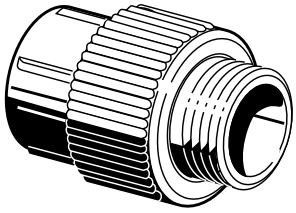
aquatherm greenpipe® NPT transition piece *with hex-shaped threaded transition*

Brass Art.-No. (NPT)	Stainless Steel Art.-No. (NPT)	Dimension Pipe (Nom. I.D. -- O.D.) X Thread Type	Packing unit	Price unit	lb/pc
0121106	-	(3/8" -- 16 mm) X 1/2" F	10	1	0.192
0121108	-	(1/2" -- 20 mm) X 1/2" F	10	1	0.192
0121110	-	(1/2" -- 20 mm) X 3/4" F	10	1	0.249
0121111	-	(3/4" -- 25 mm) X 1/2" F	10	1	0.192
0121112	-	(3/4" -- 25 mm) X 3/4" F	10	1	0.245
0121113	-	(1" -- 32 mm) X 3/4" F	5	1	0.251
0121114	1121114	(1" -- 32 mm) X 1" F	5	1	0.527
0121115	1121115	(1.25" -- 40 mm) X 1" F	5	1	0.542
0121116	1121116	(1.25" -- 40 mm) X 1.25" F	5	1	0.844
0121117	1121117	(1.5" -- 50 mm) X 1.25" F	5	1	0.884
0121118	1121118	(1.5" -- 50 mm) X 1.5" F	5	1	0.981
0121119	1121119	(2" -- 63 mm) X 1.5" F	1	1	1.032
0121120	-	(2" -- 63 mm) X 2" F	1	1	1.433
0121122	-	(2.5" -- 75 mm) X 2" F	1	1	1.479



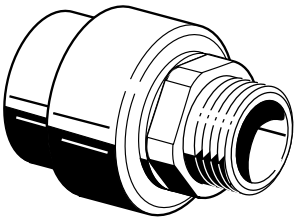
aquatherm greenpipe® transition piece *round*

Brass Art.-No. (NPT)	Stainless Steel Art.-No. (ISO)	Dimension Pipe (Nom. I.D. -- O.D.) X Thread Type	Packing unit	Price unit	lb/pc
0121206	-	(3/8" -- 16mm) X 1/2" M	10	1	0.216
0121208	921208	(1/2" -- 20mm) X 1/2" M	10	1	0.212
0121210	921210	(1/2" -- 20mm) X 3/4" M	10	1	0.238
0121211	921211	(3/4" -- 25mm) x 1/2" M	10	1	0.218
0121212	921212	(3/4" -- 25mm) X 3/4" M	10	1	0.238
0121213	921213	(1" -- 32mm) X 3/4" M	5	1	0.249



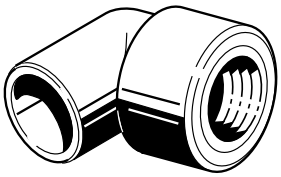
Transition Pieces

aquatherm greenpipe® NPT transition piece *hex-shaped threaded transition*



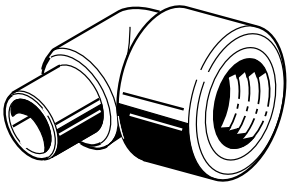
Art.-No.	Dimension Pipe (Nom. I.D. -- O.D.) X Thread Type	Packing unit	Price unit	Price	lb/pc
0121306	(3/8" -- 16mm) X 1/2" M	10	1		0.265
0121308	(1/2'' -- 20mm) X 1/2" M	10	1		0.260
0121310	(1/2" -- 20mm) X 3/4"M	10	1		0.284
0121312	(3/4" -- 25mm) X 3/4" M	10	1		0.282
0121314	(1" -- 32mm) X 1"M	5	1		0.538
0121316	(1" -- 32mm) X 1.25" M	5	1		0.787
0121317	(1.25" -- 40mm) X 1" M	5	1		0.551
0121318	(1.25" -- 40mm) X 1.25" M	5	1		0.802
0121319	(1.5" -- 50mm) x 1.25" M	5	1		0.862
0121320	(1.5" -- 50mm) X 1.5" M	5	1		1.058
0121321	(2" -- 63mm) X 1.5" M	1	1		1.153
0121322	(2" -- 63mm) x 2" M	1	1		1.554
0121323	(2.5" -- 75mm) X 2" M	1	1		1.660
0121324	(2.5" -- 75mm) X 2.5" M	1	1		2.258
0121325	(3" -- 90mm) X 3" M	1	1		3.373
0121327	(3.5" -- 110mm) X 4" M	1	1		6.208

aquatherm greenpipe® transition elbow



Brass Art.-No. (NPT)	Stainless Steel Art.-No. (ISO)	Dimension	Packing unit	Price unit	lb/pc
0123006	-	(3/8" -- 16mm) X 1/2" F	10	1	0.181
0123008	923008	(1/2" -- 20mm) X 3/4" F	10	1	0.238
0123010	923010	(1/2" -- 20mm) X 1/2" F	10	1	0.179
0123012	923012	(3/4" -- 25mm) X 3/4" F	10	1	0.234
0123014	923014	(3/4" -- 25mm) X 1/2" F	10	1	0.192
0123016	923016	(1" -- 32mm) X 3/4" F	5	1	0.243
	(NPT)				
0123018	1123018	(1" -- 32mm) X 1" F	5	1	0.573

aquatherm greenpipe® NPT transition elbow *(male/female)*

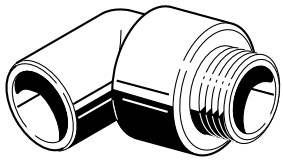


Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0123208	(1/2" -- 20mm) X 1/2" F	10	1		0.176

Transition Pieces

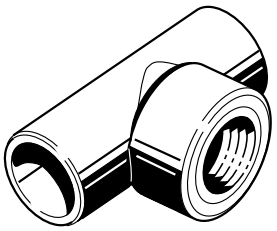
aquatherm greenpipe® transition elbow *(male)*

