

We offer you



German **Plastics** Center
Product Quality · Training · Research · Certification

SKZ

Chlorine Resistance of Plastic Pipes

Tests in accordance with:

- ASTM F 2023: Standard Test Method for Evaluating the Oxidative Resistance of Crosslinked Polyethylene (PEX) Tubing and Systems to Hot Chlorinated Water
- NSF P171: Protocol for Chlorine Resistance of Plastic Piping Materials
- ASTM F 2263: Standard Test Method for Evaluating the Oxidative Resistance of Polyethylene (PE) Pipe to Chlorinated Water

Temporary, defined loading of pipes under specified conditions and subsequent evaluation with analytic methods, such as OIT measurements and IR microscopy.

Solving complex questions in connection with chlorine resistance within the scope of research projects.

SKZ – “THE ADDRESS” when it comes to plastics.

As the largest plastics institute in Germany we offer practical solutions – tailored exactly to your requirements. For the past 50 years now we have seen ourselves as a partner to the plastics industry providing extensive system expertise: By means of **Testing and Quality Assurance** we support your product policy, supplying you with valuable arguments for your key markets. With more than 10,000 participants each year, we are the market leader for **Training and the Transfer of Knowledge** in the field of plastics. Our **Research** division bets on the development and improvement of production technologies in line the market requirements. With the **Certification of Management Systems** we offer you the best prerequisite for efficiency and economic success.

Become part of a strong community!

With more than 340 members, the association for the promotion of the SKZ currently constitutes the most important and dynamic network in the field of plastics. Benefit from the numerous opportunities for cooperation achieved through the networking of experts from all areas of the plastics industry. Our network reflects the wide spectrum of the industry and offers excellent opportunities for the cooperation of economy, science and politics. For further information, please visit www.skz.de or contact us at fskz@skz.de

SKZ – TeConA GmbH | Testing, Quality Assurance, Certification

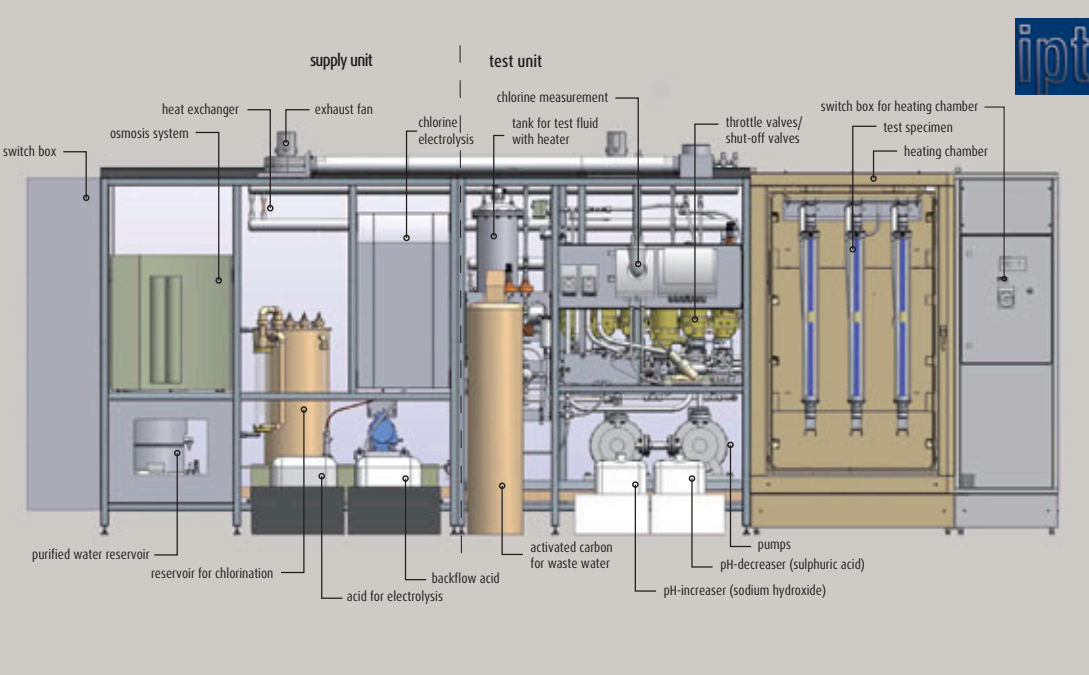
Friedrich-Bergius-Ring 22 • 97076 Würzburg/Germany
phone +49 931 4104-347 • fax +49 931 4104-477 • rohrpruefung@skz.de



New test facilities

Product Quality

www.skz.de



Schematic representation of the test unit



The chlorine test unit

Motivation

Chlorine is used both in the field of drinking water disinfection and the disinfection of water distribution systems. This involves an accelerated ageing of the polymer and possibly a reduced service life of the plastic pipes.

The German Drinking Water Regulation stipulates a minimum concentration of 0.1 mg/l of free chlorine after the treatment and permits a maximum addition of 0.3 mg/l. In the field of water distribution systems, the DVGW worksheet W 291 allows chlorine concentrations of up to 50 mg/l for the intermittent disinfection. Being a strong oxidizing agent, chlorine affects the failure behaviour of the plastic pipes. In combination with factors such as temperature, pressure, pH-value, flow-through rate and oxygen content of the water the time-to-failure is possibly considerably shorter than in the respective hydrostatic long-term internal pressure tests without the influence of chlorine, which are performed as a standard for evaluating the lifetime of plastic pipes.

Since today plastic pipes have to fulfil high requirements in terms of their service life (50 or even 100 years), it is important to assess the relevant products also in view of their chlorine resistance. For this reason within the scope of a joint project with company IPT a testing machine was developed which is designed to determine the chlorine resistance of pipes under operating conditions in an accelerated way.

Chlorine test unit

- integrated osmosis device to generate constant initial quality of the test water
- chlorine electrolysis unit to generate a hypochlorous acid
- test circuit with maximum pressure of 16 bar and maximum temperature of 120 °C
- 3 test specimens with different test pressures and flow-through rates
- active control of pH-value and chlorine concentration
- control of oxidation reduction potential (ORP), conductivity and oxygen content of the test water
- failure detection for each individual test specimen
- pipe dimensions of up to a maximum external diameter of 32 mm

Range of possible test parameters

test parameter	requirement		test unit
	ASTM F 2023-05	NSF P171-99	
chlorine concentration	2.5- 5.0 ± 0.3 mg/l	4.3 ± 0.3 mg/l	0 ... 100 ± 0.2 mg/l
temperature	95, 105, 115 ± 2 °C	95, 105, 115 ± 1 °C	20 ... 120 ± 1 °C
pressure	± 0.2 bar	± 0.5 %	2 ... 16 ± 0.2 bar
pH	6.5 ... 8.0 ± 0.2	6.8 ± 0.2	6 ... 8 ± 0.2
flow rate	0.24l/min	0.4l/min	0.2 ... 1.5 l/min
ORP	> 825 ± 30 mV	± 10 mV	0 ... 1000 ± 1 mV
oxygen content	-	-	0 ... 20 ± 0.1 mg/l
conductivity	-	-	0 ... 2500 ± 1 µS/cm

Example

- time-to-failure of pipes made of polypropylene random copolymer (PP-R)
- quasi-brittle failure (2 nd branch of creep curve)
- chlorine concentrations between 0 and 50 mg/l
- for comparison hydrostatic long-term internal pressure test and minimum time-to-failure according to DIN 8075

Effect of chlorine concentration on the time-to-failure of pipes made of PP-R

