Wavin PP-RCT Piping System

Technical Manual

wavin

orbia

Making the sustainable, attainable

Sustainable thinking is good. Sustainable action is better. Better for the communities that we live in. Better for the planet that we share.

As a market leading contributor to the built environment, our sights are firmly set on leading our industry in sustainability by 2025. We're backing this ambition with real investment, real action, real outcomes and real leadership. Ultimately, our goal is to achieve Net Zero Carbon emissions by 2050.

Working with our customers, users and suppliers, we'll design out carbon from every product and process that we're responsible for. Our focus throughout will be to build healthier, more sustainable environments for all.

Our sustainability journey is well and truly underway at Wavin.

Let's work together to help build a better future for generations to come.

Our purpose

Building healthy, sustainable environments

There are four pillars driving our sustainability journey, selected to reflect where we can contribute to the United Nation's published Sustainable Development Goals. These pillars form the foundation of our purpose: to build healthy, sustainable environments.

While we build and create value through our products and services, we do so in a mindful way – by using as much recycled material as possible, reducing energy consumption and waste, and keeping a close eye on our footprint. In other words, doing our utmost to create a sustainable future.

1 2 3 4

The four pillars form the foundation of our purpose: to build healthy, sustainable environments

Safe and efficient water supply

Future generations face a 40% shortfall between water supply and demand. Alongside other experts, Wavin is working to deliver safe and clean water security through enhanced rainwater reuse, the digitalisation of water management and more secure and durable piping.

Better sanitation and hygiene

Outdated sewer systems are overwhelmed by a triple whammy of urbanisation, population growth and climate change. We're working towards a healthier future with long-lasting sanitation solutions that deliver greater capacity, fewer leaks, less clogging and better monitoring.

Climate resilient cities

Smarter systems are needed to meet the five big challenges our cities face: floods, droughts, heat stress, ground water depletion and surface-water pollution. From roof to river, we are helping with connected water capture, attenuation, cleaning, reuse and transportation solutions to make cities climate resilient.

Better building performance

Constrained by time, cost and product sourcing challenges, many of today's buildings fail to deliver on their expected performance. Through improved digital modelling, we can help our partners predict time and resource needs throughout the building process and provide intelligent solutions for better urban living.

References

Wavin PP-RCT is a tested system that has been widely used all over Europe, Asia, Middle East, and other parts of the world for decades. It is the number one choice for all professionals as well as owners.

National Theater
Prague, Czech Republic

General sanitation
Male, Maldives

Elementary School
Třanovice, Czech Republic

Serenia Residence The Palm
Dubai, United Arab Emirates

Residential building complex
Bard Lakopark, Hungary

Circular Economy Project
Breda, Netherlands

Product sustainability

At Wavin, we're committed to measuring the real-world impacts of our products and services throughout their life cycle. By assessing their carbon footprint and understanding what effect they have on the environment, we can seek more sustainable alternatives and continue to refi ne our blueprint for building a better future.

About us

Wavin is a leading global provider of innovative water management solutions for resilient construction. As an Orbia business and a part of the business group 'Building & Infrastructure', **Wavin offers sustainability-based customer solutions for drinking water, sanitation, climate resilient cities and better building performance**. Redefining today's pipes and fittings industry with durable products and solutions that require less construction to install and innovating sustainable technologies for water collection and management, heating and cooling and a revolutionary road surface. Wavin headquarters are located in Zwolle, the Netherlands and it **serves 80+ countries on three continents with its 66 production sites located in 36 countires**. Wavin employs approximately 12 000 people

Wavin is part of Orbia

Wavin is part of Orbia, a **community of companies bound together by a shared purpose: to advance life around the world**. Orbia is a purpose-led company, passionate about the challenges that define how people will live and thrive tomorrow. Our decades-long history began as a leading producer of commodities, and through investment and strategic growth we've become **a global leader in polymers, materials, and infrastructure**. **Today, we operate in 41 countries and employ more than 22,000 people worldwide**.

Solutions for Drinking Water

Delivering clean water efficiently and safely has become a world-wide problem. Water is lost due to leakages and ageing networks. We need to improve the distribution of clean drinking water from source to tap. We will work towards these goals by **raising the quality and performance of high-pressure water distribution networks, improving safety levels of indoor drinking water supply, and building towards a new (smarter) ways of managing drinking water**.

Choice of pipe material

Steel, copper or stainless steel are history

Metal was undoubtedly the most widespread material in the field of water distribution in the past. Galvanized steel and copper were most commonly used. **Galvanized steel is very rarely used for installations today, as the disadvantages are considerable laborious assembly, complex connection by means of threads, relatively large pressure losses in the distribution system, and especially the deposition of impurities in the pipeline, which negatively affects drinking water quality**. However, due to its low price and good fire protection properties, pipes made of this material are relatively widely used for utility water and fire water mains.

Copper pipes have their challenges when it comes to distributing drinking water. Like steel pipes, they are prone to deposits. This is one of the reasons why copper is mainly used for heating distribution. Compared to steel, it offers easier assembly and lower pressure losses, on the other hand, it is quite expensive.

Undoubtedly, the highest quality metal systems are stainless steel pipes. They meet all the requirements for maintaining the required quality of drinking water, but due to the high purchase price, they are very rarely used for internal water distribution.

Plastic is popular. And rightly so.
In the case of indoor plumbing, plastic replaces metal. There are several reasons: plastic pipes have a lower weight, can be easily and quickly installed, are durable, have a long service life, no dirt settles in them, have no negative effect on water quality and meet the strictest hygiene standards.

As in the case of metal, there is a relatively large selection of variants in plastic. Probably the most commonly used socket fusion welded system made of polypropylene (PP-R, PP-RCT), there are single-layer but also multi-layer pipes, which bring even greater pressure resistance at higher temperatures, and thus safety and durability. A good example of such a pipe is Wavin PP-RCT Basalt, which is reinforced with basalt fiber.

In the last few years, the PP-RCT material – a new-generation polypropylene, which gives the pipe exceptional strength and durability, has also begun to gain ground in the field of plastic distribution. Due to its properties, it is possible to use pipes with a reduced wall thickness than PP-R pipes for the same applications. For example, PP-RCT pipes, which are manufactured in the Czech Republic by Wavin, offer 37% higher flow rate compared to the previous generation of pipes, which allows the use of smaller pipes and thus significantly save not only costs but also the environment.

Wavin PP-RCT Piping System

Contents

Basic Information

Pipes and fittings of the Wavin PP-RCT System are produced in the following sizes (external pipe diameter is shown): 1/2", 3/4", 1", 1 1/4", 1 1/2", 2", 2 1/2", 3", 3 1/2", 4", 6", 8", 10" (20, 25, 32, 40, 50, 63, 75, 90, 110, 125, 160, 200 and 250 mm).

Pipes

The pipes are produced in various combinations of operating pressure and temperatures in separate pressure lines (of various wall thicknesses):

- Monolayer pipe (PP-RCT) – Wavin PP-RCT pipes in standard single layer construction, SDR 7.4 & 9 suitable for hot & cold water
- Multilayer pipe (PP-RCT) – Wavin PP-RCT Basalt SDR 7.4 & 9 reinforced with basalt fiber, for hot water and central heating
- Multilayer pipe (PP-RCT) – Wavin PP-RCT Basalt Clima SDR 9 & 11 reinforced with basalt fiber for cold water, air conditioning and cooling

Wavin PP-RCT Basalt pipes

Three-layer pipes: The inner and outer layer is made of polypropylene type 4 (PP-RCT). The middle layer is from polypropylene type 4 (PP-RCT) reinforced with basalt fibers (BF). The composition of the layers can be schematically described as PP-RCT / PP-RCT + BF / PP-RCT. Due to the basalt fiber the thermal expansion occurring in the Basalt pipe is three times lower than in the all-plastic pipes.

Fittings

Fittings (and adaptors) are manufactured for all piping types in the highest pressure range and in various configurations:

- Full-plastic fittings (sockets, elbows, T-pieces reduced and full-sized, reducers, blindings, cross-pieces)
- Combined fittings with lead free DZR brass (reducing coupling with metal thread, T-pieces, elbows for wall mounting, wall mounting groups with tap connectors, plastic reducing coupling with cap nut)
- Combined fittings for flanged joints
- Plastic ball- and globe- valves with metal insert
- Metal ball valves
- Special elements (crossovers, compensation pipes)
- Pipes and fittings of larger diameters than 125 mm are designed for butt fusion

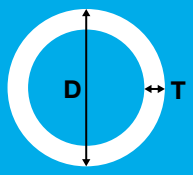
Recommendations Tool manufacturers:

- McElroy
- Widos
- Ritmo-America

SDRs and Sizes

SDR – Standard Dimension Ratio

The PP-RCT plastic pipes have standardized outer diameter and wall thickness. Pipes of identical material with different wall thickness have different service parameters (service pressure / service temperature / service life). Wavin PP-RCT pipes are manufactured using a Standard Dimension Ratio (SDR), which is the ratio of pipe diameter to wall thickness.

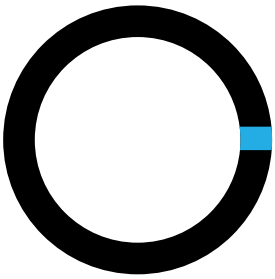


SDR = D/T

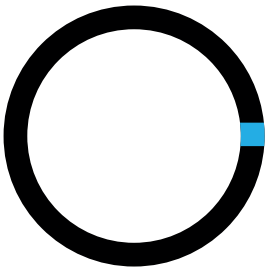
For example, SDR for a 1" nominal pipe with outside diameter (D) of 1.22" (32 mm) and a wall thickness (T) of 0.14" (3.6 mm), the SDR is 9. A SDR 9 means that the outside diameter (D) of the pipe is 9 times the thickness (T) of the wall.

With a small SDR ratio, the pipe wall is thick compared to the diameter of the pipe. As a result, a low SDR pipe has a high-pressure rating, and a high SDR pipe has a low-pressure rating.*

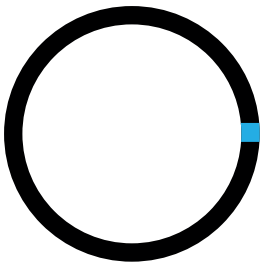
Wavin offers the following SDRs piping system in North America



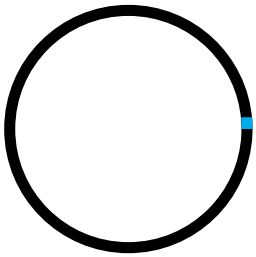
SDR = 7.4
330 PSI @ 73 °F
185 PSI @ 140 °F
120 PSI @ 180 °F



SDR = 9
260 PSI @ 73 °F
145 PSI @ 140 °F
95 PSI @ 180 °F***



SDR = 11
210 PSI @ 73 °F
115 PSI @ 140 °F
75 PSI @ 180 °F***



SDR = 17**
130 PSI @ 73 °F

Minimum pressure ratings according per ASTM F 2389 requirements. For higher operating conditions please contact Wavin.

Sizes

Wavin PP-RCT piping systems are manufactured in metric sizes. The pipes and packaging are marked in both metric sizes and imperial nominal dimension diameters. The tables provide a conversion from millimeters to inches based on similar dimensions and flow rate.

* SDR pictures shown are for illustration purpose only. They are not actual SDR dimensions.
** SDR 17 coming soon. SDR 17 product is not typically used or rated at 140 °F and 180 °F.
*** This rating does not comply with the 100 PSI minimum pressure rating requirements in plumbing codes

Nominal Diameter Imperial	Actual Diameter Metric
inches	mm
1/2	20
3/4	25
1	32
1 1/4	40
1 1/2	50
2	63
2 1/2	75
3	90
3 1/2	110
4	125
6	160
8	200
10	250

Applications

Wavin PP-RCT is a plumbing & mechanical hot & cold-water pressure piping distribution system. It is designed for a wide range of applications, such as residential, commercial, HVAC and industrial. Its chemical resistant composition and the high pressure & temperature performance rating, makes the system suitable for a wide range of applications.

Some of those most common field of applications are:

Hot & cold potable water plumbing distribution, for residential and commercial

Chilled water and condenser water for cooling towers, data centers, supercomputers

Reclaimed water collection and distribution

Hydronic distribution to radiators, convectors, fan coils, chilled beams, etc.

Geothermal heating and cooling systems

Industrial and process piping for applications such as chemical processes, semiconductor manufacturing, and high-purity pharmaceuticals.

Ship building industry

Irrigation

Standards & Certifications

Wavin national and international standards and approvals pertinent to PP-RCT piping system

- **NSF/ANSI 61-9**
  (Commercial Hot 180 °F/82 °C)
  Suitable for potable water
- **NSF/ANSI 14**
  Meets piping performance requirements
- **NSF/ANSI 372**
  Standard for lead content in drinking water components
- **ASTM F2389-21**
  Standard specification for pressure rated polypropylene (PP) piping system
- **CSA B 137.11**
  Polypropylene (PP and PP-RCT) pipe and fittings for pressure applications

National Standards:

- Uniform Plumbing Code (UPC)
- Uniform Mechanical Code (UMC)
- International Plumbing Code® (IPC)
- International Residential Code® (IRC)
- International Mechanical Code® (IMC)
- National Plumbing Code of Canada
- California Residential Code (CRC)
- City of Los Angeles Residential Code
- Code of Massachusetts Regulation (CMR)

International Standards:

- **EN ISO 15874**
  Plastic piping system for hot and cold water installation
- **EN ISO 9001**
  Quality management systems
- **EN ISO 14001**
  Standard for environmental management

Properties of Wavin PP-RCT

Specification of raw material used in production

All Wavin PP-RCT fittings are manufactured from Polypropylene type 4. Electrofusion couplers are made from Polypropylene Type 3. All monolayer pipes Wavin PP-RCT, multilayer pipes Wavin PP-RCT Basalt and Wavin PP-RCT Basalt Clima are made from polypropylene Type 4, PP-RCT.

Selected characteristics of pipes

Characteristics		Units	PPR value
Specific gravity	PPR, PP-RCT	g/cm³	0.9
Thermal expansion coefficient (elongation)	all plastic pipes	mm/m °C	0.12
	multilayer pipes		0.05
Thermal conductivity coefficient	all types of pipes	W/m °C	0.24

Product manufacturing and testing standards

Wavin PP-RCT products are manufactured according to internal company standard PN 01 corresponding to EN ISO 15874 and German standards DIN 8077 and DIN 8078, DIN 16962, DIN 4726. The internal company standards are continuously being updated with further specification guidelines taken from the newly introduced European (EN) System of Standards.

In order to meet quality requirements specified in ISO 9001, the following activities are regularly controlled within the framework of specified procedures:

- characteristics of raw materials entering the manufacturing process
- intermediate product parameters at every production stage
- manufacturing facilities
- parameters of measuring instruments

Operating Conditions

Basic parameters of internal water distribution systems

The following table shows basic criteria of pressure class selection – i.e. pressure and temperature values – as they may be present in internal water distribution systems:

Medium	Max. operating pressure [psi]	Max. operating temperature
cold water	145	do 68 °F *
PWH (potable water hot)	145	do 140 °F **

* For hygienic reasons, the maximum temperature for drinking water is specified as 68 °F.

** To prevent scalding, maximum temperature of 135 °F is always assumed at the mixing tap in PWH distribution systems. A short-term overheating to higher temperature levels (158 °F) is expected for hygienic reasons (extermination of patogenic mycobacteria and bacteria Legionella pneumophila).

Wavin PP-RCT can be used for internal water distribution systems (i.e. cold drinking water, cold industrial water, hot water, circulation systems).

The piping system is expected to have a 50 years service life under the condition that the material and piping have been selected correctly and the system properly installed. The pressure class depends on the hot water heating system and its proper regulation and should therefore be specified by the relevant project designer.

Basic parameters of heating systems

When assessing the suitability of Wavin PP-RCT elements, the temperature t1 – the highest temperature in the whole system – should be used as the input value for calculation. The heating system designer will determine this value depending on the temperature level required at the entry, heat source parameters, and expansion vessel types. According to this value, the following heating system types are specified.

Recommended values for heating – Wavin PP-RCT

Temperature interval			
158 / 122 °F	158 / 140 °F	167 / 149 °F	176 /140 °F

and for low-temperature applications

When installing plastic piping system behind a boiler or a water heater tank, we recommend to install metal piping in length according to your local plumbing code as protection against overheating the piping system.

Pipeline Routing Options

Routing options for water supply & distribution piping and heating systems are identical (leaving aside specific properties of heating systems). The major aspects are the requirements for piping protection, support and compensation of expansion.

It is recommended that pipes are installed inside building structures (such as: wall, floor or ceiling structures) or covered. Connections to radiators should be, for visual appearance reasons, made of metal pipes, e.g. a chromium-coated copper pipe.

Pipes can be laid

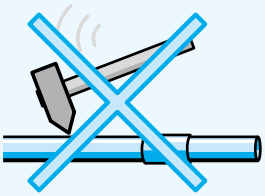
- in wall chases
- in stack partitions
- inside floor/ceiling structures
- along walls (freely or inside covers)
- in installation shafts and channels
- outdoor piping applications should be considered
- depending on local conditions

Assembly Instructions

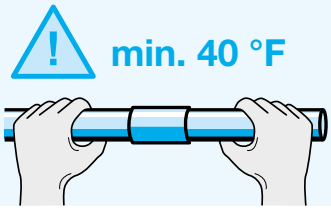
General

Only components not damaged or contaminated, either during storage or transport, may be used for installation works.

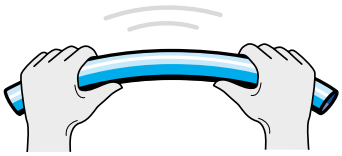
Components of PP-RCT piping systems must be protected against damage during transport and installation.



At lower temperatures it is difficult to provide proper working conditions for high-quality pipe coupling.

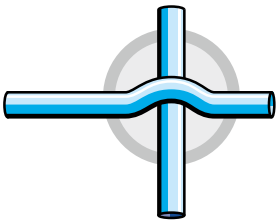


Pipe bending should be done at 60 °F. For pipes of diameter range 1/2" to 1" (20 - 25 mm) a minimum bending radius equals diameter multiplied by eight (D).



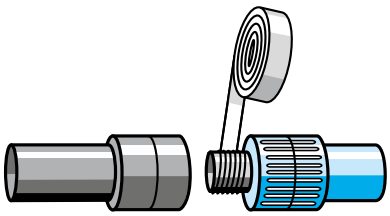
Components must not be exposed to naked flames.

Pipeline cross-overs should be made with components designed explicitly for this purpose.

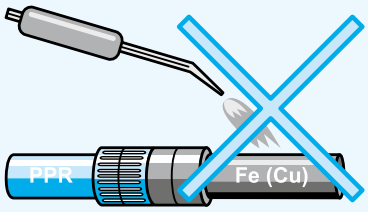


Plastic parts joining is done by socket fusion welding or by using electrofusion sockets and butt welding techniques. A high-quality homogeneous joint is the result. The welding process must follow proper procedures and must be performed with appropriate tools.

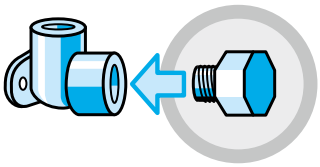
Threaded fittings must be used for screw-type joints. Threads should never be cut directly into plastic components. Threads are sealed with a special PTFE tape or sealing compounds.



Brazing or soldering of metal fittings should not take place close to a joint between metal and plastic systems due to the potential hazard of heat transfer to the fitting.

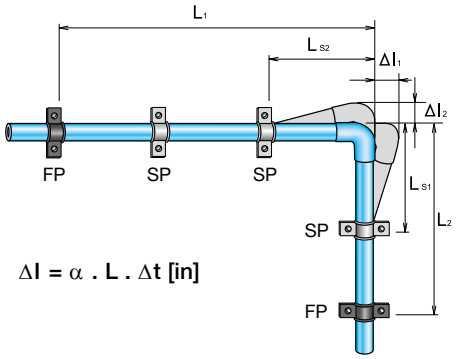


It is recommended to use plastic plugs for blanking elbows or wall mounting groups (plastic plugs are designated only for temporary use). Long term blanking requires using plugs with metal thread.



