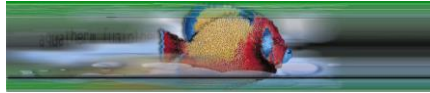




Aquatherm Australia Pty Limited



Pipe Specifics and Regulations



We've got a pipe for that



aquatherm
state of the pipe



Aquatherm Australia Pty Limited Ecological pipe systems: just say yes to a better world!

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ACN 059 578 782

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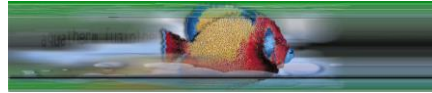
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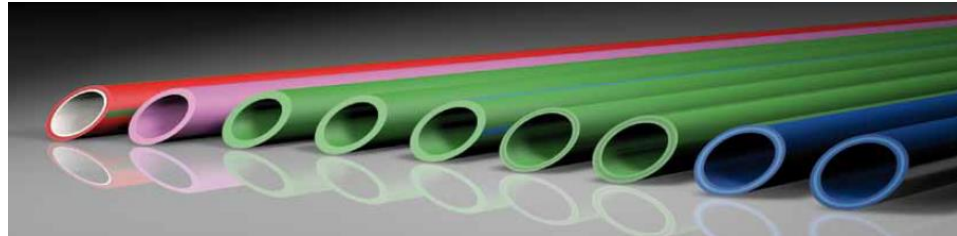


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New brand names for aquatherm PP-R pipe systems:



short cuts material		short cuts structure of pipe	
PP	polypropylene	S	single
PP-R	polypropylene random	M	multilayer
PP-RP	polypropylen with raised pressure	MF	multilayer faser
PB	polybutene	MS	multilayer stabi
PE-RT	polyethylene with raised temperature resistance	OT	oxygen tight
PEX	cross-linked polyethylene	UV	UV-resistant
AL	aluminium	TI	thermal insulation
		HI	hardly inflammable

article-no.	old brand name	new branding structure					
		new brand name		Standard Dimension Ratio	structure of pipe	special feature of pipe	material
		company	system				
10208 ... 10248	fusiotherm SDR11	aquatherm	green pipe	SDR 11	S		PP-R
10806 ... 10818	fusiotherm SDR7,4	aquatherm	green pipe	SDR 7,4	S		PP-R
10006 ... 10024	fusiotherm SDR6	aquatherm	green pipe	SDR 6	S		PP-R
70806 ... 70824	fusiotherm stabi composite pipe	aquatherm	green pipe	SDR 7,4	MS		PP-R
70708 ... 70744	fusiotherm faser composite pipe	aquatherm	green pipe	SDR 7,4	MF		PP-R
70758 ... 70794	fusiotherm faser composite pipe UV	aquatherm	green pipe	SDR 7,4	MF	UV	PP-R
1270711 ... 1270737	fusiotherm faser composite pipe ISO	aquatherm	green pipe	SDR 7,4	MF	TI	PP-R
370712 ... 370744	aquatherm green pipe	aquatherm	green pipe	SDR 9	MF	RP	PP-RP
370762 ... 370794	aquatherm green pipe UV	aquatherm	green pipe	SDR 9	MF	RP UV	PP-RP

article-no.	old brand name	new branding structure					
		new brand name		Standard Dimension Ratio	structure of pipe	special feature of pipe	material
		company	system				
2010208 ... 2010212	climatherm SDR11	aquatherm	blue pipe	SDR 11	S		PP-R
2070112 ... 2070712	climatherm faser composite pipe SDR7,4/SDR11	aquatherm	blue pipe	SDR 7,4/SDR 11	MF		PP-R
2070162 ... 2070762	climatherm faser composite pipe SDR7,4/SDR11/SDR17,6 UV	aquatherm	blue pipe	SDR 7,4/SDR 11/SDR 17,6	MF	UV	PP-R
2170114 ... 2170712	climatherm faser composite pipe SDR7,4/SDR11 OT	aquatherm	blue pipe	SDR 7,4/SDR 11	MF	OT	PP-R
2170164 ... 2170188	climatherm faser composite pipe SDR7,4/SDR11 UV OT	aquatherm	blue pipe	SDR 7,4/SDR 11	MF	UV-OT	PP-R
2570130 ... 2570154	climatherm faser composite pipe SDR17,6	aquatherm	blue pipe	SDR 17,6	MF		PP-R
2270111 ... 2270142	climatherm faser composite pipe SDR7,4/SDR11 ISO	aquatherm	blue pipe	SDR 7,4/SDR 11	MF	TI	PP-R
2470711 ... 2470126	climatherm faser composite pipe SDR7,4/SDR11 OT ISO	aquatherm	blue pipe	SDR 7,4/SDR 11	MF	OT-TI	PP-R

article-no.	old brand name	new branding structure				
		new brand name		Standard Dimension Ratio	structure of pipe	material
		company	system			
9010212 ... 9010238	aquatherm lilac	aquatherm	lilac pipe	SDR 7,4/SDR 11	S	PP-R

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page 2

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Applications:

Hydraulic/domestic services:

- Cold and hot potable water
- Hot potable recirculation water
- Reverse Osmosis water
- Rainwater / Recycled water / Reclaimed water
- Softened water
- Demineralized water

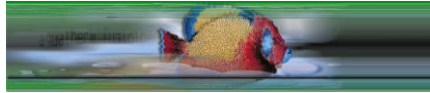
Mechanical (HVAC) – installations:

- Chilled water
- Heating water
- * concrete core activation

Industrial/commercial applications:

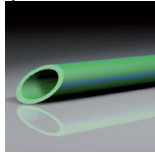
- Compressed air
- Vacuum systems
- Cooling water (e.g. machinery, engines)
- Computer cooling (data centres)
- Transport of aggressive fluids
- Swimming pool technology
- Agriculture and horticulture
- Geothermal recovery

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Product (pipe) range:

1. **aquatherm green pipe SDR11 S**
(class PN 12.9 to DIN 8078)



Colour: green with 4 blue stripes

Pipe dimensions: Ø20 – Ø450mm.

