

| Table of contents: | Page: |
|---|--------------|
| 1 Order | 3 |
| 2 Test material | 3 |
| 3 Test procedure | 3 |
| 4 Test results | 5 |
| 4.1 State of delivery | 5 |
| 4.2 Surface conditions | 5 |
| 4.3 Dimensions | 5 |
| 4.4 Amendment after heat ageing | 5 |
| 4.5 Melt mass-flow rate (MFR) on pipe | 6 |
| 4.6 Behavior at flexural impact test | 6 |
| 4.7 Long-term hydrostatic pressure test | 6 |
| 4.8 Homogeneity | 7 |
| 4.9 Hygienic requirements | 7 |
| 4.10 Mounting instructions | 8 |
| 4.11 Marking | 8 |
| 5 Summary of test results | 8 |



1 Order

By its letter of 11 July 2008 the company ZeChang International Consulting & Inspection Co., Ltd.; Suite C; 9th Floor; Sunshine Plaza; No. 1718 Da Du He Road; 200333 SHANGHAI; P. R. CHINA, instructed SKZ - TeConA GmbH to perform an initial type test on green colored pipes made of PP-R (HOSTALEN PP H5416 701183), S 2 (S 2.5), SDR 5 (SDR 6), group 1 (outside diameter 10 - 63 mm), according to DVGW-work sheet W 544 (May 2007) "Plastic pipes in the drinking water installation".

2 Test material

On 30 July 2008 SKZ - TeConA GmbH received following test material:

| Sample no.: | Designation and color | Dimension [mm] | Quantity | Marking [cl = chinese letter] |
|-------------|------------------------------------|----------------|----------|--|
| 1 | PP-R – pipe (S 2.5 / SDR 6), green | 20 x 3.4 | 22 x 1 m | cl® PP-R S2.5 D20*3.4 DIN8078 14/06/2008 time S04 - - - - - |
| 2 | PP-R – pipe (S 2 / SDR 5), green | 20 x 4.1 | 22 x 1 m | cl® PP-R S2 D20*4.1 DIN8078 14/06/2008 time S04 - - - - - |

3 Test procedure

Usually we carry out tests according to standards for which we have an accreditation. The list of all standards for which we are accredited is shown on the homepage at www.skz.de.

All tests were carried out according to the requirements of DVGW-work sheet W 544 (May 2007) "Plastic pipes in the drinking water installation".

Unless otherwise noted all tests were carried out at standard atmosphere 23/50, class 2, according to DIN EN ISO 291:2008-08 "Plastics - Standard atmospheres for conditioning and testing (ISO 291:2008); German version EN ISO 291:2008" and after a storage of at least 88 hours in this climate.



Following individual tests were performed:

| No.: | Test | Requirement according to | Test executed according to |
|------|-------------------------------------|--|--|
| 1 | State of delivery | DVGW W 544, par. 6.1.2, and DIN 8078:2008-09, par. 4.1, respectively | DVGW W 544, par. 6.1.2 |
| 2 | Surface conditions | DVGW W 544, par. 6.1.3, and DIN 8078:2008-09, par. 4.2, respectively | DVGW W 544, par. 6.1.3, and DIN 8078:2008-09, par. 5.1, respectively |
| 3 | Dimensions and tolerances | DVGW W 544, par. 6.1.4, and DIN 8077:2008-09 with DIN 8078:2008-09, par. 4.3, respectively | DVGW W 544, par. 6.1.4, and DIN 8078:2008-09, par. 5.2, respectively |
| 4 | Amendment after heat ageing | DVGW W 544, par. 6.1.5, and DIN 8078:2008-09, par. 4.6, respectively | DVGW W 544, par. 6.1.5, and DIN 8078:2008-09, par. 5.6, respectively |
| 5 | Melt mass-flow rate (MFR) on pipe | DVGW W 544, par. 6.1.6 | DVGW W 544, par. 6.1.6, and DIN EN ISO 1133:2005-09, respectively |
| 6 | Behavior at flexural impact test | DVGW W 544, par. 6.1.7, and DIN 8078:2008-09, par. 4.5, respectively | DVGW W 544, par. 6.1.7, and DIN 8078:2008-09, par. 5.5, respectively |
| 7 | Long-term hydrostatic pressure test | DVGW W 544, par. 6.1.8 | DVGW W 544, par. 6.1.8 |
| 8 | Homogeneity | DVGW W 544, par. 6.1.9 | DVGW W 544, par. 6.1.9 |
| 9 | Hygienic requirement | DVGW W 544, annex A, and par. 4.1, respectively | DVGW W 544, annex A, and par. 4.1, respectively |
| 10 | Mounting instruction | DVGW W 544, annex A, and par. 4.2, respectively | DVGW W 544, annex A, and par. 4.2, respectively |
| 11 | Marking | DVGW W 544, annex A, and par. 4.3, respectively | DVGW W 544, annex A, and par. 4.3.1, respectively |