Linear expansion and contraction

Temperature differences during installation and under service conditions (i.e. when a medium flows through the system at a different temperature than that during the course of installation) result in linear changes – expansion or contraction (Δl).



$\Delta l = \alpha \cdot L \cdot \Delta t$ [in]

- Δl linear change [in]
- α thermal expansion coefficient [in/ft °F], for all plastic pipes design purposes $\alpha = 8.009 \times 10^{-4}$, for multilayer pipes respectively $\alpha = 3.336 \times 10^{-4}$
- L effective length (distance between two neighbouring fixed points in line) [ft]
- Δt installation and service temperature difference [°F]

$L_s = k \cdot \sqrt{(D \cdot \Delta l)}$ [in]

- L_s compensating length [in]
- k material constant, for PP-RCT k = 20
- D external diameter of the pipe [in]
- Δl linear change [in]

If pipeline linear changes are not compensated in a suitable way, i.e. if the pipes cannot contract and expand, additional pressure and tensile stress accumulating in the pipes shortens their service life.

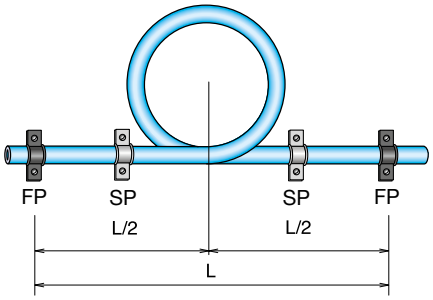
$L_k = 2 \cdot \Delta l + 6$ [in]
and also $L_k \geq 10 \cdot D$

In polypropylene applications linear compensation is often achieved through the pipe material's flexibility. Pipe bends can also be used for these purposes. One suitable compensation technique is where the pipeline is deflected perpendicularly to the original route and a free compensating length (marked as L_s) is left at the normal line. The value of L_s compensating length depends on calculated route extension (shortening), pipe material and diameter. The values of Δl linear change and L_s compensating length can also be taken from the tables shown on pages 20-23.

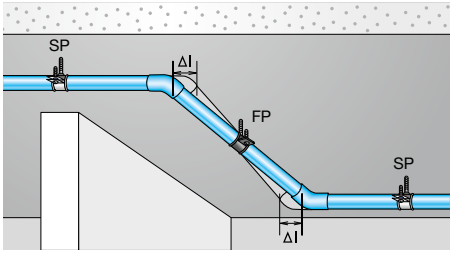
Compensation pipe table

Pipe diameter	Distances of all fixed L-points [ft]	
	multilayer pipes	all plastic pipes
1/2"	89	30
3/4"	98	33
1"	118	39
1-1/4"	138	46

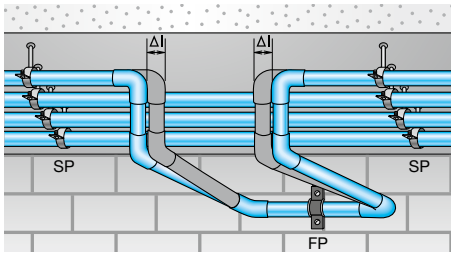
Compensation pipe



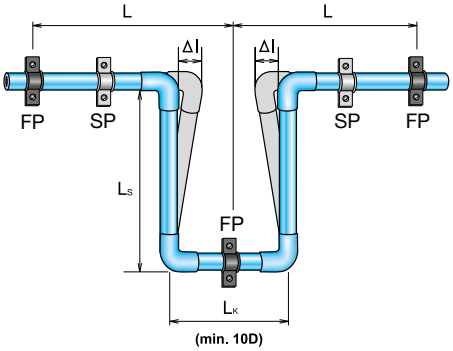
Compensation through modified pipeline routing



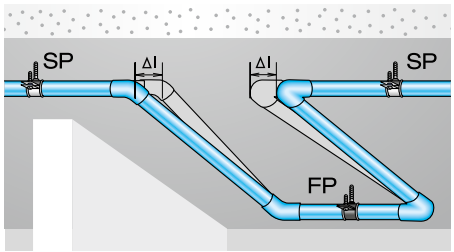
Compensation through modified height of the pipeline



Expansion U-bend



Compensating U-bend



FP – fixed point
SP – sliding point
L – design pipe length
L_s – linear change
Δl – compensating length
L_k – bend width

Assembly Instructions

Linear expansion of Wavin PP-RCT – monolayer pipes

Pipe length [ft]	Temperature difference Δt							
	18 °F (10 °C)	36 °F (20 °C)	54 °F (30 °C)	72 °F (40 °C)	90 °F (50 °C)	108 °F (60 °C)	126 °F (70 °C)	144 °F (80 °C)
	Linear change Δl [in]							
10	0.14	0.29	0.43	0.58	0.72	0.86	1.01	1.15
20	0.29	0.58	0.86	1.15	1.44	1.73	2.02	2.31
30	0.43	0.86	1.30	1.73	2.16	2.59	3.03	3.46
40	0.58	1.15	1.73	2.31	2.88	3.46	4.04	4.61
50	0.72	1.44	2.16	2.88	3.60	4.32	5.05	5.77
60	0.86	1.73	2.59	3.46	4.32	5.19	6.05	6.92
70	1.01	2.02	3.03	4.04	5.05	6.05	7.06	8.07
80	1.15	2.31	3.46	4.61	5.77	6.92	8.07	9.23
90	1.30	2.59	3.89	5.19	6.49	7.78	9.08	10.38
100	1.44	2.88	4.32	5.77	7.21	8.65	10.09	11.53
150	2.16	4.32	6.49	8.65	10.81	12.97	15.14	17.30
200	2.88	5.77	8.65	11.53	14.42	17.30	20.18	23.06

Linear expansion of Wavin PP-RCT – multilayer pipes

Pipe length [ft]	Temperature difference Δt							
	18 °F (10 °C)	36 °F (20 °C)	54 °F (30 °C)	72 °F (40 °C)	90 °F (50 °C)	108 °F (60 °C)	126 °F (70 °C)	144 °F (80 °C)
	Linear change Δl [in]							
10	0.06	0.12	0.18	0.24	0.30	0.36	0.42	0.48
20	0.12	0.24	0.36	0.48	0.60	0.72	0.84	0.96
30	0.18	0.36	0.54	0.72	0.90	1.08	1.26	1.44
40	0.24	0.48	0.72	0.96	1.20	1.44	1.68	1.92
50	0.30	0.60	0.90	1.20	1.50	1.80	2.10	2.40
60	0.36	0.72	1.08	1.44	1.80	2.16	2.52	2.88
70	0.42	0.84	1.26	1.68	2.10	2.52	2.94	3.36
80	0.48	0.96	1.44	1.92	2.40	2.88	3.36	3.84
90	0.54	1.08	1.62	2.16	2.70	3.24	3.78	4.32
100	0.60	1.20	1.80	2.40	3.00	3.60	4.20	4.81
150	0.90	1.80	2.70	3.60	4.50	5.41	6.31	7.21
200	1.20	2.40	3.60	4.81	6.01	7.21	8.41	9.61

Assembly Instructions

Determination of L_s – compensating length

Pipe diameter			Linear change ΔI [in]													
			0.4	0.8	1.2	1.6	2.0	2.4	2.8	3.1	3.5	3.9	4.3	4.7	5.1	5.5
[mm]	[in] nominal	[in] actual	Compensating length L_s [in]													
20	1/2	0.79	11	16	19	22	25	27	30	31	33	35	37	39	40	42
25	3/4	0.98	13	18	22	25	28	30	33	35	37	39	41	43	45	46
32	1	1.26	14	20	24	28	31	35	37	40	42	44	47	49	51	53
40	1-1/4	1.57	16	22	27	31	35	39	42	44	47	50	52	55	57	59
50	1-1/2	1.97	18	25	30	35	39	43	46	50	53	56	58	61	63	66
63	2	2.48	20	28	34	39	44	48	52	56	59	63	65	69	71	74
75	2-1/2	2.95	22	30	37	43	48	53	57	61	65	68	72	75	78	81
90	3	3.54	24	33	41	47	53	58	63	67	71	75	78	82	85	88
110	3-1/2	4.33	26	37	45	52	58	64	69	74	78	83	87	91	94	98
125	4	4.92	28	39	48	56	62	68	74	79	83	88	93	96	100	104

Determination of L_s – compensating length

Pipe diameter			Linear change Δl [in]									
			0.4	0.8	1.2	1.6	2.0	2.4	2.8	3.1	3.5	3.9
[mm]	[in] nominal	[in] actual	Compensating length L_s [in]									
160	6	6.30	31	44	55	63	70	77	83	89	94	100
200	8	7.87	35	50	61	70	79	86	93	100	106	111
250	10	9.84	39	56	68	79	88	96	104	111	118	124

Assembly Instructions

Spacing distance between pipe supports

Maximum distances of supports of pipeline Wavin PP-RCT Basalt Clima (SDR 9, SDR 11),
Wavin PP-RCT monolayer (SDR 7.4, SDR 9)

Pipe diameter		Spacing distances [in] at water temperature of					
[mm]	[in]	**20 °C / 68 °F**	**30 °C / 86 °F**	**40 °C / 104 °F**	**50 °C / 122 °F**	**60 °C / 140 °F**	**80 °C / 176 °F**
20	1/2	33	31	30	30	28	26
25	3/4	35	35	35	33	31	30
32	1	41	39	39	37	35	31
40	1-1/4	45	45	43	41	39	35
50	1-1/2	51	49	47	45	43	37
63	2	57	55	53	51	49	43
75	2-1/2	63	61	59	55	53	47
90	3	67	67	63	61	59	51
110	3-1/2	75	73	71	67	65	57
125	4	81	79	75	73	71	63

Maximum spacing distances Wavin PP-RCT Basalt

Pipe diameter		Spacing distances [in] independently on temperature
[mm]	[in]	
20	1/2	43
25	3/4	47
32	1	51
40	1-1/4	55
50	1-1/2	63
63	2	65
75	2-1/2	71
90	3	75
110	3-1/2	79
125	4	81

Maximum distances of supports of pipeline Wavin PP-RCT Basalt Clima and Wavin PP-RCT monolayer (SDR 11) for butt fusion

Pipe diameter		Spacing distances [in] at water temperature of				
[mm]	[in]	**20 °C / 68 °F**	**30 °C / 86 °F**	**40 °C / 104 °F**	**50 °C / 122 °F**	**60 °C / 140 °F**
160	6	87	83	79	77	73
200	8	96	93	89	87	83
250	10	108	104	98	96	93

Maximum spacing distances between supports for vertically oriented pipelines should be multiplied by 1.3.

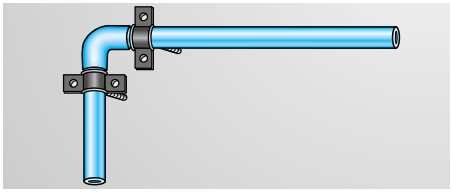
Pipe fixing

Pipeline route design must be appropriate for the system material, which means that the thermal coefficient of expansion, expansion allowance, given operating conditions (combination of pressure and temperature levels) and the type of pipe joints must be all taken into account. Pipeline systems should be fastened with both fixed and slidably mounted fixture points, allowing for appropriate linear expansion of the pipe.

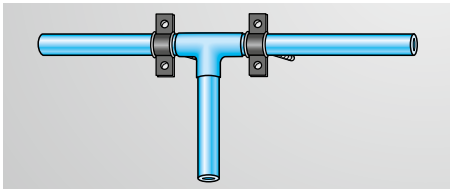
Pipe fixing techniques – pipe fixing is generally done through two types of supports:

Fixed points (FP)

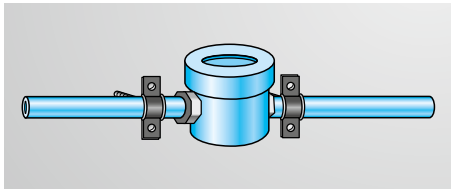
This is a type of fastening where no allowance for pipe expansion is made, i.e. the pipe cannot move along its axis in the place of support (cannot slide).



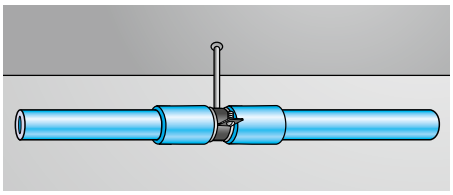
…at a pipe bend



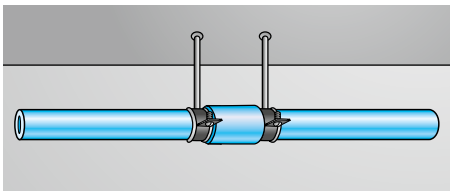
…at a branching point



…at a fitting installation



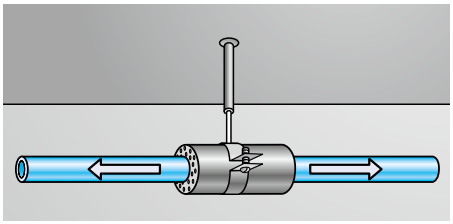
…by a sleeve between pipe fittings



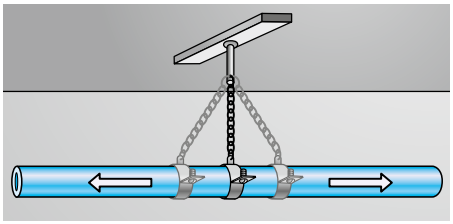
…by fixing at fitting places

Sliding point (SP)

This is a type of fixing where the pipe is not allowed to move sideways but expansion movements are not restricted (elongation, shrinkage). Slidable mounting can be designed as follows:



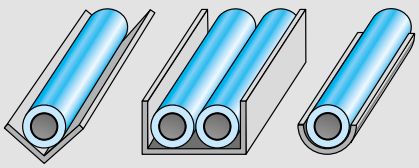
…by loose pipe-straps



…by pipe-straps suspended on hooks

For hot water, the clip must be one size larger than the pipe (needs to be fitted over the insulation).

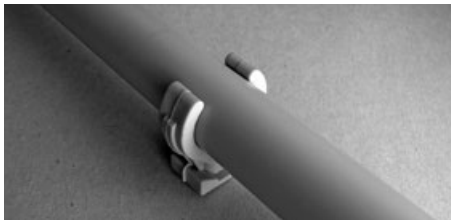
Other methods of plastic pipeline routing



…by laying the pipe freely into a trough

…by routing the pipe through insulation under plaster (flush-mounting)

Application of plastic clips



Suitable for H&C water supply

Assembly Instructions

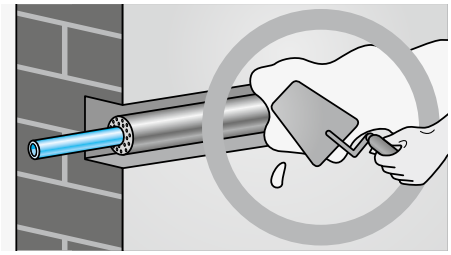
Pipeline routing

Pipes should be installed with a minimum gradient of 0.5 % towards the lowest system points, where system can be vented through a drain faucet or shut off valve with an outlet. The piping system must be divided into separate parts that can be closed if necessary. Straight valves and plastic ball taps are used for this purpose. Shut off valves or ball taps are used when routing under the plaster. It is necessary to test the fittings‘ functionality (closing/opening) before installation. It is recommended to use a wall mounting group with tap connectors at the end point with installed valve mixers.

It is neccesary to open and close the closing fitting three time a year, in order to keep their functionality and tightness.

Routing of Wavin PP-RCT inlet piping

Inlet piping systems are made mainly from 20 mm diameter pipes, usually laid in wall channels. The channel meant for insulated pipe routing must be free of obstacles and allow some room for expansion. Aside from its thermal properties, the insulation system also protects the pipe against mechanic damage and the insulation layer helps to compensate any piping expansion. It is recommended to use expanded polystyrene or polyurethane (foam) for insulation. Before sealing off the pipes inside the wall, the piping system must be firmly fixed to the channel either by plastic or metal pipe-straps, or by plastering.



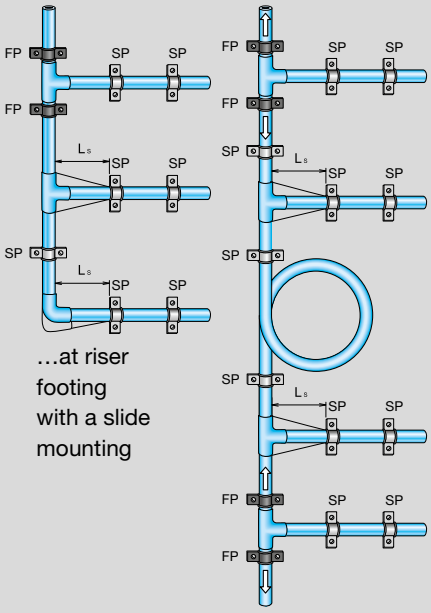
If water supply / distribution piping systems are installed inside stack partitions, they must be fixed in a suitable way – such as with a system of metal clips and supporting elements.

The systems must be insulated and correctly positioned, allowing for expansion. If water supply /distribution piping systems are installed inside floor/ceiling structures, then flexible plastic protective sleeves (made of polyethylene) are used for protection against mechanical damage, while the air layer between the sleeve and the pipe works as thermal insulation. Freely laid piping systems are rarely used for short distances in areas where visual appearance is not a priority (laundry facilities, service areas, etc.).

Supporting elements must be positioned with necessary care to fixate the piping and take into account necessary pipe expansion compensation in connecting sections, where the pipes are sealed off. A good piping insulation system is also indispensable (if, for instance, a cold water pipe is laid freely on a wall located in a heated area, there will be a considerable risk of surface condensation). Piping systems may be laid freely on walls where there is no risk of mechanical damage in normal operating conditions.

Routing of Wavin PP-RCT riser piping

In the case of riser piping it is necessary to consider precisely the layout of fixed points and sliding points, as well as create of a suitable expansion compensation system. The adjustments for expansion in riser piping systems are provided as follows.



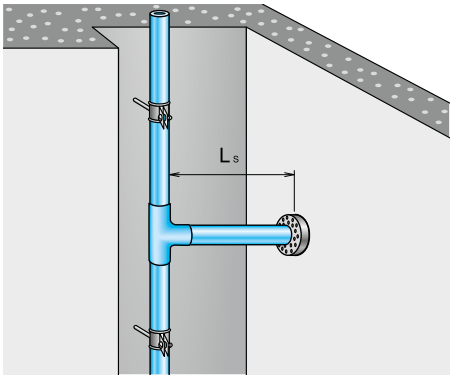
…at riser footing with a slide mounting

…by inserting a loop compensator

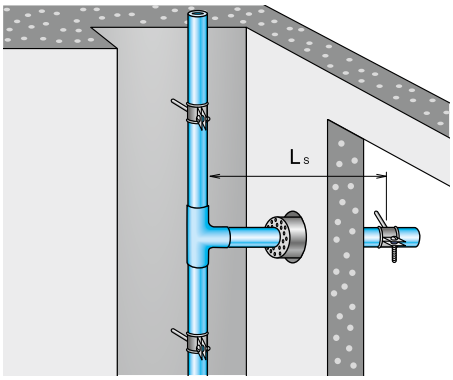
If it is necessary to divide the riser into several expansion sections, then it can be achieved by placing fixed points. The riser fixed points are always fixed under and over the T-pieces at a branch pipe or a socket, which also prevents the riser from falling. The pipe expansion must accounted for between these fixed points.

