

Test report no.: 113980/14

DVGW-file no.: 14-0599-W (2014-11-14)

Customer/production site: Aquagas Plastic Industries
Dubai Investment Park 2
P.O. Box 56790
DUBAI
UNITED ARAB EMIRATES

Order: Initial type test on green coloured pipes made of PP-R, SDR 6 (S 2.5), groups 1 and 2 , according to DVGW-work sheet W 544 (May 2007) "Plastic pipes in the drinking water installation – requirements and testing"

Model name: AQUATERRA

Summary of test results: see paragraph 5

Letter of: 2015-03-23

Ref: Tareq Shehadeh

Receipt of samples: 2015-04-29

Sampling: ---

Test period: from 2015-05-06 to 2016-06-26

This test report comprises 8 pages.

Würzburg, 2016-07-05
Sz/we

i. V.

Dr. Anton Zahn



i. A.

Martin Schütz

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1 Order

By its letter of 23 March 2015, company Aquagas Plastic Industries, Dubai Investment Park 2, P.O. Box 56790, Dubai, UNITED ARAB EMIRATES, instructed SKZ - TeConA GmbH (effective 29 July 2015, the company name has been changed to "SKZ - Testing GmbH") to perform an initial type test on green coloured pipes made of PP-R, SDR 6 (S 2.5), group 1 (\varnothing 10 mm up to \varnothing 63 mm) and group 2 (\varnothing 75 mm up to \varnothing 160 mm), according to DVGW-work sheet W 544 (May 2007) "Plastic pipes in the drinking water installation – requirements and testing".

2 Test material

On 29 April 2015, SKZ - TeConA GmbH received following test material:

Sample no.	Designation	Dimension [mm]	Quantity	Marking [CL= Company's Logo]
1	Pipe made of PP-R, green	25 x 4.2	16 x 1 m	CL AQUATERRA PP-R = 25x4.2 = A = Class 1/10bar = Class 2/8bar = Class 5/6bar = 20°C/PN20 = L02 = 23/02/2015/15:58 = EN ISO 15874 B.NO: BD B4324012028 1503
2	Pipe made of PP-R, green	40 x 6.7	16 x 1 m	CL AQUATERRA PP-R = 40x6.7 = A = Class 1/10bar = Class 2/8bar = Class 5/6bar = 20°C/PN20 = L02 = 23/02/2015/15:50 = EN ISO 15874 B.NO: BD B4324 01 2028 1503
3	Pipe made of PP-R, green	75 x 12.5	17 x 1 m	CL AQUATERRA PP-R = 75x12.5 = A = Class 1/10bar = Class 2/8bar = Class 5/6bar = 20°C/PN20 = L01 = 23/02/2015/14:29 = EN ISO 15874 B.NO: BD B4324012028 1503
4	Pipe made of PP-R, green	110 x 18.3	15 x 1 m	CL AQUATERRA PP-R = 110x18.3 = A = Class 1/10bar = Class 2/8bar = Class 5/6bar = 20°C/PN20 = L01 = 23/02/2015/15:14 = EN ISO 15874 B.NO: BD B432401 2028 1503

The customer informed that presented pipes are made of Polypropylene Random-copolymere (PP-R), denomination RA140E, supplied by Borouge Pte. Abu Dhabi, UAE, and green coloured masterbatch PP52033 supplied by Elite Dubai, UAE.

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 – requirements and testing", DIN 8077:2008-09 "Polypropylene (PP) pipes - PP-H, PP-B, PP-R, PP-RCT - Dimensions", DIN 8078:2008-09 "Polypropylene (PP) pipes - PP-H, PP-B, PP-R, PP-RCT - General quality requirements and testing", DIN EN ISO 1133:2005-09 "Determination of the melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) of thermoplastics (ISO 1133:2005); German version EN ISO 1133:2005".

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.