4 Test results

4.1 State of delivery

Cut surfaces of pipe ends were rectangular to pipe axis. Samples did not show any bubbles, voids or inhomogeneities. Pipes were colored continuously green.

4.2 Surface conditions

Pipes had smooth inner and outside surfaces and did not show any sharp-edged grooves or blisters (sink marks).

4.3 Dimensions

| Sample no.: | Dimension [mm] | Property | Actual value [mm] | | Setpoint [mm] | |
|-------------|----------------|--------------------|-------------------|---------|---------------|---------|
| | | | Maximum | Minimum | Maximum | Minimum |
| 1 | 20 x 3.4 | Outside diameter d | 20.3 | 20.2 | 20.3 | 20.0 |
| | | Wall thickness s | 3.8 | 3.6 | 4.0 | 3.4 |
| 2 | 20 x 4.1 | Outside diameter d | 20.3 | 20.3 | 20.3 | 20.0 |
| | | Wall thickness s | 4.4 | 4.3 | 4.8 | 4.1 |

4.4 Amendment after heat ageing

| Sample no.: | Dimension [mm] | Test temperature [°C] | Testing time [h] | Dimensional change after heat ageing [%] | |
|-------------|----------------|-----------------------|------------------|--|-----------|
| | | | | Mean value | Set value |
| 1 | 20 x 3.4 | 135 | 2 | 0.5 | ≤ 2.0 |
| 2 | 20 x 4.1 | 135 | 2 | 0.4 | ≤ 2.0 |



4.5 Melt mass-flow rate (MFR) on pipe

| Sample no.: | Dimension [mm] | MFR 230/2.16 [g/(10 min)] | |
|-------------|----------------|---------------------------|------------------------|
| | | Actual | Setpoint ¹⁾ |
| 1 | 20 x 3.4 | 0.3 | 0.2 – 0.3 |
| 2 | 20 x 4.1 | 0.3 | 0.2 – 0.3 |

¹⁾ taken from Inspection Certificate 3.1 according to EN 10204 from the material supplier LyondellBasell.

4.6 Behavior at flexural impact test

| Sample no.: | Dimension [mm] | Quantity of samples | | Breaking rate [%] | |
|-------------|----------------|---------------------|--------|-------------------|----------|
| | | tested | broken | Actual | Setpoint |
| 1 | 20 x 3.4 | 10 | 0 | 0 | ≤ 10 |
| 2 | 20 x 4.1 | 10 | 0 | 0 | ≤ 10 |

4.7 Long-term hydrostatic pressure test

| Sample no.: | Dimension [mm] | Test temperature [°C] | Test stress [N/mm ²] | Test pressure [bar] | Time-to-failure [h] | |
|-------------|----------------|-----------------------|----------------------------------|---------------------|---------------------|----------|
| | | | | | Actual | Setpoint |
| 1 | 20 x 3.4 | 95 | 3.8 | 16.4 | > 165 | ≥ 165 |
| 2 | 20 x 4.1 | 95 | 3.8 | 20.4 | > 165 | ≥ 165 |
| 1 | 20 x 3.4 | 95 | 3.5 | 15.1 | > 1,000 | ≥ 1,000 |
| 2 | 20 x 4.1 | 95 | 3.5 | 18.8 | > 1,000 | ≥ 1,000 |
| 1 | 20 x 3.4 | 110 | 1.9 | 8.2 | > 8,760 | ≥ 8,760 |