In branching off the feeder piping it is necessary to allow for riser expansion by:

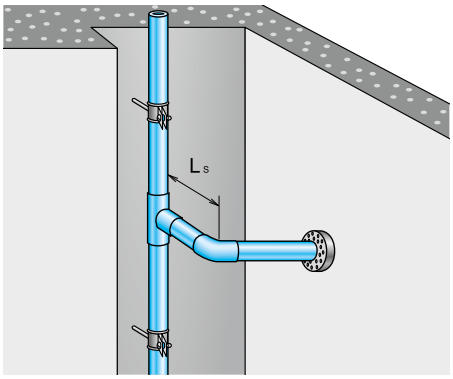
…keeping a sufficient distance from the wall pass-through point



…allowing a certain degree of movement for the branch pipe in the wall pass-through point

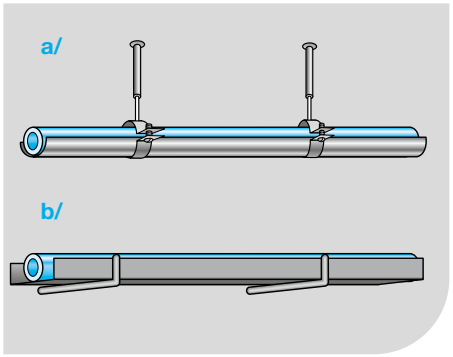


…creating a compensating length, allowing for vertical expansion at the riser



Routing of horizontal Wavin PP-RCT piping

With horizontal piping systems, it is necessary to pay very close attention to their expansion conditions and how to lay the piping correctly. The most common routing is done with galvanised metal or plastic troughs, sleeves, or in-wall channels (these must be kept free from any obstructions).



Expansion is most commonly compensated by a change in the routing or through expansion U-bends, but it is also possible to use a loop compensator for the same purpose. Expansion adjustment may be designed both in perpendicular and parallel plane to the ceiling structures. In the option a) a pipe is insulated together with the through right on the spot, while in the option b) a fully insulated pipe is laid into the trough. If the pipeline is laid into a galvanized or plastic trough, it is possible to put pipes support in max. lenght of 80 inch.

Routing of Wavin PP-RCT Basalt, Basalt Clima inlet piping

Basalt and Basalt Clima have a three times lesser expansion, higher rigidity and better mechanic resistance than the all-plastic monolayer pipes. Basalt and Basalt Clima can be installed in the same way as the all-plastic systems (as described above), i.e. with conventional expansion adjustments, except with potentially greater support spacing and shorter expansion and adjustment lengths. When routing inside the in-wall channels, the so-called „rigid“ assembly can be used, which means the pipe is secured to fixed points so the thermal expansion is transferred to the piping material and thus remains unnoticeable. This type of installation however requires firmly anchored sleeves, capable of holding and supporting the piping system.

Coupling to the system

The Wavin PP-RCT pipeline system can be coupled by welding or mechanic coupling. Coupling of pipes and fittings is done in the same way in all types of pipes – the fittings are the same.

Welding

Socket fusion welding, electrofusion sockets, or butt welding techniques can all be used. All the techniques must be performed accurately and according to standard working procedures, using reliable, well-checked and well-maintained tools.

Assembly Instructions

Pipe cutting

Pipes can be cut by saws or shears. The cutting tools must be in good condition and sharp. Special shears or plastic pipe cutters are recommended.

Threaded couplings, plastic/metal couplings

Plastic/metal couplings in hot water piping and heating systems contain pressed-in DZR Lead Free* brass. If a coupling is not fitted with a hexa- or multigonal piece directly on its metal part, tightening wrenches with a tape should be used.

Warning

For thermal/technical and physical/mechanical reasons, usage of plastic threaded couplings is not permissible in sanitary engineering.

Sealing of couplings

Threaded couplings may be sealed with a teflon tape, sealing teflon fibre, or special sealant only.

Insulation

While hot water piping systems and heating systems are insulated against heat loss, the cold water pipes are conversely insulated against heat gain and pipe condensation. Cold water system insulation is necessary, as drinking water health requirements demand that the temperature level be kept under 20 °C. Similarly, the hot water temperature must be below the upper limit given by the standard of protection against scalding, though the temperature limits are also aimed at keeping the bacteria populations under control. Specialized technical solutions aside (such as thermal sterilisation), properly functioning circulation and keeping hot water at the required temperature level are both crucial for protection against bacteria such as Legionella pneumophila.

The thickness and type of insulation layers are determined on the basis of thermal resistance of the insulation system to be used, air humidity in the area of the piping system and the difference between the room temperature (air) and that of the flowing water.

The piping system must be insulated along its whole length, including fittings and valves. It is necessary to maintain a minimum insulation layer thickness along both the pipe diameter and the pipeline length; this means the insulation types that are cut lengthwise to be wrapped over the pipes must be throughly sealed after the installation (e.g. using an adhesive, clamps or a sealing tape). Minimum thermal insulation layer for cold water system – example:

Placement / routing of pipes	insulation layer thickness λ = 0.278 BTU-in/h-ft²-°F
Freely laid pipes in unheated areas (e.g. basement areas)	0.16"
Freely laid pipes in heated areas	0.35"
Pipes in crawlways without concurrently running hot water lines	0.16"
Pipes in crawlways with concurrently running hot water lines	0.5"
Independently running underplaster pipes (in channels)	0.16"
Underplaster pipes (in channels) running in parallel with hot water lines	0.5"
pipes cast over with concrete	0.16"

Note: the above thickness values must be re-calculated for other thermal characteristics

Usage of plastic pipes in such systems may therefore present a significant cost-saving solution! In highly demanding systems (such as in bathrooms, bathtubs, washing machines, etc.) heat losses in plastic pipes with flowing water can be up to 20 % smaller than in metal ones. Another 15 % can be saved by thorough insulation. In systems with small and/or short-time demand, where pipes are not regularly heated to operating temperatures, the savings will be smaller (only 10 %) although up to 20 % can be expected at peak demand.

The insulation layer thickness for hot water systems usually ranges between 0.35" and 0.6" at the value of thermal resistance λ = 0.278 BTU-in/h-ft²-°F.

* Metal alloy complies with ≤ 0.25 % weighted average lead content on wetted surfaces in accordance with Safe Water Drinking Act (SDWA) Weighted

Socket Fusion Welding Working Procedures

The following installation instructions are meant to be just for general information on how to install PP-RCT piping system. Installers will need to be trained and certified by an authorized Wavin trainer. Failure to follow proper installation procedures and certification requirements, will void the Wavin warranty.

Wavin offers different courses taught by its authorized technical trainers' representatives.

The fusion tools manufacturer McElroy, Widos & Ritmo-America, have been approved to be used on Wavin PP-RCT piping system in North America. Using other fusion tools manufacturers will void the warranty. Contact Wavin Technical Service representative to have a different tool manufacturer approved.

Tools

1/ Electric socket fusion welding machine fitted with welding adapters of suitable dimensions, incl. a movable feeder cable
2/ Contact thermometer
3/ Special shears or cutter (i.e. jaw with a cutting wheel); metal hand saw if nothing else is available
4/ Sharp penknife with short blade
5/ Textile rag (non-synthetic material only)
6/ Degreaser (Tangit, Spirit)
7/ Folding ruler + marker
8/ Scraper and assembly jig for welding of diameters over 1-1/2"

Tool check

First, attach the welding adapter to the welding machine (usually done with screws, depending on the type of the welding machine). With the welder controller set the temperature at 480 - 520 °F and connect the power supply. Time necessary to heat up the welding machine will depend on ambient conditions. Once the welding machine is warm, clean the welding adapters of impurities left from the previous use with a rag made from non-synthetic textile; failure to do so may damage the teflon surfaces. You may start working with the welding apparatus when it is sufficiently hot, which you can check using the LED diode or a contact thermometer. Use the contact thermometer if you need to fine-tune the temperature up to 480 - 520 °F.

Check the proper functionality of the special shears or cutting wheel by making two cuts on a pipe assigned for testing purposes. The trial cutting should not deform or depress the outer diameter of the pipe; if it does, the tools need to be sharpened further.

Materials check

All the material should be inspected thoroughly prior to welding. The components must not contain any wall thinning defects and closing elements should be checked if they function properly and correspond to their matching piece. Welding sockets and the end of the pipe to be inserted into the fitting should be cleaned and degreased. Test the fittings by sliding them on the heating plug (which of course must remain cold for now) and check if they are not too loose. Wobbly fittings must be discarded!

Welding process

1/ Measure and cut off a piece of pipe of a desirable length. When using a metal hand saw, make sure to clean the burr and dross from the pipe's edge.

2/ It is also recommended to bevel the outer edges of the pipe that we mean to heat up. Use of a special cutter or a sharp knife at approximate angle of 30–45°. This procedure is strongly recommended especially for pipe diameters over 1-1/4". This modification will prevent the material from bunching up when the pipe end is inserted into a fitting.

3/ If you are welding larger diameters (1-1/4" and more) it is recommended that you check their ovality first. You should also scrape off the oxidized surface layer (about 0.01" in depth) along the whole length of the pipe to be inserted. The oxidized material can have negative effect on the weld quality.

4/ The insertion depth of the pipe (to be inserted into a pipe fitting) should be marked with a marker or a sharpie. Keep in mind that the pipe must not be pushed into the fitting socket as far as it can possibly go. About a 1mm gap should be preserved for material accumulation so as not to reduce the fitting's intern.

5/ Furthermore, it is recommended that you also mark the weld position on both the pipe and the fitting, in order to prevent the pipe from rotating after insertion. You can also use installation marks on fittings for the same purpose.

6/ The surfaces to be welded should be cleaned and degreased after the marking is complete. If this step is left out, then the melted layers may bond inadequately! Now you can begin the heating-up process.

Socket fusion Welding Working Procedures

7/ Due to its thicker walls, the fitting needs more time to heat up properly and should be put on the welding adapter first. Check if it is not too loose once again; a fitting that wobbles or does not fit the whole surface of the adapter should be discarded because uneven contact (and subsequent uneven heat up of the material) may result in poor-quality welds. Next slide the pipe onto the adapter and repeat the same procedure as with the fitting.

8/ Heat up both components for the time shown in Table, page 32. The heating time is measured starting with the moment when both the pipe and the fitting are set on the adapter with their whole marked lengths. If you experience difficulties sliding the components in place, try to rotate them slightly (max. 10°) until they are fully settled on the adapter. You may not rotate the components once the heating period begins; it could cause material to bunch up in some sections.

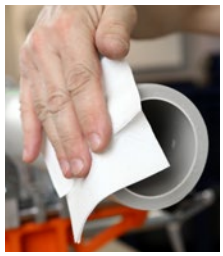
9/ After the heating period is finished, remove both the fitting and the pipe and couple them together by inserting the pipe into the fitting socket for the whole marked length with gentle and uniform pressure. Again, do not rotate the components. After this is done, check the axis alignment of both components. Table on page 32 shows maximum permissible intervals between the component removal from the adapter and their coupling. Exceeding these intervals will cause the melted layers to cool excessively, thus creating a poor-quality joint due to insufficient fusion of the material.

Recommendation for welding operations involving large diameters:

Pipes up to 1-1/4" in diameter may be welded while holding them in your hand; for the larger diameters (1-1/2" and more) machine welding or at least a welding jig is recommended in order to ensure sufficient pressure and correct alignment of the pipes.

Preparation of pipes

bevelling



scraping

Welding

Fixing and aligning the components, then heating them up

Adjustment after the heating period

Finished weld after the cool-down

Table for socket fusion welding (The minimum ambient temperature for welding is +5 °C / 41 °F)

D		Insertion depth L		Heat-up time	Time for adjustment	Cooling time	
[mm]	[in]	[mm]	[in]	[s]	[s]	Fixation [s]	Total [min]
20	1/2	14	0.55	5	4	6	2
25	3/4	15	0.59	7	4	10	2
32	1	17	0.67	8	6	10	4
40	1-1/4	18	0.71	12	6	20	4
50	1-1/2	20	0.79	18	6	20	4
63	2	26	1.02	24	8	30	6
75	2-1/2	29	1.14	30	8	30	6
90	3	32	1.26	40	8	40	6
110	3-1/2	35	1.38	50	10	50	8
125	4	41	1.61	60	10	60	8

Welding With Electrofusion Sockets – Working Procedures

Tools

1/ Electrofusion welding machine for electric welding of plastic pipes (electrofusion socket welder)
2/ Special shears or cutter
3/ Textile rag (non-synthetic material only)
4/ Degreaser, sharp knife with short blade
5/ Folding ruler + marker
6/ Welding jig to secure the pipe and fitting and ensure their correct alignment
7/ Scraper and assembly jig for welding of diameters over 50 mm

Preparing the tools

Place the welding machine at your workplace and unreel the power cable. Check your cutting tools.

It is very important to let the new joint cool down before exposing it to any strain. The weld should be also protected from mechanical tension (pipe‘s rotation or pull).

Welding process

Check the pipe and the fitting and prepare the welding machine.

Prepare the pipe of required length and remove the oxidized layer with a scraper or special agent. Degrease the external surface of the pipe and internal surface of the electrofusion socket (use alcohol or Tangit).

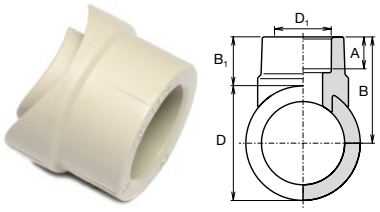
After you are done, mark the pipe insertion depth (depth of insertion inside the electrofusion socket). Insert the pipe into the electrofusion socket. Make sure the pipe is firmly fixed in the socket because due to the volume expansion of heated plastic material the pipe could be pushed out of its place during the heating process.

Connect the electrofusion welding machine to the power supply and wait until the welding machine gets into operational state. Then connect the contacts of the electrofusion socket and welding machine. Welding starts after you push the START button; the welding machine switches off automatically after the weld is completed. You can tell the electrofusion welding is proceeding well if the excess plastic material is being squeezed out of the check-points on the socket‘s surface. The newly coupled piping system may be filled with water not earlier than one hour after the last weld has been completed.

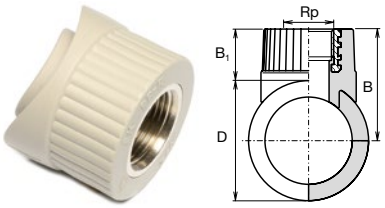
Additional Branching

- The large assortment of fittings allows to create branching with both female and male Lead Free brass DZR NPT threads.
- For Wavin PP-RCT pipelines diameters 2", 2-1/2", 3", 3-1/2", 4" (full-plastic and threaded)
- For Wavin PP-RCT pipelines 6", 8" and 10" full-plastic saddles only
- The principle of socket fusion welding type C is maintained
- Special heating adaptors for each pipeline diameter; universal for all types of flat welding machines
- Saves work and space – replaces the T-pieces and reducers
- Connecting the saddle and the pipe ensures a perfectly connected joint throughout the entire welding area

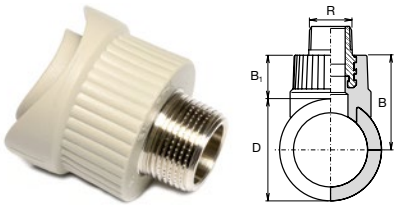
Useful tools



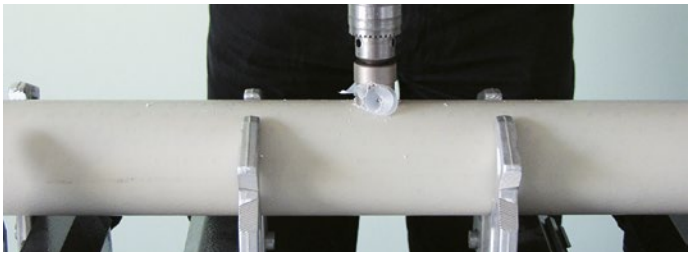
PP-RCT weld-in saddle



Weld-in saddle with metal thread female



Weld-in saddle with metal thread male



1/ Drill a hole into the pipe with the special drill.

2/ Clean and degrease the weld-in saddle as well as the drilled hole.

3/ Put the PP-RCT weld-in saddle on the adapter so that the mark on the saddle and the mark on the adapter are aligned. Heat-up the hole and the plastic weld-in saddle. The heating period is the same as with the 1" diameter (8 sec.). For weld-in saddle parts 3-1/2" × 1" and 3-1/2" × 1-1/4" the heating-up period is the same as for the 1-1/4" ones (12 sec.), 4" × 1-1/2" (24 s), 4" × 2" (24 s), see the table for socket fusion welding, page 30.

4/ Put the heated saddle on the heated hole and fasten for about 16 sec. You can fill the pipe with water and expose it to pressure one hour later.

Weld-in saddles instruction table

Place the saddle to the prepared pipe opening. Align with the pipe axis.
By applying pressure, create a 0.5 mm bead on the contact area of pipe and fitting.

Saddle size		Heating time	Fixation time
[mm]	[in]	[s]	[s]
63/32	2"/1"	8	15
75/32	2-1/2"/ 1"		
90/32	3"/1"		
110/32	3-1/2"/1"	12	20
110/40	3-1/2"/1-1/4"		
125/32	4"/1"		
125/40	4"/1-1/4"		
125/50	4"/1-1/2"	24	30
125/63	4"/2-1/2"		
160/40	6"/1-1/4"	12	20
160/50	6"/1-1/2"	18	25
160/63	6"/2"	24	30
200/50	8"/1-1/2"	18	25
200/63	8"/2"	24	30
200/75	8"/2-1/2"	30	35
200/90	8"/3"	40	40
250/63	10"/2"	24	30
250/75	10"/2-1/2"	30	35
250/90	10"/3"	40	40
250/110	10"/3-1/2"	50	45

Coefficient of pressure loss ζ for Wavin PP-RCT fittings

Fittings			ζ
		Coupling	0.2
		Reduction by 2 dimension	0.55
		Elbow 90°	1.5
		Tee – straight direction	1.1
		Tee – branch	1.5
		Reduced Tee – straight direction	1.1
		Reduced Tee – branch	4.3
		Reducing coupling with metal thread	0.4
		Metal reducer with cap nut	8.3

Butt welding process

We recommend using a special cutter for plastic pipes.

Butt welding is one way of coupling plastic piping systems and its components together. Butt welding is a process in which two pipe ends or a pipe end and a fitting are coupled by pressing the melted contact surfaces together. Butt welding can be performed only with welding equipment specifically designed for such purpose and only by appropriately qualified staff.

Butt welding is not suitable for coupling pipes and fittings of different size (the diameter and wall thickness must be the same) or different MFI value.

The following text describes the basic welding process. Detailed welding equipment manuals including welding charts are provided by the manufacturer/supplier of the welding equipment.

In order to achieve more solid welds, we recommend using welding machines with hydraulic jaws.

The butt welding procedures described herein are based on DVS 2207.

Butt welding working instructions

Welding preparations

Workplace check

Make sure the workplace meets all the health and safety requirements and take note of dust and weather conditions. During the butt welding process, the ambient temperature must not fall below 5 °C (41 °F) (use a mounting tent if needed). Similar measures must be taken in case of adverse weather conditions (rain, direct sunlight, etc.).

Welding equipment check

Check the technical condition of the welding machine (the surface and temperature of the heating plate, alignment of the fixed and movable jaws, milling cutter's functionality etc.).

Materials check

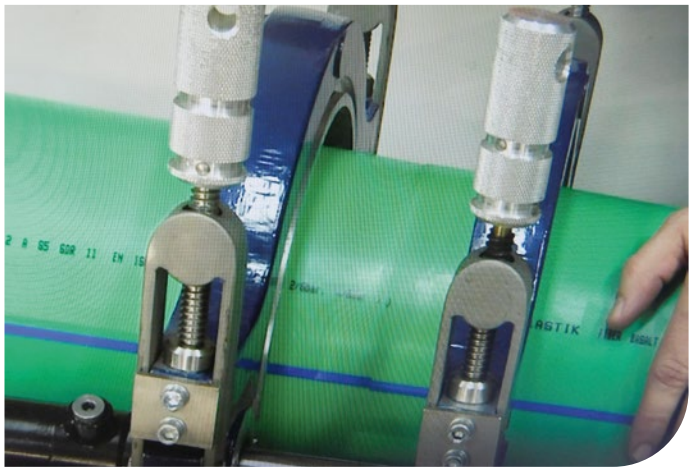
Warning: Check the mutual weldability of the materials before starting the welding process. Ensure the materials you are planning to couple have the same temperature. Butt welding can only be performed with pipes with the same wall thickness (3 mm minimum).

