TEST REPORT
TYPE TEST (TT)

REPORT NO.
829227-2

DANISH TECHNOLOGICAL INSTITUTE

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Date: 13 June 2019
Init.: ARP/FPST/MRI
Appendices: 5

Applicant:	August Kleven ApS Fynsvej 59 5500 Middelfart Denmark	Contact person: Steen Kjølby Email: sk@august-kleven.dk
Product:	Push elbow fitting for PE-X pipes, 15 mm	
Manufacturing site:	**Push part** John Guest Limited Horton Road, West Dayton Middlesex UB7 8JL United Kingdom	**Fitting body** Sure Union International Ltd./Sanitube Room 1006, Hui Hao Building 519 Machang Road Guangzhou 510627, China
Samples:	Information about manufacturing site was provided by the applicant. Sampling was carried out by the applicant, and the samples were received by DTI in September 2018.	
Test site:	Danish Technological Institute, VA Testing and Inspection (DTI) Kongsvang Allé 29 DK-8000 Aarhus C, Denmark	
Test period:	5 October 2018 – 11 June 2019	
Test methods:	EN 1254-6:2012 EN ISO 15875-5:2004 NKB 18:1990 (only a few tests are carried out according to NKB 18)	
Results:	The requirements of the test methods mentioned above were met.	
Terms:	Accredited testing was carried out in compliance with international requirements (EN/ISO/IEC 17025:2015) and in compliance with Danish Technological Institute's General Terms and Conditions regarding Commissioned Work Accepted by Danish Technological Institute. The test results apply to the tested products only. This test report may be reproduced in extract only if the Laboratory has approved the extract in writing.	
Signature:	Allan R. Pedersen Metrology Engineer	Flemming Petri Steenfeldt Consultant

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Test Reg. No. 300

Test methods and requirements in accordance with: EN 1254-6:2012 EN ISO 15875-5:2004 NKB 18:1990		Test site	Table No./ Appendix No.	Requirements met		Accredited		Sub-contractor
				Yes	No	Yes	No	Accreditation No.
Identification of the tested components and general information		DTI	Table 1					
EN 1254-6, 4.2	Materials	DTI	Table 2 Appendix 1	X		X		
EN 1254-6, 4.3	Dimensions and tolerances	DTI	Table 3	X		X		
EN 1254-6, 4.4.2	Surface condition	DTI	Table 4	X		X		
NKB 18, 2.3.4	Resistance to stress corrosion	DTI	Appendix 2	X		X		
EN 15875-5, 4.2	Leak tightness under internal pressure	DTI	Table 5	X		X		
EN 15875-5 4.3	Bending test	DTI	Table 6	X		X		
EN 15875-5, 4.4	Resistance to pull-out	DTI	Table 7	X		X		
EN 15875-5, 4.7	Leak tightness under vacuum	DTI	Table 8	X		X		
EN 15875-5, 4.5 NKB 18, 2.4.3	Temperature cycling test	DTI	Table 9	X		X		
EN 15875-5, 4.6 NKB 18, 2.4.2	Pressure cycling test	DTI	Table 10	X		X		
EN 1254-6, 5.1.12	Disconnection and re-use	DTI	Table 11	X		X		
EN 1254-6, 5.1.13	Rotation test	DTI	Table 12	X		X		
EN 1254-6, 8 NKB 18, 2.2.3	Marking	DTI	Table 13	X		X		
Material certificate			Appendix 3					
Drawings of fitting			Appendix 4					
Sealing ring			Appendix 5					

Table 1

Identification of the tested components and general information

Fittings
Type: Elbow fitting
Construction: Compression fitting for PE-X pipes intended for use in hot and cold water installations.
Classification: Class 2/10 bar

Item id.	Photo	Model	Dimension/size	Type No.
1		Push coupler Plastic inserts Brass inserts	15x1/2”	-

The following pipes were used for the testing of the fittings:
Approved PE-X pipes according to EN ISO 15875-2: Henco 5l made in Belgium pe-xc/evoh/pe-xc 15x2.5 dimension class b1 EN ISO 15875 class 5/10 bar class 2/10 bar.