Main applications: (cold) drinking water, rainwater, demineralized water & R.O. water.
Has Australian AS/NZS 4020 - 1999 and Australian Watermark approval.

Linear expansion coefficient: $\alpha = 0,15 \text{ mm}/(\text{mK})$.

Thermal conductivity coefficient: $\lambda = 0,15 \text{ W}/(\text{mK})$

2. **aquatherm green pipe SDR7.4 MF (Multilayer Fibre)**
(class PN20 to DIN 8078)



Colour: green with 4 dark-green stripes

Pipe dimensions: Ø20 - Ø355mm.

Main applications: (hot) drinking water, hot water recirculation systems, heating, chilled water, cooling water, compressed air, demineralized water and R.O. water.
Has Australian AS/NZS 4020 - 1999 and Australian Watermark approval.

Linear expansion coefficient: $\alpha = 0,035 \text{ mm}/(\text{mK})$.

Thermal conductivity coefficient: $\lambda = 0,15 \text{ W}/(\text{mK})$

3. **aquatherm green pipe SDR9 MF RP (Multilayer Fibre Raised Pressure)**
(ISO 21003)



Colour: green with 4 dark-green stripes

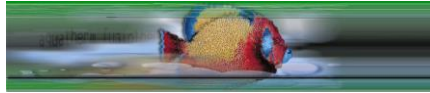
Pipe dimensions: Ø32 - Ø355mm.

Main applications: (hot) drinking water, hot water recirculation systems, heating, chilled water, cooling water, compressed air, demineralized water and R.O. water.
Has Australian AS/NZS 4020 - 1999 and Australian Watermark approval.

Linear expansion coefficient: $\alpha = 0,035 \text{ mm}/(\text{mK})$.

Thermal conductivity coefficient: $\lambda = 0,15 \text{ W}/(\text{mK})$

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4. **aquatherm lilac pipe SDR7.4 / SDR11 S**
(class PN 12.9 to DIN 8078)



Colour: violet and labelled "RECYCLED/RECLAIMED WATER – DO NOT DRINK continuously along the pipe at intervals not exceeding 1 meter.

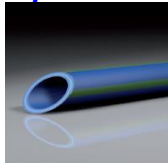
Pipe dimensions: Ø20 – Ø25mm (SDR7.4), Ø32 – Ø125mm (SDR11)

Main applications: recycled / reclaimed water, non-potable water applications.

Linear expansion coefficient: $\alpha = 0,15 \text{ mm}/(\text{mK})$.

Thermal conductivity coefficient: $\lambda = 0,15 \text{ W}/(\text{mK})$

5. **aquatherm blue pipe SDR7.4 MF / SDR11 MF / SDR17.6 MF (Multilayer Fibre)**



Colour: blue with 4 wider green stripes

Pipe dimensions: Ø20 – Ø32mm (SDR7.4; to DIN 8078)

Ø32 – Ø450mm (SDR11; to DIN 8078)

Ø160 – Ø630mm (SDR17.6; to DIN 8078)

Main applications: (HVAC) heating, chilled water, cooling water, compressed air, computer cooling, non-potable water applications.

Linear expansion coefficient: $\alpha = 0,035 \text{ mm}/(\text{mK})$.

Thermal conductivity coefficient: $\lambda = 0,15 \text{ W}/(\text{mK})$

6. **aquatherm blue pipe SDR7.4 / SDR11 MF OT (Multilayer Fibre Oxygen Tight)**
(oxygen tight according to DIN 4726 by diffusion barrier)



Colour: blue (glossy)

Pipe dimensions: Ø20 – Ø25mm (SDR7.4; to DIN 8078)

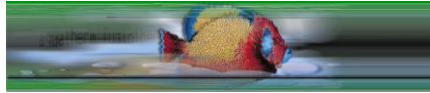
Ø32 – Ø250mm (SDR11; to DIN 8078)

Main applications: (HVAC) heating, chilled water, cooling water, computer cooling, non-potable water applications.

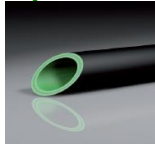
Linear expansion coefficient: $\alpha = 0,035 \text{ mm}/(\text{mK})$.

Thermal conductivity coefficient: $\lambda = 0,15 \text{ W}/(\text{mK})$

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7. **aquatherm green pipe** SDR7.4 MF / SDR9 MF RP UV (*Multilayer Fibre UV*)



Colour: outer layer: black (UV protection PE), inner layer: green

Pipe dimensions: Ø20 – Ø355mm (SDR7.4) / Ø32 – Ø355mm (SDR9).

Main applications: **Outdoor use:** (hot) drinking water, hot water recirculation systems, heating, chilled water, cooling water, compressed air, demineralized water and reverse osmosis.

Linear expansion coefficient: $\alpha = 0,035 \text{ mm}/(\text{mK})$.