Preparing the materials

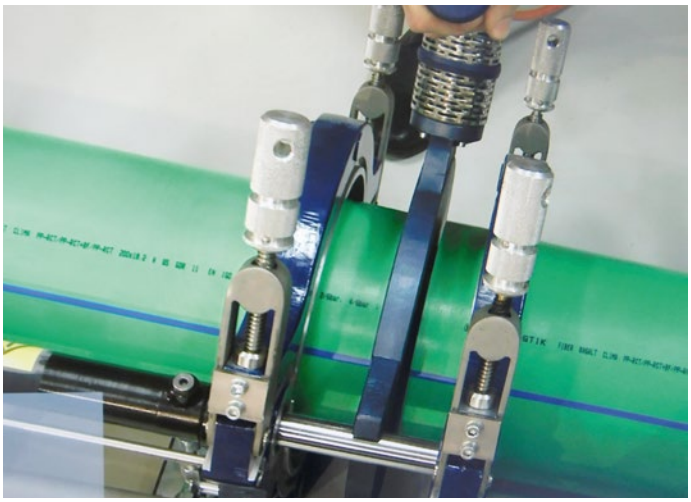
Once prepared and properly fastened, cut the pipe perpendicularly to the pipe axis with the tool designated for the purpose. Since the contact surface of the pipe must be clean, dry and free of any oils or fat, avoid using chainsaws with oil chain lubrication. After completing the cut, always make sure to remove any burrs, sawdust or any other impurities created during the pipe cutting process.

Check if the newly created contact surfaces fit well together; a careful inspection can reveal inadequate pipe ovality or tucked ends caused by the manufacturing process. Find out the passive resistance, plane the pipe surfaces as needed, test the fit once again, check for any gaps between the pipes, and finally clean the external surface of the pipes.

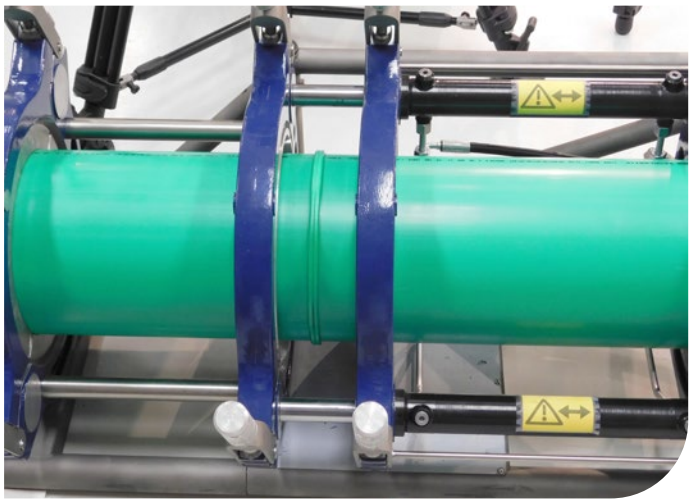
Planing the pipe ends



Properly prepared for welding



Heating with the heating plate



Cooling the weld seam

Welding phase

Truing phase
Push the contact surfaces against the heating plate until the two contact surfaces line up, which is indicated by the level of burr listed in the welding charts.

Heating phase
The contact surfaces should be heated with minimal contact pressure (see the welding charts for details). Heat up the contact surfaces until the welding zone reaches plastification (see the welding charts for details).

Positioning phase
Slide the contact surfaces away and remove the heating plate. Slide the pipes back as quickly as possible and push them together so their contact surfaces touch.

Coupling phase
When the contact surfaces are touching, raise the contact pressure until you reach full welding pressure.

Cooling phase
During the cooling phase keep the pipes under constant pressure (must be overseen by the welder), until the time allotted for cooling runs out. After the weld is done, perform its visual inspection in accordance with the client's requirements.

Compatibility
In order to ensure proper welding compatibility, pipes and fittings meant for butt welding should not be combined with pipes or fittings produced by a different manufacturer.

Welding parameters
Included with the welding equipment.
Guideline values for polypropylene as specified in DVS 2207 - Part 11
Hot body temperature: 390 - 430 °F

Welding pressure
- Truing and coupling: 14.5 psi
- Heating: 1.45 psi

Flange connections

Installation of flanged connections

During the process of designing flanged connections there should be taken into account the following conditions (When planning flanged connections, the following conditions should be taken into account): In general, it is necessary to distinguish a classic flange connecting (connection) of two plastic pipes from a flanged connection, where the edge adapter (collar) constitutes a junction piece between a plastic pipe and a shut-off valve (fitting). Hence, in each case it is necessary to choose a right seal and a suitable flange. The flanges to be used should possess a sufficient thermal and mechanical stability.

Axial flange setting

In horizontally mounted pipelines, flanges must be affixed (bolted) as it is shown in the illustration hereto in order to prevent possible leakage of the transferred medium through bolt threads.

Note

It is impossible to use flange connections for elastic and / or compensatory structures, because in this case, they will be under the bend load that can break the hermetic proofing of flanged connections. The adapter (collar), flange, and the sealing gasket should be aligned exactly by the pipeline axel. When installing gaskets between flanges, make sure to check whether the seal dimensions match the inner and outer flange adapter (collar). If the difference between the internal gasket diameter and the collar exceeds 0.4", issues with the connection may occur.

Before final tightening of the bolts, the surfaces to be connected must be aligned and precisely settled on the sealing gasket. Any tension on a pipe with flange connections is unacceptable due to the emerging tension load. The bolt length must be chosen so that its thread does exceed the flange (rise over the flange) by two or free turns of the entire thread. It is necessary to put the washer under the head of the bolt and under the nut.

In order to easily remove the bolts even after long-term use, their threads should be lubricated (e.g. molybdenum sulfide based lubricant). The bolts are tightened diagonally with a smooth transfer of power, and the nuts must be first tightened manually, so that the gasket will sit exactly in place and the distance between adapters (shoulders) is minimal. Afterwards the bolts will be cross-tightened at recommended 50% of the tightening torque, and just after this on at total 100% of the tightening torque.

Later it is recommended to check flange connections within 24 hours after the installation and, if necessary, to tighten them up again. More connection checks are required after pressure tests; tighten them once more if necessary. For more detailed information on flange connections, please refer to DVS 2210-1, Annex No. 3.

Wavin flange adaptors match with flanges with ANSI/ASME B16.5 150# hole patterns. The tightening of the bolts should follow a criss-cross pattern, the exact pattern of varies according to the number of holes.

Air Plenum Installation requirements

The Wavin PP-RCT piping system does not produce toxic by-products during combustion. In a fully developed fire, PP-RCT 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, including wood and paper.

According to the IMC and UMC building codes, materials that are completely enclosed in a fire-rated material, such as pipe insulation, are considered fire rated as well, because they are not technically exposed in the plenum.

When installed in an Air Plenum Wavin PP-RCT must be wrapped in a fiberglass or mineral wool insulation approved to ASTM E84. Fittings should ideally be wrapped and bare fittings must be kept to a minimum, under no circumstances being less than 6ft apart.

Pressure Loss Tables

Wavin PP-RCT Basalt, SDR 9, SDR 7.4; water temperature = 50 °F (10 °C)

	1/2" (20 × 2.8 mm)		3/4" (25 × 3.5 mm)		1" (32 × 4.5 mm)		1-1/4" (40 × 5.6 mm)		1-1/2" (50 × 6.9 mm)		2" (63 × 8.6 mm)		2-1/2" (75 × 8.4 mm)		3" (90 × 10.1 mm)		3-1/2" (110 × 12.3 mm)		4" (125 × 14.0 mm)	
Q US gpm	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s
0.32	0.12	0.3	0.04	0.3																
0.63	0.41	0.7	0.14	0.7																
0.95	0.83	1.3	0.29	0.7	0.09	0.3														
1.27	1.38	1.6	0.48	1.0	0.15	0.7	0.05	0.3												
1.59	2.05	2.0	0.70	1.3	0.22	0.7	0.07	0.7												
1.90	2.82	2.3	0.97	1.6	0.30	1.0	0.10	0.7	0.04	0.3										
2.22	3.71	3.0	1.28	2.0	0.40	1.0	0.14	0.7	0.04	0.3										
2.54	4.70	3.3	1.62	2.0	0.50	1.3	0.17	0.7	0.06	0.7										
2.85	5.79	3.6	1.99	2.3	0.62	1.3	0.21	1.0	0.07	0.7	0.02	0.3								
3.17	6.99	3.9	2.39	2.6	0.74	1.6	0.26	1.0	0.08	0.7	0.03	0.3	0.01	0.3						
4.76	14.43	5.9	4.92	3.9	1.52	2.3	0.52	1.6	0.18	1.0	0.06	0.7	0.02	0.3						
6.34	24.21	8.2	8.22	5.2	2.53	3.3	0.86	2.0	0.29	1.3	0.10	0.7	0.04	0.7	0.01	0.3				
7.93	36.25	10.2	12.26	6.6	3.76	3.9	1.28	2.6	0.43	1.6	0.14	1.0	0.06	0.7	0.02	0.3				
9.51			17.03	7.9	5.21	4.6	1.77	3.0	0.59	2.0	0.20	1.3	0.07	1.0	0.03	0.7				
11.10			22.50	9.2	6.86	5.6	2.32	3.6	0.77	2.3	0.26	1.3	0.10	1.0	0.03	0.7	0.01	0.3		
12.68			28.67	10.2	8.72	6.2	2.94	3.9	0.98	2.6	0.33	1.6	0.12	1.0	0.04	0.7	0.02	0.3		
14.27			35.53	11.5	10.78	7.2	3.64	4.6	1.21	3.0	0.40	2.0	0.15	1.3	0.05	0.7	0.02	0.7		
15.85					13.03	7.9	4.39	4.9	1.46	3.3	0.48	2.0	0.20	1.6	0.06	1.0	0.02	0.7	0.01	0.3
19.02					18.12	9.5	6.08	5.9	2.02	3.9	0.67	2.3	0.27	1.6	0.08	1.0	0.03	0.7	0.02	0.7
22.19					23.99	11.2	8.03	6.9	2.66	4.6	0.88	3.0	0.33	2.0	0.11	1.3	0.04	0.7	0.02	0.7
25.36							10.22	8.2	3.38	5.2	1.11	3.3	0.42	2.3	0.14	1.3	0.05	1.0	0.03	0.7
28.53							12.65	9.2	4.17	5.6	1.37	3.6	0.50	2.6	0.17	1.6	0.07	1.0	0.04	0.7
31.70							15.32	10.2	5.04	6.2	1.66	3.9	0.60	2.6	0.21	1.6	0.08	1.3	0.04	1.0
34.87							18.22	11.2	5.99	6.9	1.96	4.3	0.69	3.0	0.24	2.0	0.09	1.3	0.05	1.0
38.04									7.00	7.5	2.29	4.9	0.81	3.3	0.29	2.0	0.11	1.3	0.06	1.0
41.22									8.10	8.2	2.65	5.2	0.91	3.6	0.33	2.3	0.12	1.6	0.07	1.3
44.39									9.26	8.9	3.02	5.6	1.04	3.6	0.38	2.3	0.15	1.6	0.08	1.3
47.56									10.50	9.5	3.42	5.9	1.16	3.9	0.43	2.6	0.16	1.6	0.09	1.3
50.73									11.81	10.2	3.84	6.6	1.30	4.3	0.49	2.6	0.18	2.0	0.10	1.3
53.90									13.18	10.8	4.29	6.9	1.43	4.6	0.54	3.0	0.20	2.0	0.11	1.6
57.07									14.63	11.5	4.75	7.2	1.58	4.6	0.59	3.0	0.23	2.0	0.12	1.6
60.24											5.24	7.5	1.73	4.9	0.66	3.3	0.25	2.3	0.13	1.6
63.41											5.75	7.9	1.90	5.2	0.73	3.6	0.27	2.3	0.15	1.6
66.58											6.28	8.5	2.06	5.6	0.79	3.6	0.29	2.3	0.16	2.0
69.75											6.84	8.9	2.24	5.6	0.86	3.9	0.33	2.6	0.18	2.0
72.92											7.41	9.2	2.41	5.9	0.92	3.9	0.35	2.6	0.19	2.0
76.09											8.01	9.5	2.61	6.2	0.99	4.3	0.38	2.6	0.21	2.3
79.26											8.62	10.2	2.78	6.6	1.08	4.3	0.40	3.0	0.22	2.3
82.43													2.99	6.6	1.16	4.6	0.44	3.0	0.23	2.3
85.60													3.21	6.9	1.24	4.6	0.47	3.0	0.26	2.3
88.77													3.41	7.2	1.32	4.9	0.50	3.3	0.27	2.6
91.94													3.64	7.5	1.42	4.9	0.53	3.3	0.29	2.6
95.11													3.85	7.5	1.51	5.2	0.57	3.6	0.30	2.6
103.04													4.19	7.9	1.74	5.6	0.65	3.6	0.35	3.0
110.96													5.08	8.9	1.99	5.9	0.74	3.9	0.40	3.3
118.89													5.46	9.2	2.25	6.6	0.85	4.3	0.45	3.3
126.82													6.16	9.8	2.53	6.9	0.96	4.6	0.51	3.6
134.74															2.83	7.2	1.06	4.9	0.57	3.9
142.67															3.14	7.9	1.18	5.2	0.64	3.9
150.59															3.46	8.2	1.30	5.6	0.70	4.3
158.52															3.80	8.5	1.44	5.9	0.77	4.6
166.45															4.16	8.9	1.55	5.9	0.84	4.6
174.37															4.53	9.5	1.70	6.2	0.92	4.9
182.30															4.94	9.8	1.84	6.6	0.99	5.2
190.22																	1.98	6.9	1.07	5.2
198.15																	2.14	7.2	1.15	5.6
206.08																	2.31	7.5	1.24	5.9
214.00																	2.48	7.9	1.33	5.9
221.93																	2.63	7.9	1.41	6.2
245.71																	2.81	8.2	1.51	6.6
237.78																	3.00	8.5	1.61	6.6
245.71																	3.19	8.9	1.71	6.9
253.63																	3.37	9.2	1.82	7.2
261.56																	3.57	9.5	1.91	7.2
269.48																	3.78	9.8	2.02	7.5
277.41																			2.14	7.9
285.34																			2.26	7.9
293.26																			2.36	8.2
301.19																			2.48	8.5
309.11																			2.61	8.5
317.04																			2.74	8.9
324.97																			2.85	9.2
332.89																			2.98	9.2
340.82																			3.12	9.5
348.74																			3.26	9.8

Wavin PP-RCT Basalt, SDR 9, SDR 7.4; water temperature = 122 °F (50 °C)

	1/2" (20 × 2.8 mm)		3/4" (25 × 3.5 mm)		1" (32 × 4.5 mm)		1-1/4" (40 × 5.6 mm)		1-1/2" (50 × 6.9 mm)		2" (63 × 8.6 mm)		2-1/2" (75 × 8.4 mm)		3" (90 × 10.1 mm)		3-1/2" (110 × 12.3 mm)		4" (125 × 14.0 mm)	
Q US gpm	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s
0.32	0.10	0.3	0.04	0.3																
0.63	0.33	0.7	0.11	0.7																
0.95	0.68	1.3	0.23	0.7	0.07	0.3														
1.27	1.13	1.6	0.39	1.0	0.12	0.7	0.04	0.3												
1.59	1.68	2.0	0.58	1.3	0.18	0.7	0.06	0.7												
1.90	2.33	2.3	0.80	1.6	0.25	1.0	0.08	0.7	0.03	0.3										
2.22	3.07	3.0	1.05	2.0	0.32	1.0	0.11	0.7	0.04	0.3										
2.54	3.91	3.3	1.33	2.0	0.41	1.3	0.14	0.7	0.05	0.7										
2.85	4.84	3.6	1.64	2.3	0.51	1.3	0.17	1.0	0.06	0.7	0.02	0.3								
3.17	5.85	3.9	1.98	2.6	0.61	1.6	0.21	1.0	0.07	0.7	0.02	0.3	0.01	0.3						
4.76	12.26	5.9	4.12	3.9	1.25	2.3	0.42	1.6	0.14	1.0	0.05	0.7	0.01	0.3						
6.34	20.83	8.2	6.95	5.2	2.10	3.3	0.71	2.0	0.24	1.3	0.08	0.7	0.02	0.7	0.01	0.3				
7.93	31.52	10.2	10.46	6.6	3.15	3.9	1.06	2.6	0.35	1.6	0.11	1.0	0.04	0.7	0.01	0.3				
9.51			14.64	7.9	4.39	4.6	1.47	3.0	0.48	2.0	0.16	1.3	0.05	0.7	0.02	0.7				
11.10			19.48	9.2	5.82	5.6	1.94	3.6	0.64	2.3	0.21	1.3	0.06	1.0	0.03	0.7	0.01	0.3		
12.68			24.98	10.2	7.43	6.2	2.47	3.9	0.81	2.6	0.27	1.6	0.08	1.0	0.04	0.7	0.01	0.3		
14.27			31.14	11.5	9.24	7.2	3.06	4.6	1.01	3.0	0.33	2.0	0.10	1.0	0.04	0.7	0.02	0.7		
15.85					11.22	7.9	3.71	4.9	1.22	3.3	0.40	2.0	0.12	1.3	0.05	1.0	0.02	0.7	0.01	0.3
19.02					15.75	9.5	5.19	5.9	1.69	3.9	0.55	2.3	0.16	1.6	0.07	1.0	0.03	0.7	0.01	0.7
22.19					21.00	11.2	6.89	6.9	2.25	4.6	0.73	3.0	0.22	1.6	0.09	1.3	0.04	0.7	0.02	0.7
25.36							8.82	8.2	2.86	5.2	0.93	3.3	0.28	2.0	0.11	1.3	0.04	1.0	0.03	0.7
28.53							10.98	9.2	3.55	5.6	1.15	3.6	0.35	2.3	0.14	1.6	0.05	1.0	0.03	0.7
31.70							13.36	10.2	4.31	6.2	1.39	3.9	0.41	2.6	0.17	1.6	0.07	1.3	0.04	1.0
34.87							15.97	11.2	5.14	6.9	1.66	4.3	0.50	2.6	0.20	2.0	0.07	1.3	0.04	1.0
38.04									6.04	7.5	1.94	4.9	0.58	3.0	0.24	2.0	0.09	1.3	0.05	1.0
41.22									7.01	8.2	2.25	5.2	0.67	3.3	0.28	2.3	0.10	1.6	0.06	1.3
44.39									8.05	8.9	2.58	5.6	0.77	3.6	0.32	2.3	0.12	1.6	0.07	1.3
47.56									9.15	9.5	2.92	5.9	0.88	3.6	0.36	2.6	0.13	1.6	0.07	1.3
50.73									10.32	10.2	3.29	6.6	0.98	3.9	0.41	2.6	0.15	2.0	0.07	1.3
53.90									11.56	10.8	3.68	6.9	1.10	4.3	0.45	3.0	0.17	2.0	0.09	1.6
57.07									12.88	11.5	4.09	7.2	1.21	4.6	0.50	3.0	0.19	2.0	0.10	1.6
60.24											4.53	7.5	1.35	4.6	0.55	3.3	0.21	2.3	0.11	1.6
63.41											4.98	7.9	1.47	4.9	0.61	3.6	0.21	2.3	0.12	2.0
66.58											5.45	8.5	1.62	5.2	0.67	3.6	0.25	2.3	0.14	2.0
69.75											5.95	8.9	1.76	5.6	0.72	3.9	0.27	2.6	0.15	2.0
72.92											6.46	9.2	1.91	5.6	0.78	3.9	0.29	2.6	0.16	2.0
76.09											6.99	9.5	2.06	5.9	0.85	4.3	0.32	2.6	0.17	2.3
79.26											7.55	10.2	2.24	6.2	0.92	4.3	0.34	3.0	0.18	2.3
82.43													2.39	6.6	0.99	4.6	0.37	3.0	0.20	2.3
85.60													2.58	6.6	1.05	4.6	0.39	3.0	0.21	2.3
88.77													2.74	6.9	1.12	4.9	0.42	3.3	0.23	2.6
91.94													2.94	7.2	1.21	4.9	0.45	3.3	0.24	2.6
95.11													3.15	7.5	1.29	5.2	0.48	3.6	0.26	2.6
103.04													3.64	7.9	1.49	5.6	0.55	3.6	0.29	3.0
110.96													4.21	8.5	1.71	5.9	0.63	3.9	0.34	3.3
118.89													4.77	9.2	1.94	6.6	0.72	4.3	0.38	3.3
126.82													5.39	9.8	2.19	6.9	0.81	4.6	0.43	3.6
134.74															2.45	7.2	0.90	4.9	0.49	3.9
142.67															2.72	7.9	1.01	5.2	0.54	3.9
150.59															3.01	8.2	1.12	5.6	0.60	4.3
158.52															3.31	8.5	1.23	5.9	0.66	4.6
166.45															3.63	8.9	1.34	5.9	0.72	4.6
174.37															3.96	9.5	1.47	6.2	0.78	4.9
182.30															4.33	9.8	1.59	6.6	0.85	5.2
190.22																	1.72	6.9	0.92	5.2
198.15																	1.86	7.2	0.99	5.6
206.08																	2.00	7.5	1.07	5.9
214.00																	2.15	7.9	1.15	5.9
221.93																	2.29	7.9	1.22	6.2
229.85																	2.45	8.2	1.31	6.6
237.78																	2.62	8.5	1.40	6.6
245.71																	2.79	8.9	1.48	6.9
253.63																	2.94	9.2	1.58	7.2
261.56																	3.13	9.5	1.66	7.2
269.48																	3.31	9.8	1.76	7.5
277.41																			1.86	7.9
285.34																			1.97	7.9
293.26																			2.06	8.2
301.19																			2.17	8.5
309.11																			2.28	8.5
317.04																			2.39	8.9
324.97																			2.50	9.2
332.89																			2.61	9.2
340.82																			2.74	9.5
348.74																			2.87	9.8

