

Test report no. 118681/15

Customer: Aquaform AG
Gewerbestraße 16
4105 Biel-Benken
SWITZERLAND

Order: Tests on multi-range couplings Hymax® PN16, according to SVGW guideline ZW 163 (January 2016) including DIN EN 14525:2005-02

Summary of test results: see item 5

Letter of: 2015-10-26 **Ref:** Mr. Matteucci

Receipt of samples: see item 2 **Sampling:** -

Test period: from 2016-02-08 to 2016-08-12

This test report comprises 12 pages and 1 annex of totally 17 pages.

Würzburg, 2016-08-17
Bar / we

i. V.

Dr. Anton Zahn



i. A.

Dipl.-Ing. Tobias Bauer

Die ungekürzte oder auszugsweise Wiedergabe, Vervielfältigung und Übersetzung dieses Berichtes zu Werbezwecken bedarf der schriftlichen Genehmigung der SKZ - Testing GmbH. Die Ergebnisse beziehen sich auf die geprüften Produkte. Die Akkreditierungen gelten nur für die in den Urkunden aufgeführten Normen und Verfahren, die im Internet unter www.skz.de eingesehen werden können.

Table of contents:	Page:
1 Order	3
2 Test material	4
3 Test procedure	5
4 Test results	7
4.1 Hygienic non-toxicity	7
4.2 Materials	7
4.3 Groove and insert depth	8
4.4 Diameter groups	8
4.5 Movable joints	8
4.6 Movable axial joints	8
4.7 Tightness against positive internal pressure	9
4.8 Tightness against negative internal pressure	10
4.9 Tightness against dynamic internal pressure	10
4.10 Product data	11
4.11 Corrosion protection	11
4.12 Mounting	11
4.13 Factory production control	12
4.14 Third-party inspection	12
5 Assessment of test results	12

1 Order

By its letter of 26 October 2015 company Aquaform AG, Gewerbestraße 16, 4105 Biel-Benken, Switzerland, instructed SKZ - Testing GmbH to test multi-range couplings Hymax® PN16 according to SVGW-guideline ZW 163 (January 2016) including DIN EN 14525:2005-02.

2 Test material

On 26 October 2015 SKZ – Testing GmbH received following samples for testing:

Sample No.	Designation	Dimension	Quantity	Marking [FZ = company's logo]
1.1	Multi-range coupling Hymax PN16	DN 100	2 pcs.	<i>Dichtung:</i> 0757-825 KRAUSZ EPDM 19/15 G <i>Aufkleber:</i> FZ Aquaform FZ KRAUSZ HYMAX DN 100 08/15 Durchmesserbereich Tolérances [mm]: 108 – 143 mm Betriebsdruck Pression de service [Bar]: 16 Drehmoment Torque [Nm]: 80 Dichtung Joint: KTW, W270 EPDM Beschichtung Revêtement: EPOXY Part No: 860-825-0108-16C Mit SVGW Zertifizierung, Avec Certification SVGW
1.2	Steel pipe, turned off	DN 100/OD 113	2 x 1 m	---
1.3	Cast iron	DN100/OD 118	2 x 1 m	
2.1	Multi-range coupling Hymax PN16	DN 150	2 pcs.	<i>Dichtung:</i> 0757-825 KRAUSZ EPDM 11/15 <i>Aufkleber:</i> FZ Aquaform FZ KRAUSZ HYMAX DN 150 06/15 Durchmesserbereich Tolérances [mm]: 158 – 190 mm Betriebsdruck Pression de service [Bar]: 16 Drehmoment Torque [Nm]: 80 Dichtung Joint: KTW, W270 EPDM Beschichtung Revêtement: EPOXY Part No: 860-825-0158-16 Mit SVGW Zertifizierung, Avec Certification SVGW
2.2	Steel pipe, turned off	DN 150/OD 169	2 x 1 m	---
2.3	Cast pipe	DN 150/OD 170	2 x 1 m	---

Multi-range couplings are manufactured by:

Krausz Industries Ltd
 6 Hapatish Street
 66559 Tel-Aviv
 ISRAEL

Multi-range 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 as well as with steel pipes DN100/OD113 including DN150/AD169 which had been made available by the customer.

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 096/14 of 12 June 2014, valid until 31.12.2016, for gasket "EPDM-825-c" contacting drinking water, according to DVGW-work sheet W 270 (11/2007).

4.2 Materials

The customer informed that multi-range couplings consist of following materials:

Part	Material designation
Basic body	Steel P235, according to EN10217-1
Basic body Hymax Reducer "1.5x2"	Steel S275JR, according to EN10025
Body end	Steel S235JR, according to EN 10025-2 (DIN 17100)
Body end	Steel according to DIN 17100
Gasket	EPDM
Bolts and nuts	Stainless steel AISI 304
Gasket bridge	Stainless steel AISI 304
Retainer plate	Stainless steel AISI 304
Coating	Epoxid resin (250 µm)

4.3 Joint gap and insert depth

Upon consulting the customer as well as Mr. Ebner from SVGW it was agreed to calculate the joint gap. Minimum insert depth mentioned in the mounting instruction is sufficient.

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 steel 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 / 1.2	Tightness with 3 ° deflection	29 bar	≥ 120	tight
1.1 / 1.2	Tightness with 451.8 kg shear load	29 bar	≥ 120	tight
1.1 / 1.3	Tightness with 3 ° deflection	29 bar	≥ 120	tight
1.1 / 1.3	Tightness with 672.1 kg shear load	29 bar	≥ 120	tight
2.1 / 2.1	Tightness with 3 ° deflection	29 bar	≥ 120	tight
2.1 / 2.2	Tightness with 470.4 kg shear load	29 bar	≥ 120	tight
2.1 / 2.3	Tightness with 3 ° deflection	29 bar	≥ 120	tight
2.1 / 2.3	Tightness with 679.0 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 / 1.2	Tightness with 454.1 kg shear load	- 0.8	≥ 120	Difference in pressure < 0.08 bar Without any complaint
1.1./ 1.3	Tightness with 678.4 kg shear load	- 0.8	≥ 120	Difference in pressure < 0.08 bar Without any complaint
2.1 / 2.3	Tightness with 472.8 kg shear load	- 0.8	≥ 120	Difference in pressure < 0.08 bar Without any complaint
2.1./ 2.3	Tightness with 685.3 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 / 1.2	24,000 cycles tight with 451.8 kg shear load	9 / 18	≥ 120	tight
1.1./ 1.3	24,000 cycles tight with 672.1 kg shear load	9 / 18	≥ 120	tight
2.1 / 2.3	24,000 cycles tight with 470.4 kg shear load	9 / 18	≥ 120	tight
2.1./ 2.4	24,000 cycles tight with 679.0 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 multi-range couplings are not made of cast iron, this requirement is not applicable. Marking is legible and permanently fixed by labels.

According to DIN EN 14525, following information was missing in marking of presented samples:

- Standard DIN EN 14525 ¹⁾
- Maximum joint gap ²⁾

¹⁾ The customer confirmed that standard "EN 14525" will be added on label. SVGW will be informed accordingly.

²⁾ Upon consulting the customer as well as Mr. Ebner from SVGW it was agreed to calculate the joint gap. Minimum insert depth mentioned in the mounting instruction is sufficient.

4.11 Corrosion protection

Epoxid resin covers metal parts contacting water thus ensuring corrosion protection.

4.12 Mounting

Multi-range 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 IL-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**

Within performed tests, presented multi-range couplings Hymax PN16 have met the requirements of SVGW-guideline ZW 163 (January 2016) including DIN EN 14525: 2005-02.