Thermal conductivity coefficient: $\lambda = 0,15 \text{ W}/(\text{mK})$

8. **aquatherm blue pipe** SDR7.4 / SDR11 / SDR17.6 MF UV (*Multilayer Fibre UV*)



Colour: outer layer: black (UV protection PE), inner layer: blue

Pipe dimensions: Ø20 – Ø32mm (SDR7.4)

Ø32 – Ø450mm (SDR11; class PN 12.9 to DIN 8078)

Ø160 – Ø630mm (SDR17.6; class PN 8/9 to DIN 8078)

Main applications: **Outdoor use:** (HVAC) heating, chilled water, cooling water, computer cooling, non-potable water applications.

Linear expansion coefficient: $\alpha = 0,035 \text{ mm}/(\text{mK})$.

Thermal conductivity coefficient: $\lambda = 0,15 \text{ W}/(\text{mK})$

9. **aquatherm blue pipe** SDR7.4 / SDR11 / SDR17.6 MF UV OT (*Multilayer Fibre UV*) (oxygen tight acc. to DIN 4726 by diffusion barrier)



Colour: outer layer: black (UV protection PE), inner layer: blue

Pipe dimensions: Ø20 – Ø25mm (SDR7.4)

Ø32 – Ø250mm (SDR11; class PN 12.9 to DIN 8078)

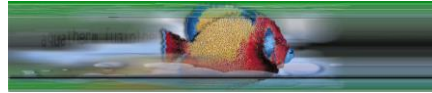
Main applications: **Outdoor use:** (HVAC) heating, chilled water, cooling water, non-potable water applications.

Linear expansion coefficient: $\alpha = 0,035 \text{ mm}/(\text{mK})$.

Thermal conductivity coefficient: $\lambda = 0,15 \text{ W}/(\text{mK})$

Other pipes on request.

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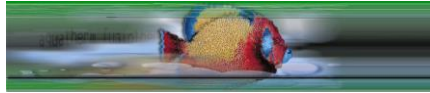
Aquatherm Pipe Systems Pty Ltd can also supply:

- wet fire sprinkler pipe systems (**aquatherm red pipe**)
- pre-insulated pipes (**aquatherm green pipe MF Ti** or **aquatherm blue pipe MF Ti**)
- floor heating pipe system
(**aquatherm orange system** and **aquatherm grey pipe**)
- room heating / cooling wall & ceiling grid systems (**aquatherm black system**)

The fusiolen[®] PP-R material

- All aquatherm green and blue pipes and fittings are made of the environmental friendly fusiolen[®] PP-R material.
This material is corrosion resistant, has a good chemical resistance, PVC free, free from heavy metals hazardous to health (e.g. Cu, Pb, Ni), smell- and taste neutrality, recyclable, has good heat- and sound insulating characteristics, very good welding properties, high heat stability, is light tight and has a long service life.
- The fusiolen[®] PP-R material has excellent characteristics for use at higher temperatures. The physical and chemical properties make the material suitable for both potable water and heating applications.
In combination with a certain pressure most aquatherm PP-R pipes and fittings may be used, for the duration of more than 50 years, up to a constant water temperature of 70°C. The service life will become shorter in the case of water temperatures above 70°C to 90°C or the presence of excessive concentrations of certain metals (like copper) and chemicals, such as disinfecting products as chlorine.
(See 1.7 cautionary note on page 10).
- With lower pressure systems, peak temperatures of 100°C arising from short disruptions are unproblematic due to long-term heat stabilization of the fusiolen[®] PP-R material. Please refer to the permissible working pressure / temperature tables, on request from Aquatherm Australia Pty Ltd.
- By adding suitable food-approved additives the risk of a material damage caused by metal under extreme conditions of application is substantially reduced.





aquatherm green fittings:

- All aquatherm green fittings are produced according to DIN 16962, made from the fusiofen® PP-R material and can be used in combination with all the above aquatherm green, blue and lilac pipes. The aquatherm PP-R fittings meet the required pipe temperature / pressure ratings. Colour: green.
- The transition fittings are made of a dezincification resistant brass, which lowers the risk of stress corrosion, at lower temperatures (< +5°C). See the below chapter: "Stress corrosion cracking of brass".
- Transition fittings, with stainless steel inserts (R.O. water), or specially manufactured aquatherm green PP-R male threaded fittings are on request.

Pipe Specifications

1.0 POLYPROPYLENE (PP-R) TYPE III PIPES & FITTINGS – PRESSURE

All Polypropylene pipe & fittings shall be of any of the above aquatherm green, blue or lilac pipe/fittings and must;

- a) Be approved by Local Authority
- b) Be Socket fusion welded, butt welded and/or electrofusion welded jointed in accordance with the manufacturers instructions
- c) Incorporate fittings of the same manufacture as the pipe used.
- d) Have Australian Standard's approval.
- e) Have Australian AS/NZS 4020 - 1999 approval (*not aquatherm lilac and blue pipes*).
- f) **Lilac pipe:** Be lilac colour and labelled "RECYCLED/RECLAIMED WATER – DO NOT DRINK continuously along the pipe at intervals not exceeding 1 meter.

1.1 INSTALLATION

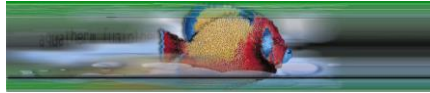
Polypropylene systems of mixed manufacturing origin will NOT be accepted.

All tradespersons assigned to the project are to be adequately trained by the manufacturer of the PP-R pipe system proposed, prior to commencement of work on site.

All PP-R pipework to be installed in accordance with the installation catalogue, to be provided by the manufacturer, and any other written or verbal instructions provided.