The individual tests are listed in following table:

Test	Requirements according to	Execution according to
4.1 Melt mass-flow rate (MFR), raw material	W 544, par. 6.1.1.1	W 544, par. 6.1.1.1, and DIN EN ISO 1133
4.2 State of delivery and surface structure	W 544, par. 6.1.2, and 6.1.3, and DIN 8078, par. 4.1 and 4.2	W 544, par. 6.1.2, and 6.1.3, and DIN 8078, par. 5.1
4.3 Dimension and tolerances	W 544, par. 6.1.4, and DIN 8077, par. 5 and DIN 8078, par. 4.3	W 544, par. 6.1.4, and DIN 8078, par. 5.2 and 5.3
4.4 Amendment after heat ageing	W 544, par. 6.1.5, and DIN 8078, par. 4.6	W 544, par. 6.1.5, and DIN 8078, par. 5.6
4.5 Melt mass-flow rate (MFR), pipe, compared to the material	W 544, par. 6.1.6	W 544, par. 6.1.6, and DIN EN ISO 1133
4.6 Flexural impact test	W 544, par. 6.1.7, and DIN 8078, par. 4.5	W 544, par. 6.1.7, and DIN 8078, par. 5.5
4.7 Resistance during long-term internal pressure test	W 544, par. 6.1.8	W 544, par. 6.1.8
4.8 Homogeneity of pipe structure	W 544, par. 6.1.9	W 544, par. 6.1.9
4.9 Hygienic requirements	W 544, par. 4.1	W 544, par. 4.1, and Annex A
4.10 Mounting and assembly instructions	W 544, par. 4.2	W 544, par. 4.2, and Annex A
4.11 Marking	W 544, par. 4.3	W 544, par. 4.3 and Annex A

4 Test results

4.1 Melt mass-flow rate (MFR), raw material

Denomination	MFR 230/2.16 [g/(10 min)]
PP-R - granulate, natural RA140E, Borouge	0.29

4.2 State of delivery, appearance

Cut surfaces of pipe ends were rectangular to pipe axis. Pipes did not show any bubbles, voids and inhomogeneities. Pipes were colored continuously green. Pipes had smooth inner and outside surfaces. There were no sharp-edged grooves and blisters (sink marks) present.

4.3 Dimension and tolerances

Sample no.	Dimension [mm]	Measurements	Actual value [mm]		Setpoint value [mm]	
			Minimum	Maximum	Minimum	Maximum
1	25 x 4.2	Outside diameter d_1	25.0	25.0	25.0	25.3
		Wall thickness s_1	4.3	4.6	4.2	4.9
2	40 x 6.7	Outside diameter d_1	40.1	40.1	40.0	40.4
		Wall thickness s_1	7.0	7.3	6.7	7.6
3	75 x 12.5	Outside diameter d_1	75.0	75.0	75.0	75.7
		Wall thickness s_1	13.0	13.9	12.5	14.0
4	110 x 18.3	Outside diameter d_1	110.3	110.5	110.0	110.9
		Wall thickness s_1	18.8	19.8	18.3	20.4

4.4 Amendment after heat ageing

Sample no.	Dimension [mm]	Test temperature [°C]	Time [h]	Amendment in length [%]	
				Actual value	Setpoint value
1	25 x 4.2	135	2	0.7	≤ 2.0
2	40 x 6.7	135	2	0.8	≤ 2.0
3	75 x 12.5	135	2	0.8	≤ 2.0
4	110 x 18.3	135	2	0.9	≤ 2.0

4.5 Melt mass-flow rate (MFR) of the pipe, compared to the raw material

Sample no.	Dimension [mm]	MFR 230/2.16 [g/(10 min)]		Deviation [%]	
		Granulate	Pipe	Actual value	Setpoint value
1	25 x 4.2	0.29	0.31	7	≤ 20
2	40 x 6.7	0.29	0.31	7	≤ 20
3	75 x 12.5	0.29	0.32	10	≤ 20
4	110 x 18.3	0.29	0.33	14	≤ 20