Brass Art.-No. (NPT)	Stainless Steel Art.-No. (ISO)	Dimension	Packing unit	Price unit	lb/pc
0123504	-	(3/8" -- 16mm) X 1/2" M	10	1	0.236
0123506	923506	(1/2" -- 20mm) X 1/2" M	10	1	0.240
0123508	923508	(1/2" -- 20mm) X 3/4" M	10	1	0.282
0123510	923510	(3/4" -- 25mm) X 3/4" M	10	1	0.273
0123512	923512	(1" -- 32mm) X 3/4" M	5	1	0.293
0123514	-	(1" -- 32mm) X 1" M	5	1	0.573



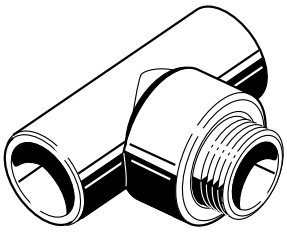
aquatherm greenpipe® transition tee *(female)*

Brass Art.-No. (NPT)	Stainless Steel Art.-No. (ISO)	Dimension	Packing unit	Price unit	lb/pc
0125004	-	(3/8" -- 16mm) X (3/8" -- 16mm) X 1/2" F	10	1	0.198
0125006	925006	(1/2" -- 20mm) X (1/2" -- 20mm) X 1/2" F	10	1	0.194
0125008	925008	(1/2" -- 20mm) X (1/2" -- 20mm) X 3/4" F	10	1	0.265
0125010	925010	(3/4" -- 25mm) X (3/4" -- 25mm) X 1/2" F	10	1	0.205
0125012	925012	(3/4" -- 25mm) X (3/4" -- 25mm) X 3/4" F	10	1	0.256
0125014	925014	(1" -- 32mm) X (1" -- 32mm) X 3/4" F	5	1	0.260
	(NPT)				
0125016	1125016	(1" -- 32mm) X (1" -- 32mm) X 1" F	5	1	0.600
0125022	-	(1.5" -- 50 mm) X (1.5" -- 50 mm) X 1" F	5	1	-



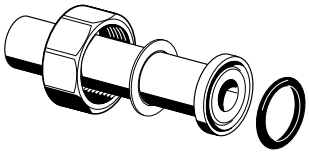
aquatherm greenpipe® NPT transition tee *(male)*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0125506	(1/2" -- 20mm) X 1/2" M X (1/2" -- 20mm)	10	1		0.254



aquatherm greenpipe® ISO pump adapter *with joint ring length: 100 mm*

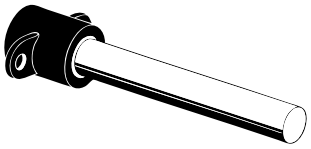
Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0126708	1/2" - 20 mm / nut G 1"	1	1		0.182
0126710	3/4" -- 25 mm / nut G 1 1/4"	1	1		0.257
0126712	7/8"-- 30 mm / nut G 1 1/2"	1	1		0.352
0126714	1.25"--40 mm / nut G 2"	1	1		0.564
0126716	1.5"--50 mm / nut G 2 1/4"	1	1		0.961
0126718	2" -- 63 mm / nut G 2 3/4"	1	1		1.192
0126720	2.5" -- 75 mm / nut G 3 1/2"	1	1		2.023
0126722	3" -- 90 mm / nut G 4"	1	1		2.729



Transition Pieces

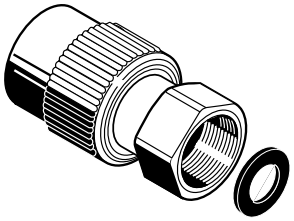
aquatherm greenpipe® transition to compression fitting (PP-R to Brass)

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0199031	1/2” (20 mm) PPR to 3/8” Compression	5	1		2.204



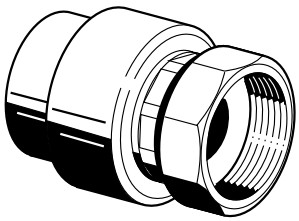
aquatherm greenpipe® ISO water meter connecting union *with gasket*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0126808	(1/2” -- 20mm) X nut G 3/4”	1	1		0.332
0126810	(3/4” -- 25mm) X nut G 3/4”	1	1		0.332
0126812	(1” -- 32mm) X nut G 3/4”	1	1		0.357



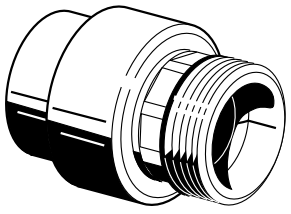
aquatherm greenpipe® transition joint ISO-*Standard*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0127010	(1/2” -- 20mm) X nut G 1”	10	1		0.401
0127011	(3/4” -- 25mm) X nut G 1”	10	1		0.407
0127012	(3/4” -- 25mm) X nut G 1.25”	10	1		0.557
0127013	(1” -- 32mm) X nut G 1.25”	5	1		0.599
0127014	(1” -- 32mm) X nut G 1.5”	5	1		0.963
0127015	(1.25” -- 40mm) X nut G 1.5”	5	1		0.996
0127016	(1.25” -- 40mm) X nut G 2”	5	1		1.554
0127017	(2” -- 50mm) X nut G 2”	5	1		1.593
0127018	(2” -- 50mm) X nut G 2.25”	5	1		2.026
0127019	(2” -- 63mm) X nut G 2.25”	1	1		2.096
0127020	(2” -- 63mm) X nut G 2.75”	1	1		2.724
0127021	(2.5” -- 75mm) X nut G 2.75”	1	1		2.777
0127022	(2.5” -- 75mm) X nut G 3.5”	1	1		4.038



aquatherm greenpipe® counterpart *with welding socket and male thread for ISO-threaded joints*

