Test report no.	**112721/14-II**
Customer:	Aquaform AG Gewerbestraße 16 4105 Biel-Benken SWITZERLAND
Order:	Tests on repair couplings RepaFlex® 22, RepaFlex® 12 Long including RepaFlex® 22 Long, according to SVGW guideline ZW 163 (January 2016) including DIN EN 14525:2005-02
Summary of test results:	see item 5

Letter of:	2014-09-30	**Ref:**	Mr. Matteucci
Receipt of samples:	see item 2	**Sampling:**	-
Test period:	from 2014-10-29 to 2016-04-06		

This test report comprises 13 pages and 1 annex of totally 18 pages.

Würzburg, 2016-04-12
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1 Order

By its letter of 30 September 2014 company Aquaform AG, Gewerbestraße 16, 4105 Biel-Benken, Switzerland, instructed SKZ - TeConA GmbH (on 29 July 2015 the company name was changed to "SKZ – Testing GmbH") to test repair couplings RepaFlex® 22 Long according to SVGW-guideline ZW 163 (January 2016) including DIN EN 14525:2005-02.

2 Test material

On 20 October 2014, 20 February 2015, 26 October 2015 as well as on 1 February 2016 SKZ – Testing GmbH received following samples for testing:

Sample No.	Designation	Dimension	Quantity	Marking [*FZ* = company's logo]
1.1	Repair coupling Repaflex 22 Long	DN 100	2 pcs.	Formteil: Ø FZ KRAUSZ 316 TH 01/01/14 Dichtung: 14/2014 Aufkleber: FZ Aquaform AG FZ KRAUSZ REPAFLEX 22 Durchmesserbereich Plage de serrage: 104 – 126 mm DN: 100 mm 07/14 *barcode* Dichtung Joint: EPDM Breite Largeur (mm): 280 Betriebsdruck Pression de service (bar): 16 Drehmoment Couple (Nm): 60
1.2	Repair coupling Repaflex 22	DN 100	2 pcs.	Formteil: Ø FZ KRAUSZ 304 CD/47/13 Dichtung: 0818-812 KRAUSZ EPDM 34/2014 Aufkleber: FZ Aquaform AG FZ KRAUSZ REPAFLEX 22 Durchmesserbereich Plage de serrage: 104 – 126 mm DN: 100 mm 12/14 *barcode* Dichtung Joint: EPDM Breite Largeur (mm): 210 Betriebsdruck Pression de service (bar): 16 Drehmoment Couple (Nm): 60
1.3	Steel pipe, turned off	DN 100/OD105	2 x 1 m	---
1.4	Cast pipe	DN 100/OD 118	2 x 1 m	---
2.1	Repair coupling Repaflex 22 Long	DN 200	2 pcs.	Formteil: Ø FZ KRAUSZ 304 TH 01/01/14 Dichtung: 0818-812 KRAUSZ EPDM 20/2014 Aufkleber: FZ Aquaform AG FZ KRAUSZ REPAFLEX 22 Durchmesserbereich Plage de serrage: 207 – 229 mm 07/14 *barcode* Dichtung Joint: EPDM Breite Largeur (mm): 280 Betriebsdruck Pression de service (bar): 16 Drehmoment Couple (Nm): 80
2.2	Repair coupling Repaflex 22	DN 200	2 pcs.	Formteil: Ø FZ KRAUSZ 304 CD/47/13 Dichtung: 0818-812 KRAUSZ EPDM 34/2014 Aufkleber: FZ Aquaform AG FZ KRAUSZ REPAFLEX 22 Durchmesserbereich Plage de serrage: 207 – 229 mm 12/14 *barcode* Dichtung Joint: EPDM Breite Largeur (mm): 210 Betriebsdruck Pression de service (bar): 16 Drehmoment Couple (Nm): 80

2.3	Steel pipe, turned off	DN 200/OD 209	2 x 1 m	---
2.4	Cast pipe	DN 200/OD 222	2 x 1 m	---
3.1	Repair coupling Repaflex 22 Long	DN 150	1 pcs.	Formteil: Ø FZ KRAUSZ 304 TH/52/14 Dichtung: 0818-812 KRAUSZ EPDM 24/15 Aufkleber: FZ Aquaform AG FZ KRAUSZ REPAFLEX 22 Durchmesserbereich Plage de serrage: 152 – 174 mm 08/15 *barcode* Dichtung Joint: EPDM Breite Largeur (mm): 280 Betriebsdruck Pression de service (bar): 16 Drehmoment Couple (Nm): 80
3.2	Repair coupling Repaflex 22	DN 150	1 pcs.	Formteil: Ø FZ KRAUSZ 304 CD/35/14 Dichtung: 0762-812 KRAUSZ EPDM 34/2014 Aufkleber: FZ Aquaform AG FZ KRAUSZ REPAFLEX 22 Durchmesserbereich Plage de serrage: 152 – 174 mm 03/15 *barcode* Dichtung Joint: EPDM Breite Largeur (mm): 210 Betriebsdruck Pression de service (bar): 16 Drehmoment Couple (Nm): 80
3.3	Steel pipe	DN 150/OD 169	2 x 1 m	---
3.4	Cast pipe	DN 150/OD 170	2 x 1 m	---

Repairing couplings are manufactured by:

Krausz Industries Ltd
6 Hapatish Street
66559 Tel-Aviv
ISRAEL

Repairing couplings are sold by:

Aquaform AG
Gewerbestraße 16
4105 Biel-Benken
SWITZERLAND

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.

