



Copper velocities in alignment with International best practice

Early April 2014 **The International Copper Association Australia (ICAA)** released its new “Hydraulic Services E-Design Guide and Pipe Sizing for Plumbing”. Pleasingly the guide acknowledges that water velocities, in hot potable water reticulation systems, are not covered under the current AS3500.4:2003.



Recommended Water Velocities				
Service	Velocity Range m/s.			
	Recommended Design Velocity m/s	Institute of Plumbing Australia Selection and Sizing of Copper Tubes for Water Piping Systems	Australian Standards AS 3500.4 2003 +Amend 1&2	British Standard BS 6700:2006 +A1:2009
Cold Water - Mains pressure water services pipelines	Up to 2.4 Up to 1.6 within Dwelling / Apartment	1.0 to 2.1	Max. 3.0	Max. 3.0
Cold Water - Gravity flow pipelines from upper level storage tanks – Top two floors only	0.1 to 0.4	0.1 to 0.4	Max. 3.0	Max. 3.0
Cold Water - Gravity flow pipelines from upper level storage tanks – below top two floors	1.0 to 2.1	1.0 to 2.1	Max. 3.0	Max. 3.0
Cold Water - Pump suction pipelines	1.2 to 2.1	1.2 to 2.1	Max. 3.0	Max. 3.0
Cold Water - Pump delivery pipelines	1.5 to 2.1	1.5 to 2.1	Max. 3.0	Max. 3.0
Heated water - Flow and return – circulating system	1.0	Not Specified	Not Specified	Max. 3.0
Heated water - Non-circulatory systems	2.0	1.0 to 2.1	Max. 3.0	Max. 3.0

Table 17.1
Recommended Water Velocities for Cold and Heated Water Supplies





The current and widespread misinterpretation of a velocity of max. 3.0 m/s for hot potable water recirculation systems (please read **AS3500.4:2003 chapter 4.14.1**) is corrected emphatically to read max. 1.0 m/s for copper pipes in hot potable water recirculation systems (HWRS).

This recommended max. velocity of 1.0 m/s in HWRS is recommended to prevent internal erosion-corrosion of copper pipes.

Many International (Copper) associations and International Standards have for some time recommended a similar velocity:

- **Copper Development Association Inc. (CDA) U.S.A.**



- **Canadian Copper & Brass Development Association (CCBDA)**



- **Copper Development Association (CDA) U.K.**



- **German DIN1988-3 (followed by DIN1988-300)**



- **German DVGW worksheet W553**



- **Dutch KIWA**



The Copper Development Association Inc. (CDA) U.S.A. also advised in 1996 that “a copper alloy **C70600 (90:10 copper-nickel)** should be specified when water temperature is likely to exceed 140°F (60°C) and higher velocities are involved.”

The CDA U.S.A. also mentioned that “erosion-corrosion also can be a concern when the local water pressure exceeds about 80 psi (550 kPa)”.

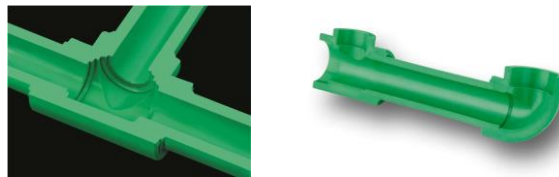


As mentioned in our “Cautionary Note” and confirmed by Polymer Scientists around the world, all polyolefins (PP, PE, PE-X and PB), can fail in the **main ring** of a mixed (**PP-R/Copper**) hot water recirculation system (**only**) due to “**Oxidative Stress Cracking**”.

“**Oxidative Stress Cracking**” in PP-R will only occur when there is a combination of:

- Internal or external stress on the PP-R material (for example no proper expansion facilities, incorrect clipping, excessive water pressure)
 - High temperatures (> 70°C)
 - Entrapped oxygen in the hot water
 - Pro-oxidants, i.e. **copper ions**
- Pro-oxidants have a catalytic effect on the oxidation process of polyolefins and other less noble metals.

Aquatherm uses **metal deactivators** in their PP-R pipe system, to the maximum allowed for potable water systems, to prevent the oxidative effect of copper suffering erosion-corrosion. The more **copper ions**, resulting from this velocity/temperature driven erosion-corrosion process, in the hot water recirculating system, the quicker these metal deactivators will be depleted, leaving the PP-R vulnerable to oxidative degradation. PP-R and other polyolefins in the ring main, downstream of the eroding-corroding copper pipes, will harvest these **copper ions**.



1) New undamaged **aquatherm green PP-R pipes**



2) Erosion-corrosion in **copper pipes**



3) **Copper ions** harvested in **PP-R HWRS pipes** having a catalytic effect on oxidative stress cracking.



Elsewhere in the world where designed for permissible hot water recirculation velocities, temperatures and pressure, are under control, PP-R and copper work in harmony in HWRS, as they have done for decades. Only in Australia has **aquatherm** and other PP-R manufacturers experienced oxidative degradation.

This outcome is now known all over the world as **“The Australian Phenomenon”**.

Because of this “Australian Phenomenon” many respectable international PP-R pipe system manufacturers have left the Australian market or are not prepared to even enter the Australian market while this failure within AS3500.4:2003 to align with International constant hot potable water recirculation design practice continues to cause confusion in Hydraulic design, and especially so in Design & Construct practices!

By publishing a “Cautionary Note” in their **aquatherm** technical brochure (NZ 10101 Edition 01/2011), **aquatherm green pipe / aquatherm blue pipe / aquatherm lilac pipe** technical brochure (NZ 10101 Edition 6/2013), **aquatherm Training Manuals 2011 and 2012** and website, **Aquatherm** has sought since 2010 to inform the Plumbing Industry about the care that should be exercised in mixed PP-R/Copper hot potable water recirculation systems.

The **Aquatherm** “Cautionary Note” has now been adopted by other PP-R pipe system manufacturers.



By conducting trainings (on site) **Aquatherm** has also informed plumbers about this “Cautionary Note” for mixed PP-R/Copper HWRS.

In 2012 **Aquatherm** organized Capital City Roadshows to inform the Plumbing Industry (AHSCA) about “The Australian Phenomenon”, our speakers were:

- Prof. Graeme George - Emeritus Professor of Polymer Science - AM Qld Uni Technology
- Dr David Nicholas - Principal Consultant Nicholas Corrosion
- Jeremy Bowler - Former director of Building and Engineering, Barwon Health

Even a DVD has been prepared by **Aquatherm** about “The Australian Phenomenon”.





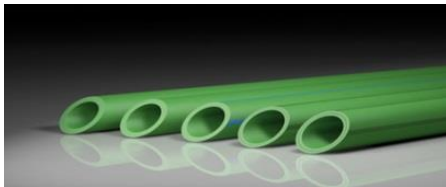
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Aquatherm applauds **The International Copper Association Australia (ICAA)** for its recommendations on HWRS velocities for copper pipes and welcomes the new Hydraulic Services Designers Guide as an initiative that will enable copper and all Watermarked thermo polymers to work in harmony in HWRS as they do around the world.



With this welcomed announcement it would be expected the **Australian Plumbing Standard AS3500.4** (hot potable water) will be amended to now cover hot potable water recirculation and align with International HWRS velocities and temperatures.

21st Century Pipe Innovation with **aquatherm PP-R.**



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