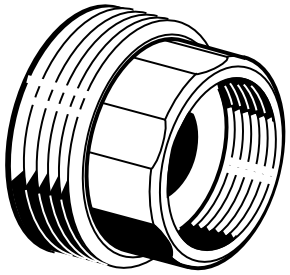
Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0127310	(1/2” -- 20mm) X 1” M	10	1		0.328
0127311	(3/4” -- 25mm) X 1” M	10	1		0.330
0127312	(3/4” -- 25 mm) X 1.25”M	10	1		0.489
0127313	(1” -- 32 mm) X 1.25” M	5	1		0.498
0127314	(1” -- 32 mm) X 1.5” M	5	1		0.890
0127315	(1.25” -- 40 mm) X 1.5”M	5	1		0.901
0127316	(1.25” -- 40 mm) X 2” M	5	1		1.331
0127317	(1.5” -- 50 mm) X 2” M	5	1		1.388
0127318	(1.5” -- 50 mm) X 2.25” M	5	1		1.466
0127319	(2” -- 63 mm) X 2.25” M	1	1		1.530
0127320	(2” -- 63 mm) X 2.75” M	1	1		2.361
0127321	(2.5” -- 75 mm) X 2.75” M	1	1		2.414
0127322	(2.5” -- 75 mm) X 3.5” M	1	1		3.179



Transition Pieces

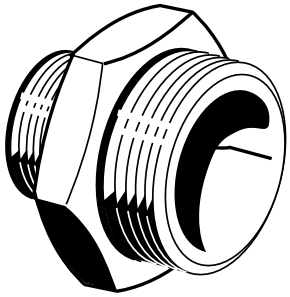
Brass counterpart *with female thread, for ISO-threaded joints / threaded connection*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0127510	1” M X 1/2” F	10	1		0.138
0127512	1.25” M X 3/4” F	10	1		0.264
0127514	1.5” M X 1” F	5	1		0.381
0127516	2” M X 1.25” F	5	1		0.566
0127518	2.25” M X 1.5” F	5	1		0.738
0127520	2.75” M X 2” F	1	1		1.119
0127522	3.5” M X 2.5” F	1	1		1.781
0127524	4” M X 3” F	1	1		2.085



Brass counterpart *with male thread, for ISO-threaded joints / threaded connection*

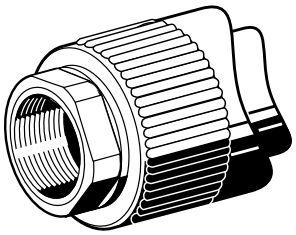
Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0127710	1/2” M X 1” M	10	1		0.238
0127712	3/4” M X 1.25” M	10	1		0.418
0127714	1” M X 1.5” M	5	1		0.546
0127716	1.25” M X 2” M	5	1		0.974
0127718	1.5” M X 2.25” M	5	1		1.038
0127720	2” M X 2.75” M	1	1		1.781
0127722	2.5” M X 3.5” M	1	1		2.742
0127724	3” M X 4” M	1	1		3.095



Transition Pieces

aquatherm greenpipe® NPT fusion outlet *with hex shaped female thread, weld-in surface and weld-in socket for fusion with the inner wall of the pipe*

Brass Art.-No. (NPT)	Stainless Steel Art.-No. (ISO)	Dimension	Packing unit	Price unit	lb/pc
0128214	928214	1.25" / 3/4" -- 40 /25 mm - 1/2" F	5	1	0.192
0128216	928216	1.5" / 3/4" -- 50 / 25 mm - 1/2" F	5	1	0.194
0128218	928218	2" / 3/4" – 63 / 25 mm - 1/2" F	5	1	0.194
0128220	928220	2.5" / 3/4" – 75 / 25 mm - 1/2" F	5	1	0.194
0128222	928222	3" / 3/4" – 90 / 25 mm - 1/2" F	5	1	0.194
0128224	928224	3.5" / 3/4" -- 110 / 25 mm - 1/2" F	5	1	0.194
0128226	928226	4" / 3/4"" -- 125 / 25 mm - 1/2" F	5	1	0.201
0128230	928230	6" / 3/4" -- 160 / 25 mm - 1/2" F	5	1	0.209
0128232	928232	8 - 10" / 3/4" – 200 - 250 / 25 mm - 1/2" F	5	1	0.238
0128234	928234	1.25" / 3/4" – 40 / 25 mm - 3/4" F	5	1	0.245
0128236	928236	1.5" / 3/4" -- 50 / 25 mm - 3/4" F	5	1	0.243
0128238	928238	2" / 3/4" – 63 / 25 mm - 3/4" F	5	1	0.240
0128240	928240	2.5" / 3/4" – 75 / 25 mm - 3/4" F	5	1	0.243
0128242	928242	3" / 3/4" – 90 / 25 mm - 3/4" F	5	1	0.245
0128244	928244	3.5" / 3/4" -- 110 / 25 mm - 3/4" F	5	1	0.247
0128246	928246	4" / 3/4" -- 125 / 25 mm - 3/4" F	5	1	0.287
0128250	928250	6" / 3/4" -- 160 / 25 mm - 3/4" F	5	1	0.194
0128254	928254	8 - 10" / 3/4" – 200 - 250 / 25 mm - 3/4" F	5	1	0.194
	(NPT)				
0128260	1128260	2.5" / 1" – 75 / 32 mm - 1" F	5	1	0.522
0128262	1128262	3" / 1" – 90 / 32 mm - 1" F	5	1	0.522
0128264	1128264	3.5" / 1" -- 110 / 32 mm - 1" F	5	1	0.538
0128266	1128266	4" / 1" -- 125 / 32 mm 1" F	5	1	0.522
0128270	1128270	6" / 1" -- 160 / 32 mm - 1" F	5	1	0.538
0128274	1128274	8 - 10" / 1" – 200 - 250 / 32 mm - 1" F	5	1	0.538

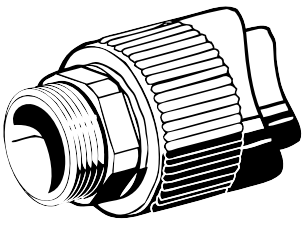


The necessary tools for the fusion of aquatherm greenpipe® fusion outlets are listed on page 6.40

Welding tools for fusion outlets Art. No. 0050614 - 0050640

aquatherm greenpipe® NPT fusion outlet *with hex shaped male thread, weld-in surface and weld-in socket for fusion with the inner wall of the pipe*