Pressure Loss Tables

Wavin PP-RCT Basalt, SDR 9, SDR 7.4; water temperature = 176 °F (80 °C)

	1/2" (20 × 2.8 mm)		3/4" (25 × 3.5 mm)		1" (32 × 4.5 mm)		1-1/4" (40 × 5.6 mm)		1-1/2" (50 × 6.9 mm)		2" (63 × 8.6 mm)		2-1/2" (75 × 8.4 mm)		3" (90 × 10.1 mm)		3-1/2" (110 × 12.3 mm)		4" (125 × 14.0 mm)	
Q US gpm	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s
0.32	0.08	0.3	0.03	0.3																
0.63	0.29	0.7	0.10	0.7	0.03	0.3	0.01	0.3												
0.95	0.59	1.3	0.21	0.7	0.06	0.3	0.02	0.3	0.01	0.3										
1.27	0.97	1.6	0.33	1.0	0.10	0.7	0.04	0.3	0.01	0.3										
1.59	1.44	2.0	0.49	1.3	0.15	0.7	0.05	0.7	0.02	0.3										
1.90	2.05	2.3	0.68	1.6	0.21	1.0	0.07	0.7	0.03	0.3	0.01	0.3								
2.22	2.69	3.0	0.91	2.0	0.28	1.0	0.09	0.7	0.04	0.3	0.01	0.3								
2.54	3.42	3.3	1.16	2.0	0.36	1.3	0.12	0.7	0.04	0.7	0.01	0.3								
2.85	4.30	3.6	1.44	2.3	0.43	1.3	0.15	1.0	0.05	0.7	0.02	0.3								
3.17	5.19	3.9	1.75	2.6	0.52	1.6	0.18	1.0	0.06	0.7	0.02	0.3	0.01	0.3						
4.76	10.97	5.9	3.64	3.9	1.09	2.3	0.37	1.6	0.12	1.0	0.04	0.7	0.01	0.3						
6.34	18.92	8.2	6.19	5.2	1.84	3.3	0.61	2.0	0.21	1.3	0.07	0.7	0.02	0.7	0.01	0.3				
7.93	28.78	10.2	9.37	6.6	2.78	3.9	0.93	2.6	0.31	1.6	0.10	1.0	0.03	0.7	0.01	0.3				
9.51			13.29	7.9	3.90	4.6	1.29	3.0	0.42	2.0	0.14	1.3	0.04	0.7	0.02	0.7				
11.10			17.74	9.2	5.19	5.6	1.71	3.6	0.56	2.3	0.18	1.3	0.06	1.0	0.02	0.7	0.01	0.3		
12.68			22.82	10.2	6.74	6.2	2.21	3.9	0.72	2.6	0.23	1.6	0.07	1.0	0.03	0.7	0.01	0.3		
14.27			28.67	11.5	8.39	7.2	2.73	4.6	0.88	3.0	0.29	2.0	0.09	1.0	0.04	0.7	0.01	0.7		
15.85					10.23	7.9	3.35	4.9	1.07	3.3	0.35	2.0	0.11	1.3	0.04	1.0	0.02	0.7	0.01	0.3
19.02					14.43	9.5	4.67	5.9	1.52	3.9	0.48	2.3	0.15	1.6	0.06	1.0	0.02	0.7	0.01	0.7
22.19					19.32	11.2	6.26	6.9	2.01	4.6	0.65	3.0	0.20	1.6	0.08	1.3	0.03	0.7	0.02	0.7
25.36							8.08	8.2	2.57	5.2	0.83	3.3	0.25	2.0	0.11	1.3	0.04	1.0	0.02	0.7
28.53							10.04	9.2	3.22	5.6	1.03	3.6	0.31	2.3	0.13	1.6	0.05	1.0	0.03	0.7
31.70							12.29	10.2	3.91	6.2	1.24	3.9	0.37	2.6	0.15	1.6	0.06	1.3	0.03	1.0
34.87							14.76	11.2	4.70	6.9	1.50	4.3	0.45	2.6	0.18	2.0	0.07	1.3	0.04	1.0
38.04									5.52	7.5	1.76	4.9	0.52	3.0	0.22	2.0	0.08	1.3	0.04	1.0
41.22									6.45	8.2	2.03	5.2	0.62	3.3	0.25	2.3	0.09	1.6	0.05	1.3
44.39									7.40	8.9	2.33	5.6	0.70	3.6	0.29	2.3	0.11	1.6	0.06	1.3
47.56									8.41	9.5	2.67	5.9	0.80	3.6	0.33	2.6	0.12	1.6	0.07	1.3
50.73									9.54	10.2	3.01	6.6	0.89	3.9	0.37	2.6	0.14	2.0	0.07	1.3
53.90									10.68	10.8	3.37	6.9	1.01	4.3	0.41	3.0	0.15	2.0	0.08	1.6
57.07									11.95	11.5	3.74	7.2	1.11	4.6	0.46	3.0	0.17	2.0	0.09	1.6
60.24											4.17	7.5	1.24	4.6	0.50	3.3	0.18	2.3	0.10	1.6
63.41											4.59	7.9	1.36	4.9	0.56	3.6	0.21	2.3	0.11	1.6
66.58											5.02	8.5	1.50	5.2	0.61	3.6	0.22	2.3	0.12	2.0
69.75											5.48	8.9	1.62	5.6	0.66	3.9	0.25	2.6	0.14	2.0
72.92											5.99	9.2	1.77	5.6	0.72	3.9	0.26	2.6	0.14	2.0
76.09											6.48	9.5	1.91	5.9	0.77	4.3	0.29	2.6	0.15	2.3
79.26											6.99	10.2	2.07	6.2	0.85	4.3	0.31	3.0	0.17	2.3
82.43													2.22	6.6	0.91	4.6	0.34	3.0	0.18	2.3
85.60													2.39	6.6	0.97	4.6	0.36	3.0	0.19	2.3
88.77													2.58	6.9	1.03	4.9	0.39	3.3	0.21	2.6
91.94													2.74	7.2	1.12	4.9	0.41	3.3	0.22	2.6
95.11													2.93	7.5	1.19	5.2	0.44	3.6	0.23	2.6
103.04													3.39	7.9	1.38	5.6	0.51	3.6	0.27	3.0
110.96													3.91	8.5	1.58	5.9	0.58	3.9	0.31	3.3
118.89													4.46	9.2	1.80	6.6	0.66	4.3	0.35	3.3
126.82													5.05	9.8	2.03	6.9	0.75	4.6	0.40	3.6
134.74															2.28	7.2	0.83	4.9	0.45	3.9
142.67															2.54	7.9	0.93	5.2	0.50	3.9
150.59															2.81	8.2	1.03	5.6	0.55	4.3
158.52															3.09	8.5	1.14	5.9	0.60	4.6
166.45															3.39	8.9	1.24	5.9	0.66	4.6
174.37															3.71	9.5	1.36	6.2	0.73	4.9
182.30															4.06	9.8	1.48	6.6	0.79	5.2
190.22																	1.59	6.9	0.85	5.2
198.15																	1.73	7.2	0.92	5.6
206.08																	1.87	7.5	0.99	5.9
214.00																	2.01	7.9	1.07	5.9
221.93																	2.14	7.9	1.13	6.2
229.85																	2.29	8.2	1.13	6.6
237.78																	2.45	8.5	1.30	6.6
245.71																	2.61	8.9	1.38	6.9
253.63																	2.76	9.2	1.47	7.2
261.56																	2.93	9.5	1.55	7.2
269.48																	3.11	9.8	1.64	7.5
277.41																			1.74	7.9
285.34																			1.84	7.9
293.26																			1.92	8.2
301.19																			2.02	8.5
309.11																			2.13	8.5
317.04																			2.24	8.9
324.97																			2.34	9.2
332.89																			2.45	9.2
340.82																			2.57	9.5
348.74																			2.69	9.8

Wavin PP-RCT Basalt Clima SDR 9, SDR 11; water temperature = 50 °F (10 °C)

	1/2" (20 × 2.3 mm)		3/4" (25 × 2.8 mm)		1" (32 × 2.9 mm)		1-1/4" (40 × 3.7 mm)		1-1/2" (50 × 4.6 mm)		2" (63 × 5.8 mm)		2-1/2" (75 × 6.9 mm)		3" (90 × 8.2 mm)		3-1/2" (110 × 10 mm)		4" (125 × 11.4 mm)	
Q US gpm	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s
0.32	0.09	0.3																		
0.63	0.29	0.7	0.07	0.3	0.03	0.3														
0.95	0.60	1.0	0.15	0.7	0.05	0.3	0.02	0.3												
1.27	1.00	1.3	0.33	1.0	0.08	0.7	0.03	0.3	0.01	0.3										
1.59	1.48	1.6	0.50	1.0	0.12	0.7	0.04	0.3	0.01	0.3										
1.90	2.05	2.0	0.69	1.3	0.17	0.7	0.06	0.3	0.02	0.3										
2.22	2.69	2.6	0.87	1.6	0.22	1.0	0.07	0.7	0.03	0.3	0.01	0.3								
2.54	3.41	3.0	1.11	1.6	0.28	1.0	0.10	0.7	0.03	0.3	0.01	0.3								
2.85	4.20	3.3	1.37	2.0	0.34	1.0	0.12	0.7	0.04	0.3	0.01	0.3								
3.17	5.06	3.6	1.66	2.3	0.41	1.3	0.14	0.7	0.05	0.7	0.02	0.3	0.01	0.3						
4.76	10.43	5.2	3.33	3.3	0.85	2.0	0.29	1.3	0.10	0.7	0.03	0.3	0.01	0.3						
6.34	17.48	6.9	5.58	4.6	1.40	2.6	0.48	1.6	0.16	1.0	0.05	0.7	0.02	0.3	0.01	0.3				
7.93	26.14	8.9	8.34	5.6	2.09	3.0	0.70	2.0	0.24	1.3	0.08	0.7	0.04	0.7	0.01	0.3				
9.51	36.39	10.5	11.60	6.6	2.88	3.6	0.97	2.3	0.33	1.6	0.11	1.0	0.05	0.7	0.02	0.3	0.01	0.3		
11.10			15.35	7.9	3.80	4.3	1.28	2.6	0.44	1.6	0.15	1.0	0.06	0.7	0.03	0.7	0.01	0.3		
12.68			19.58	8.9	4.82	4.9	1.62	3.3	0.55	2.0	0.18	1.3	0.08	1.0	0.04	0.7	0.01	0.3	0.01	0.3
14.27			24.14	9.8	5.95	5.6	2.00	3.6	0.68	2.3	0.22	1.3	0.10	1.0	0.04	0.7	0.02	0.3	0.01	0.3
15.85			29.30	11.2	7.19	6.2	2.42	3.9	0.82	2.6	0.27	1.6	0.12	1.0	0.05	0.7	0.02	0.7	0.01	0.3
19.02					9.99	7.5	3.35	4.6	1.14	3.0	0.37	2.0	0.16	1.3	0.07	1.0	0.03	0.7	0.01	0.3
22.19					13.20	8.5	4.41	5.6	1.50	3.6	0.49	2.3	0.22	1.6	0.09	1.0	0.04	0.7	0.02	0.3
25.36					16.81	9.8	5.60	6.2	1.90	3.9	0.63	2.6	0.27	1.6	0.11	1.3	0.04	1.0	0.02	0.7
28.53					20.83	11.2	6.93	7.2	2.34	4.6	0.77	3.0	0.33	2.0	0.14	1.3	0.05	1.0	0.03	0.7
31.70							8.38	7.9	2.83	4.9	0.93	3.3	0.40	2.3	0.17	1.6	0.06	1.0	0.04	0.7
34.87							9.96	8.5	3.35	5.6	1.10	3.6	0.48	2.3	0.20	1.6	0.07	1.0	0.04	1.0
38.04							11.66	9.5	3.92	5.9	1.29	3.9	0.55	2.6	0.23	2.0	0.09	1.3	0.04	1.0
41.22							13.49	10.2	4.53	6.6	1.48	4.3	0.64	3.0	0.26	2.0	0.10	1.3	0.05	1.0
44.39							15.44	11.2	5.18	6.9	1.69	4.3	0.73	3.3	0.30	2.3	0.11	1.3	0.06	1.0
47.56									5.86	7.5	1.92	4.6	0.83	3.3	0.34	2.3	0.13	1.6	0.07	1.3
50.73									6.59	7.9	2.15	4.9	0.93	3.6	0.38	2.6	0.15	1.6	0.08	1.3
53.90									7.36	8.5	2.40	5.2	1.03	3.9	0.43	2.6	0.16	1.6	0.08	1.3
57.07									8.16	9.2	2.66	5.6	1.14	3.9	0.47	2.6	0.18	2.0	0.10	1.3
60.24									9.00	9.5	2.93	5.9	1.26	4.3	0.52	3.0	0.20	2.0	0.11	1.6
63.41									9.89	10.2	3.22	6.2	1.38	4.6	0.57	3.0	0.22	2.0	0.11	1.6
66.58									10.80	10.5	3.51	6.6	1.51	4.6	0.62	3.3	0.24	2.3	0.12	1.6
69.75									11.76	11.2	3.82	6.9	1.64	4.9	0.67	3.3	0.26	2.3	0.14	1.6
72.92									12.76	11.5	4.14	7.2	1.78	5.2	0.73	3.6	0.28	2.3	0.15	2.0
76.09											4.47	7.5	1.92	5.2	0.79	3.6	0.30	2.6	0.16	2.0
79.26											4.81	7.9	2.06	5.6	0.85	3.9	0.32	2.6	0.17	2.0
82.43													2.17	5.9	0.89	3.9	0.34	2.6	0.18	2.0
85.60													2.30	5.9	0.96	4.3	0.37	3.0	0.20	2.3
88.77													2.47	6.6	1.03	4.3	0.39	3.0	0.21	2.3
91.94													2.63	6.6	1.09	4.6	0.41	3.0	0.22	2.3
95.11													2.80	6.6	1.16	4.6	0.44	3.0	0.24	2.3
98.28													2.96	6.9	1.24	4.9	0.46	3.3	0.26	2.6
101.45															1.30	4.9	0.50	3.3	0.27	2.6
104.62															1.38	5.2	0.52	3.3	0.28	2.6
107.79															1.46	5.2	0.55	3.6	0.30	2.6
110.96															1.55	5.6	0.58	3.6	0.31	3.0
118.89															1.73	5.9	0.66	3.9	0.36	3.0
126.82															1.96	6.2	0.74	4.3	0.40	3.3
134.74															2.19	6.6	0.83	4.3	0.45	3.3
142.67															2.44	6.9	0.91	4.6	0.50	3.6
150.59																	1.00	4.9	0.55	3.9
158.52																	1.10	5.2	0.60	3.9
166.45																	1.21	5.6	0.65	4.3
174.37																	1.32	5.6	0.71	4.3
182.30																	1.43	5.9	0.77	4.6
190.22																	1.55	6.2	0.83	4.9
198.15																	1.66	6.6	0.89	4.9
206.08																	1.78	6.6	0.96	5.2
214.00																	1.91	6.9	1.03	5.6
221.93																	2.04	7.2	1.10	5.6
245.71																	2.18	7.5	1.18	5.9
237.78																	2.32	7.9	1.25	5.9
245.71																			1.33	6.2
253.63																			1.40	6.6
261.56																			1.48	6.6
269.48																			1.57	6.9
277.41																			1.65	6.9
285.34																			1.74	7.2
293.26																			1.84	7.5
301.19																			1.93	7.5
309.11																			2.02	7.9

Pressure Loss Tables

Wavin PP-RCT Basalt Clima SDR 9, SDR 11; water temperature = 122 °F (50 °C)

