TECHNEWS

Edition No.3 2013

"Fifty shades of Green"

Aquatherm GmbH Germany is a World-wide producer of **green** polypropylene (PP-R) pipe systems for the potable water and heating sector. **Aquatherm** was founded in **1973** in **Germany** as a company for the development, production and installation of warm water floor heating systems.
In 1980 **aquatherm** developed the fusiotherm® pipe system of polypropylene (PP-R) for potable water and heating installations.

Trade innovations were the basis for a constant growth. Our product range has expanded beyond water services into mechanical and civil services, such as compressed air, recycled, large bore HVAC systems (up to Ø630mm) and wet sprinkler pipe systems. Special grid systems for comfort heating and cooling have now been introduced in residential and commercial constructions sectors.

Today **aquatherm** has subsidiaries in Radeberg/Dresden and Carrara/Italy and more than

78 marketing partners around the world.

aquatherm is the largest selling PP-R pressure pipe system in the world market.

All Innovation, Engineering and Production remains in **Germany**.

aquatherm is proud of the fact that all of its products are "**Made in Germany**".

Since then many plastic pipe manufacturers worldwide have seen the advantages of the **aquatherm PP-R pipe** systems for water services and have tried to copy the successful **aquatherm** formula.
Most of these PP-R pipe manufacturers have even adopted the **green** colour, but there is a "*shade difference*".

Aquatherm Australia Pty Ltd
Unit 6f, 443 West Botany Street Rockdale NSW 2216 I T: (02) 9553 7199 I F: (02) 9553 7899 I E: aquatherm@aquatherm.com.au I www.aquatherm.com.au

TECHNEWS

aquatherm state of the pipe

Edition No.3 2013

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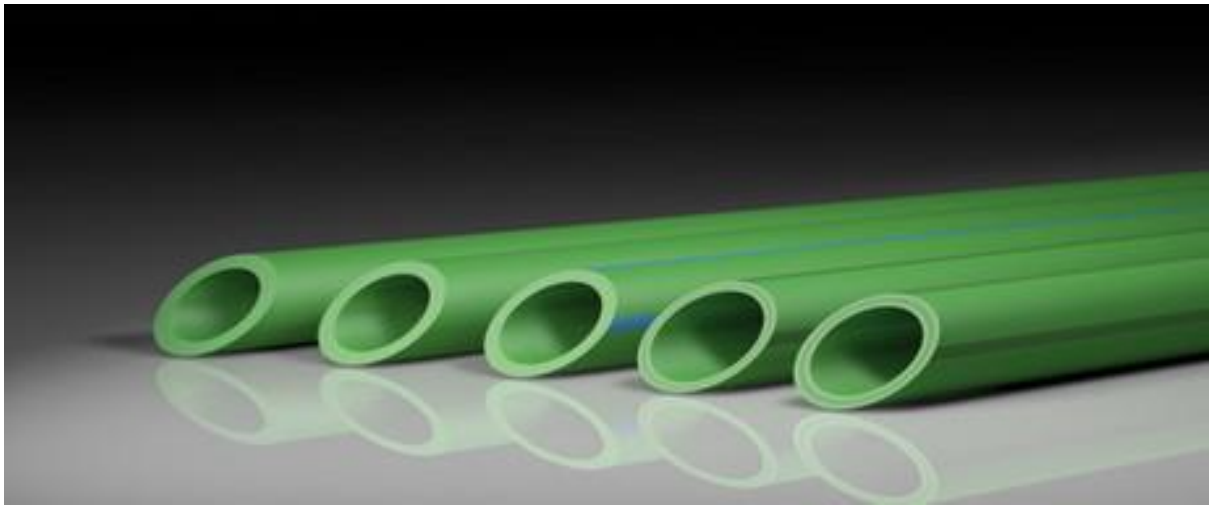
Since **aquatherm PP-R** was the first **green** PP-R pipe system supplied in Australia many people associate the **green** colour pipes and fittings with **aquatherm PP-R systems** but beware,

they may look the same from the outside but the inside (physical properties and quality) might be different.

Not all **green** pipes are **aquatherm PP-R** pipes



"We set the standards for quality and reliability
Request the original, beware of imitation!"