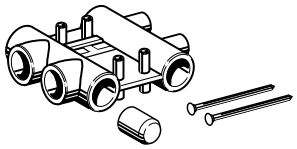
Brass Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0128314	1.25" / 3/4" -- 40 /25 mm - 1/2" M	5	1		0.192
0128316	1.5" / 3/4" -- 50 / 25 mm - 1/2" M	5	1		0.198
0128318	2" / 3/4" – 63 / 25 mm - 1/2" M	5	1		0.194
0128320	2.5" / 3/4" – 75 / 25 mm - 1/2" M	5	1		0.212
0128322	3" / 3/4" – 90 / 25 mm - 1/2" M	5	1		0.196
0128324	3.5" / 3/4" -- 110 / 25 mm - 1/2" M	5	1		0.196
0128326	4" / 3/4"" -- 125 / 25 mm - 1/2" M	5	1		0.201
0128330	6" / 3/4" -- 160 / 25 mm - 1/2" M	5	1		0.201
0128334	1.25" / 3/4" – 40 / 25 mm - 3/4" M	5	1		0.236
0128336	1.5" / 3/4" -- 50 / 25 mm - 3/4" M	5	1		0.240
0128338	2" / 3/4" – 63 / 25 mm - 3/4" M	5	1		0.238
0128340	2.5" / 3/4" – 75 / 25 mm - 3/4" M	5	1		0.238
0128342	3" / 3/4" – 90 / 25 mm - 3/4" M	5	1		0.243
0128344	3.5" / 3/4" -- 110 / 25 mm - 3/4" M	5	1		0.240
0128346	4" / 3/4" -- 125 / 25 mm - 3/4" M	5	1		0.245
0128350	6" / 3/4" -- 160 / 25 mm - 3/4" M	5	1		0.245



Distributors

aquatherm greenpipe® distribution block plumbing *including 1 plug and 2 fastenings*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0130115	3/4” X 1/2” -- 25 X 20mm	1	1		0.608



*Material: fusiolen® **PP-R***
passage: 25 mm (socket) / 2 branches: 20 mm (sockets)

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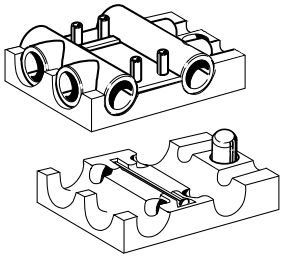
aquatherm greenpipe® distribution block plumbing *with insulation block (3” X 3” -- 70 X 70mm)*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0130130	3/4” X 1/2” -- 25 X 20mm	1	1		0.696



*Material: fusiolen® **PP-R / PPO/PS***
passage: 25 mm (socket) / 2 branches: 20 mm (sockets)

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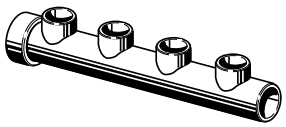
aquatherm greenpipe® distribution pipe *Length: 246 mm, with four branch connections*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0130602	1” X 3/8” -- 32 X 16mm	1	1		0.310
0130604	1” X 1/2” -- 32 X 20mm	1	1		0.295



The distribution pipe can be shortened or supplemented by fusion with further distribution pipes as needed.

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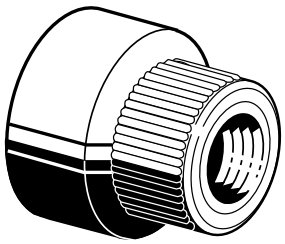
aquatherm greenpipe® distributor end piece *with female thread* **NPT**

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0130804	(1” -- 32 mm) X 1/2” F	1	1		0.182

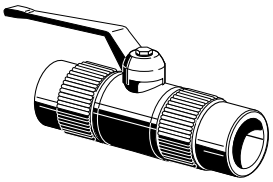


to empty or aerate the distribution pipe

Valves

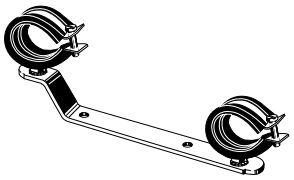
aquatherm greenpipe® ball valve *(male/female)*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0078000	(1” -- 32 mm) M/F	1	1		2.574



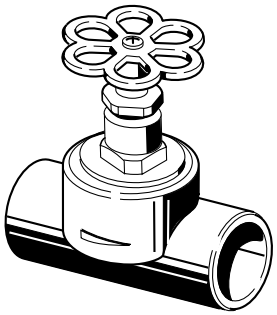
Supporting strap for aquatherm distribution pipe *galvanized, twin*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0060210	1” -- 32mm	2	1		0.489



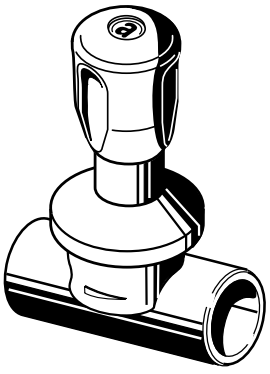
aquatherm greenpipe® screw-down stop globe valve *for surface installation*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0140808	1/2” -- 20 mm	1	1		0.452
0140810	3/4” -- 25 mm	1	1		0.465
0140812	1” -- 32 mm	1	1		0.774
0140814	1.25” -- 40 mm	1	1		1.257



aquatherm greenpipe® concealed valve *chromium-plated*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0140858	1/2” -- 20 mm	1	1		0.712
0140860	3/4” -- 25 mm	1	1		0.732
0140862	1” -- 32 mm	1	1		0.915

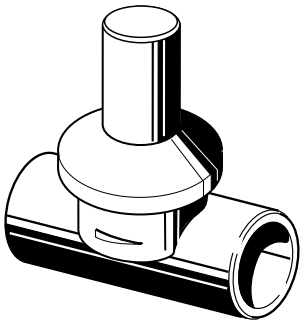


Valves

aquatherm greenpipe® concealed valve *chromium-plated, tamper proof, short design*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0140868	1/2” -- 20 mm	1	1		0.648
0140870	3/4” -- 25 mm	1	1		0.758
0140872	1” -- 32 mm	1	1		0.947

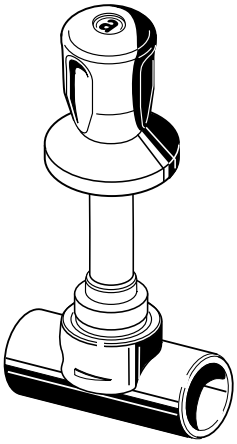
Art.-No. 0140868 - 0140870 *suitable for construction depths up to 1”*
Art.-No. 0140872 *suitable for construction depths up to 1 1/8”*



aquatherm greenpipe® concealed valve *chromium-plated*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0140878	1/2” -- 20 mm	1	1		0.787
0140880	3/4” -- 25 mm	1	1		0.816
0140882	1” -- 32 mm	1	1		0.972