	1/2" (20 × 2.3 mm)		3/4" (25 × 2.8 mm)		1" (32 × 2.9 mm)		1-1/4" (40 × 3.7 mm)		1-1/2" (50 × 4.6 mm)		2" (63 × 5.8 mm)		2-1/2" (75 × 6.9 mm)		3" (90 × 8.2 mm)		3-1/2" (110 × 10 mm)		4" (125 × 11.4 mm)	
Q US gpm	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s
0.32	0.06	0.44																		
0.63	0.23	0.7	0.08	0.3	0.01	0.3														
0.95	0.48	1.0	0.15	0.7	0.04	0.3	0.01	0.3												
1.27	0.80	1.3	0.26	1.0	0.07	0.7	0.03	0.3	0.01	0.3										
1.59	1.19	1.6	0.39	1.0	0.10	0.7	0.04	0.3	0.01	0.3										
1.90	1.62	2.0	0.55	1.3	0.12	0.7	0.04	0.3	0.01	0.3										
2.22	2.14	2.6	0.70	1.6	0.17	1.0	0.06	0.7	0.02	0.3										
2.54	2.74	3.0	0.89	1.6	0.22	1.0	0.07	0.7	0.03	0.3	0.01	0.3								
2.85	3.41	3.3	1.11	2.0	0.26	1.0	0.10	0.7	0.03	0.3	0.01	0.3								
3.17	4.07	3.6	1.35	2.3	0.31	1.3	0.11	0.7	0.04	0.7	0.01	0.3								
4.76	8.57	5.2	2.75	3.3	0.66	2.0	0.22	1.3	0.08	0.7	0.03	0.3	0.01	0.3						
6.34	14.61	7.2	4.66	4.6	1.08	2.3	0.38	1.6	0.13	1.0	0.04	0.7	0.02	0.3	0.01	0.3				
7.93	22.01	8.9	7.04	5.6	1.63	3.0	0.56	2.0	0.19	1.3	0.06	0.7	0.03	0.7	0.01	0.3				
9.51	31.02	10.5	9.87	6.6	2.25	3.6	0.78	2.3	0.26	1.6	0.09	1.0	0.04	0.7	0.02	0.3				
11.10			10.08	7.9	3.00	4.3	1.03	2.6	0.35	1.6	0.11	1.0	0.05	0.7	0.02	0.7	0.01	0.3		
12.68			16.89	8.9	3.81	4.9	1.32	3.3	0.44	2.0	0.15	1.3	0.06	1.0	0.03	0.7	0.01	0.3		
14.27			20.94	9.8	4.75	5.6	1.63	3.6	0.55	2.3	0.18	1.3	0.07	1.0	0.03	0.7	0.01	0.3	0.01	0.3
15.85			25.55	11.2	5.74	6.2	1.98	3.9	0.66	2.6	0.22	1.6	0.09	1.0	0.04	0.7	0.02	0.7	0.01	0.3
19.02					8.12	7.2	2.77	4.6	0.92	3.0	0.30	2.0	0.13	1.3	0.05	1.0	0.02	0.7	0.01	0.7
22.19					10.81	8.5	3.68	5.6	1.22	3.6	0.39	2.3	0.17	1.6	0.07	1.0	0.03	0.7	0.01	0.7
25.36					13.86	9.8	4.71	6.2	1.55	3.9	0.51	2.6	0.22	1.6	0.09	1.3	0.04	1.0	0.02	0.7
28.53					17.28	10.8	5.85	7.2	1.95	4.6	0.63	3.0	0.27	2.0	0.11	1.3	0.04	1.0	0.02	0.7
31.70							7.12	7.9	2.35	4.9	0.75	3.3	0.33	2.3	0.13	1.6	0.05	1.0	0.03	0.7
34.87							8.51	8.5	2.80	5.6	0.90	3.6	0.38	2.3	0.16	1.6	0.06	1.3	0.04	1.0
38.04							10.02	9.5	3.31	5.9	1.07	3.9	0.44	2.6	0.18	2.0	0.07	1.3	0.04	1.0
41.22							11.57	10.2	3.83	6.6	1.22	4.3	0.52	3.0	0.22	2.0	0.08	1.3	0.04	1.0
44.39							13.31	11.2	4.38	6.9	1.41	4.6	0.59	3.3	0.25	2.3	0.09	1.3	0.05	1.0
47.56									4.97	7.5	1.61	4.9	0.66	3.3	0.28	2.3	0.11	1.6	0.06	1.3
50.73									5.63	8.2	1.80	5.2	0.75	3.6	0.31	2.6	0.12	1.6	0.07	1.3
53.90									6.29	8.5	2.02	5.2	0.85	3.9	0.35	2.6	0.13	1.6	0.07	1.3
57.07									6.99	9.2	2.23	5.6	0.94	3.9	0.39	3.0	0.15	2.0	0.08	1.3
60.24									7.77	9.5	2.47	5.9	1.03	4.3	0.42	3.0	0.16	2.0	0.09	1.6
63.41									8.54	10.2	2.73	6.2	1.14	4.6	0.47	3.3	0.18	2.0	0.10	1.6
66.58									9.35	10.5	2.97	6.6	1.25	4.6	0.52	3.3	0.19	2.3	0.11	1.6
69.75									10.25	11.2	3.25	6.9	1.36	4.9	0.55	3.3	0.21	2.3	0.11	2.0
72.92									11.12	11.5	3.54	7.2	1.47	5.2	0.60	3.6	0.22	2.3	0.12	2.0
76.09											3.81	7.5	1.59	5.2	0.66	3.6	0.24	2.6	0.14	2.0
79.26											4.13	7.9	1.72	5.6	0.71	3.9	0.27	2.6	0.15	2.0
82.43											4.45	8.2	1.85	5.9	0.76	3.9	0.29	2.6	0.15	2.0
85.60											4.76	8.5	1.97	5.9	0.81	4.3	0.31	3.0	0.17	2.3
88.77											5.11	8.9	2.12	6.2	0.88	4.3	0.33	3.0	0.18	2.3
91.94											5.47	9.2	2.27	6.6	0.92	4.6	0.35	3.0	0.19	2.3
95.11											5.80	9.5	1.54	6.6	0.99	4.6	0.37	3.0	0.20	2.3
98.28											6.18	9.8	2.55	6.9	1.05	4.9	0.39	3.3	0.22	2.6
101.45											6.54	10.2	2.72	7.2	1.11	4.9	0.42	3.3	0.22	2.6
104.62											6.95	10.5	2.88	7.2	1.18	5.2	0.44	3.3	0.23	2.6
107.79											7.36	10.8	3.05	7.5	1.25	5.2	0.47	3.6	0.25	2.6
110.96											7.75	11.2	3.20	7.9	1.32	5.6	0.49	3.6	0.26	3.0
118.89															1.49	5.9	0.56	3.9	0.30	3.0
126.82															1.69	6.2	0.63	4.3	0.34	3.3
134.74															1.89	6.6	0.70	4.3	0.38	3.3
142.67															2.11	6.9	0.77	4.6	0.42	3.6
150.59															2.32	7.2	0.86	4.9	0.46	3.9
158.52															2.55	7.9	0.95	5.2	0.51	3.9
166.45																	1.04	5.6	0.55	4.3
174.37																	1.13	5.6	0.61	4.3
182.30																	1.23	5.9	0.66	4.6
190.22																	1.33	6.2	0.71	4.9
198.15																	1.43	6.6	0.77	4.9
206.08																	1.54	6.6	0.82	5.2
214.00																	1.66	6.9	0.89	5.6
221.93																	1.77	7.2	0.95	5.6
245.71																	1.90	7.5	1.02	5.9
237.78																	2.02	7.9	1.08	5.9
245.71																			1.14	6.2
253.63																			1.21	6.6
261.56																			1.29	6.6
269.48																			1.36	6.9
277.41																			1.44	6.9
285.34																			1.51	7.2
293.26																			1.60	7.5
301.19																			1.68	7.5
309.11																			1.77	7.9

Wavin PP-RCT (monolayer) SDR 7.4, SDR 9; water temperature = 50 °F (10 °C)

	1/2" (20 × 2.3 mm)		3/4" (25 × 2.8 mm)		1" (32 × 3.6 mm)		1-1/4" (40 × 4.5 mm)		1-1/2" (50 × 4.6 mm)		2" (63 × 7.1 mm)		2-1/2" (75 × 8.4 mm)		3" (90 × 10.1 mm)		3-1/2" (110 × 12.3 mm)		4" (125 × 14.0 mm)	
Q US gpm	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s
0.32	0.09	0.3																		
0.63	0.29	0.7	0.07	0.3	0.03	0.3														
0.95	0.60	1.0	0.15	0.7	0.04	0.3	0.02	0.3												
1.27	1.00	1.3	0.33	1.0	0.08	0.7	0.03	0.3												
1.59	1.48	1.6	0.50	1.0	0.16	0.7	0.04	0.3	0.01	0.3										
3.17	5.06	3.6	1.66	2.3	0.50	1.3	0.17	1.0	0.06	0.7	0.02	0.3	0.01	0.3						
4.76	10.43	5.2	3.33	3.3	1.03	2.0	0.36	1.3	0.12	1.0	0.04	0.7	0.02	0.3						
6.34	17.48	6.9	5.58	4.6	1.73	2.6	0.59	1.6	0.21	1.0	0.07	0.7	0.04	0.7	0.01	0.3				
7.93	26.14	8.9	8.34	5.6	2.58	3.3	0.87	2.3	0.29	1.3	0.10	1.0	0.06	0.7	0.02	0.3				
9.51	36.39	10.5	11.60	6.6	3.53	3.9	1.20	2.6	0.42	1.6	0.14	1.0	0.07	1.0	0.03	0.7				
11.10			15.35	7.9	4.67	4.9	1.60	3.0	0.54	2.0	0.18	1.3	0.10	1.0	0.03	0.7	0.01	0.3		
12.68			19.58	8.9	5.95	5.6	2.02	3.6	0.69	2.3	0.23	1.3	0.12	1.0	0.04	0.7	0.02	0.3		
14.27			24.14	9.8	7.30	6.2	2.48	3.9	0.85	2.6	0.28	1.6	0.15	1.3	0.05	0.7	0.02	0.7		
15.85			29.30	11.2	8.86	6.9	2.98	4.3	1.03	3.0	0.33	1.6	0.20	1.6	0.06	1.0	0.02	0.7	0.01	0.3
19.02					12.29	8.2	4.17	5.2	1.40	3.3	0.47	2.0	0.27	1.6	0.08	1.0	0.03	0.7	0.02	0.7
22.19					16.34	9.5	5.48	6.2	1.85	3.9	0.62	2.6	0.33	2.0	0.11	1.3	0.04	0.7	0.02	0.7
25.36							7.02	6.9	2.36	4.6	0.79	3.0	0.42	2.3	0.14	1.3	0.05	1.0	0.03	0.7
28.53							8.66	7.9	2.91	4.9	0.96	3.3	0.50	2.6	0.17	1.6	0.07	1.0	0.04	0.7
31.70							10.53	8.9	3.53	5.6	1.17	3.6	0.60	2.6	0.21	1.6	0.08	1.3	0.04	1.0
34.87							12.49	9.5	4.20	6.2	1.39	3.9	0.69	3.0	0.24	2.0	0.09	1.3	0.05	1.0
38.04							14.70	10.5	5.19	6.6	1.61	4.3	0.81	3.3	0.29	2.0	0.11	1.3	0.06	1.0
41.22									5.70	7.2	1.87	4.6	0.91	3.6	0.33	2.3	0.12	1.6	0.07	1.3
44.39									6.52	7.9	2.15	4.9	1.04	3.6	0.38	2.3	0.15	1.6	0.08	1.3
47.56									7.40	8.2	2.42	5.2	1.16	3.9	0.43	2.6	0.16	1.6	0.09	1.3
50.73									8.33	8.9	2.72	5.6	1.30	4.3	0.49	2.6	0.18	2.0	0.10	1.3
53.90									9.31	9.5	3.05	5.9	1.43	4.6	0.54	3.0	0.20	2.0	0.11	1.6
57.07											3.36	6.2	1.58	4.6	0.59	3.0	0.23	2.0	0.12	1.6
60.24											3.72	6.6	1.73	4.9	0.66	3.3	0.25	2.3	0.13	1.6
63.41											4.09	6.9	1.90	5.2	0.73	3.6	0.27	2.3	0.15	1.6
66.58											4.48	7.5	2.06	5.6	0.79	3.6	0.29	2.3	0.16	2.0
69.75											4.85	7.9	2.24	5.6	0.86	3.9	0.33	2.6	0.18	2.0
72.92											5.27	8.2	2.41	5.9	0.92	3.9	0.35	2.6	0.19	2.0
76.09											5.71	8.5	2.61	6.2	0.99	4.3	0.38	2.6	0.21	2.3
79.26											6.12	8.9	2.78	6.6	1.08	4.3	0.40	3.0	0.22	2.3
82.43											6.59	9.2	2.99	6.6	1.16	4.6	0.44	3.0	0.23	2.3
85.60											7.08	9.5	3.21	6.9	1.24	4.6	0.47	3.0	0.26	2.3
88.77											7.54	9.8	3.41	7.2	1.32	4.9	0.50	3.3	0.27	2.6
91.94													3.64	7.5	1.42	4.9	0.53	3.3	0.29	2.6
95.11													3.85	7.5	1.51	5.2	0.57	3.6	0.30	2.6
98.28													4.19	7.9	1.74	5.6	0.65	3.6	0.35	3.0
101.45													5.08	8.9	1.99	5.9	0.74	3.9	0.40	3.3
104.62													5.46	9.2	2.25	6.6	0.85	4.3	0.45	3.3
107.79													6.16	9.8	2.53	6.9	0.96	4.6	0.51	3.6
110.96															2.83	7.2	1.06	4.9	0.57	3.9
118.89															3.14	7.9	1.18	5.2	0.64	3.9
126.82															3.46	8.2	1.30	5.6	0.70	4.3
134.74															3.80	8.5	1.44	5.9	0.77	4.6
142.67															4.16	8.9	1.55	5.9	0.84	4.6
150.59															4.53	9.5	1.70	6.2	0.92	4.9
158.52															4.94	9.8	1.84	6.6	0.99	5.2
166.45																	1.98	6.9	1.07	5.2
174.37																	2.14	7.2	1.15	5.6
182.30																	2.31	7.5	1.24	5.9
190.22																	2.48	7.9	1.33	5.9
198.15																	2.63	7.9	1.41	6.2
206.08																	2.81	8.2	1.51	6.6
214.00																	3.00	8.5	1.61	6.6
221.93																	3.19	8.9	1.71	6.9
245.71																	3.37	9.2	1.82	7.2
237.78																	3.57	9.5	1.91	7.2
245.71																	3.78	9.8	2.02	7.5
253.63																			2.14	7.9
261.56																			2.26	7.9
269.48																			2.36	8.2
277.41																			2.48	8.5
285.34																			2.61	8.5
293.26																			2.74	8.9
301.19																			2.85	9.2
309.11																			2.98	9.2
317.04																			3.12	9.5
324.97																			3.26	9.8

Pressure Loss Tables

Wavin PP-RCT (monolayer) SDR 7.4, SDR 9; water temperature = 122 °F (50 °C)

	1/2" (20 × 2.3 mm)		3/4" (25 × 2.8 mm)		1" (32 × 3.6 mm)		1-1/4" (40 × 4.5 mm)		1-1/2" (50 × 4.6 mm)		2" (63 × 7.1 mm)		2-1/2" (75 × 8.4 mm)		3" (90 × 10.1 mm)		3-1/2" (110 × 12.3 mm)		4" (125 × 14.0 mm)	
Q US gpm	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s
0.32	0.06	0.3																		
0.63	0.23	0.7	0.08	0.3	0.01	0.3														
0.95	0.48	1.0	0.15	0.7	0.04	0.3	0.01	0.3												
1.27	0.80	1.3	0.26	1.0	0.07	0.7	0.03	0.3	0.01	0.3										
1.59	1.19	1.6	0.39	1.0	0.12	0.7	0.04	0.3	0.01	0.3										
3.17	4.07	3.6	1.35	2.3	0.40	1.3	0.14	1.0	0.07	0.7	0.02	0.3	0.01	0.3						
4.76	8.57	5.2	2.75	3.3	0.84	2.0	0.29	1.3	0.10	1.0	0.03	0.7	0.01	0.3						
6.34	14.61	7.2	4.66	4.6	1.42	2.6	0.48	1.6	0.16	1.0	0.05	0.7	0.02	0.7	0.01	0.3				
7.93	22.01	8.9	7.04	5.6	2.14	3.3	0.71	2.3	0.24	1.3	0.08	1.0	0.04	0.7	0.01	0.3				
9.51	31.02	10.5	9.87	6.6	2.94	3.9	0.99	2.6	0.34	1.6	0.11	1.0	0.05	0.7	0.02	0.7				
11.10			10.08	7.9	3.92	4.9	1.33	3.0	0.44	2.0	0.15	1.3	0.06	1.0	0.03	0.7	0.01	0.3		
12.68			16.89	8.9	5.03	5.6	1.68	3.6	0.57	2.3	0.19	1.3	0.08	1.0	0.04	0.7	0.01	0.3		
14.27			20.94	9.8	6.20	6.2	2.07	3.9	0.70	2.6	0.23	1.6	0.10	1.0	0.04	0.7	0.02	0.7		
15.85			25.55	11.2	7.56	6.9	2.51	4.3	0.85	3.0	0.27	1.6	0.12	1.3	0.05	1.0	0.02	0.7	0.01	0.3
19.02					10.58	8.2	3.53	5.2	1.17	3.3	0.39	2.0	0.16	1.6	0.07	1.0	0.03	0.7	0.01	0.7
22.19					14.18	9.5	4.67	6.2	1.55	3.9	0.52	2.6	0.22	1.6	0.09	1.3	0.04	0.7	0.02	0.7
25.36							6.01	6.9	1.99	4.6	0.66	3.0	0.28	2.0	0.11	1.3	0.04	1.0	0.03	0.7
28.53							7.46	7.9	2.47	4.9	0.81	3.3	0.35	2.3	0.14	1.6	0.05	1.0	0.03	0.7
31.70							9.12	8.9	3.00	5.6	0.98	3.6	0.41	2.6	0.17	1.6	0.07	1.3	0.04	1.0
34.87							10.86	9.5	3.59	6.2	1.17	3.9	0.50	2.6	0.20	2.0	0.07	1.3	0.04	1.0
38.04							12.83	10.5	4.22	6.6	1.36	4.3	0.58	3.0	0.24	2.0	0.09	1.3	0.05	1.0
41.22									4.90	7.2	1.58	4.6	0.67	3.3	0.28	2.3	0.10	1.6	0.06	1.3
44.39									0.00	7.9	1.82	4.9	0.77	3.6	0.32	2.3	0.12	1.6	0.07	1.3
47.56									6.40	8.2	2.06	5.2	0.88	3.6	0.36	2.6	0.13	1.6	0.07	1.3
50.73									7.23	8.9	2.32	5.6	0.98	3.9	0.41	2.6	0.15	2.0	0.07	1.3
53.90									8.10	9.5	2.61	5.9	1.10	4.3	0.45	3.0	0.17	2.0	0.09	1.6
57.07											2.88	6.2	1.21	4.6	0.50	3.0	0.19	2.0	0.10	1.6
60.24											3.19	6.6	1.35	4.6	0.55	3.3	0.21	2.3	0.11	1.6
63.41											3.52	6.9	1.47	4.9	0.61	3.6	0.21	2.3	0.12	2.0
66.58											3.86	7.5	1.62	5.2	0.67	3.6	0.25	2.3	0.14	2.0
69.75											4.20	7.9	1.76	5.6	0.72	3.9	0.27	2.6	0.15	2.0
72.92											4.57	8.2	1.91	5.6	0.78	3.9	0.29	2.6	0.16	2.0
76.09											4.96	8.5	2.06	5.9	0.85	4.3	0.32	2.6	0.17	2.3
79.26											5.33	8.9	2.24	6.2	0.92	4.3	0.34	3.0	0.18	2.3
82.43											5.74	9.2	2.39	6.6	0.99	4.6	0.37	3.0	0.20	2.3
85.60											6.18	9.5	2.58	6.6	1.05	4.6	0.39	3.0	0.21	2.3
88.77											6.59	9.8	2.74	6.9	1.12	4.9	0.42	3.3	0.23	2.6
91.94													2.94	7.2	1.21	4.9	0.45	3.3	0.24	2.6
95.11													3.15	7.5	1.29	5.2	0.48	3.6	0.26	2.6
98.28													3.64	7.9	1.49	5.6	0.55	3.6	0.29	3.0
101.45													4.18	8.5	1.71	5.9	0.63	3.9	0.34	3.3
104.62													4.77	9.2	1.94	6.6	0.72	4.3	0.38	3.3
107.79													5.39	9.8	2.19	6.9	0.81	4.6	0.43	3.6
110.96															2.45	7.2	0.90	4.9	0.49	3.9
118.89															2.72	7.9	1.01	5.2	0.54	3.9
126.82															3.01	8.2	1.12	5.6	0.60	4.3
134.74															3.31	8.5	1.23	5.9	0.66	4.6
142.67															3.63	8.9	1.34	5.9	0.72	4.6
150.59															3.96	9.5	1.47	6.2	0.78	4.9
158.52															4.33	9.8	1.59	6.6	0.85	5.2
166.45																	1.72	6.9	0.92	5.2
174.37																	1.86	7.2	0.99	5.6
182.30																	2.00	7.5	1.07	5.9
190.22																	2.15	7.9	1.15	5.9
198.15																	2.29	7.9	1.22	6.2
206.08																	2.45	8.2	1.31	6.6
214.00																	2.62	8.5	1.40	6.6
221.93																	2.79	8.9	1.48	6.9
245.71																	2.94	9.2	1.58	7.2
237.78																	3.13	9.5	1.66	7.2
245.71																	3.31	9.8	1.76	7.5
253.63																			1.86	7.9
261.56																			1.97	7.9
269.48																			2.06	8.2
277.41																			2.17	8.5
285.34																			2.28	8.5
293.26																			2.39	8.9
301.19																			2.50	9.2
309.11																			2.61	9.2
317.04																			2.74	9.5
324.97																			2.87	9.8