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MADE IN GERMANY PIPESYSTEMS

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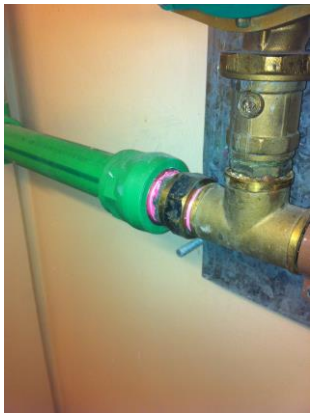
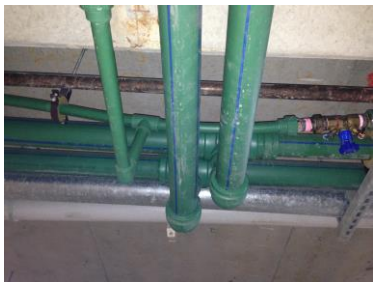
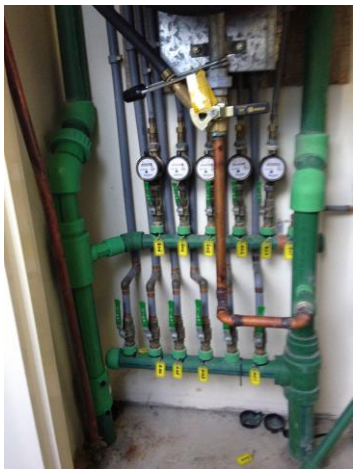
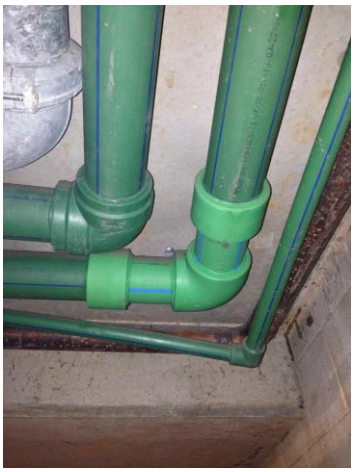
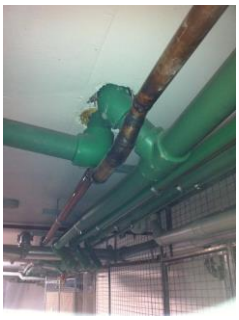
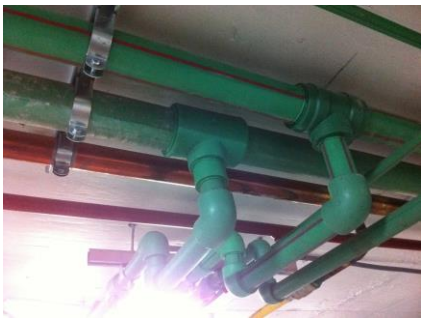
"Fifty shades of Green"





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aquatherm state of the pipe

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Quality Control:

Over the years **aquatherm** GmbH has invested a lot of time in innovation and internal and external quality control. This has resulted in the quality and large pipe and fitting range we now supply to the market.
Aquatherm GmbH produces 150 km of pipe and 230.000 fittings daily.

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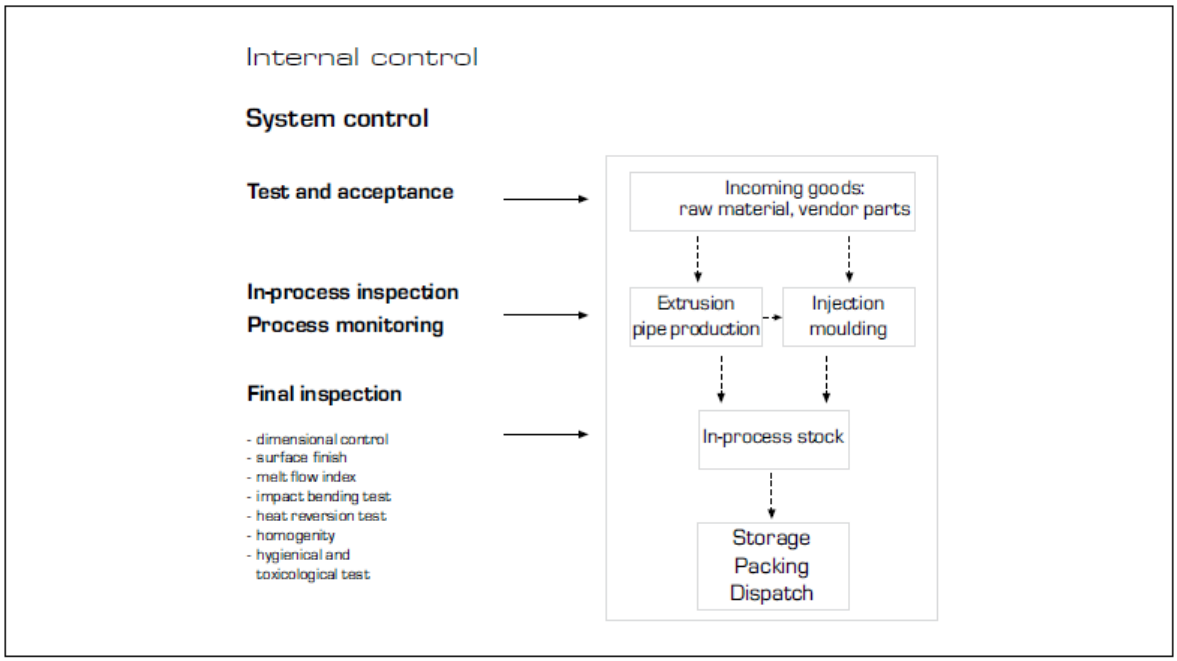
AQUATHERM QUALITY MANAGEMENT SYSTEM



In addition to the permanent internal quality control, an external control is made by i.e. SKZ, SAI, TGM, Hygieneinstitut.

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External Quality Control

External supervision consists of tests of a defined scope and in defined intervals. The respective supervising institutions appoint authorised test organisations to carry out these tests.

The external supervision includes external tests of the products and

a) Internal audit of **aquatherm's** quality assurance system and test procedures.
b) Calibration of the test equipment and
c) Hygienic and toxicity tests.

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

In Germany the external supervision of the **aquatherm green pipe** system is carried out by the

- SKZ (Süddeutsches Kunststoffzentrum Würzburg)
- Institute for Hygiene, Gelschenkirchen (Hygieneinstitute Gelschenkirchen)

who are authorized by the DVGW (German Institute for Gas and Water) as controlling organisation. The external supervision for certificates from abroad is carried out in a similar way.