4.6 Flexural impact test

Sample no.	Dimension [mm]	Quantity of samples		Breaking rate [%]	
		tested	broken	Actual value	Setpoint value
1	25 x 4.2	10	0	0	≤ 10
2	40 x 6.7	10	1	10	≤ 10
3	75 x 12.5	10	0	0	≤ 10
4	110 x 18.3	10	0	0	≤ 10

4.7 Resistance during long-term internal pressure test

Sample no.	Dimension [mm]	Test temperature [°C]	Stress [N/mm ²]	Pressure [bar]	Time-to-failure [h]	
					Actual	Setpoint
1	25 x 4.2	95	3.8	15.8	> 165	≥ 165
2	40 x 6.7	95	3.8	16.1	> 165	≥ 165
1	25 x 4.2	95	3.5	14.5	> 1,000	≥ 1,000
2	40 x 6.7	95	3.5	14.8	> 1,000	≥ 1,000
1	25 x 4.2	110	1.9	7.9	> 8,760	≥ 8,760

Sample no.	Dimension [mm]	Test temperature [°C]	Stress [N/mm ²]	Pressure [bar]	Time-to-failure [h]	
					Actual	Setpoint
3	75 x 12.5	95	3.8	15.9	> 165	≥ 165
4	110 x 18.3	95	3.8	15.6	> 165	≥ 165
3	75 x 12.5	95	3.5	14.7	> 1,000	≥ 1,000
4	110 x 18.3	95	3.5	14.4	> 1,000	≥ 1,000

There are test reports of the pipe manufacturer on hand about long-term hydrostatic pressure tests at 95 °C with $\sigma = 3.5$ MPa, carried out on 100 pipe samples of different dimensions. There was no pipe failure before 2,000 h during test period from 2015-05-11 to 2016-06-13.

4.8 Homogeneity of pipe structure

Sample no.	Dimension [mm]	Cross sectional surface of inhomogeneities [mm ²]	
		Actual	Setpoint
1	25 x 4.2	< 0.01	≤ 0.02
2	40 x 6.7	< 0.01	≤ 0.02
3	75 x 12.5	< 0.01	≤ 0.02
4	110 x 18.3	< 0.01	≤ 0.02

4.9 Hygienic requirements

Following test reports with positive results are presented in form of copies:

Work sheet / Guideline	Test laboratory	Test certificate	Date
KTW-guideline of the Federal Environment Department (Test on pipes made of PP-R, green, RA140E/PP52033, dimension 32 x 5.4 mm)	TZW Karlsruhe Prüfstelle Wasser Wasserwerkstrasse 4 76137 Karlsruhe GERMANY	Test report with TZW-file no.: KR 200/15	2016-06-10
DVGW W 270 (Test on plates made of PP-R, RA140E)	TZW Karlsruhe Prüfstelle Wasser Wasserwerkstrasse 4 76137 Karlsruhe GERMANY	Test report with TZW-file no.: MO 029/15	2015-09-23

4.10 Mounting and assembly instructions

There is a comprehensible and clear mounting and installation instruction in German available.

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4.11 Marking

Pipes were marked continuously, permanently and in a readable way in distances of max. 1000 mm. The marking depth was below 0.1 mm.

Minimum declaration according to DVGW W 544, paragraph 4.3.1	Remark
Manufacturer sign	available
DVGW-mark with registration number	not available ¹⁾
Material	available
Outside diameter x wall thickness	available
Date of production (Day / Month / Year)	available
Machine no.	available
Allowable operating pressure	available
continuous service temperature (70°C)	not available
period of application (50 years)	not available

¹⁾ Because a DVGW-registration number has not been granted yet.

5 Summary of test results

The requirements according to DVGW-work sheet W 544 (May 2007) "Plastic pipes in the drinking water installation - Requirements and testing" were met except parts of the marking. The marking has to be completed after receipt of DVGW-registration number.

First visit has taken place on 15 March 2016.