Wavin PP-RCT (monolayer) SDR 7.4, SDR 9; water temperature = 176 °F (80 °C)

	1/2" (20 × 2.3 mm)		3/4" (25 × 2.8 mm)		1" (32 × 3.6 mm)		1-1/4" (40 × 4.5 mm)		1-1/2" (50 × 4.6 mm)		2" (63 × 7.1 mm)		2-1/2" (75 × 8.4 mm)		3" (90 × 10.1 mm)		3-1/2" (110 × 12.3 mm)		4" (125 × 14.0 mm)	
Q US gpm	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s	R psi/100 ft	v ft/s
0.32																				
0.63																				
0.95					0.01	0.3														
1.27					0.03	0.3														
1.59	1.07	1.6	0.35	1.0	0.11	0.7	0.04	0.3	0.01	0.3										
3.17	3.70	3.6	1.21	2.3	0.36	1.3	0.12	1.0	0.04	0.7	0.01	0.3	0.01	0.3						
4.76	7.87	5.2	2.50	3.3	0.76	2.0	0.26	1.3	0.08	1.0	0.03	0.7	0.01	0.3						
6.34	13.51	7.2	4.27	4.6	1.29	2.6	0.43	1.6	0.15	1.0	0.05	0.7	0.02	0.7	0.01	0.3				
7.93	20.48	8.9	6.48	5.6	1.95	3.3	0.64	2.3	0.22	1.3	0.07	1.0	0.03	0.7	0.01	0.3				
9.51	29.01	10.5	9.13	6.6	2.69	3.9	0.89	2.6	0.30	1.6	0.10	1.0	0.04	0.7	0.02	0.7				
11.10			12.21	7.9	3.60	4.9	1.21	3.0	0.40	2.0	0.13	1.3	0.06	1.0	0.02	0.7	0.01	0.3		
12.68			15.73	8.9	4.63	5.6	1.53	3.6	0.52	2.3	0.17	1.3	0.07	1.0	0.03	0.7	0.01	0.3		
14.27				9.8	5.73	6.2	1.90	3.9	0.63	2.6	0.21	1.6	0.09	1.0	0.04	0.7	0.01	0.7		
15.85					7.00	6.9	2.30	4.3	0.77	3.0	0.25	1.6	0.11	1.3	0.04	1.0	0.02	0.7	0.01	0.3
19.02					9.84	8.2	3.25	5.2	1.07	3.3	0.35	2.0	0.15	1.6	0.06	1.0	0.02	0.7	0.01	0.7
22.19					13.24	9.5	4.32	6.2	1.42	3.9	0.47	2.6	0.20	1.6	0.08	1.3	0.03	0.7	0.02	0.7
25.36							5.58	6.9	1.82	4.6	0.60	3.0	0.25	2.0	0.11	1.3	0.04	1.0	0.02	0.7
28.53							6.94	7.9	2.28	4.9	0.74	3.3	0.31	2.3	0.13	1.6	0.05	1.0	0.03	0.7
31.70							8.50	8.9	2.77	5.6	0.90	3.6	0.37	2.6	0.15	1.6	0.06	1.3	0.03	1.0
34.87							10.15	9.5	3.32	6.2	1.07	3.9	0.45	2.6	0.18	2.0	0.07	1.3	0.04	1.0
38.04							12.02	10.5	3.91	6.6	1.25	4.3	0.52	3.0	0.22	2.0	0.08	1.3	0.04	1.0
41.22									4.55	7.2	1.46	4.6	0.62	3.3	0.25	2.3	0.09	1.6	0.05	1.3
44.39									5.24	7.9	1.68	4.9	0.70	3.6	0.29	2.3	0.11	1.6	0.06	1.3
47.56									5.97	8.2	1.89	5.2	0.80	3.6	0.33	2.6	0.12	1.6	0.07	1.3
50.73									6.75	8.9	2.14	5.6	0.89	3.9	0.37	2.6	0.14	2.0	0.07	1.3
53.90									7.58	9.5	2.41	5.9	1.01	4.3	0.41	3.0	0.15	2.0	0.08	1.6
57.07											2.67	6.2	1.11	4.6	0.46	3.0	0.17	2.0	0.09	1.6
60.24											2.96	6.6	1.24	4.6	0.50	3.3	0.18	2.3	0.10	1.6
63.41											3.27	6.9	1.36	4.9	0.56	3.6	0.21	2.3	0.11	1.6
66.58											3.60	7.5	1.50	5.2	0.61	3.6	0.22	2.3	0.12	2.0
69.75											3.90	7.9	1.62	5.6	0.66	3.9	0.25	2.6	0.14	2.0
72.92											4.26	8.2	1.77	5.6	0.72	3.9	0.26	2.6	0.14	2.0
76.09											4.63	8.5	1.91	5.9	0.77	4.3	0.29	2.6	0.15	2.3
79.26											4.97	8.9	2.07	6.2	0.85	4.3	0.31	3.0	0.17	2.3
82.43											5.37	9.2	2.22	6.6	0.91	4.6	0.34	3.0	0.18	2.3
85.60											5.78	9.5	2.39	6.6	0.97	4.6	0.36	3.0	0.19	2.3
88.77											6.17	9.8	2.58	6.9	1.03	4.9	0.39	3.3	0.21	2.6
91.94													2.74	7.2	1.12	4.9	0.41	3.3	0.22	2.6
95.11													2.93	7.5	1.19	5.2	0.44	3.6	0.23	2.6
103.04													3.39	7.9	1.38	5.6	0.51	3.6	0.27	3.0
110.96													3.91	8.5	1.58	5.9	0.58	3.9	0.31	3.3
118.89													4.46	9.2	1.80	6.6	0.66	4.3	0.35	3.3
126.82													5.05	9.8	2.03	6.9	0.75	4.6	0.40	3.6
134.74															2.28	7.2	0.83	4.9	0.45	3.9
142.67															2.54	7.9	0.93	5.2	0.50	3.9
150.59															2.81	8.2	1.03	5.6	0.55	4.3
158.52															3.09	8.5	1.14	5.9	0.60	4.6
166.45															3.39	8.9	1.24	5.9	0.66	4.6
174.37															3.71	9.5	1.36	6.2	0.73	4.9
182.30															4.06	9.8	1.48	6.6	0.79	5.2
190.22																	1.59	6.9	0.85	5.2
198.15																	1.73	7.2	0.92	5.6
206.08																	1.87	7.5	0.99	5.9
214.00																	2.01	7.9	1.07	5.9
221.93																	2.14	7.9	1.13	6.2
229.85																	2.29	8.2	1.13	6.6
237.78																	2.45	8.5	1.30	6.6
245.71																	2.61	8.9	1.38	6.9
253.63																	2.76	9.2	1.47	7.2
261.56																	2.93	9.5	1.55	7.2
269.48																	3.11	9.8	1.64	7.5
277.41																			1.74	7.9
285.34																			1.84	7.9
293.26																			1.92	8.2
301.19																			2.02	8.5
309.11																			2.13	8.5
317.04																			2.24	8.9
324.97																			2.34	9.2
332.89																			2.45	9.2
340.82																			2.57	9.5
348.74																			2.69	9.8

Pressure Loss Tables

Wavin PP-RCT Basalt Clima and PP-RCT monolayer, SDR 11; water temperature = 50 °F (10 °C)

	6" (160 × 14.6 mm)		8" (200 × 18.2 mm)		10" (250 × 22.7 mm)	
Q	R	v	R	v	R	v
US gpm	psi/100 ft	ft/s	psi/100 ft	ft/s	psi/100 ft	ft/s
22	0.00	0.3				
25	0.01	0.3				
29	0.01	0.3				
32	0.01	0.7				
35	0.01	0.7				
38	0.01	0.7				
41	0.02	0.7				
44	0.02	0.7				
48	0.02	0.7	0.01	0.3		
51	0.03	0.7	0.01	0.7		
54	0.03	1.0	0.01	0.7		
57	0.03	1.0	0.01	0.7		
60	0.03	1.0	0.01	0.7		
63	0.04	1.0	0.01	0.7		
67	0.04	1.0	0.01	0.7		
70	0.04	1.0	0.01	0.7		
73	0.04	1.0	0.02	0.7		
76	0.05	1.3	0.02	0.7		
79	0.05	1.3	0.02	0.7		
82	0.06	1.3	0.02	1.0	0.01	0.7
86	0.06	1.3	0.02	1.0	0.01	0.7
89	0.07	1.3	0.02	1.0	0.01	0.7
92	0.07	1.3	0.03	1.0	0.01	0.7
95	0.07	1.6	0.03	1.0	0.01	0.7
98	0.07	1.6	0.03	1.0	0.01	0.7
101	0.08	1.6	0.03	1.0	0.01	0.7
105	0.09	1.6	0.03	1.0	0.01	0.7
108	0.09	1.6	0.03	1.0	0.01	0.7
111	0.10	1.6	0.03	1.0	0.01	0.7
119	0.11	2.0	0.04	1.3	0.01	0.7
127	0.12	2.0	0.04	1.3	0.01	0.7
135	0.14	2.0	0.04	1.3	0.02	1.0
143	0.15	2.3	0.05	1.3	0.02	1.0
151	0.18	2.3	0.06	1.6	0.02	1.0
159	0.18	2.3	0.06	1.6	0.02	1.0
166	0.20	2.6	0.07	1.6	0.02	1.0
174	0.22	2.6	0.07	1.6	0.03	1.0
182	0.24	3.0	0.08	2.0	0.03	1.3
190	0.25	3.0	0.09	2.0	0.03	1.3
198	0.27	3.0	0.09	2.0	0.03	1.3
206	0.29	3.3	0.10	2.0	0.04	1.3
214	0.31	3.3	0.11	2.0	0.04	1.3
222	0.33	3.3	0.11	2.3	0.04	1.3
230	0.36	3.6	0.12	2.3	0.04	1.3
238	0.38	3.6	0.13	2.3	0.04	1.6
246	0.40	3.9	0.14	2.3	0.05	1.6
254	0.42	3.9	0.15	2.6	0.05	1.6
262	0.45	3.9	0.15	2.6	0.05	1.6
269	0.48	4.3	0.16	2.6	0.06	1.6
277	0.50	4.3	0.17	2.6	0.06	1.6

	6" (160 × 14.6 mm)		8" (200 × 18.2 mm)		10" (250 × 22.7 mm)	
Q	R	v	R	v	R	v
US gpm	psi/100 ft	ft/s	psi/100 ft	ft/s	psi/100 ft	ft/s
285	0.53	4.3	0.18	3.0	0.06	2.0
293	0.55	4.6	0.19	3.0	0.06	2.0
301	0.58	4.6	0.19	3.0	0.07	2.0
309	0.61	4.9	0.21	3.0	0.07	2.0
317	0.64	4.9	0.22	3.3	0.07	2.0
325	0.67	4.9	0.23	3.3	0.07	2.0
333	0.70	5.2	0.24	3.3	0.08	2.0
341	0.73	5.2	0.25	3.3	0.08	2.3
349	0.76	5.2	0.26	3.6	0.09	2.3
357	0.79	5.6	0.27	3.6	0.09	2.3
365	0.82	5.6	0.28	3.6	0.10	2.3
373	0.86	5.9	0.29	3.6	0.10	2.3
380	0.89	5.9	0.30	3.6	0.10	2.3
388	0.92	5.9	0.31	3.9	0.11	2.6
396	0.96	6.2	0.33	3.9	0.11	2.6
404	0.99	6.2	0.33	3.9	0.11	2.6
412	1.03	6.2	0.35	3.9	0.12	2.6
420	1.07	6.6	0.36	4.3	0.12	2.6
428	1.10	6.6	0.37	4.3	0.13	2.6
436	1.14	6.9	0.39	4.3	0.13	2.6
444	1.18	6.9	0.40	4.3	0.14	3.0
452	1.21	6.9	0.41	4.6	0.14	3.0
460	1.26	7.2	0.42	4.6	0.15	3.0
468	1.30	7.2	0.44	4.6	0.15	3.0
476	1.33	7.2	0.45	4.6	0.15	3.0
483	1.38	7.5	0.46	4.9	0.16	3.0
491	1.43	7.5	0.48	4.9	0.16	3.0
499	1.46	7.5	0.49	4.9	0.17	3.0
507	1.51	7.9	0.51	4.9	0.17	3.3
515	1.55	7.9	0.52	5.2	0.18	3.3
523			0.54	5.2	0.18	3.3
531			0.55	5.2	0.19	3.3
539			0.57	5.2	0.19	3.3
547			0.58	5.2	0.20	3.6
555			0.59	5.6	0.20	3.6
563			0.61	5.6	0.21	3.6
571			0.63	5.6	0.21	3.6
579			0.65	5.6	0.22	3.6
587			0.66	5.9	0.22	3.6
594			0.67	5.9	0.23	3.6
602			0.70	5.9	0.24	3.9
610			0.71	5.9	0.24	3.9
618			0.73	6.2	0.25	3.9
626			0.75	6.2	0.25	3.9
634			0.76	6.2	0.26	3.9
642			0.78	6.2	0.26	3.9
650			0.80	6.6	0.27	4.3
658			0.81	6.6	0.27	4.3

Wavin PP-RCT Basalt Clima and PP-RCT monolayer, SDR 11; water temperature = 50 °F (10 °C)

	6" (160 × 14.6 mm)		8" (200 × 18.2 mm)		10" (250 × 22.7 mm)	
Q	R	v	R	v	R	v
US gpm	psi/100 ft	ft/s	psi/100 ft	ft/s	psi/100 ft	ft/s
666			0.84	6.6	0.28	4.3
674			0.85	6.6	0.29	4.3
682			0.88	6.9	0.29	4.3
690			0.89	6.9	0.30	4.3
697			0.91	6.9	0.31	4.3
705			0.93	6.9	0.31	4.6
713			0.95	6.9	0.32	4.6
721			0.96	7.2	0.33	4.6
729			0.99	7.2	0.33	4.6
737			1.00	7.2	0.34	4.6
745			1.03	7.2	0.35	4.6
753			1.05	7.5	0.35	4.6
761			1.07	7.5	0.36	4.9
769			1.09	7.5	0.37	4.9
777			1.10	7.5	0.37	4.9
785			1.12	7.9	0.38	4.9
793			1.15	7.9	0.39	4.9
801			1.17	7.9	0.40	4.9
808			1.20	7.9	0.40	5.2
816			1.21	8.2	0.41	5.2
824					0.41	5.2
832					0.43	5.2
840					0.43	5.2
848					0.44	5.2
856					0.44	5.2
864					0.45	5.6
872					0.46	5.6
880					0.47	5.6
888					0.48	5.6
896					0.48	5.6
904					0.49	5.6
911					0.50	5.9
919					0.51	5.9
927					0.52	5.9
935					0.52	5.9
943					0.53	5.9
951					0.54	5.9
959					0.55	5.9
967					0.56	6.2
975					0.56	6.2
983					0.58	6.2
991					0.58	6.2
999					0.59	6.2
1007					0.60	6.2
1015					0.61	6.6
1022					0.62	6.6
1030					0.63	6.6
1038					0.63	6.6

	6" (160 × 14.6 mm)		8" (200 × 18.2 mm)		10" (250 × 22.7 mm)	
Q	R	v	R	v	R	v
US gpm	psi/100 ft	ft/s	psi/100 ft	ft/s	psi/100 ft	ft/s
1046					0.65	6.6
1054					0.65	6.6
1062					0.66	6.6
1070					0.67	6.9
1078					0.68	6.9
1086					0.69	6.9
1094					0.70	6.9
1102					0.70	6.9
1110					0.72	6.9
1118					0.73	6.9
1125					0.74	7.2
1133					0.74	7.2
1141					0.76	7.2
1149					0.77	7.2
1157					0.77	7.2
1165					0.79	7.2
1173					0.79	7.5
1181					0.81	7.5
1189					0.81	7.5
1197					0.83	7.5
1205					0.83	7.5
1213					0.85	7.5
1221					0.85	7.5
1229					0.87	7.9
1236					0.88	7.9
1244					0.89	7.9
1252					0.89	7.9
1260					0.91	7.9
1268					0.92	7.9
1276					0.93	8.2

Pressure Loss Tables

Wavin PP-RCT Basalt Clima and PP-RCT monolayer, SDR 11; water temperature = 122 °F (50 °C)

	6" (160 × 14.6 mm)		8" (200 × 18.2 mm)		10" (250 × 22.7 mm)	
Q	R	v	R	v	R	v
US gpm	psi/100 ft	ft/s	psi/100 ft	ft/s	psi/100 ft	ft/s
22						
25						
29	0.01	0.3				
32	0.01	0.7				
35	0.01	0.7				
38	0.01	0.7				
41	0.01	0.7				
44	0.02	0.7				
48	0.02	0.7				
51	0.02	0.7	0.01	0.7		
54	0.02	1.0	0.01	0.7		
57	0.03	1.0	0.01	0.7		
60	0.03	1.0	0.01	0.7		
63	0.03	1.0	0.01	0.7		
67	0.03	1.0	0.01	0.7		
70	0.04	1.0	0.01	0.7		
73	0.04	1.0	0.01	0.7		
76	0.04	1.3	0.01	0.7		
79	0.04	1.3	0.01	0.7		
82	0.05	1.3	0.02	1.0		
86	0.05	1.3	0.02	1.0		
89	0.05	1.3	0.02	1.0		
92	0.06	1.3	0.02	1.0	0.01	0.7
95	0.06	1.6	0.02	1.0	0.01	0.7
98	0.07	1.6	0.02	1.0	0.01	0.7
101	0.07	1.6	0.02	1.0	0.01	0.7
105	0.07	1.6	0.02	1.0	0.01	0.7
108	0.07	1.6	0.03	1.0	0.01	0.7
111	0.08	1.6	0.03	1.0	0.01	0.7
119	0.09	2.0	0.03	1.3	0.01	0.7
127	0.10	2.0	0.04	1.3	0.01	0.7
135	0.11	2.0	0.04	1.3	0.01	1.0
143	0.13	2.3	0.04	1.3	0.01	1.0
151	0.14	2.3	0.05	1.6	0.02	1.0
159	0.15	2.3	0.05	1.6	0.02	1.0
166	0.17	2.6	0.06	1.6	0.02	1.0
174	0.18	2.6	0.06	1.6	0.02	1.0
182	0.20	3.0	0.07	2.0	0.02	1.3
190	0.21	3.0	0.07	2.0	0.02	1.3
198	0.23	3.0	0.07	2.0	0.03	1.3
206	0.25	3.3	0.08	2.0	0.03	1.3
214	0.26	3.3	0.09	2.0	0.03	1.3
222	0.28	3.3	0.10	2.3	0.04	1.3
246	0.30	3.6	0.10	2.3	0.04	1.3
238	0.33	3.6	0.11	2.3	0.04	1.6
246	0.34	3.9	0.11	2.3	0.04	1.6
254	0.36	3.9	0.12	2.6	0.04	1.6
262	0.38	3.9	0.13	2.6	0.04	1.6
269	0.41	4.3	0.14	2.6	0.05	1.6
277	0.43	4.3	0.14	2.6	0.05	1.6