Tested quality – Highest standards

Certifications in accordance with ISO 9001, 14001 & 50001

Since 1996 aquatherm has been meeting the requirements of the certifiable **quality management system** in accordance with the German DIN **ISO 9001** standard.

The 2012 **TüV certificate** was extended by the **environment management system in** accordance with **ISO 14001** and currently by the **energy management system in** accordance with **ISO 50001.**


Certificate

Standard ISO 9001:2008

Certificate Holder: aquatherm

Scope: Development, Production and Sale of System elements for sanitary-/heating-applications and fixed fire fighting systems

Validity: The certificate is valid from 2012-01-23 until 2014-12-31.

2012-01-23

TÜVRheinland®


Certificate

Standard ISO 14001:2004

Certificate Holder: aquatherm

Scope: Development, Production and Sale of System elements for sanitary-/heating-applications and fixed fire fighting systems

Validity: The certificate is valid from 2012-01-23 until 2015-01-22.

2012-01-23

TÜVRheinland®


Certificate

Standard ISO 50001:2011

Certificate Holder: aquatherm

Scope: Development, Production and Sale of System elements for sanitary-/heating-applications and fixed fire fighting systems

Validity: The certificate is valid from 21.01.2013 until 20.01.2016.

2013-01-22

TÜVRheinland®

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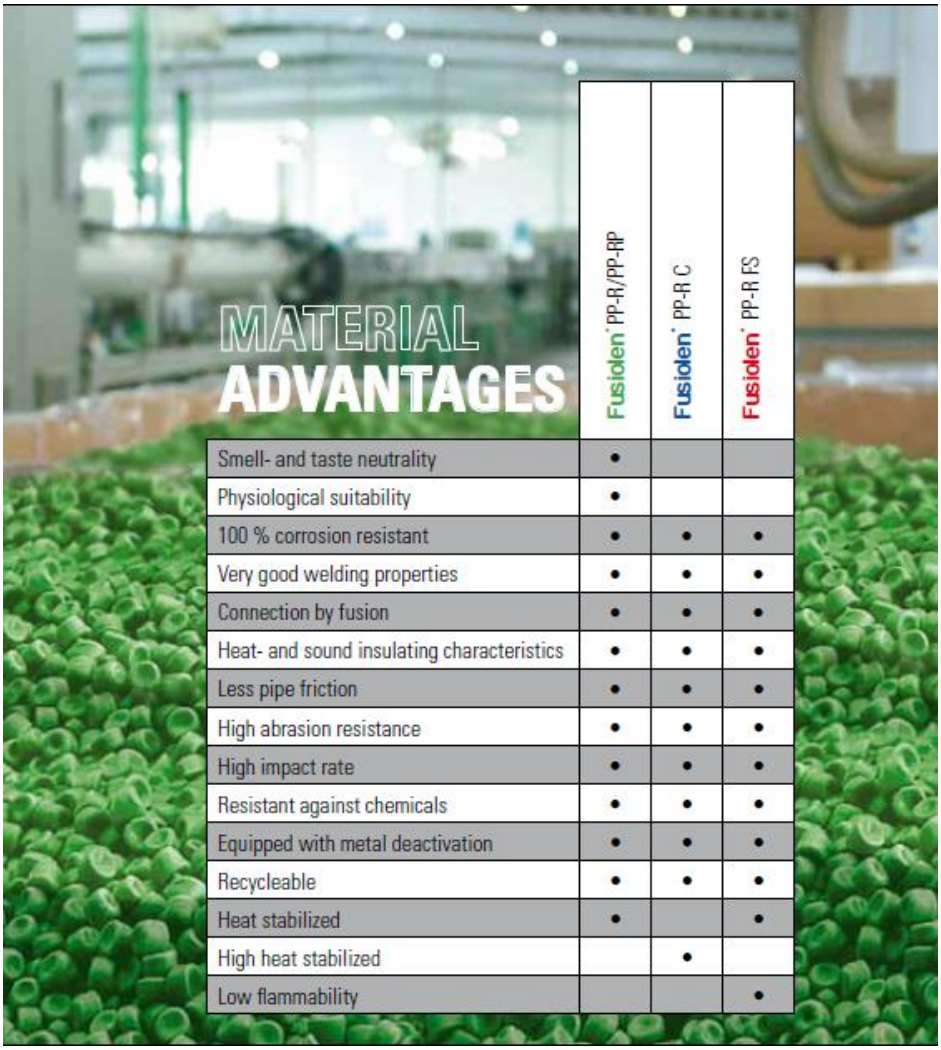
Aquatherm has its own laboratory at their main site in Attendorn (Germany). This laboratory meets **NATA** standards. This does not only guarantee constant quality controls but also the further development of the basic material to be prepared for the most different product requirements as well as to develop innovative materials for new fields of application.