Table 2

Materials
EN 1254-6, 4.2

Requirements
Fittings shall be made of copper or copper alloys selected from materials specified in European standards for copper and copper alloy products provided that the fittings manufactured from them meet the functional requirements of the applicable European standard.

Material(s)
Push body: CC499K
Sealing ring: NBR 70
The information regarding material is provided by the approval holder.

Requirements met: Yes

Table 3

Dimensions and tolerances
EN 1254-6, 4.3

Requirements

The construction and dimensions of the fitting shall conform to the manufacturer's drawings.

All the dimensions and tolerances specified in the drawings must meet the dimensional requirement specified in the relevant standard(s).

Measured fittings

The bore area ratio between pipe and insert of item id. 1 was measured and compared with the specifications.

Dimension mm	Measured (bore area ratio) %	Requirement (min. bore area) %
15x2.5	74	30

Assessment

All the measured fittings are within the dimensions and tolerances specified by the manufacturer.

Requirements met: Yes

Test equipment: 270-A-1437

Table 4

Surface condition
EN 1254-6, 4.4.2

Requirement

Fittings shall be clean and with the exception of the gripping device, shall be free from sharp edges.

Assessment

Visual examination of the samples. No surface irregularities were found.

Requirements met: Yes

Table 5

Leak tightness under internal pressure EN 15875-5, 4.2

Item Id.	Sample No.	Nominal size mm	Temperature °C ±1°	Environment	Applied pressure bar ±1	Test duration h	Type of failure	Requirements met Yes	Requirements met No
1	1-3	15x2.5	95	Water	13.6*)	>1000	None	X	

*) EN 15875-5 class 5, 10 bar

Test conditions
Tested number of samples: 3 x couplers 15x1/2”
Tightening torque of fitting: Push
Conditioning time: 15 x 2.5 mm: 1 hour (EN ISO 1167, 9, table 1)
Test was carried out in an oven
Test equipment: 163029, 270-A-2500-5, 101846

Table 6

Bending test EN 15875-5, 4.3

Item Id.	Sample No.	Nominal size mm	Free length mm	Bending radius mm	Tempe-rature °C	Hoop stress MPa	Test pressure bar	Test duration h	Leakage	Requirements met Yes	Requirements met No
1	4-6	15x2.5	10xde	15xde	20	-	37.1	1	None	X	

Test conditions
Test method: EN 713
Tested number of samples: 3 x couplers 15x1/2”
Tightening torque of fitting: Push
Test equipment: 163029, 270-A-2500-5

Table 7

Resistance to pull-out EN 15875-5, 4.4

Item Id.	Sample No.	Nominal size mm	Temperature °C	Pull-out force *) N	Test duration h	Requirements met Yes	Requirements met No
1	7-9	15x2.5	23	530	1	X	
1	10-12	15x2.5	95	354	1	X	

*) The applied pull-out force is from EN 15875-5 with 2xF and 3xF.

Test conditions
Test method: EN 712
Tested number of samples: 6 x couplers 15x1/2”
Tightening torque of fitting: Push
Test was carried out in an oven at 95 °C
Test equipment: 77230, 270-A-2500-5

Table 8

Leak tightness under vacuum
EN 15875-5, 4.7

Item Id.	Sample No.	Nominal size mm	Temperature °C ±2°	Test duration min	Vacuum applied bar	Vacuum after 60 min. bar	Permitted drop of vacuum bar	Requirement met Yes	Requirement met No
1	13-15	15x2.5	23	60	0.8	0.8	0.05	X	

Test conditions
Test method: EN 12294
Tested number of samples: 3 x couplers 15x1/2”
Tightening torque of fitting: Push
Test equipment: 101844, 270-A-2500-5

Table 9

Temperature cycling test
EN 15875-5, 4.5 - NKB 18, 2.4.3

Item Id.	Sample No.	Nominal size mm	Tensile stress Mpa	Bending radius branch C**) mm	Temperature Low °C	Temperature High °C	Pressure bar	Number of cycles	Leakage	Requirement met Yes	Requirement met No
1	16-25	15x2.5	1.8	1	20	93*)	10	5,000	None	X	

*) The temperature is taken from NKB 18.
**) Branch C type 1 or 2:
Type 1 - Branch C for flexible pipes 6xDN
Type 2 - Branch C for rigid pipes

Requirement

No leakage after 5,000 cycles.