	6" (160 × 14.6 mm)		8" (200 × 18.2 mm)		10" (250 × 22.7 mm)	
Q	R	v	R	v	R	v
US gpm	psi/100 ft	ft/s	psi/100 ft	ft/s	psi/100 ft	ft/s
285	0.45	4.3	0.15	3.0	0.05	2.0
293	0.48	4.6	0.16	3.0	0.05	2.0
301	0.49	4.6	0.17	3.0	0.06	2.0
309	0.52	4.9	0.18	3.0	0.06	2.0
317	0.55	4.9	0.18	3.3	0.06	2.0
325	0.58	4.9	0.19	3.3	0.07	2.0
333	0.60	5.2	0.20	3.3	0.07	2.0
341	0.63	5.2	0.21	3.3	0.07	2.3
349	0.66	5.2	0.22	3.6	0.07	2.3
357	0.68	5.6	0.23	3.6	0.07	2.3
365	0.71	5.6	0.24	3.6	0.08	2.3
373	0.74	5.9	0.25	3.6	0.08	2.3
380	0.77	5.9	0.26	3.6	0.09	2.3
388	0.80	5.9	0.27	3.9	0.09	2.6
396	0.83	6.2	0.28	3.9	0.09	2.6
404	0.86	6.2	0.29	3.9	0.10	2.6
412	0.89	6.2	0.30	3.9	0.10	2.6
420	0.92	6.6	0.31	4.3	0.11	2.6
428	0.96	6.6	0.32	4.3	0.11	2.6
436	0.99	6.9	0.33	4.3	0.11	2.6
444	1.02	6.9	0.34	4.3	0.11	3.0
452	1.06	6.9	0.36	4.6	0.12	3.0
460	1.10	7.2	0.37	4.6	0.12	3.0
468	1.13	7.2	0.37	4.6	0.13	3.0
476	1.16	7.2	0.39	4.6	0.13	3.0
483	1.20	7.5	0.40	4.9	0.14	3.0
491	1.24	7.5	0.41	4.9	0.14	3.0
499	1.27	7.5	0.43	4.9	0.14	3.3
507	1.31	7.9	0.44	4.9	0.15	3.3
515	1.36	7.9	0.45	5.2	0.15	3.3
523	1.40	8.2	0.46	5.2	0.15	3.3
531			0.48	5.2	0.16	3.3
539			0.49	5.2	0.16	3.3
547			0.50	5.2	0.17	3.6
555			0.52	5.6	0.17	3.6
563			0.53	5.6	0.18	3.6
571			0.54	5.6	0.18	3.6
579			0.56	5.6	0.18	3.6
587			0.57	5.9	0.19	3.6
594			0.59	5.9	0.20	3.6
602			0.60	5.9	0.20	3.9
610			0.62	5.9	0.21	3.9
618			0.63	6.2	0.21	3.9
626			0.65	6.2	0.22	3.9
634			0.66	6.2	0.22	3.9
642			0.68	6.2	0.22	3.9
650			0.69	6.6	0.23	4.3
658			0.70	6.6	0.24	4.3

Wavin PP-RCT Basalt Clima and PP-RCT monolayer, SDR 11; water temperature = 122 °F (50 °C)

	6" (160 × 14.6 mm)		8" (200 × 18.2 mm)		10" (250 × 22.7 mm)	
Q	R	v	R	v	R	v
US gpm	psi/100 ft	ft/s	psi/100 ft	ft/s	psi/100 ft	ft/s
666			0.73	6.6	0.24	4.3
674			0.74	6.6	0.25	4.3
682			0.76	6.9	0.26	4.3
690			0.77	6.9	0.26	4.3
697			0.79	6.9	0.26	4.3
705			0.81	6.9	0.27	4.6
713			0.82	6.9	0.28	4.6
721			0.84	7.2	0.28	4.6
729			0.86	7.2	0.29	4.6
737			0.88	7.2	0.29	4.6
745			0.90	7.2	0.30	4.6
753			0.91	7.5	0.30	4.6
761			0.93	7.5	0.31	4.9
769			0.95	7.5	0.32	4.9
777			0.97	7.5	0.32	4.9
785			0.98	7.9	0.33	4.9
793			1.01	7.9	0.33	4.9
801			1.02	7.9	0.34	4.9
808			1.05	7.9	0.35	5.2
816			1.06	8.2	0.36	5.2
824					0.36	5.2
832					0.37	5.2
840					0.37	5.2
848					0.38	5.2
856					0.38	5.2
864					0.39	5.6
872					0.40	5.6
880					0.40	5.6
888					0.41	5.6
896					0.42	5.6
904					0.43	5.6
911					0.44	5.9
919					0.44	5.9
927					0.45	5.9
935					0.45	5.9
943					0.46	5.9
951					0.47	5.9
959					0.48	5.9
967					0.49	6.2
975					0.49	6.2
983					0.50	6.2
991					0.51	6.2
999					0.52	6.2
1007					0.52	6.2
1015					0.53	6.6
1022					0.54	6.6
1030					0.55	6.6
1038					0.55	6.6

	6" (160 × 14.6 mm)		8" (200 × 18.2 mm)		10" (250 × 22.7 mm)	
Q	R	v	R	v	R	v
US gpm	psi/100 ft	ft/s	psi/100 ft	ft/s	psi/100 ft	ft/s
1046					0.56	6.6
1054					0.57	6.6
1062					0.58	6.6
1070					0.59	6.9
1078					0.59	6.9
1086					0.60	6.9
1094					0.61	6.9
1102					0.62	6.9
1110					0.63	6.9
1118					0.63	6.9
1125					0.64	7.2
1133					0.65	7.2
1141					0.66	7.2
1149					0.67	7.2
1157					0.68	7.2
1165					0.69	7.2
1173					0.70	7.5
1181					0.70	7.5
1189					0.71	7.5
1197					0.72	7.5
1205					0.73	7.5
1213					0.74	7.5
1221					0.75	7.5
1229					0.76	7.9
1236					0.77	7.9
1244					0.78	7.9
1252					0.78	7.9
1260					0.80	7.9
1268					0.80	7.9
1276					0.81	8.2

Pressure Testing

1. Test pressure selection

A pressure test mustalways be conducted on an assembled pipeline in order to ensure integrity of the connections. To set the right test pressure, the type of pipe and applications are crucial.

- If the piping system consists of various SDR pipes, test shall be conducted with the lowest SDR's test pressure. For example, if the piping system consists of SDR 9 pipe and SDR 7.4 pipes, test shall be conducted according to SDR 7.4 requirement.
- For SDR 17 pipes and intended operating pressure equals to 65 or less psi, test pressure has to be set to 100 psi.
- For SDR 17 pipes and intended operating pressure is higher than 65 psi, test pressure is set to 150% of intended operating pressure (max. 170 psi).
- For SDR 11 or lower pipes and intended operating pressure of 100 psi or less, test pressure is set to 150 psi.
- For SDR 11 or lower pipes and intended operating pressure higher than 100 psi, the test pressure is set to 150% of the intended operating pressure.

In case of any concerns regarding your testing pressure, please contact Wavin. Any exceptions are subject to Wavin written approval.

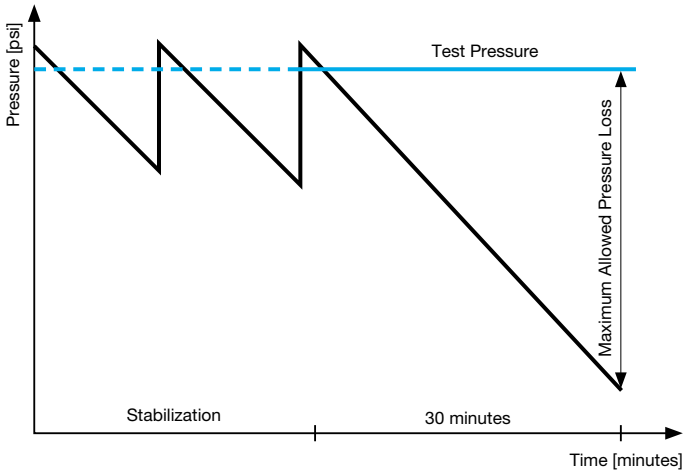
Highest Pipe SDR installed in the system	Operating Pressure	Test Pressure (For Liquid)	Max. Test Pressure [1] (Liquid)	Low Pressure Leak Test Max. Test Pressure [2] (Gas)
SDR 17 Pipe 3 1/2" (110 mm) and lower with weld-in saddles	85 psi or lower	85 psi	85 psi	15 psi
SDR 17 pipe without weld-in saddles or SDR 17 pipe 4" (125 mm) and higher with weld-in saddles	65 psi or lower	100 psi	170 psi	15 psi
	> 65 psi	150% of Operating Pressure		
SDR 11	100 psi or lower	150 psi	270 psi	15 psi
	> 100 psi	150% of Operating Pressure		
SDR 9	100 psi or lower	150 psi	340 psi	15 psi
	> 100 psi	150% of Operating Pressure		
SDR 7.4	100 psi or lower	150 psi	430 psi	15 psi
	> 100 psi	150% of Operating Pressure		

[1] Maximum testing pressures allowed at lowest pipe in test section. Utilizing the lowest pipe in the testing zone is extremely important for testing high rises.

[2] Low pressure compressed air may be used to detect leaks so that leak areas can be repaired before filling system with water for the required three step pressure test.

2. Initial 30-minute Pressure Test

- Introduce the test pressure to the system. Slight expansion of the piping can occur, which would require adding more pressure to stabilize. Make sure all the entrapped air is removed from the piping system.
- Once the pressure is steady, observe it for 30 minutes. The piping system shall maintain the pressure.
- Pressure loss exceeding 9 psi (6 psi for SDR 17 piping) or steadily decreasing pressure during this test indicates leakage. Repeat the test after fixing the leakage.
- A successful result of this test must be achieved before proceeding.

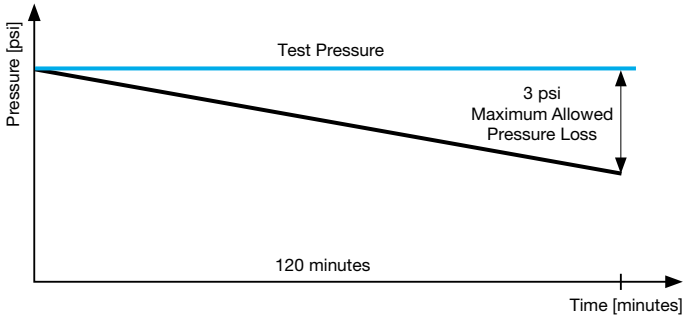


Max. Allowed Pressure Loss = 9 psi for SDR 7.4, SDR 9 a SDR 11
6 psi for SDR 17

3. 120-minute Leak Test

Successfully passing the initial 30-minute test is a prerequisite for starting this test.

- The piping system shall maintain test pressure.
- Pressure loss exceeding 3 psi or steadily decreasing pressure during this test indicates leakage. Repeat all the previous tests after fixing the leakage.

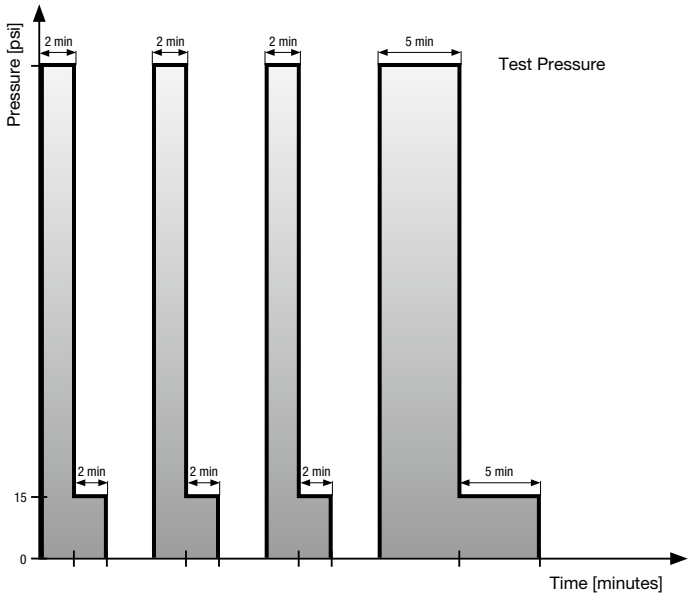


Pressure Testing

4. Final Cyclic Test

- Release pressure from the piping system.
- Set test pressure for two minutes.
- Reduce the pressure to 15 psi for two minutes.
- Release pressure from the piping system.
- Set test pressure for two minutes.
- Reduce the system pressure to 15 psi for two minutes.
- Release pressure from the piping system.
- Set test pressure for two minutes.
- Reduce the system pressure to 15 psi for two minutes.
- Release pressure from the piping system.
- Set test pressure for five minutes.
- Reduce the system pressure to 15 psi for five minutes.
- Release pressure from the piping system.
- The test is successfully finished if no leakage occurs. In case of any leakage, repeat all the previous tests after fixing the leakage.

If you successfully passed the above mentioned procedures, please keep a record and submit a copy of the pressure test report to Wavin, along with pertinent electronic drawings which show all the sections that were tested.



Materials Combination

Integration of other systems or components with Wavin piping for pressure pipe applications

When combining Wavin piping systems with other systems or components not made of PP-RCT, like valves, pumps, other pipe materials, check valves, strainers, etc), care must be taken to ensure the operating parameters for PP-RCT won't damage the other materials or vice versa.

Be aware that even if the Wavin PP-RCT pipe is compatible with the fluid being transported, other materials in the system may not be. All parts of the system must be verified as compatible with the medium being carried before installing them.

Take into account that while Wavin PP-RCT pipe does not require treatment to protect it from corrosion, metals (ferrous and nonferrous) in the system may be susceptible. Do not mix Wavin pipe with other piping systems in conditions that will cause the other system or components to fail.

Domestic hot water recirculation (DHWR)

The Domestic Hot Water Recirculating (DHWR) system includes all portions of an installation where the water is being circulated, including supply and return piping and any components other than end-of the line fixtures.

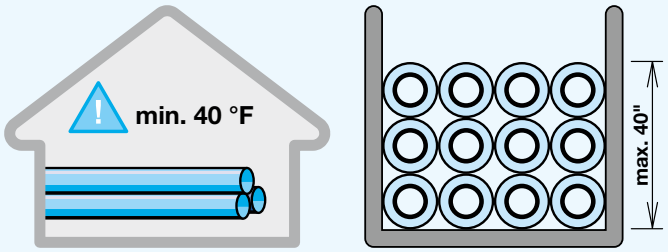
When there is limited copper piping used in conjunction with PP-RCT in a DHWR system, care should be taken to ensure the operating conditions will not cause degradation or erosion/corrosion of the copper. Wavin recommends following the Copper Development Association guidelines (CDA Publication A4015-14/16: The Copper Tube handbook – www.copper.org) for sizing, temperature and flow velocity in copper tubing.

This will also help ensure that the copper levels in the water do not approach the regulatory action levels recommended by independent institutions (e.g. U.S. Environmental Protection Agency (EPA) and The World Health Organization (WHO)). Sustained high levels of copper in DHWR piping can damage components within the system, including PP-RCT. **Damage caused by copper in the water resulting from erosion/corrosion or other degradation of copper components in the DHWR system will void the Wavin warranty**.

Material Transport and Storage

Protection

The system components must be protected against weather, UV radiation and contamination.



Stores of plastic components must be separated from such areas where solvents, adhesives, paints or similar products are stored.

It is recommended to store the components at minimum temperature of 40 °F. If the temperature is lower than 40 °F, it is necessary to be careful at pipeline manipulation.

Plastic pipes in stock must be supported along their whole lengths or protected in another suitable way against deflection. Plastic pipe fittings are usually stored in sacks on palettes or freely loaded in boxes, containers, baskets, etc. Maximum storage height of one metre (40") must be respected if plastic pipes are stored in plastic sleeves and/or pipe fittings in plastic sacks. Each of the different types of pipes and fittings are stored separately. When dispatching from storage, the oldest stock should be dispatched first.

During their transport it is not allowed to drag pipes over the ground or lorry deck. The components/pipes must not be transported by throwing or letting them fall off the lorry to the ground. If they are transported to/on the site then they must be protected against mechanical damage and stored at the spot on a suitable underlay where protected against dirt, solvents, direct heat (contact with a radiator, etc.).

The components are supplied in protective covers (pipes in polyethylene bags, pipe fittings also in sacks or cardboard boxes) and it is desirable to let them in these as long as possible before the start of installation works (to protect them against dirt and other contamination).

Safety welding principles

1. Welder is an electrical equipment. The condition of safe use consists of the electrical connection in manner prescribed by standard (three-wire system, in socket with earthing contact with the corresponding current load).
2. The electrical installation must be equipped with properly chosen overload protection.
3. The power cord must be protected against mechanical damage and burning of insulation cover.
4. Welder must be protected against humidity and direct contact with water.
5. Welder shall not be used in flammable and explosive environment.
6. Welder must be handled carefully, and protected against hitting, throwing, inappropriate pulling the cord.
7. In case the welder does not work properly, you must immediately unplug it from source of electric power. Damaged welder must be sent back to the manufacturer or seller together with an accurate description of the defect.
8. Operation with the welder requires special caution because of the high temperature of its body and nozzles.
9. Never leave the welder unattended while energized.
10. The welding process should always be performed in a well-aired room (due to the vapors formed during heating and melting of plastic elements while welding).

Warning!

Protect the welder from shocks and impacts, as they can lead to damage of the electronic regulation! The product must be protected from children and ineligible persons.

Limited Warranty and Limitations of Liability

WAVIN PP-RCT Pipes and fittings (the “Products”) are manufactured and sold by Wavin Czechia, s.r.o. (“Seller”). The Products conform to ASTM D2389-21, Standard Specification for pressure rated polypropylene (PP) piping system. The Products are certified by NSF International Standard 14 and 61 for use in potable water applications and meet the requirement for lead-free plumbing.

LIMITED WARRANTY

The Products are warranted to be free from defects in materials and workmanship under normal use in hot and cold potable water installations only, for a period of ten years from the date of purchase (the “Warranty”). In order for this Warranty to apply, the Products must be handled, stored, and installed in accordance with the instructions provided in this product booklet. As set forth more fully in Section 7.5 of our Terms and Conditions of Sale (which is incorporated by reference), this Warranty does not cover any damage caused by improper handling, storage, shipping, or installation of the Products (including installation in any applications other than hot and cold potable water).

Claims under this Warranty must be made in writing and submitted to Seller promptly after the defect is discovered and, in any event, within ten years of the date of purchase. In order to make a claim under this Warranty, any Product alleged to be defective must be made available to Seller for inspection, verification, and testing.

If Seller confirms that the Product is defective, the exclusive remedy for breach of this Warranty is limited to (1) replacement of the defective product, or (2) refund of the purchase price. Seller shall have no liability for the cost of removal or reinstallation with respect to any replaced Product. The election of said remedies will be determined by Seller in its sole discretion and shall be considered final disposition.

To the extent that this Warranty conflicts with our Terms and Conditions of Sale, the terms of this Warranty shall prevail. This Warranty may only be modified or altered in a writing signed by the President of Seller.

LIMITATION OF LIABILITY

FOR THE AVOIDANCE OF DOUBT, SELLER’S LIABILITY FOR ANY AND ALL LOSS OR DAMAGE, HOWSOEVER ARISING AND UNDER ANY LEGAL OR EQUITABLE THEORY (INCLUDING WITHOUT LIMITATION BREACH OF CONTRACT; BREACH OF WARRANTY; COMMON LAW, EQUITABLE, OR CONTRACT INDEMNITY; NEGLIGENCE; OR TORT) SHALL BE STRICTLY LIMITED TO THE PURCHASE PRICE OF THE PRODUCT.

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CHOICE OF LAW AND VENUE

Georgia law will govern all disputes arising out of or relating to the Products and/or to this Warranty, without regard to conflict of law principles. The Parties acknowledge and agree that the applicability of the United Nations Convention on Contracts for the International Sale of Goods (often referred to as the Vienna Sales Convention) is expressly excluded.

Any disputes related to the Products or this Warranty will be resolved exclusively in the state or federal courts of Fulton County, Georgia, USA, and you and Seller consent to personal jurisdiction in those courts.

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