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



	Fusiolen® PP-R/PP-RP	Fusiolen® PP-R C	Fusiolen® PP-R FS
Smell- and taste neutrality	•		
Physiological suitability	•		
100 % corrosion resistant	•	•	•
Very good welding properties	•	•	•
Connection by fusion	•	•	•
Heat- and sound insulating characteristics	•	•	•
Less pipe friction	•	•	•
High abrasion resistance	•	•	•
High impact rate	•	•	•
Resistant against chemicals	•	•	•
Equipped with metal deactivation	•	•	•
Recycleable	•	•	•
Heat stabilized	•		•
High heat stabilized		•	
Low flammability			•

Excellent results of this research program are the innovative pipe materials fusiolen® PP-R, fusiolen® PP-R C and fusiolen® PP-R FS, used as the basic for the worldwide successful pipe systems:

aquatherm green pipe, **aquatherm blue pipe**, **aquatherm lilac pipe** and **aquatherm red pipe**.

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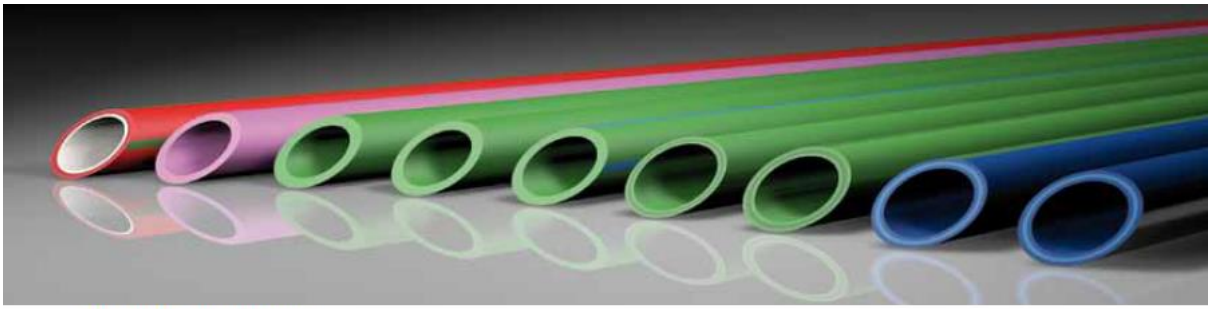

FIELDS OF APPLICATION

System recommended due to its technical advantages: ●
Application of the system is suitable: ❍

	aquatherm red pipe	aquatherm lilac pipe	aquatherm green pipe	aquatherm blue pipe
Potable water application			●	
Heating system construction			❍	●
Climate technology			❍	●
Chilled water technology			❍	●
Swimming-pool technology			●	●
Chemical transport due to high chemical resistance			●	●
Rainwater application		●	❍	
Irrigation		●	❍	●
Compressed air systems			❍	●
Under-floor-heating-systems			❍	●
Application in the field of ship building			●	●
District heating pipeline systems			●	●
Geothermal				●
Agriculture		●	●	●
Fire protection sprinkler-systems	●			

Satisfied customers in more than 80 countries as well as numerous seals of quality and authorization certificates confirm the high quality standard of the **aquatherm** products.

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Emission Test Certificate

Monday, October 25th, 2011

Supplier: Aquatherm (6F 443 West Botany St, Rockdale, NSW 2216)

Sample Description: Aquatherm Fusiotherm Potable Water Pipe System

Date Tested: October 2011 (Tested by FORAY Laboratories – NATA Accreditation 1231)

Test Method: ASTM D5116 "Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Material/Products".

Emission Data:

Green Building Council of Australia Green Star Office Interiors IEQ-11	Aquatherm Fusiotherm Potable Water Pipe System
Total Volatile Organic Compound Emission Rate limit <0.5mg/m²/hr	Total Volatile Organic Compound Emission Rate: <0.008 mg/m²/hr (24 hours)

Dr. Vyt Gamys
PhD, BSc(Hons) AIMM, ARACI, ISIAQ
ACA, AIRAH, FMA
Managing Director and Principal Consultant

Anne Saletti
BNanotech/BSc(Hons)
Consultant

CV110924

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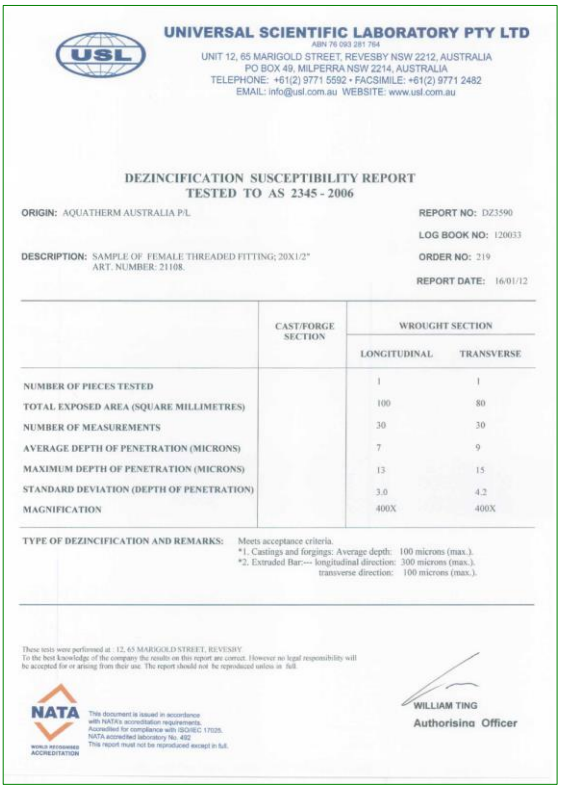
1/65 Nicholson St, St Leonards, NSW 2065 - T: +612 9966 9211 - F: +612 9966 9210 - E: sydney@cetec-foray.com.au