Test conditions
Test method: EN 12293
Cycling time: Hot 15 min., cold 15 min.
Tested number of samples: 10 x couplers 15x1/2”
Tightening torque of fitting: Push
Test equipment: 6505

Table 10

Pressure cycling test
EN 15875-5, 4.6 - NKB 18, 2.4.2

Item	Sample	Nominal size	Tempera-ture	Test pressure		Cycling frequency	Total number of cycles	Leakage	Requirement met	
Id.	No.	mm	°C±2°	upper bar	lower bar	/min.			Yes	No
1	26-28	15x2.5	23	15.0	0.5	30	10,000	None	X	
1	29-31	15x2.5	93*)	15.0	1.0[1)]	30	10,000	None	X	

*) Test pressure and temperature from NKB 18, 3.4.2

Requirement

The test sample made up of PE-X and fitting shall be leakproof after 10,000 cycles.

Test conditions

Test method: EN 12295
Tested number of samples: 6 x couplers 15x1/2”
Tightening torque of fitting: Push
Test was carried out in an oven at 93 °C
Conditioning time: 1 hour according to EN 12295, 5.3 table 1
Test equipment: 270-A-1454, 270-A-2500-5

Table 11

Disconnection and re-use
1254-6, 5.1.12

Sample	Nominal size	Number of connection/ disconnections, Annex H	Test, Annex A			Require-ment	Leakage	Requirement met	
			Duration	Temperature	Pressure				
No.	mm		min	°C	bar			Yes	No
32	15x2.5	20	15	23	15	No leakage after 15 minutes	None	X	

Test conditions

The fitting is connected and disconnected from the pipe the given number of times. Then the tightness test is carried out.
Test method: EN 1254-6
Test equipment: 163029

Table 12

Rotation test
1254-6, 5.1.13

Sample	Nominal size	Angular displacement Annex I		Test, Annex A			Require-ment	Leakage	Requirement met	
				Duration	Tempe-rature	Pressure				
No.	mm	Number of angular displacements	Angular displace-ment °	min	°C	bar			Yes	No
33	15x2.5	10	±5	15	23	15	No leakage after 15 minutes	None	X	

Test conditions

The fitting is subject to angular displacement relative to the pipe the given number of times and magnitude while under the hydrostatic pressure. Then the tightness test is carried out.

Test method: EN 1254-6
Test equipment: 163029

Table 13

Marking
EN 1254-6, 8 - NKB 18, 2.2.3

Requirement

Each fitting shall be legibly and durably marked, at the minimum with the manufacturer's identity symbol and, if it is practicable, with the nominal diameter and the number and part of this standard.

Marking of fittings

Insert brass: DZR, 15x2.5
Insert plastic: No marking
Push elbow fitting body: Logo, 51, 15 mm, VA, O

Marking of pipes

Henco 5l made in Belgium pe-xc/evoh/pe-xc 15x2.5 dimension class b1 EN ISO 15875 class 5/10 bar class 2/10 bar.