There are test reports on hand about long-term hydrostatic pressure tests (test period: from 2008-03-26 to 2009-06-28) carried out by pipe manufacturer, according to DVGW-work sheet W 544, paragraph 6.1.8 a), with $\sigma = 3.5 \text{ N/mm}^2 / 95 \text{ °C}$ / up to break (min. 1,000 h, max. < 2,000 h), on more than 100 pipes of different dimensions and pipe series.

There were no breaks stated before 1,000 h on none of tested pipe specimen. The minimum run time was 1,385 h. The maximum run time was 1,440 h.



4.8 Homogeneity

| Sample no.: | Dimension [mm] | Cross sectional surface of inhomogeneities [mm ²] | |
|-------------|----------------|---|----------|
| | | Actual | Setpoint |
| 1 | 20 x 3.4 | < 0.02 | ≤ 0.02 |
| 2 | 20 x 4.1 | < 0.02 | ≤ 0.02 |

4.9 Hygienic requirements

All components of pipes contacting drinking water are commodity goods according to the law for food and commodity goods (LMBG) in Germany. They have to meet the recommendations for cold and warm water of the KTW-recommendations of the Federal Environment Department (UBA) as well as the requirements according to DVGW-work sheet

W 270 (A) "The growth of micro-organisms on materials intended for use in drinking water systems - Examination and assessment".

SKZ - TeConA GmbH received a copy of a positive test report from TZW Karlsruhe, Prüfstelle Wasser, of 11 December 2008, about the organoleptic examinations on pipe material **Hostalen PP H5416 701183**.

There is another copy of a test report from TZW of 8 September 2005, about the positive test according to W 270 on test samples made of **Hostalen PP H5416 701183**. This test report is older than 5 years. An updated W 270-report will be supplied later by TZW Karlsruhe.

The hygienic tests for cold and warm water on pipes according to KTW-recommendations of the Federal Environment Department (UBA) have been running since third calendar week (information by TZW Karlsruhe, Ms Cornelia Brutzler). This test report will be directly sent to DVGW CERT GmbH by TZW Karlsruhe .



4.10 Mounting and installation instructions

There are mounting and installation instructions in German letters available.

4.11 Marking

| Sample no.: | Dimension [mm] | Actual | Setpoint | Remark |
|-------------|----------------|----------------|---|---|
| 1 | 20 x 3.4 | Chinese letter | Manufacturer mark | without any objection |
| | | --- | DVGW-test mark with registration no. | not applicable during initial type test |
| | | PP-R | Material | without any objection |
| | | D20 * 3.4 | Dimension | without any objection |
| | | 14/06/2008 | Date of production | without any objection |
| | | S04 | Machine no. | without any objection |
| | | --- | Allowable operating pressure, continuous service temperature, period of application | missing ¹⁾ |
| 2 | 20 x 4.1 | Chinese letter | Manufacturer mark | without any objection |
| | | --- | "DVGW" with registration no. | not applicable during initial type test |
| | | PP-R | Material | without any objection |
| | | D20 * 4.1 | Dimension | without any objection |
| | | 14/06/2008 | Date of production | without any objection |
| | | S04 | Machine no. | without any objection |
| | | --- | Allowable operating pressure, continuous service temperature, period of application | missing ¹⁾ |

¹⁾ Customer documented that missing parts will be printed after DVGW-approval.

5 Summary of test results

The requirements according to DVGW-work sheet W 544 (May 2007) "Plastic pipes in the drinking water installation" were met - except the missing documents (see paragraph 4.9) which will be supplied later by customer/TZW Karlsruhe.