USL

UNIVERSAL SCIENTIFIC LABORATORY PTY LTD
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UNIT 12, 65 MARIGOLD STREET, REVESBY NSW 2212, AUSTRALIA
PO BOX 49, MILPERRA NSW 2214, AUSTRALIA
TELEPHONE: +61(2) 9771 5592 • FACSIMILE: +61(2) 9771 2482
EMAIL: info@usl.com.au WEBSITE: www.usl.com.au

DEZINCIFICATION SUSCEPTIBILITY REPORT
TESTED TO AS 2345 - 2006

ORIGIN: AQUATHERM AUSTRALIA P/L

REPORT NO: DZ3590
LOG BOOK NO: 120033
ORDER NO: 219
REPORT DATE: 16/01/12

DESCRIPTION: SAMPLE OF FEMALE THREADED FITTING; 20X1/2"
ART. NUMBER: 21108.

	CAST/FORGE SECTION	WROUGHT SECTION	
		LONGITUDINAL	TRANSVERSE
NUMBER OF PIECES TESTED		1	1
TOTAL EXPOSED AREA (SQUARE MILLIMETRES)		100	80
NUMBER OF MEASUREMENTS		30	30
AVERAGE DEPTH OF PENETRATION (MICRONS)		7	9
MAXIMUM DEPTH OF PENETRATION (MICRONS)		13	15
STANDARD DEVIATION (DEPTH OF PENETRATION)		3.0	4.2
MAGNIFICATION		400X	400X

TYPE OF DEZINCIFICATION AND REMARKS: Meets acceptance criteria.
*1. Castings and forgings: Average depth: 100 microns (max.).
*2. Extruded Bar:— longitudinal direction: 300 microns (max.).
transverse direction: 100 microns (max.).

These tests were performed at : 12, 65 MARIGOLD STREET, REVESBY
To the best knowledge of the company the results on this report are correct. However no legal responsibility will be accepted for or arising from their use. The report should not be reproduced unless in full.

NATA
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WILLIAM TING
Authorising Officer

CERTIFICATE OF CONFORMITY

SAI Global hereby grants:

Aquatherm GmbH
Finnentroper Strasse 82, ATTENDORN, Germany

Watermark Certificate of Conformity - Level 1

Evaluated to:
ISO 15874.3:2003 - Plastics piping systems for hot and cold water installations - Polypropylene (PP) - Part 3: Fittings
& ISO 15874.2:2003 - Plastics piping systems for hot and cold water installations - Polypropylene (PP) - Part 2: Pipes

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Certificate No:WMKA02437

Issued: 11 December 2009
Expires: 24 November 2014
Originally Certified: 25 November 1999
Current Certification: 25 November 2009

Duncan Lilley
Global Head – Assurance Services

Alex Ezrakhovich
General Manager – Certification Services

WaterMark

* For details of manufacture, refer to the licensee

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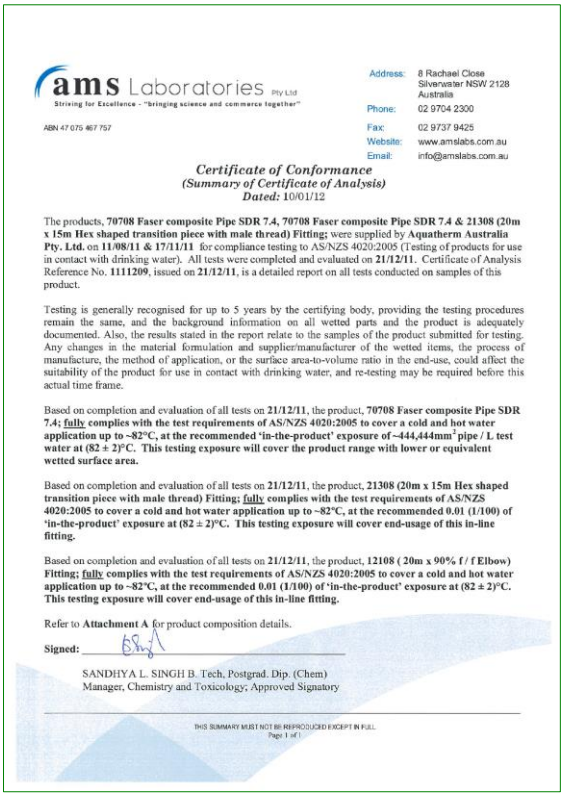


ams Laboratories Pty Ltd
Striving for Excellence - "bringing science and commerce together"
ABN 47 075 467 757

Address: 8 Rachael Close, Silverwater NSW 2128 Australia
Phone: 02 9704 2300
Fax: 02 9737 9425
Website: www.amslabs.com.au
Email: info@amslabs.com.au

Certificate of Conformance
(Summary of Certificate of Analysis)
Dated: 10/01/12

The products, **70708 Faser composite Pipe SDR 7.4, 70708 Faser composite Pipe SDR 7.4 & 21308 (20m x 15m Hex shaped transition piece with male thread) Fitting;** were supplied by **Aquatherm Australia Pty. Ltd.** on **11/08/11 & 17/11/11** for compliance testing to AS/NZS 4020:2005 (Testing of products for use in contact with drinking water). All tests were completed and evaluated on **21/12/11.** Certificate of Analysis Reference No. **1111209**, issued on **21/12/11**, is a detailed report on all tests conducted on samples of this product.