Test Report

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Requestor:	August Kleven ApS Contact person: Steen Kjølby Fynsvej 59 DK – 5500 Middelfart VA order No.: 829227
Test specimen:	Push fitting, material CC499K, 15 mm, no surface treatment
Sampling:	The sampling was done by August Kleven. The test samples were received at DTI September 2019.
DTI mark:	16772 866022
Test date:	4 March 2019
Test procedure:	Material analysis (OES) according to ISO DS/EN 15079
Result:	The measured elemental composition of the test specimen complies with the specified material composition of CC499K according to DS/EN 13388:2015. The test is only valid for the specifically tested item(s)
Storage:	The test specimen will be kept for 6 months from the date stated on the report.
Terms:	Accredited testing was carried out in compliance with international requirements (EN/ISO/IEC 17025:2005) and in compliance with Danish Technological Institute's General Terms and Conditions regarding Commissioned Work Accepted by the Danish Technological Institute. The test results apply to the tested products only. This test report may be reproduced in extract only if the Laboratory has approved the extract in writing.
Location:	8 April 2019, Danish Technological Institute, Industrial Materials Technology

Signature:

Maja Brusgaard Drøhse
Consultant, M.Sc.

Per Sigaard Christensen
Senior Specialist, PhD

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Digitally signed by: Søren Jepsen Mark

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SPECIMEN

CHEMICAL COMPOSITION (WEIGHT %)

DTI mark	16772 866022						
Instrument	Spectro SPECTROMAXx			Analytical method		Cu-50	
Reference	31x 7835.10A						
	Zn	**Pb**	**Sn**	**P**	**Mn**	**Fe**	**Ni**
Average	5,610	0,780	4,810	0,034	<0,001	0,075	0,318
Uncertainty	0,036	0,012	0,046	0,001	0,000	0,001	0,006
	Si	**As**	**Sb**	**Al**	**S**	**Bi**	**Cr**
Average	<0,001	0,002	0,033	<0,001	0,018	0,486	<0,000
Uncertainty	0,000	0,000	0,000	0,000	0,001	0,013	0,000
	Cu						
	Bal.						

COMMENTS

The measured elemental composition of the specimen complies with the specified material composition of CC499K according to DS/EN 13388:2015.

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OES Analysis
Chemical analysis with optical emission spectroscopy

Instrument: SPECTROMAXx M

Programs: Cu-orientation, Pure Cu, Cu/Zn-alloys, Cu/Zn/Ni-alloys, Cu/Ni-alloys, Gunmetal, Cu/Sn/Pb-alloys, Cu/Al-alloys and Cu/Be/Co/Ag-alloys.

Applicable to analysis 10 times over detection limit (3σ) at
Sr ≤1% and sR ≤2%.

The standard deviation are calculated for each measurement, and can be found in the report

Element	Calibration range (%)	Uncertainty at concentration interval (%)				
		0.001-0.05	0.1-0.5	1-5	10-20	30-40
Zn	0.0014-44.5	0.0015	0.008	0.06	0.1	0.12
Pb	0.0003-17.8	0.001	0.01	0.06	0.12	-
Sn	0.0003-14.8	0.001	0.008	0.02	0.1	-
P	0.0001-1.0	0.0015	0.006	0.01	-	-
Mn	0.0004-6.0	0.001	0.004	0.03	-	-
Fe	0.0008-6-0	0.0005	0.005	0.035	0.07	-
Ni	0.0002-33.5	0.0005	0.004	0.02	0.06	0.085
Si	0.0005-7.1	0.001	0.003	0.08	-	-
Mg	0.0002-0.2	0.001	0.003	-	-	-
Cr	0.0003-2.4	0.0007	0.007	0.02	-	-
Te	0.0005-0.5	0.002	0.004	-	-	-
As	0.0003-0.4	0.001	0.01	-	-	-
Sb	0.0005-1.7	0.0015	0.01	0.04	-	-
Cd	0.0002-0.1	0.0015	0.003	-	-	-
Bi	0.0005-5.8	0.002	0.025	0.08	-	-
Ag	0.0005-1.2	0.001	0.005	0.012	-	-
Co	0.0015-2.4	0.001	0.004	0.012	-	-
Al	0.001-11.1	0.0005	0.003	0.025	0.045	-
S	0.0003-0.16	0.001	0.006	-	-	-
Be	0.0001-2.4	0.001	0.003	0.017	-	-
Zr	0.0003-0.22	0.0011	-	-	-	-
Au	0.0005-0.05	0.002	-	-	-	-
B	0.0005-0.01	0.0005	-	-	-	-
C	0.0005-0.06	0.0025	-	-	-	-
Ti	0.0002-0.15	0.001	0.003	-	-	-
Se	0.0003-1.65	0.001	0.03	-	-	-