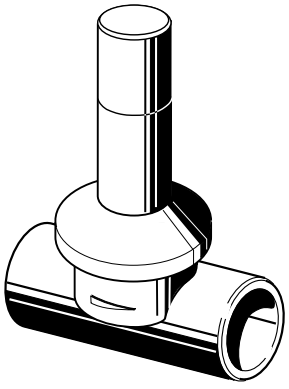
suitable for construction depths from 2 1/8” - 4”



aquatherm greenpipe® concealed valve *chromium-plated, tamper proof*

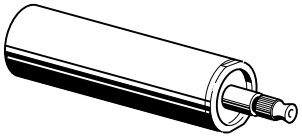
Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0140888	1/2” -- 20 mm	1	1		0.728
0140890	3/4” -- 25 mm	1	1		0.752
0140892	1” -- 32 mm	1	1		0.935

suitable for construction depths up to 2 1/3”



Extension for aquatherm greenpipe® concealed valve *chromium-plated for Art.-No. 0040858 - 0040862*

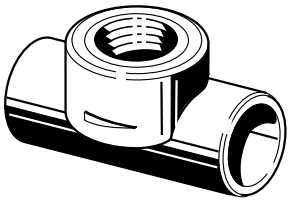
Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0040900	Length = 3.2” -- 92 mm	1	1		0.302
0040902	Lenght = 4.25” -- 132 mm	1	1		0.447



Valves

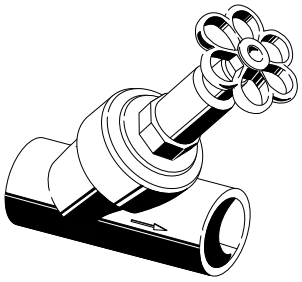
aquatherm-greenpipe® stop valve body

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0040908	(1/2” -- 20 mm) X 3/4”	1	1		0.234
0040910	(3/4” -- 25 mm) X 3/4”	1	1		0.216
0040912	(1” -- 32 mm) X 1”	1	1		0.317
0040914	(1.25” -- 40 mm) X 1.25”	1	1		0.681



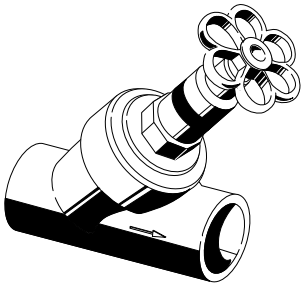
aquatherm greenpipe® inclined valve *without drain*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0041108	1/2” -- 20 mm	1	1		0.648
0041110	3/4” -- 25 mm	1	1		0.622
0041112	1” -- 32 mm	1	1		0.933
0041114	1.25” -- 40 mm	1	1		1.836



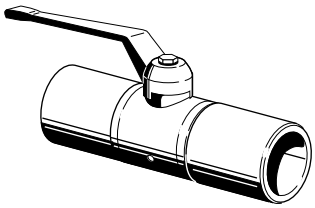
aquatherm greenpipe® combination valve, check valve *without drain*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0041208	1/2” -- 20 mm	1	1		0.657
0041210	3/4” -- 25 mm	1	1		0.631
0041212	1” -- 32 mm	1	1		0.957
0041214	1.25” -- 40 mm	1	1		1.856



aquatherm greenpipe® ball valve *without drain*

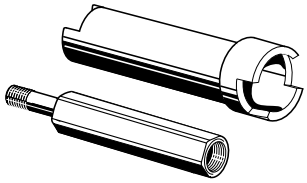
Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0041308	1/2” -- 20 mm	1	1		0.617
0041310	3/4” -- 25 mm	1	1		0.818
0041312	1” -- 32 mm	1	1		1.307
0041314	1.25” -- 40 mm	1	1		2.094
0041316	1.5” -- 50 mm	1	1		3.494
0041318	2” -- 63 mm	1	1		5.626



Valves

Extension for aquatherm greenpipe® ball valve

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0041378	(1/2" - 3/4") -- (20 - 25mm) X 35mm	1	1		0.265
0041382	(1" - 1.25") -- (32 - 40mm) X 35 mm	1	1		0.265
0041386	(1.5" - 2") -- (50 - 63mm) X 46 mm	1	1		0.602



Art. 0041378 suitable for Art. No. 0041308 / 0041310
Art. 0041382 suitable for Art. No. 0041312 / 0041314
Art. 0041386 suitable for Art. No. 0041316 / 0041318

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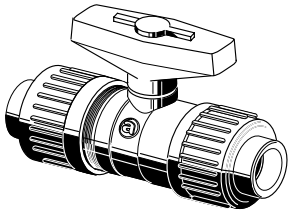
aquatherm greenpipe® ball valve *polypropylene*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0141388	1/2" -- 20 mm	1	1		0.287
0141390	3/4" -- 25 mm	1	1		0.441
0141392	1" -- 32 mm	1	1		0.639
0141394	1.25" -- 40 mm	1	1		1.036
0141396	1.5" -- 50 mm	1	1		1.631
0141398	2" -- 63 mm	1	1		2.579
0141400	2.5" -- 75 mm	1	1		13.448



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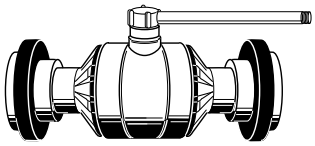
aquatherm greenpipe® ball valve *polypropylene (European flange ring)*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0141402	3" -- 90 mm	1	1		20.503
0141404	3.5" -- 110 mm	1	1		24.912
0141406	4" -- 125 mm	1	1		29.762
0041407	6" -- 160 mm	1	1		60.847



Execution with double flange units. Reference to aquatherm greenpipe® flange adapter (Art. No. 0115520-0115531), as well as PP-R flange (Art. No. 0115720-0115730)

