German Plastics Center

SKZ service climate-neutral

| | |
|---|---|
| **Test report no.:** | **230980-I** |
| **Client:** | BAHRAIN Pipes BSC.<br>Building 780, Road 228<br>SALMABAD 702<br>KINGDOM OF BAHRAIN |
| **Order:** | Initial type test on green pipes for drinking water installation, made of PP-R, SDR 6, group 1, according to DVGW-work sheet W 544:2007-05 |
| | Production plant: SALMABAD, Kingdom of BAHRAIN<br>Brand name: MIDAD<br>File no.: 23-0583-WNE<br>Material: Borstar RA150E + EP-54079 |

| | | | |
|---|---|---|---|
| **Letter of:** | 2023-11-26 | **Reference:** | PO2311-016 |
| **Receipt of samples:** | 2024-01-23 | **Sampling:** | --- |
| **Test period:** | 2024-02-08 to 2025-02-17 | | |

This test report comprises 6 pages.

Würzburg, 2025-04-02
Cp/we

i. V. M. Heindl

Dr.-Ing. Marcus Heindl
Head of Testing Laboratory

Das Kunststoff-Zentrum SKZ - Testing GmbH

i. A. Cpom

Dipl.-Ing. (FH) Christopher Pommer
Project Manager Pipe Systems



SKZ – Testing GmbH
Testing, Inspection, Certification
Friedrich-Bergius-Ring 22
97076 Würzburg/Germany

Managing Director
Dr. rer. nat. Thomas Hochrein
HRB 7840
Local court Würzburg/Germany

Tel. +49 931 4104-0
Fax +49 931 4104-477
testing@skz.de
www.skz.de

ilac-MRA DAkkS Deutsche Akkreditierungsstelle D-PL-19033-01-00

## 1 Test material

SKZ – Testing GmbH had no influence on the selection of samples and received the following test material from the client:

| Sample no. | Designation | DN/OD [mm] | SDR | Colour | Quantity | Date of sampling | Date of delivery |
|---|---|---|---|---|---|---|---|
| 1 | Granulate | --- | --- | nature | 100 g | --- | 2024-01-23 |
| 2 | 1 m pipe | 20 x 3.4 | 6 | green | 22 | --- | 2024-01-23 |
| 3 | 1 m pipe | 32 x 5.4 | 6 | green | 22 | --- | 2024-01-23 |

The markings of the samples read as follows:

| Sample no. | Marking |
|---|---|
| 2 | BP BAHRAIN PIPES BSC MIDAD PP-R TYPE-3 20x3.4mm 4 Mtr SDR6 (PN20) DIN8077/78<br>2312-094 M13 16:48 231412 Made in Bahrain Barcode |
| 3 | logo BP BAHRAIN PIPES BSC MIDAD PP-R TYPE-3 32x5.4mm - 4 Mtr SDR6 (PN20) DIN8077/78<br>2312-093 M13 17:17 231812 Made in Bahrain Barcode |

## 2 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 can be viewed as an annex to the accreditation certificate on the homepage at https://www.skz.de/en/testing/products. In case of non-accredited procedures, they are marked with *. If it is only a matter of deviating test conditions of an accredited standard, this is marked with #.

In case that a conformity assessment is issued, the general decision rule is as follows: The measurement uncertainty and the standard deviation are not taken into account. Deviations from this rule are only made at the client's request, in the case of standard specifications or other specifications about which the client is informed in each individual case.

Unless otherwise noted all tests were carried out at standard atmosphere 23/50, according to DIN EN ISO 291:2008-08 “Plastics – Standard atmospheres for conditioning and testing”, class 2.

The tests were carried out according to DVGW W 544:2007-05 “Kunststoffrohre in der Trinkwasserversorgung”.

The following tests were carried out:

| Section | Test | Requirements acc. DVGW W 544:2007-05 | Test acc. to |
|---|---|---|---|
| 3.1 | Material composition | --- | --- |
| 3.2 | Melt mass-flow rate raw material | Section 6.1.1.1 | DIN EN ISO 1133-1:2022-10 |
| 3.3 | State of delivery and appearance | Sections 6.1.2 and 6.1.3 | Visual assessment |
| 3.4 | Dimensions | Section 6.1.4 | DIN EN ISO 3126:2005-05 |
| 3.5 | Amendment after heat agening (longitudinal reversion) | Section 6.1.5 | DIN EN ISO 2505:2005-08 |
| 3.6 | Long-term hydrostatic pressure behaviour | Section 6.1.8 | DIN EN ISO 1167-1:2006-05<br>DIN EN ISO 1167-2:2006-05 |
| 3.7 | Impact resistance: Flexural impact test | Section 6.1.9 | DIN 8078:2008-09<br>ISO 9854-1:2023-06<br>ISO9854-2:1994-12 |
| 3.8 | Homogeneity | Section 4.2.8 | ISO 18553:2002-03 |
| 3.9 | Melt mass-flow rate compared to material | Section 6.1.6 | DIN EN ISO 1133-1:2022-10 |

## 3 Test results

### 3.1 Material composition

According to customer's declaration of formulation the raw material PP-R "Borstar RA150E" with green-coloured PP-R master batch "EnerPlastics EP-54079" was used for pipe production. A test report of the long-term hydrostatic strength ISO 9080 "Regression analysis according to EN ISO 9080 of the PP-R pipe grade RA150E" by Element Materials Technology was available.