Test Report

Report no:
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Tested by: MBD/SJM

Requestor:	August Kleven ApS Fynsvej 59 DK-5500 Middelfart VA order No.: 829227 Contact person: Steen Kjølby
Test specimen:	Push fitting, material CC499K, 15 mm, no surface treatment
Sampling:	The sampling was done by August Kleven. The test samples were received at DTI September 2019.
DTI mark:	16771 866022
Tested:	4 – 5 March 2019
Test procedure:	Stress corrosion resistance according to ISO 6957-1988
Result:	No cracks were observed See page 2 for a complete overview of the results
Storage:	The test specimens will be kept for 6 months from the date stated on the report.
Terms:	Accredited testing was carried out in compliance with international requirements (EN/ISO/IEC 17025:2005) and in compliance with Danish Technological Institute's General Terms and Conditions regarding Commissioned Work Accepted by the Danish Technological Institute. The test results apply to the tested products only. This test report may be reproduced in extract only if the Laboratory has approved the extract in writing.
Location:	Date 7 April 2019, Danish Technological Institute, Industrial Materials Technology
Signature:	Maja Brusgaard Drøhse M.Sc. Materials Engineering Søren Mark Senior Consultant, M.Sc.

ilac-MRA DANAK
Test Reg. nr. 300

Digitally signed by: Søren Jeppesen Mark

Report no.: 16771 866022
Date: 08-04-2019

DANISH TECHNOLOGICAL INSTITUTE

STRESS CORROSION TEST — ISO 6957:1988(E)

Type: Push fitting	**Dimension:** Ø15 mm
Test media: Ammonium chloride	**pH** = 10.498
Degreasing media: Acetone	**Pickling solution:** 5% sulphuric acid
Numbers of replicates: 3	**Magnification:** 10-15x
Exposure time: 24h	**Exposure temp.:** 25°C

Test piece	Crack observed YES/NO
Fitting 1	NO
Support bushing 1	NO
Fitting 1	NO
Support bushing 2	NO
Fitting 2	NO
Support bushing 2	NO

Remarks:
Estimated test area: ~2,49 dm^2
Test solution volume: 1000ml

ACCEPTANCE CRITERIA ACCORDING TO NKB 18, PKT. 3.3.4.

NKB18 is not cover by accreditation Test Reg. no. 300.

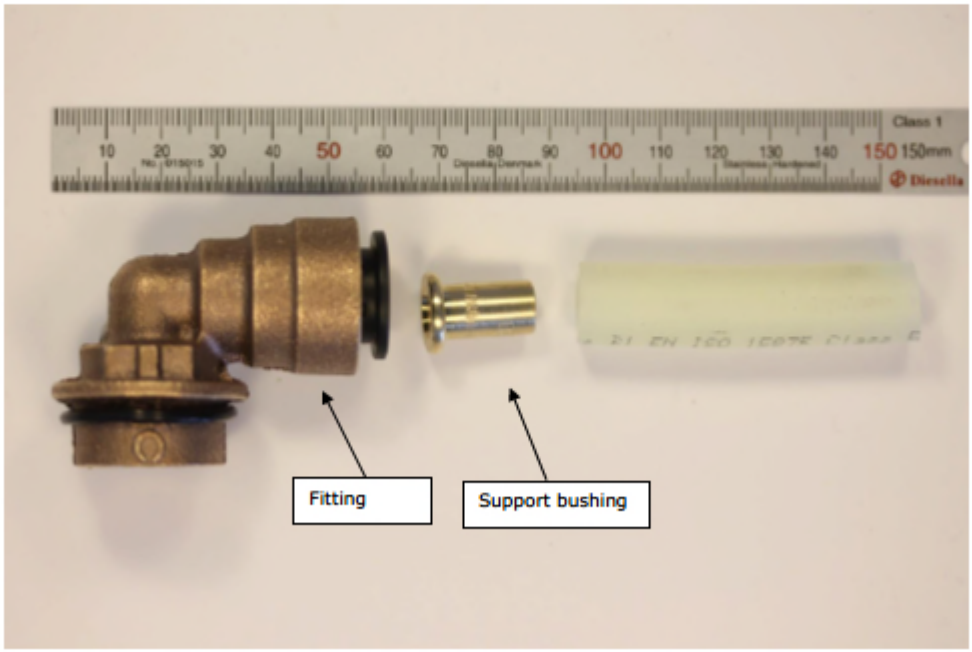
Specimen	Wall thickness [mm]	Max. allowed crack depth	Max. measured crack depth [mm]	Test piece accepted YES/NO
Fitting	-	1/3 wall thickness	-	**YES**
Support bushing	-	1/3 wall thickness	-	**YES**