Testing is generally recognised for up to 5 years by the certifying body, providing the testing procedures remain the same, and the background information on all wetted parts and the product is adequately documented. Also, the results stated in the report relate to the samples of the product submitted for testing. Any changes in the material formulation and supplier/manufacturer of the wetted items, the process of manufacture, the method of application, or the surface area-to-volume ratio in the end-use, could affect the suitability of the product for use in contact with drinking water, and re-testing may be required before this actual time frame.

Based on completion and evaluation of all tests on **21/12/11**, the product, **70708 Faser composite Pipe SDR 7.4; fully complies with the test requirements of AS/NZS 4020:2005 to cover a cold and hot water application up to ~82°C, at the recommended 'in-the-product' exposure of ~444,444mm² pipe / L test water at (82 ± 2)°C. This testing exposure will cover the product range with lower or equivalent wetted surface area.**

Based on completion and evaluation of all tests on **21/12/11**, the product, **21308 (20m x 15m Hex shaped transition piece with male thread) Fitting; fully complies with the test requirements of AS/NZS 4020:2005 to cover a cold and hot water application up to ~82°C, at the recommended 0.01 (1/100) of 'in-the-product' exposure at (82 ± 2)°C. This testing exposure will cover end-usage of this in-line fitting.**

Based on completion and evaluation of all tests on **21/12/11**, the product, **12108 (20m x 90% f / f Elbow) Fitting; fully complies with the test requirements of AS/NZS 4020:2005 to cover a cold and hot water application up to ~82°C, at the recommended 0.01 (1/100) of 'in-the-product' exposure at (82 ± 2)°C. This testing exposure will cover end-usage of this in-line fitting.**

Refer to **Attachment A** for product composition details.

Signed:

SANDHYA L. SINGH B. Tech, Postgrad. Dip. (Chem)
Manager, Chemistry and Toxicology; Approved Signatory

THIS SUMMARY MUST NOT BE REPRODUCED EXCEPT IN FULL
Page 1 of 1

This success is a great contribution and represents a further step to strengthen our competitive position and to meet the high requirements and the responsibility for our customers, partners and the environment.

Aquatherm prides itself on its environmental-friendly production, processing and the highest quality standard of all products.

Prime ecological advantages:

- PVC free
- The additive share of the **fusiolen**® material is below 3%
- Free from heavy metals hazardous to health (e.g. Cu, Pb, Ni)
- Longevity
- Recyclable

TECHNEWS

aquatherm state of the pipe

Edition No.3 2013

Hygienic suitability:

According to DIN 1988 T2 all installation parts coming directly in contact with potable water are commodity goods acc. to the Law for Food and Commodity Goods.
Plastic pipes have to comply with the KTW-recommendations of the Federal Public Health Department.

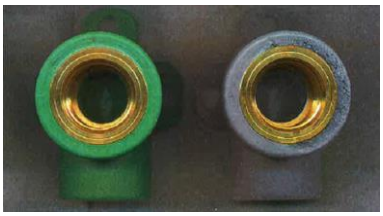
Material:

The hygienic suitability of the material used for the **aquatherm green pipe** system is independently verified through test certificates from the Hygiene Institute Gelschenkirchen. The suitability for potable water pipes in the field of cold and hot water is confirmed by current tests.

WaterMark

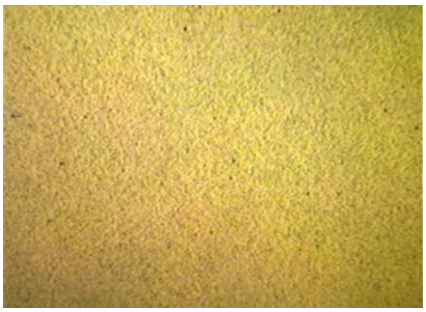
Dezincification Resistant (DR) Brass:

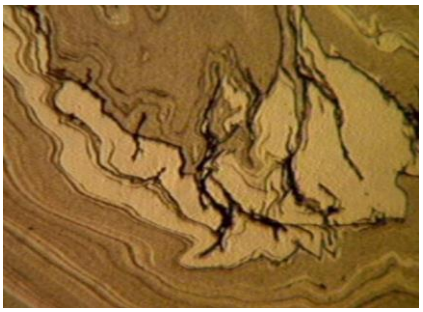
Since the use of Nickel (Ni) has been reduced in the European Directive for drinking water from 0.05 mg/l to 0.02 mg/l, **aquatherm** has not applied a Nickel coating to their brass threaded parts.
aquatherm only uses dezincification resistant (DR) brass for their threaded parts.
For Reverse Osmosis (R.O.) water or some chemical applications, **aquatherm** can also supply PP-R/Stainless Steel transition fittings.



fusiolen® PP-R with metal deactivators and standard PP-R without metal deactivators

Homogeneity of PP-R:





Homogeneity of fusiolen® PP-R **Homogeneity of manufacturer X PP-R**

The above left microscope image shows a very good mixture of PP-R, additives, stabilizers and pigments.
The right one doesn't show a very good mixture and will not withstand high pressures or temperatures.