### 3.2 Melt mass-flow rate of raw material

| Sample no. | MFR at 230 °C / 2.16 kg [g/10 min] | |
|---|---|---|
| | Mean value | Set value |
| 1 | 0.23 | ≤ 0.5 |

## 3.3 State of delivery and appearance

When viewed without magnification the internal and external surfaces of pipes (samples no. 2 and 3) were smooth, clean and free from scoring, cavities and other surface defects to an extent that would prevent conformity to this standard. The material did not contain any visible impurities.

The pipes were uniformly coloured green. The ends of the pipes were cut cleanly and square to the axis of the pipe.

## 3.4 Dimensions

| Sample no. | Designation | | Actual value [mm] | | Set value [mm] | |
|---|---|---|---|---|---|---|
| | | | Minimum | Maximum | Minimum | Maximum |
| 2 | outside diameter | $d_1$ | 20.1 | 20.1 | 20.0 | 20.3 |
| | wall thickness | $s_1$ | 3.6 | 3.8 | 3.4 | 3.9 |
| 3 | outside diameter | $d_1$ | 32.2 | 32.2 | 32.0 | 32.3 |
| | wall thickness | $s_1$ | 5.7 | 5.9 | 5.4 | 6.1 |

## 3.5 Amendment after heat ageing (longitudinal reversion)

| Sample no. | Test temperature [°C] | Test duration [min] | Longitudinal reversion [%] | | Surface condition during and after heat aging |
|---|---|---|---|---|---|
| | | | Mean value | Set value | |
| 2 | 135 | 120 | 0.5 | ≤ 2.0 | No objection |
| 3 | 135 | 120 | 0.6 | ≤ 2.0 | No objection |

## 3.6 Long-term hydrostatic pressure behaviour

End cap: type A
Conditioning duration: 6 h
Test medium: water-in-water
Number of samples: 3

| Sample no. | Test temperature [°C] | Hoop stress [MPa] | Test pressure [bar] | Time-to-failure [h] | |
|---|---|---|---|---|---|
| | | | | Actual value | Set value |
| 2 | 95 | 3.8 | 16.6 | > 165[1)] | ≥ 165 |
| | 95 | 3.5 | 15.3 | > 1000[1)] | ≥ 1000 |
| | 110 | 1.9 | 8.3 | ≥ 8760[1)] | ≥ 8760 |
| 3 | 95 | 3.8 | 16.4 | > 165[1)] | ≥ 165 |
| | 95 | 3.5 | 15.1 | > 1000[1)] | ≥ 1000 |

1) No failure during test duration. Test was stopped.

## 3.7 Impact resistance: Flexural impact test

Nominal pendulum energy: 15 J
Conditioning temperature: 0 °C

| Sample no. | Conditioning duration (medium) [h] | Support distance [mm] | Sample type | Number of samples | | Failure rate [%] | |
|---|---|---|---|---|---|---|---|
| | | | | Tested | Failed | Actual value | Set value |
| 2 | > 6 (air) | 70 | I | 10 | 0 | 0 | ≤ 10 |
| 3 | > 1,5 (iced water) | 70 | III | 10 | 0 | 0 | ≤ 10 |

## 3.8 Homogeneity

| Sample no. | Procedure A: Cross-sectional area of inhomogeneities [mm²] | |
|---|---|---|
| | Actual value | Set value |
| 2 | < 0.01 | ≤ 0.02 |
| 3 | < 0.01 | ≤ 0.02 |

## 3.9 Melt mass-flow rate compared to material

| Sample no. | MFR at 230 °C / 2.16 kg [g/10 min] | | Deviation from granules [%] | |
|---|---|---|---|---|
| | Mean value of the pipe | Mean value of the granules | Mean value | Set value |
| 2 | 0.26 | 0.23[2)] | 13 | ≤ 30 |
| 3 | 0.27 | 0.23[2)] | 17 | ≤ 30 |

[2)] see section 3.2

# 4 Summary of test results

The presented test material met the requirements of of DVGW W 544:2007-05 “Kunststoffrohre in der Trinkwasserversorgung” within the tested scope.

Hygiene certification has been applied for. The tests are still ongoing at the SKZ.