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1.1.1 JOINTING METHODS

The aquatherm green, blue and lilac pipes are to be jointed to the aquatherm green PP-R fittings only by:

- Socket fusion (Ø16 - Ø125), at a welding temperature of 260°C +/- 10°C
- Buttwelding (Ø160 - Ø630), , at a welding temperature of 210°C +/- 10°C
- Electrofusion (Ø20 - Ø250 electrofusion sockets; pipe to pipe joints only), at an ambient (welding) temperature of +5°C to +40°C (according to DVS 2207).
- Weld-in saddles (branches Ø20 – Ø63, ½” – 1” female threads or ½” – ¾” male threads)

All pipework to be tested in accordance with the installation catalogue, to be provided by the manufacturer, prior to commissioning.

1.2 EXPANSION

Allowance for expansion in pipework materials shall be in accordance with the AS3500 and any other written or verbal instructions provided.

1.3 INSULATION

All PP-R pipework shall be insulated in accordance with AS3500 and BCA requirements.

1.4 BRACKETING

All pipes should be fastened with only Aquatherm's green rubber compound fasteners, with expansion spacers, or other as deemed equal or approved by Aquatherm and / or the project's Hydraulic or Mechanical Consultant.

Spacing / support intervals to be in accordance with the installation catalogue, to be provided by the manufacturer, and any other written or verbal instructions provided.

1.5 TRAINING

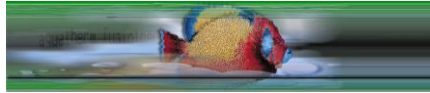
All installing plumbers must be first trained by an Aquatherm Technician in the installation methods and procedures as set out in the Aquatherm training manual.

Successful applicants are to receive an accredited installer's certificate.

Only tools provided by the manufacturer, or approved by the manufacturer, are to be used.

All tools on delivery must have a temperature and calibration certificate.

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1.6 TESTING

All testing is to be strictly conducted in accordance with the manufacturer's testing program as set out in the manufacturer's catalogue and training manual. The hydraulic pressure test requires a preliminary, principal and final test. To have passed the pressure interval test is essential for getting the aquatherm warranty.

An Aquatherm technician should, where ever possible, be in attendance when testing and provide a compliance signature.

All testing documents should be retained by the plumber/contractor with copies provided to the manufacturer and building contractor.

Please set the safety pressure valves at 800 kPa (hot water applications).

1.7 CAUTIONARY NOTE for mixed (PP-R/Cu) Hot Potable Water Reticulation Systems

Aquatherm Australia has found out that PP-R, like any other polyolefin, can fail in the main ring of a mixed (PP-R/Copper) hot water recirculation system (only) due to "Oxidative Stress Cracking".

AQUATHERM AUSTRALIA PTY LTD CAUTIONARY NOTE (FOR HOT POTABLE WATER RECIRCULATION APPLICATIONS ONLY)

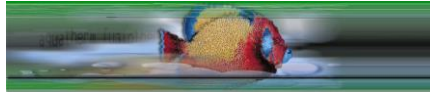
- 1 Constant hot potable water temperatures should not exceed 70°C. Temperatures above 70°C will shorten the service life of PP-R.
- 2 Care should be exercised in mixed PP-R/Copper hot potable water recirculation systems where temperatures/pressures may exceed 70°C (permissible working pressures see page 14 of fusiotherm®/climatherm pipe systems brochure Edition 01/2011) and where copper pipe velocities may exceed established international copper design practice – enquirers should refer to the projects Hydraulic Consultant.

In the mixed PP-R/copper pipe system bring the hot water velocity in the copper pipe system down to **0.7 m/s** (absolute max. **0.9 m/s**) to avoid excessive copper (erosion-) corrosion.

- 3 Upstream use of copper pipe in PP-R hot water recirculation systems where the above operational parameters are exceeded should be avoided. Better it would be to replace all copper by another metal, such as Stainless Steel.
- 4 When the velocity in the hot water generation copper plants can't be held under the 0.7 m/s (max. 0.9 m/s) Aquatherm recommends a stainless steel heat exchanger between the PP-R and the upstream copper pipework.
- 5 Keep the working pressure in the whole system under 800 kPa (with temperatures not to exceed 70°C)



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Please set the safety pressure valves at 800 kPa.

- 6 The service life of aquatherm PP-R pipe systems could be reduced by using excessive concentration of disinfecting products (for example chlorine).
(the use of Chlorine dioxide (ClO₂) should not be used in our PP-R system)
- 7 Use the original aquatherm pipe clips with (green) rubber layer.
- 8 Install proper expansion facilities (expansion loops and/or bending sides) in the horizontal pipes (de-stress the PP-R system)
(See aquatherm brochure 10101 Edition 01/2011 page 55 -67).

The only pipe clips Aquatherm Australia Pty Ltd would advise, in combination with Aquatherm PP-R pipes, are the green rubber lined Aquatherm pipe clips, with distance rings.



Fixed point clip



Sliding point clip

These pipe clips do not mechanically damage the surface of the pipe or causing external stress to the PP-R pipe due to the fact that they are especially dimensioned for PP-R pipe (OD) sizes.

Other (metal) pipe clips can/will cause external stress, especially in combination with hot water PP-R pipes, since they are not dimensioned for the Outside Diameter (OD) of the PP-R pipes.



Since the Aquatherm PP-R Faser SDR7.4 pipes have a linear expansion coefficient of $\alpha = 0.035 \text{ mm/mK}$, the pipe wants to and will expand when hot water is conveyed through the pipe.

Linear expansion due to temperature difference between operating temperature and installation temperature can be compensated by installing proper bending sides or expansion loops.