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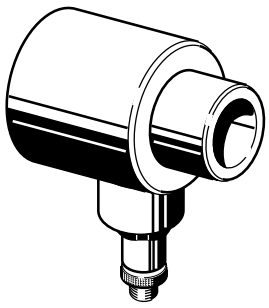
aquatherm greenpipe® draining branch *to weld in aquatherm greenpipe® valves*

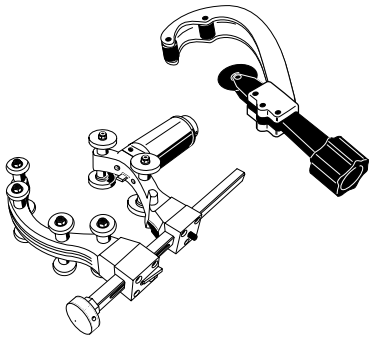
Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0041408	1/2" -- 20 mm	1	1		0.216
0041410	3/4" -- 25 mm	1	1		0.207
0041412	1" -- 32 mm	1	1		0.254
0041414	1.25" -- 40 mm	1	1		0.306
0041416	1.5" -- 50 mm	1	1		0.443
0041418	2" -- 63 mm	1	1		0.635



Tools

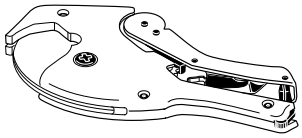
aquatherm pipe cutter

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0050102	(3/8” - 1.25”) -- (16 - 40 mm)	1	1		0.937
0050105	(1.5” - 4”) -- (50 - 125 mm)	1	1		3.126
0050106	(6”) -- (160 mm)	1	1		-



aquatherm pipe cutter

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0050104	(3/8” - 1.25”) -- (16 - 40 mm)	1	1		1.307



Note: Intended for use with PP-R pipe and fittings only.

aquatherm orbital circular saw

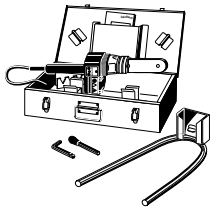
Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0050108	for pipes 6” - 14” (160 - 355mm)	1	1		1.307

This orbital circular saw can be ordered directly from Rothenberger with Art.-No. 5.5620 (www.rothenberger.com). High-performance orbital circular saw for fast, precise, perfectly aligned and right-angled cutting of plastic pipes 160 - 355 mm at the building site or in the workshop.

aquatherm heating iron *110 V*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0452336	(3/8” - 1”) -- (16 - 32mm)	1	1		13.007

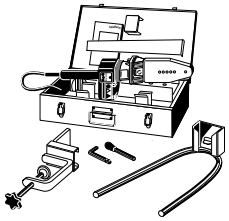
with base and case for storage of welding tools



aquatherm heating iron *110 V*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0452337	(3/8” - 2”) -- (16 - 63 mm)	1	1		17.196

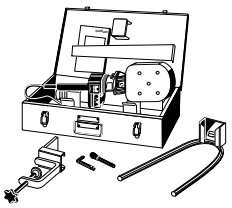
with base and case for storage of welding tools



aquatherm heating iron *110 V*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0452341	(1.5” - 4”) -- (50 - 125 mm)	1	1		20.503

with base and case for storage of welding tools

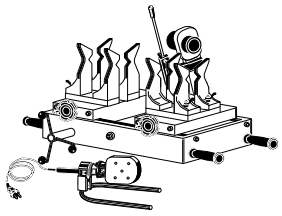


Tools

aquatherm bench welding machine *110 V*

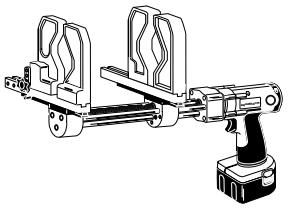
Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0450147	(1.5” - 4”) -- (50 - 125 mm)	1	1		185.18

including welding tools 50 - 125 mm (Art. 0050216 - 0050226)
manual welding device (1400 W) (Art. 0452341*) and wooden case for transport*



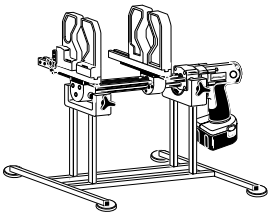
aquatherm electric welding jig

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0450149	(2” - 4”) -- (63 - 125 mm)	1	1		41.888



aquatherm stand for electric welding jig *(pictured with jig, sold separately)*

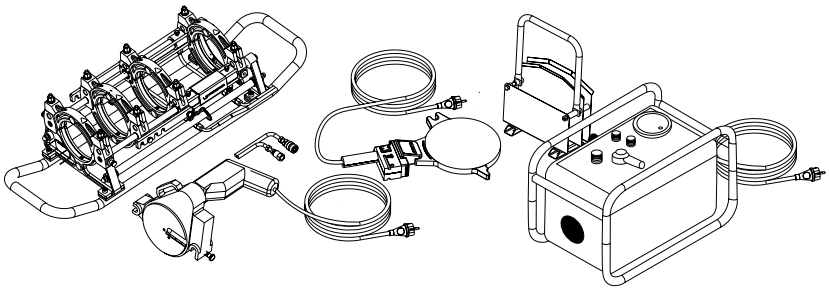
Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0050151	-	1	1		6.042



aquatherm butt welding machine *with milling cutter and heating plate*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0450163	(6” - 10”) -- (160 - 250 mm)	1	1		222.66

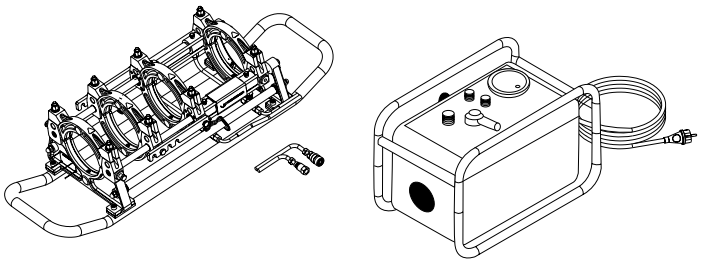
including wooden transport case



aquatherm butt welding machine *without milling cutter and heating plate*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0450164	(6” - 10”) -- (160 - 250 mm)	1	1		-

including wooden transport case

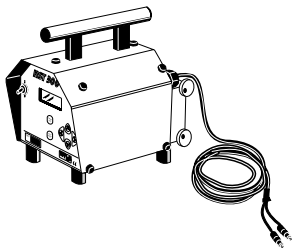


Tools

aquatherm electrofusion device

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0450175	(3/8" - 6") -- (20 - 160 mm)	1	1		45.194

for aquatherm greenpipe® electrofusion sockets Art.-No. 0117208-0117230

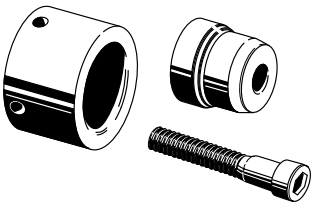


aquatherm cleaning wipes *e.g. for electrofusion sockets*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0050193	box of 100 wipes	1	1		0.765