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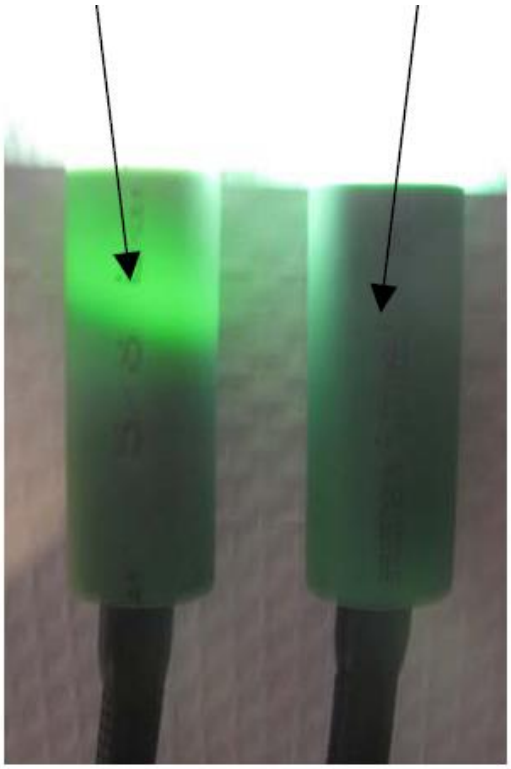
Transparency of PP-R:

PP-R from manufacturer X aquatherm PP-R



aquatherm PP-R is opaque / non transparent by adding the right pigments to the PP-R.
If the used raw PP-R material is transparent, algaes might start to grow in the drinking water.

Algaes growth will reduce the quality of our drinking water.

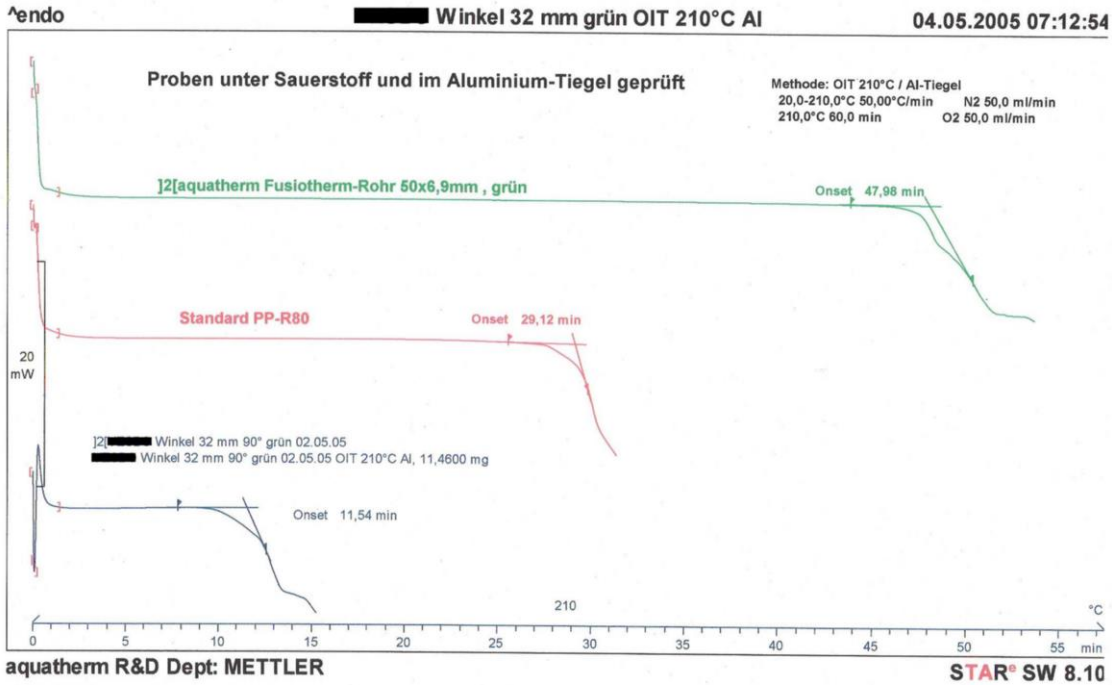
TECHNEWS

aquatherm state of the pipe

Edition No.3 2013

Aquatherm uses food-approved heat stabilizers and metal deactivators in their PP-R, to the maximum allowed for potable water systems.

Heat and metal- stabilizers (OIT Test)



Polymers (i.e. PP-R) age throughout their lifetime due to exposure to environmental elements such as heat, pressure, oxygen, (UV) light, chemicals, pro-oxidants (Cu ions or Chlorine) and radiation. Aging causes the degradation of the physical properties of polymers and will lead to their failure.
By using the right heat- and metal- stabilizers (Anti-oxidants) you can prolong the service life of Polymers.

By doing an **OIT** (**O**xidative **I**nduction **T**ime) test on PP-R pipes and fittings provides you information about the oxidative stability of the used PP-R material; in other words it provides you some information about the quality (service life) of the used PP-R material.

In the OIT test method, the (PP-R) specimen is heated to a specific temperature (210°C - 230°C for PP-R) in an open (Aluminium or Copper) pan under an inert (N_2 ; Nitrogen) atmosphere.
After a short period of time, at the isothermal temperature (melting of the material), the gas is switched from N_2 (Nitrogen) to O_2 (Oxygen). The time taken from the O_2 gas switching to the onset of oxidation reaction is defined as the OIT (onset time in minutes).
The higher the OIT (longer onset time) the better the oxidative stability of the (PP-R) material.