If not otherwise noted, all tests were performed at standard atmosphere 23/50, class 2, according to DIN EN ISO 291:2008-08 "Climates and their technical application; standard climates" and after a storage of at least 88 hours in this climate.

Tests were performed according to guideline ZW 163 (January 2016) "Pipe couplings, transition and large range couplings including repair couplings" of SVGW (Swiss Gas and Water Industry Association) including DIN EN 14525:2005-02 "Ductile iron wide tolerance couplings and flange adaptors for use with pipes of different materials: Ductile iron, grey iron, steel, PVC-U, PE, fibre-cement" .

Tests were performed on cast iron pipes DN100/OD118, DN150/OD170 including DN200/OD222 as well as with steel pipes DN100/OD105, DN150/AD169 including DN200/OD209 which had been made available by the customer.

Design and sealing of repair couplings RepaFlex® 12 Long correspond to those of repair couplings RepaFlex® 22 Long. Couplings RepaFlex® 22 Long DN 100 were tested as a representative for dimension group outside diameter 40 to 140. Therefore a separate test on RepaFlex® 12 Long couplings was not required.

Repair couplings RepaFlex® 22 Long were tested under test order no. 114901/15 whose results were integrated in this test report.

Individual tests are listed in following table:

Test	Requirements according to ZW 163 (January 2016), par.	Execution according to
Hygienic non-toxicity	4.7	ZW 163 (January 2016), par. 4.7
Materials	4.3.1	DIN 86128-1
Joint gap and insert depth	4.3.2	DIN EN 14525
Diameter groups	4.3.3	DIN EN 14525
Movable joints	4.3.4	DIN EN 14525
Movable axial joints	4.3.5	DIN EN 14525
Tightness against positive internal pressure	4.3.6	DIN EN 14525
Tightness against negative internal pressure	4.3.7	DIN EN 14525
Tightness against dynamic internal pressure	4.3.8	DIN EN 14525
Product data	4.3.9	DIN EN 14525
Corrosion protection	4.5	ZW 163 (January 2016), par. 6.5
Assembly and operating instruction	4.6	ZW 163 (January 2016), par. 6.6
Factory production control	4.8	ZW 163 (January 2016), par. 6.7
Third-party inspection	4.9	ZW 163 (January 2016), par. 6.8

4 Test results

4.1 Hygienic non-toxicity

There is a test report, TZW file ref. MO 095/14 of 12 June 2014, valid until 31.12.2016, for gasket "EPDM-812-c" contacting drinking water, according to DVGW-work sheet W 270 (11/2007).

4.2 Materials

The customer informed that repairing couplings consist of following materials:

Part	Manufacturer	Material designation	Documentation
Basic body	Packer Quality Metals Ltd., Haifa, Israel	Rolled stainless steel tape DIN 1.4301	Declaration YU174254 Mills quality certificate Yieh Mau Corp., Taiwan
Gasket	Ein Shemer Rubber Industries A.C.A., Ltd., Israel	EPDM-812-c	Test report by TZW MO095/14 of 16 June 2014 (valid until 31 Dec. 2016)
Gasket bridge	Iskoor Metal & Steels Ltd., Ramala, Israel	Stainless steel 304	Inspection certificate 2783200-1 of 20.11.2014 by Columbus Stainless (Pty) Ltd., South Africa
Gasket retainer plate	Packer Quality Metals Ltd., Haifa, Israel	Rolled stainless steel DIN 1.4301	Declaration YU174254 Mills quality certificate Yieh Mau Corp., Taiwan
Compression beam	Qing Dao Jiatuo Trade Co. Ltd., China	Stainless steel	Test report JT140615 of 23.07.2014
Lug	Mor-Gal Plastic, Israel	Polycarbonate	Certificate of 25.01.2015 by manufacturer Certificate of analysis of 03.10.2013 by raw material supplier Teijin Polycarbonate Singapore PTE Ltd.

4.3 Joint gap and insert depth

Irrelevant.

4.4 Diameter groups

Within this initial type test the functioning of the joints of diameter ranges outside diameter 40 to 140 and 141 to 315 was tested on one diameter representing each diameter range.

4.5 Movable joints

Presented repairing couplings are appropriate for non-axial joints. Sleeves are not required for using steal or cast pipes.

4.6 Movable axial joints

Irrelevant.