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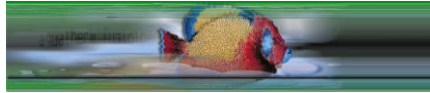
page 11

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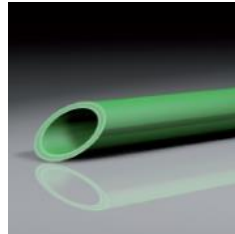


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Aquatherm recommends expansion loops in straight lengths longer than 40 metres. For straight lengths shorter than 40 metres proper bending sides are recommended. The bending sides and expansion loops have to be calculated for the expected linear expansion and installed pipe size.



**aquatherm green pipe SDR7.4 MF or aquatherm green pipe SDR9 MF RP
(to be used for hot potable water application)**

WARRANTY (valid for 2018)

As a statement to Aquatherm quality standards the aquatherm green, blue, red, black, orange, grey and lilac pipe system carries a 10 year warranty, beginning with the date of production, with insurance sums of € 20 million for damage to property, personal injuries and financial losses.

The warranty is only valid if installed by an Aquatherm certified installer, using Aquatherm approved tools. A final pressure test report should be submitted to verify proper installation. The aquatherm pipes and fittings only being exposed to pressures, water velocities, temperatures and/or any other relevant operating parameters within the permissible parameters specified in the aquatherm Technical Catalogue (Brochure 10101 Edition 03/2015). Aquatherm is only responsible for supplying pipes and fittings and is not in any way responsible for any matter which may affect operating parameters such as the design, installation or maintenance of any system in which the pipes and fittings may be present. The aquatherm warranty does not apply to mixed PP-R systems.

LINEAR EXPANSION OF AQUATHERM PIPES (α)

- **aquatherm green S, blue S and lilac S pipes** $\alpha = 0,15 \text{ mm/mK.}$
- **aquatherm green pipe SDR7,4 MF, aquatherm green pipe SDR9 MF RP, aquatherm blue pipe SDR7,4/SDR11 MF (OT), aquatherm green pipe SDR7,4 MF UV, aquatherm blue pipe SDR7,4/SDR11 MF (OT) UV** $\alpha = 0,035 \text{ mm/mK.}$

THERMAL CONDUCTIVITY OF FUSIOLEN® PP-R (λ)

fusiole[®] PP-R: $\lambda = 0,15 \text{ W/(mK)}$

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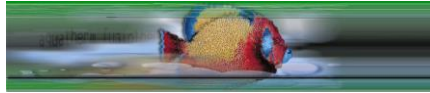
page 12

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This low λ value of fusiolen® PP-R could save you insulation costs.

PIPE WALL ROUGHNESS

Inner pipe roughness of aquatherm green, blue and lilac pipes: 0,0070 mm.

FASTENING TECHNIQUE

Pipe clamps for aquatherm pipes must be dimensioned for the external diameter of the plastic pipe.

Take care, that the fastening material does not mechanically damage the surface of the pipe.

The ideal fastening material for aquatherm pipes are rubber lined pipe clamps (aquatherm pipe clamps Art.No.: 60516 – 60660 and 60668 – 60678 for fixed points for large pipe diameters). The rubber compound is especially made for applications with plastic pipes.

Basically it must be distinguished on pipe assembly, whether the fastening material is used as:

- a fixed point
- a sliding point

FIXED POINTS

On locating fixed points the pipelines are divided into individual sections. This avoids uncontrolled movements of the pipe.

In principle fixed points have to be measured and installed in a way, that the forces of expansion of aquatherm pipes as well as probably additional loads are accommodated.

On using threaded rods or threaded screws the drop from the ceiling should be as short as possible (20cm max. if possible). Swinging clamps should not be used as fixed points.

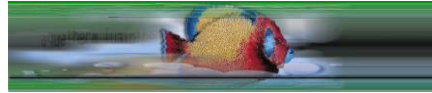
Risers do not require expansion loops, provided that fixed points are located immediately under a branch (tee).

To compensate the forces arising from the linear pipe expansion sufficient and stable clamps and mounting brackets must be installed.

Aquatherm pipe clamps meet all mentioned requirements and, when considering the installation instructions, are perfect for fixed point installations.



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SLIDING POINTS

Sliding clamps have to allow axial pipe movements without damaging the pipe.

To guarantee the functioning of a sliding clamp it has to be ensured that movements of the pipelines are not hindered by fittings or armatures installed next to the clamps.

Aquatherm pipe clamps have an extra even and smooth surface, sound insulation rubber layer.

Aquatherm pipe clamps are perfectly suited for fixed point or sliding point installations.

The application of distance rings depends on the type of pipe.

Fastening method	aquatherm green pipe S aquatherm green pipe MF (RP) aquatherm blue pipe MF aquatherm lilac pipe S
Sliding point	1 distance ring
Fixed point	No distance ring

SUPPORT INTERVALS

Beside the layout of pipes, factors for calculating the support distances are the mechanical property, pipe size, operation and ambient temperature as well as the fluid's specific weight.

The following information refers to horizontally installed pipes, as well as a flow medium with a density of 1.0 g/cm³ (e.g. water).

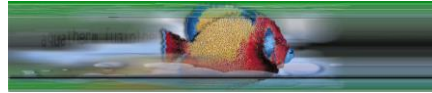
In case of media with a density of more than 1.0 g/cm³ up to 1.25 g/cm³ (e.g. water/glycol), the support distances are to be reduced by 4%.