Via an OIT test you can compare the aging resistance of different PP-R materials
(**see above OIT test example**). Compared to the PP-R materials used by other PP-R pipe and fitting manufacturers, the **aquatherm** PP-R material has the longer OIT.

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TECHNEWS

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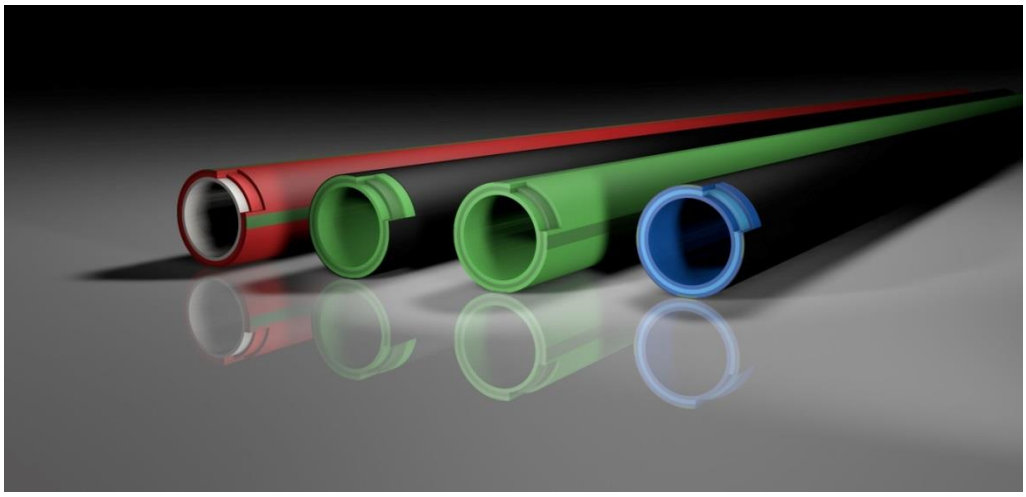
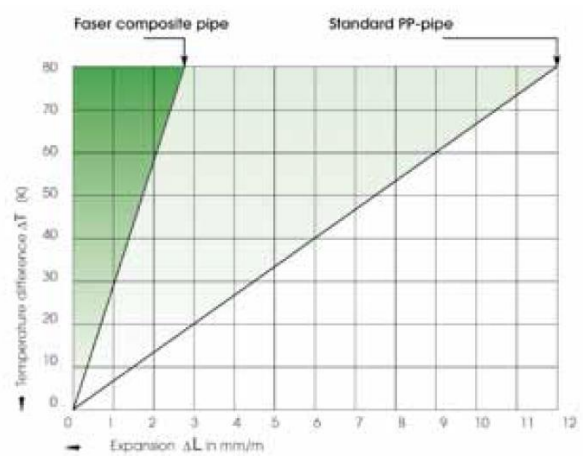
Faser Composite Technology

The composite (MF; Multilayer Faser) pipes made in the multi-layer extrusion process produce a higher stability due to fibre filling in the middle layer.
The advantages of the faser composite pipes compared to full PP-R pipes are:

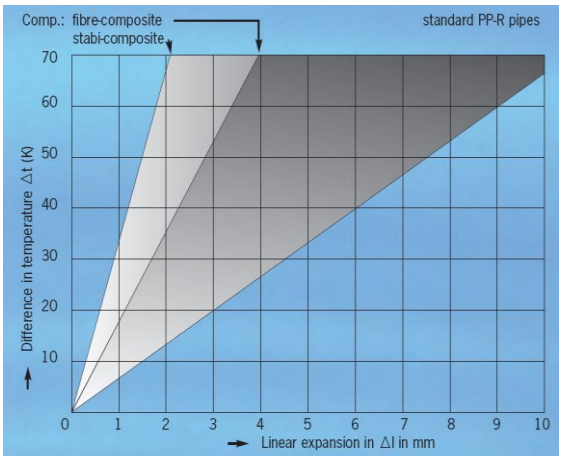
- Reduced linear expansion (**α = 0.035 mm/mK**); better than the competition.
- Larger support intervals
- Higher flow rate due to increased inner diameter
- Less weight



aquatherm PP-R *faser* (MF) pipes



aquatherm PP-R (*faser*) MF pipe



PP-R *faser/fibre* pipe manufacturer X

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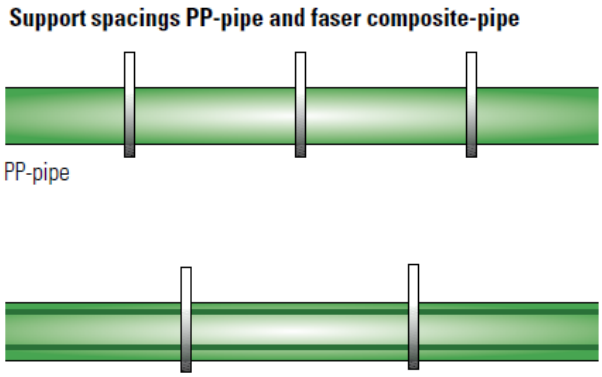
Support Intervals:



Thermal conductivity:

The thermal conductivity coefficient (at 20°C) of the **aquatherm** PP-R material is **λ = 0.15 W/mK**, which is better than the thermal conductivity coefficient of our PP-R competitors.