4.7 Tightness against positive internal pressure

Sample no.	Test condition	Test pressure [bar]	Testing time [min]	Remark
1.1 / 1.3	Tightness with 3 ° deflection	29 bar	≥ 120	tight
1.1 / 1.3	Tightness with 423.3 kg shear load	29 bar	≥ 120	tight
1.1./ 1.4	Tightness with 3 ° deflection	29 bar	≥ 120	tight
1.1./ 1.4	Tightness with 471.9 kg shear load	29 bar	≥ 120	tight
1.2/ 1.3	Tightness with 3 ° deflection	29 bar	≥ 120	tight
1.2 / 1.3	Tightness with 423.3 kg shear load	29 bar	≥ 120	tight
1.2./ 1.4	Tightness with 3 ° deflection	29 bar	≥ 120	tight
1.2./ 1.4	Tightness with 471.9 kg shear load	29 bar	≥ 120	tight
3.1 / 3.3	Tightness with 3 ° deflection	29 bar	≥ 120	tight
3.1 / 3.3	Tightness with 672.9 kg shear load	29 bar	≥ 120	tight
3.1 / 3.4	Tightness with 3 ° deflection	29 bar	≥ 120	tight
3.1 / 3.4	Tightness with 679.8 kg shear load	29 bar	≥ 120	tight
3.2 / 3.3	Tightness with 3 ° deflection	29 bar	≥ 120	tight
3.2 / 3.3	Tightness with 676.8 kg shear load	29 bar	≥ 120	tight
3.2 / 3.4	Tightness with 3 ° deflection	29 bar	≥ 120	tight
3.2 / 3.4	Tightness with 683.7 kg shear load	29 bar	≥ 120	tight

4.8 Tightness against negative internal pressure

Sample no.	Test condition	Test pressure [bar]	Testing time [min]	Remark
1.1 / 1.3	Tightness with 421.4 kg shear load	- 0.8	≥ 120	Difference in pressure < 0.08 bar Without any complaint
1.1./ 1.4	Tightness with 474.2 kg shear load	- 0.8	≥ 120	Difference in pressure < 0.08 bar Without any complaint
1.2 / 1.3	Tightness with 421.4 kg shear load	- 0.8	≥ 120	Difference in pressure < 0.08 bar Without any complaint
1.2./ 1.4	Tightness with 474.2 kg shear load	- 0.8	≥ 120	Difference in pressure < 0.08 bar Without any complaint
2.1 / 2.3	Tightness with 845.0 kg shear load	- 0.8	≥ 120	Difference in pressure < 0.08 bar Without any complaint
2.1./ 2.4	Tightness with 888.2 kg shear load	- 0.8	≥ 120	Difference in pressure < 0.08 bar Without any complaint
2.2 / 2.3	Tightness with 845.0 kg shear load	- 0.8	≥ 120	Difference in pressure < 0.08 bar Without any complaint
2.2./ 2.4	Tightness with 888.2 kg shear load	- 0.8	≥ 120	Difference in pressure < 0.08 bar Without any complaint

4.9 Tightness against dynamic internal pressure

Sample no.	Test condition	Test pressure [bar]	Testing time [min]	Remark
1.1 / 1.3	24.000 cycles tight with 423.3 kg shear load	9 / 18	≥ 120	tight
1.1./ 1.4	24.000 cycles tight with 471.9 kg shear load	9 / 18	≥ 120	tight
1.2 / 1.3	24.000 cycles tight with 423.3 kg shear load	9 / 18	≥ 120	tight
1.2./ 1.4	24.000 cycles tight with 471.9 kg shear load	9 / 18	≥ 120	tight
2.1 / 2.3	24.000 cycles tight with 837.8 kg shear load	9 / 18	≥ 120	tight
2.1./ 2.4	24.000 cycles tight with 880.9 kg shear load	9 / 18	≥ 120	tight
2.2 / 2.3	24.000 cycles tight with 837.8 kg shear load	9 / 18	≥ 120	tight
2.2./ 2.4	24.000 cycles tight with 880.9 kg shear load	9 / 18	≥ 120	tight

4.10 Product data

Marking (see item 2)
According to DIN EN 14525 parts of marking shall be cast or embossed. As repairing couplings are not made of cast iron, this requirement is not applicable. Marking is legible and permanently fixed by labels.

Following information was missing in marking:
- Standard DIN EN 14525
- Maximum joint gap
- Smallest insert depth

4.11 Corrosion protection

All metal materials consist of stainless steel types.

4.12 Mounting

Repair couplings were packed with a clear comprehensible mounting and operating instruction.

4.13 Factory production control

There is a certificate no. 10128 according to ISO 9001:2008 (issued by QS Zürich AG) for company Aquaform AG. This certificate is valid until 12 November 2016.

On 3 April 2016 an inspector of SKZ – Testing GmbH performed an audit with a positive result at company Krausz Industries Ltd., Hapatish Street, 66559 Tel-Aviv, Israel,.

There is a certificate L-49307, valid until 5 February 2017, (issued by IQNet and SII, Israel) for company Krausz Industries Ltd..

4.14 Third-party inspection

A draft of the third-party inspection contract was issued while writing this test report.

5 Assessment of test results

Presented repair couplings RepaFlex® 22, RepaFlex® 12 Long including RepaFlex® 22 Long have met the requirements of SVGW-guideline ZW 163 (January 2016) including DIN EN 14525:2005-02.