Results for all specimens complies with acceptance criteria of NKB 18, Pkt. 3.3.4.

Report no.: 16771 866022
Date: 08-04-2019

DANISH TECHNOLOGICAL INSTITUTE

Picture of the sample



CuSn5Zn5Pb2-C (CC499K) Rg5 Pbarm

Standards

KMM Metals cast alloy	EN 1982:2008	German DIN	British BS	US ASTM	Russian GOST
Rg5 Pbarm	CuSn5Zn5Pb2-C (CC499K)	DIN 50930-6***	-	-	БрО6Ц6С3 (ГОСТ 613-79)

*** The alloy Rg5 Pbarm complies with DIN 50930-6.

Chemical Composition in %

	Cu	Sn	Pb	Zn	Ni	Al	Fe	Mn	P	S	Si	Sb	As	Cr	Bi	Cd	Se
Min	84.0	4.0	-	4.0	-	-	-	-	-	-	-	-	-	-	-	-	-
Max	88.0	6.0	3.0	6.0	0.6	0.01	0.3	-	0.04	0.04	0.01	0.1	0.03	0.02	0.02	0.02	-

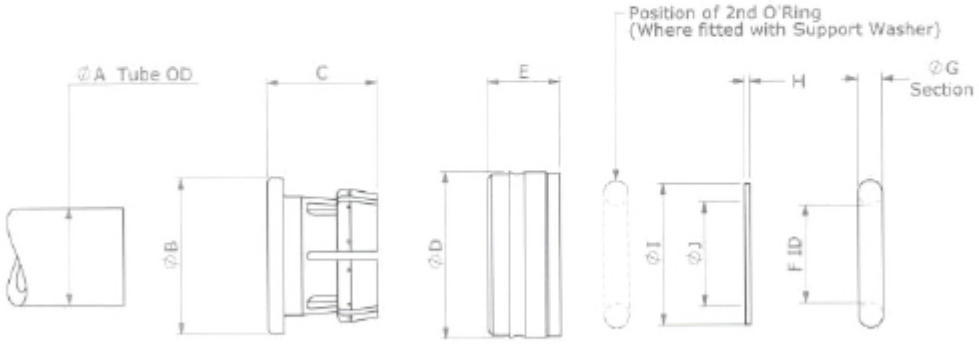
For drinking water applications no other single element should be more than 0.02 %. The sum of these single elements should not exceed 0.25%.
Alloy also meets standard DIN 50930-6 requirements.

John Guest®

Data Sheet DS-CM28-METAL

Metric Metal Half Cartridges

The John Guest CM Range of Metric Metal Half Cartridges are designed to provide a means to secure tubes into manifolds, flow direction splitters and many other components in a wide variety of materials.
As this style of Cartridge is intended for use by Original Equipment Suppliers, they are only supplied in bulk quantities.
Customers should ensure Cartridges are suitable for their applications, materials and operating conditions etc.