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

aquatherm green pipe SDR11 S and aquatherm lilac pipe SDR11 S:

Medium temperature [°C]	Pipe diameter [mm]																
	20	25	32	40	50	63	75	90	110	125	160	200	250	315	355	400	450
	Support intervals [cm]																
20	60	75	90	100	120	140	150	160	180	200	260	265	275	280	285	295	305

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aquatherm green pipe SDR7.4 MF (UV):

Medium temperature [°C]	Pipe diameter [mm]														
	20	25	32	40	50	63	75	90	110	125	160	200	250	315	355
	Support intervals [cm]														
10	120	140	160	180	205	230	245	260	290	320	330	335	345	355	360
30	90	105	120	135	155	175	185	195	215	240	240	255	260	265	270
40	90	105	120	135	155	175	185	195	210	225	230	240	245	255	260
50	85	95	110	125	145	165	175	185	200	215	220	230	240	240	245
60	85	95	110	125	145	165	175	185	190	195	205	220	230	235	235
70	80	90	105	120	135	155	165	175	180	185	195	205	215	220	225
80	70	80	95	110	130	145	155	165	170	175	185	195	200	215	220

aquatherm green pipe SDR9 MF RP (UV):

Medium temperature [°C]	Pipe diameter [mm]												
	32	40	50	63	75	90	110	125	160	200	250	315	355
	Support intervals [cm]												
10	155	175	200	225	240	255	285	300	310	315	325	335	340
30	115	130	150	170	180	190	210	225	225	240	245	250	255
40	115	130	150	170	180	190	200	210	215	225	230	240	245
50	105	120	140	160	170	180	190	200	205	215	225	225	230
60	105	120	140	160	170	180	180	185	195	205	215	220	220
70	100	115	130	150	160	170	170	175	185	195	200	205	210
80	90	105	125	140	155	155	160	165	175	185	190	200	205

aquatherm blue pipe SDR11 MF (OT or UV):

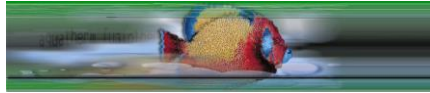
Medium temperature [°C]	Pipe diameter [mm]																
	20	25	32	40	50	63	75	90	110	125	160	200	250	315	355	400	450
	Support intervals [cm]																
10	110	130	150	170	195	220	235	250	275	280	285	290	300	310	315	325	325
30	80	95	110	125	145	165	175	185	200	205	210	220	225	230	235	250	265
40	80	95	110	125	145	165	175	185	190	195	200	210	215	220	225	240	255
50	75	85	100	115	135	155	165	175	180	185	190	200	210	210	215	230	245
60	75	85	100	115	135	155	160	170	170	175	180	190	200	205	205	220	235
70	70	80	95	110	125	145	150	160	160	165	170	180	185	190	195	205	220
80	60	70	85	100	120	135	140	145	150	155	160	170	175	185	190	195	210

aquatherm blue pipe SDR17.6 MF:

Medium temperature [°C]	Pipe diameter [mm]									
	160	200	250	315	355	400	450	500	560	630
	Support intervals [cm]									
10	260	265	275	280	285	295	305	315	325	330
30	190	200	205	210	215	230	240	255	270	280
40	180	190	195	200	205	220	230	245	260	275
50	175	180	190	190	195	210	225	235	250	265
60	165	175	180	185	190	200	215	230	240	255
70	155	165	170	175	180	185	200	215	230	240
80	145	155	160	170	175	180	190	205	220	230



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STRESS CORROSION CRACKING OF BRASS

It is known that brass is generally sensitive to stress corrosion. Stress corrosion cracking is a mechanism whereby in stress corrosion sensitive material, being under the influence of tensile stress and a corrosive environment, cracking may occur.

It is known that stress corrosion cracking in brass can occur in an ammonia environment. Ammonia can escape from, for example, insulation material and can dissolve into a thin film of water (e.g. condensation in a chilled water system), which is located on the brass parts. This creates a concentrated ammonia solution.

In conjunction with high internal stresses, like in female threaded brass parts, makes the brass parts sensitive to ammonia stress corrosion. Small amounts of As (Arsenic) and Sb (Antimony) in the brass may also increase the susceptibility to brass stress corrosion. It is therefore recommended that, in the above scenario, stainless steel or male threaded brass parts (no female threaded parts) should be used.

HANDLING AND WELDING AT LOW TEMPERATURES

At temperatures below +5°C, an aquatherm green (MF), blue (MF) or lilac pipe can be damaged by high impacts, such as heavy falling objects, hammering on the pipe or throwing of the pipe. This may cause hairline cracks in the pipe which later can develop into bigger cracks. Even though the aquatherm PP-R material has a high impact strength, we recommend, at lower temperatures (below +5°C), to treat the material with care.

The minimum welding temperature is not (entirely) depending on the ambient temperature. As long as the (socket fusion) welding tools (Ø16 - Ø125) can obtain the required socket fusion welding temperature of 260°C +/- 10°C or the (butt-welding) heating element (Ø160 - Ø630) can obtain the required butt-welding temperature of 210°C +/- 10°C, people are allowed to weld. It may be recommended to build a sheltered tent or to use heaters.

Welding of the aquatherm electrofusion sockets is only allowed at a temperature between +5°C and +40°C (according to DVS 2207). Make sure that the aquatherm electrofusion sockets and the, to be welded, pipe ends are dry (i.e. free from condensation).

TRANSPORT AND STORAGE

Aquatherm pipes can be stored at all temperatures. The pipes should be stored flat and fully supported. Bending the pipes during transportation and storage, should be avoided. Due to the limited UV resistance of PP-R, unprotected storage in the open air should be avoided.