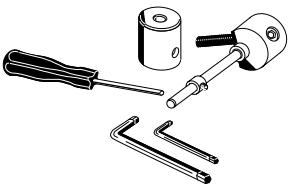
aquatherm welding heads

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0050206	3/8" -- 16 mm	1	1		0.243
0050208	1/2" -- 20 mm	1	1		0.249
0050210	3/4" -- 25 mm	1	1		0.313
0050212	1" -- 32 mm	1	1		0.461
0050214	1.25" -- 40 mm	1	1		0.679
0050216	1.5" -- 50 mm	1	1		1.001
0050218	2" -- 63 mm	1	1		1.499
0050220	2.5" -- 75 mm	1	1		2.019
0050222	3" -- 90 mm	1	1		3.122
0050224	3.5" -- 110 mm	1	1		5.401
0050226	4" -- 125 mm	1	1		7.328



aquatherm repair set *to close pipe holes up to 10mm (repair stick Art.-No. 0060600)*

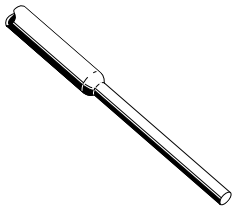
Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0050307	1/4" -- 7 mm	1	1		0.368
0050311	7/16" -- 11 mm	1	1		0.365



Tools

aquatherm greenpipe® repair plug

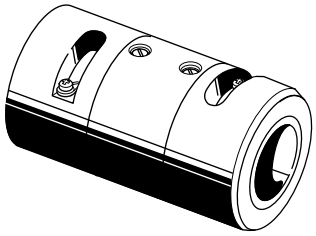
Art.-No.	Dimension O.D. for Each End	Packing unit	Price unit	Price	lb/pc
0060600	7/16” X 1/4” -- 11 X 7 mm	10	1		0.018



Material: *fusiolen® **PP-R** to close pipe holes up to 10 mm.*
Tool: **aquatherm** *repair set (Art.-No. 0050307 & 0050311).*

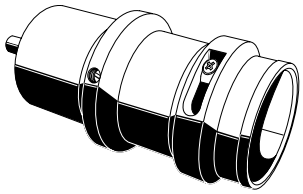
aquatherm peeling tool *for UV piping systems*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0050506	3/8” & 1/2” -- 16 mm & 20 mm	1	1		0.957
0050508	1/2” & 3/4” -- 20 mm & 25 mm	1	1		0.880
0050512	1” & 1.25” -- 32 mm & 40 mm	1	1		1.473
0050514	1.25” & 1.5” -- 40 mm & 50 mm	1	1		2.233
0050518	2” & 2.5” -- 63 mm & 75 mm	1	1		3.318
0050524	3” & 3.5” -- 90 mm & 110 mm	1	1		2.277



aquatherm peeling tool *for UV piping systems*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0050558	1/2” -- 20 mm	1	1		-
0050560	3/4” -- 25 mm	1	1		-
0050562	1” -- 32 mm	1	1		-
0050564	1.25” -- 40 mm	1	1		-
0050566	1.5” -- 50 mm	1	1		-
0050568	2” -- 63 mm	1	1		-
0050570	2.5” -- 75 mm	1	1		-
0050572	3” -- 90 mm	1	1		-
0050574	3.5” -- 110 mm	1	1		-
0050576	4” -- 125 mm	1	1		-
0050590	6” -- 160 mm	1	1		-



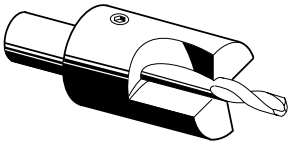
Art.-No. 0050558-005070 as insert for drilling machine

Spare blade *for* **aquatherm** *peeling tools (Art.-No. 0050506-0050524, 0050558-0050570)*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0050440	-	1	1		0.004

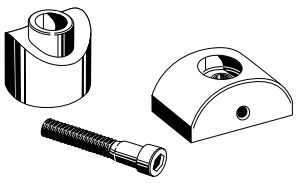
aquatherm drill bit *for the mounting of weld in fusion outlets*

Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0050940	1/2” & 3/4” -- 20 & 25 mm for pipes 1.25” - 6” -- 40 - 160 mm	1	1		0.302
0050941	1/2” & 3/4” -- 20 & 25 mm for pipes 2” - 10” -- 63 - 160 mm	1	1		-
0050942	1” -- 32 mm	1	1		0.459
0050944	1.25” -- 40 mm	1	1		0.619
0050946	1.5” -- 50 mm	1	1		-
0050948	2” -- 63 mm	1	1		0.710



Tools

aquatherm fusion outlet welding heads *for fusion outlet welding of Art.-No. 0115156 - 0115257 and 0128214 - 0128274*