CHEMICAL RESISTANCE

The aquatherm PP-R pipes and fittings are resistant against most acids and alkali. Nevertheless, for chemical applications, please consult Aquatherm Pipe Systems Pty Ltd. The chemical resistance of the used brass components such as in valves and threaded transition fittings is not equal to chemical resistance of the fusiole[®] PP-R material. The metal parts are therefore less suitable for chemical applications. Instead of threaded transition fittings, we recommend the use of aquatherm PP-R flange adaptors with plastic coated steel flanges or stainless steel threaded transition fittings.

October 2018

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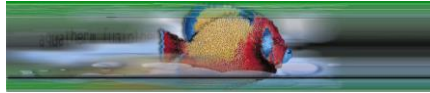
page 16

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UV RESISTANCE AND INTERNAL ALGAE GROWTH

The fusiolen® PP-R material is not permanent UV resistant. All aquatherm green and blue pipes and fittings have an UV stabilizer to bridge transport and installation times. Maximum storage time in the open air is 6 months (European conditions).

For countries where there is an intense UV radiation (i.e. Australia), storage time in the open air should be avoided.

Pipes made from fusiolen® PP-R and fusiolen® PP-R C (aquatherm blue pipe) should therefore not be installed where subject to UV radiation.

For the application in open air aquatherm offers composite pipes with an UV-protective layer made from black polyethylene (PE with carbon black), which excludes damage caused by sunlight. This PE layer must be peeled off, prior to welding.

All aquatherm green pipes and fittings are opaque / non translucent, so there won't occur any algae growth inside the pipes and in the water conveyed through the pipe. This makes it ideal for potable water applications.

ECOLOGY

The environmentally friendly raw material fusiolen® PP-R is used for the manufacturing of the aquatherm pipe systems. To ensure its environmental compatibility the basic material polypropylene, as well as all contained additives (colour pigments and stabilizers) were extensively tested, not only by aquatherm's own laboratory, but also by independent laboratories.

Their results show that the aquatherm pipe system and material fusiolen® PP-R from which it is manufactured, comply with the highest ecological standards and are thus future oriented. During the assembly of the aquatherm PP-R pipe material, no pollution will be created. The material is easily recyclable without any harmful substances being produced.

Aquatherm PP-R pipe material does not harm the environment.

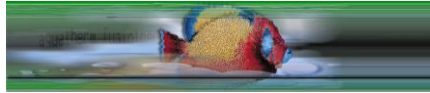
(Sustainable Green Star rated building material)

QUALITY CONTROL

The Aquatherm products meet high quality standards. This quality is assured by internal and external system- and quality- control. Various national and international independent authorities and institutions confirm aquatherm's quality standard by awarding many national and international type approvals and quality certificates, like the high standard German TÜV Certificate.



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FIRE BEHAVIOR

The aquatherm green pipe and the aquatherm blue pipe system comply with the requirements of the fire classification B2 (acc. to DIN 4102-1), normal inflammable. Compared to natural products like wood, cork or wool, aquatherm green and blue pipes do not produce any gas toxicity. In case of fire, there is no risk of dioxin emissions. To avoid fire and smoke transmission Aquatherm advises the use of fire retardant seals or fire collars. Before using fire collars, in combination with PP-R "MF" pipes, make sure they have been tested for that combination and not only for standard PP-R pipes.

COMPENSATORS / BELLOW EXPANSION JOINTS

Only rubber bellow compensators may be used in conjunction with aquatherm green and blue pipes with the sole purpose of absorbing vibration caused by cooling towers, pumps and chillers.

All bellow expansion joints made from corrugated pipes, designed for metal pipe materials, are unsuitable for aquatherm green and blue pipes.

When using axial expansion joints observe the manufacturer's instructions.

VALVES AND ACCESORIES

Aquatherm has aquatherm PP-R ball valves in their product range. These ball valves can be in-line welded into an aquatherm PP-R pipe system. After being installed, these ball valves can still be disassembled by loosening the PP-R union nuts.

By choosing the aquatherm PP-R ball valves, in lieu of traditional metal valves, saves you assembly time, minimizes the chances for leaks and corrosion and could possibly save you insulation costs.

In the other aquatherm valves, all movable parts are made of brass (dezincification resistant brass). The bodies and the connections of these valves are made of fusiolen® PP-R.

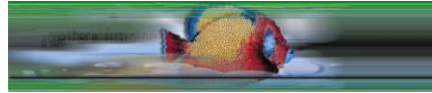
Assembly of metal butterfly valves (wafer type and lug type) into an aquatherm PP-R pipe system requires extra attention. The disc of a metal butterfly valve is standardly dimensioned for the inner diameter (DN) of a metal pipe flange, which differs to the inner diameter of a aquatherm PP-R flange adaptors.

To avoid possible jamming of the metal butterfly valve discs into the aquatherm PP-R flange adaptors, the aquatherm PP-R flange adaptors are, from Ø160mm and up, internally tapered and therefore made suitable for the use with most standardized DIN metal butterfly valves.

Selecting the right aquatherm PP-R pipe diameter in combination with a metal flanged valve: Make sure the DN size and the hole pattern (pitch circle and amount of holes; pressure rating) of the adjacent (metal) flange match with the DN size and the hole pattern of the aquatherm plastic coated steel flange. Then select the matching aquatherm PP-R flange adaptor/pipe diameter.



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OXYGEN- AND DIRT- SEPARATION (HVAC AND PROCESS INSTALLATIONS)

Air (oxygen) admission in a, mainly ferrous material, (heating) system is increasingly the cause of complaints such as noise problems, poor thermal conductivity, malfunctioning of balancing- and control- valves, loss of capacity and unnecessary energy consumption, corrosion of metal pipes, the formation of magnetite (black sludge in water), excessive wear and broken pumps.

There is always air in water (water can contain up to 15% dissolved air). Also, air will always continue to enter your system through expansion vessels (rubber membrane), rubber seals and gaskets, threaded adaptors, rubber hoses, valves (connections), fresh filling and auxiliary water and plastic pipes.

Corrosion damage to system components can be prevented by a proper planning, design and operation of water heating installations. Therefore the **VDI-2035-2** guideline was made in 1998, by The Association of German Engineers, for planners as well as for specialist companies and system operators.

(Verein Deutscher Ingenieure) VDI-2035-2 Ausgabe September 1998 Blatt 2
“Vermeidung von Schäden in Warmwasserheizanlagen, Wasserzeitige Korrosion“:

(Association of German Engineers) VDI-2035-2 Edition September 1998 Part 2
“Prevent of damage in water heating installations, water side corrosion“:

Below follow some relevant passages:

5 Causes of corrosion in ferrous materials

5.1 General information

“Whilst the potential appearance of corrosion is determined from the admission of oxygen, the type of corrosion is chiefly influenced by the water quality, the operating conditions, materials and design features.”

5.5 Admission of oxygen via gas-permeable components

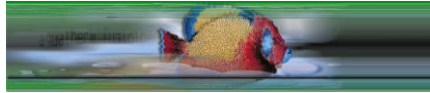
“In the presence of organic materials (floor heating tubes and radiator connecting pipes made of plastic, rubber membranes of expansion tanks, rubber hoses), the admission of oxygen in heating water can take place through the walls of such materials via diffusion. Particular attention should be paid to the fact that the permeability of oxygen doubles by approximately 10K when the temperature rises.”

“The oxygen permeability of rubber hoses is greater than for non-oxygenproof plastic pipes. Therefore corrosion damage as a result of oxygen admission through rubber hoses appears mainly in systems with a large number of hose connections.” (e.g. HVAC systems).

“Oxygen permeability of rubber can ultimately be the cause of corrosion damage from the use of membrane pressure expansion tanks in which the gas pressure is generated by an air



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compressor. Here the admission of oxygen rises in proportion to the greater system pressure.

Even in unpressurised membrane pressure expansion tanks in which only atmospheric pressure is present on the gas side of the rubber membrane, oxygen is admitted because of various oxygen partial pressures in the virtually oxygen-free heating water and in the air.”

7 Corrosion protection through proper planning

7.1 General information

“Corrosion protection starts at the planning stage with standard of materials and system design. The most important requirement is to prevent the admission of atmospheric oxygen into the heating water.

In corrosion terms, water heating installations can be designed as “open” or “closed” systems.

“Open corrosion systems” are those in which even during normal operation oxygen is necessarily admitted into the heating water, e.g., in systems with open expansion tanks or with non-oxygenproof plastic pipes.

“Closed corrosion systems” are those in which during normal operation no noticeable amount of oxygen can enter the system, e.g, as in membrane pressure tanks systems with inert gas filling and which exclude any other gas-permeable components.

The selection of materials for water heating installations does not cause any problem as far as “closed corrosion systems” are concerned. The oxygen admitted in filling and auxiliary water can only cause corrosion to such a limited extent (see Section 5.2) that damage from corrosion need not to be feared.”

“To prevent corrosion damage in the form of sludge formation in systems with plastic pipes, the use of “oxygenproof pipes” is predominantly recommended as defined in DIN 4726. These are characterised by the fact that they admit less than 0.1 g/(m³.d) of oxygen.”

aquatherm blue pipes MF OT (Oxygen Tight) are a solution.

The oxygen permeability of the **aquatherm blue pipes MF OT** meets the DIN 4726. According to the MPA NRW testreport Nr. 31 000 4814 d.d. 15th July 2014, the **aquatherm blue pipes MF OT** admits only **0,0024 g/(m³.d)** of oxygen, where a maximum 0,1 g/(m³.d) is required, in accordance with DIN 4726.

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10 Conclusions

- *“From this guideline it can be seen that corrosion damage is normally only possible if oxygen is continuously admitted into the heating water.”*
- *“To prevent oxygen entering the heating water the water heating installation must be designed as a closed system.”*
- *“In a closed water heating installation the selection of materials is of minor importance.”*
- *“Corrosion protection action is only required in open water heating installations.”*
- *“To achieve the designed service life of an expertly planned, installed and operated water heating installation without any corrosion damage, regular maintenance work is required.”*

CORROSION PROTECTION MEASURES

1. Installing a heat exchanger.
2. Installing an “Elysator” in a heating water by-pass; high purity magnesium anode (sacrificial metal).
3. Water treatment (adding chemical additives to the heating water; beware of other components, like rubber seals and gaskets!).
4. Proper regular system maintenance.
5. Installing of Air vents / (micro bubble) deaerators / Vacuum degassers / Dirt separators.

By using air vents the non-dissolved gases, like big air bubbles, are removed but not the dissolved gases, like the many micro bubbles and trapped gas bubbles.

Dissolved air (micro bubbles) can be removed by (micro bubble) deaerators or vacuum degassers.

Also dirt (rust or magnetite) in heating water systems is a cause of malfunctions, excessive wear and damage to expensive system components. By installing a dirt separator into the system, this dirt can be removed. Combinations of deaerators / dirt separators are also a solution.