Art.-No.	Dimension	Packing unit	Price unit	Price	lb/pc
0050614	1.25” X 1/2” & 3/4” -- 40 X 20 & 25 mm	1	1		0.408
0050616	1.5” X 1/2” & 3/4” -- 50 X 20 & 25 mm	1	1		0.492
0050619	2” X 1/2” & 3/4” -- 63 X 20 & 25 mm	1	1		0.540
0050620	2” X 1” -- 63 X 32 mm	1	1		0.498
0050623	2.5” X 1/2” & 3/4” -- 75 X 20 & 25 mm	1	1		0.560
0050624	2.5” X 1” -- 75 X 32 mm	1	1		0.564
0050625	2.5” X 1.25” -- 75 X 40 mm	1	1		0.990
0050627	3” X 1/2” & 3/4” -- 90 X 20 & 25 mm	1	1		0.589
0050628	3” X 1” -- 90 X 32 mm	1	1		0.604
0050629	3” X 1.25” -- 90 X 40 mm	1	1		1.023
0050631	3.5” X 1/2” & 3/4” -- 110 X 20 & 25 mm	1	1		0.613
0050632	3.5” X 1” -- 110 X 32 mm	1	1		0.631
0050634	3.5” X 1.25” -- 110 X 40 mm	1	1		1.060
0050635	3.5” X 1.5” -- 110 X 50 mm	1	1		1.717
0050636	4” X 1/2” & 3/4” -- 125 X 20 & 25 mm	1	1		0.644
0050638	4” X 1” -- 125 X 32 mm	1	1		0.661
0050640	4” X 1.25” -- 125 X 40 mm	1	1		1.120
0050642	4” X 1.5” -- 125 X 50 mm	1	1		1.746
0050644	4” X 2” -- 125 X 63 mm	1	1		2.687
0050648	6” X 1/2” & 3/4” -- 160 X 20 & 25 mm	1	1		0.710
0050650	6” X 1” -- 160 X 32 mm	1	1		0.741
0050652	6” X 1.25” -- 160 X 40 mm	1	1		1.199
0050654	6” X 1.5” -- 160 X 50 mm	1	1		1.854
0050656	6” X 2” -- 160 X 63 mm	1	1		2.818
0050660	8” X 1/2” & 3/4” -- 200 X 20 & 25 mm	1	1		-
0050662	8” X 1” -- 200 X 32 mm	1	1		-
0050664	8” X 1.25” -- 200 X 40 mm	1	1		-
0050666	8” X 1.5” -- 200 X 50 mm	1	1		-
0050668	8” X 2” -- 200 X 63 mm	1	1		-
0050672	10” X 1/2” &. 3/4” -- 250 X 20 & 25 mm	1	1		-
0050674	10” X 1” -- 250 X 32 mm	1	1		-
0050676	10” X 1.25” -- 250 X 40 mm	1	1		-
0050678	10” X 1.5” -- 250 X 50 mm	1	1		-
0050680	10” X 2” -- 250 X 63 mm	1	1		-

For more information, please visit us on the web.

www.aquathermpipe.com

Glossary

Aquatherm Advanced

A unique upgrade to the standard Aquatherm piping systems that incorporates a fire-resistant barrier with highly-efficient insulation. This layer allows the pipe to meet both energy codes and building codes in almost any application, and saves time and money on overall installation. With Aquatherm Advanced, the pipe lengths are wrapped with the reflective insulation, while the fittings are left uncovered for convenience.

Aquatherm Greenpipe®

A polypropylene pressure piping system designed for potable and food-grade applications. It is identified by its green color and joined using heat fusion. Hot water pipes have a faser-composite layer as well as dark green stripes, while cold water pipes have light blue stripes and no faser-composite layer.

Butt fusion

A heat fusion connection where the face of one pipe is fused directly to the face of another pipe. Fittings are sized to be even with the pipe walls and are joined the same way. This process is only used on sizes above 4 inches.

Climatherm®

A polypropylene pressure piping system designed for non-potable applications, such as heating and cooling, chemical transport, compressed air, etc. Climatherm is blue, with a faser-composite layer and thick green stripes, and is also joined using heat fusion.

Extrusion

The process by which **aquatherm's** pipes are manufactured. The Fusiolen material is shaped and pushed from the extrusion machine in three layers and cooled in long tanks, forming the uniquely designed **aquatherm** pipes.

Faser-composite

A patented mixture of fusiolen **PP-R** and fiberglass, specially engineered to increase the structural strength and reduce linear expansion.

Fusiolen PP-R

The basic material used in all of **aquatherm's** polypropylene piping systems. This resin is produced exclusively by **aquatherm**, using only the purest raw polypropylene.

Fusion outlet

A special fitting designed to fuse directly onto the side of a pipe. These fittings were once called saddles, but have been renamed to distinguish them from less reliable mechanical fittings.

Heat fusion

The process of simultaneously heating two similar plastics and allowing them to cool together under pressure. This process forms a seamless bond between the materials. This process is also called heat welding.

Lilac

A special formulation of the **aquatherm** piping systems engineered for use in rainwater and reclaimed water. This system is distinguished by the purple color of the pipe.

Linear (thermal) expansion

The growth in a pipe that occurs when hot water is run through the system. Contraction can also occur under cold temperatures.

Mold injection

The process through which **aquatherm's** fittings are manufactured. Heated fusiolen is pressed into molds and cooled under high pressure, creating strong fittings with no mechanical weaknesses.

Polypropylene random

A unique formulation of the thermoplastic polymer used to create all the **aquatherm** pipe and fittings. Random lengths of polypropylene molecules ensure chemical uniformity throughout the connection.

Glossary

Socket fusion

A heat-fusion connection using welding heads and special fittings. The inside of the fitting is fused to the outside of the pipe, forming a quick and simple leak-proof connection. This process is only used on sizes from 4 inches and smaller.

Transition, flange

A flange connection using a polypropylene flange, a steel flange ring, and a gasket that can be attached to a same-size flange of any other piping material.

Transition, threaded

A special fitting with a brass or stainless steel insert mold injected into the polypropylene. The insert is threaded for use with any other type of threaded connection.

Welding heads

Teflon-coated molds designed to match specific sizes of pipe and fittings. The welding heads are engineered for direct contact with the pipe and fittings and generally contain one male side and one female side in order to heat both sides of a connection at the same time.

Welding iron

An electronic heating device with a large, flat heating surface. This surface is designed to heat the welding heads to the proper welding temperature and should never be in direct contact with the material being welded.

Welding jig

An electronic device designed to act as a portable clamping system, as well as assist an installer with moving the pipe and fitting during the fusion process.

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aquatherm greenpipe®

climatherm®

aquatherm green**pipe** / **climatherm** - Pipe Systems

aquatherm - 2009 **NA Edition**

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Edition 07/09

Printed in USA