Tube Detail | Collet | Cartridge Body | Support Washer (15, 18 & 22mm Only) | O'Ring

Size	A	B	C	D	E	F	G	H	I	J
3mm	3.00 ±0.05	8.1	5.3	7.28	4.10	2.90	1.78	N/A	N/A	N/A
4mm	4.00 +0.05 / -0.07	10.1	5.1	12.74	4.88	3.60	2.40	N/A	N/A	N/A
8mm	8.00 +0.05 / -0.10	14.0	9.1	14.06	5.72	7.60	2.40	N/A	N/A	N/A
10mm	10.00 +0.05 / -0.10	15.24	10.66	16.34	7.00	9.60	2.40	N/A	N/A	N/A
12mm	12.00 +0.05 / -0.10	16.7	14.45	19.40	8.96	11.60	2.80	N/A	N/A	N/A
15mm	15.00 +0.05 / -0.10	22.8	15.24	23.10	9.30	13.90	3.30	0.80	20.10	15.30
18mm	18.00 +0.05 / -0.10	26.3	18.5	27.05	9.30	17.50	3.50	0.65	23.60	18.45
22mm	22.00 +0.05 / -0.10	32.1	18.0	31.30	11.16	21.30	3.60	0.65	27.55	22.00

Dimensions in mm

Parts List

Part Description	Material	Part Description	Material
Collet	Acetal Copolymer (Unfilled), Black or Light Grey & Stainless Steel	O'Ring	EPDM (Ethylene Propylene), Black
Cartridge Body	Brass	Support Washer	Acetal Copolymer, Natural

Technical Information

Working Pressures & Temperatures			Applications	
Air	3mm to 8mm 16 bar at -20 °C 16 bar at 23 °C 10 bar at 70 °C	10mm to 22mm 10 bar at -20 °C 10 bar at 23 °C 7 bar at 70 °C	Drinks Dispense Potable Water Applications	✓ ✓

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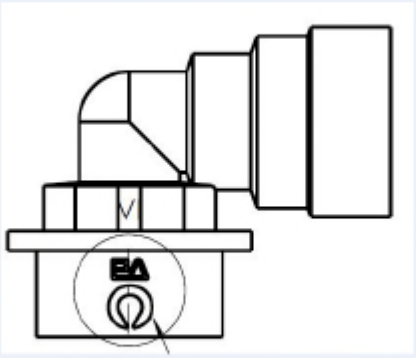
Sht 1 of 4



Datum / date 07.12.2015	**Werkstoffdatenblatt** **material test report**
Revision / revision 5	
Seite / page 1 von / of 1	

SEALTECH
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3480 Fredensborg fax +45 7028 1061
info@sealtech.dk - sealtech.dk

Werkstoffnummer material number	**1070-19001**	Werkstofftyp material type	**NBR 70**
Farbe colour	schwarz black		

Eigenschaft property	Einheit unit	Prüfmethode test method	Prüfparameter test parameter	Wert value
Härte hardness	IRHD	ASTM D 1415		70 ±5
Reißfestigkeit tensile strength	MPa	ASTM D 412		14,4
Reißdehnung ultimate elongation	%	ASTM D 412		389
Dichte specific gravity	g/cm^3	ASTM D 297		1,28 ±0,03
Druckverformungsrest compression set	%	ASTM D 395 B	22h / 100°C	11
Tieftemp.beständigkeit low temp. resistance	°C	ASTM D 2137	brittleness no cracks after 3 min. at	-40
Tieftemp.beständigkeit low temp. resistance	°C	ASTM D 1329	TR10	-26,4

Eigenschaftsänderungen nach Alterung
changes of properties after ageing

Medium medium	Prüfmethode test method	Zeit time h	Temperatur temperature °C	Härte hardness Punkte points	Reißfestigkeit tensile strength %	Reißdehnung ultimate elongation %	Volumen volume %
Luft air	ASTM D 573	70	100	+3	+1	-7	
ASTM IRM oil 901	ASTM D 471	70	100	+4	-5	-4	-5
ASTM IRM oil 903	ASTM D 471	70	100	-3	-12	-11	+8
Kraftstoff A fuel A	ASTM D 471	70	23	-2	-13	-6	+2
Kraftstoff B fuel B	ASTM D 471	70	23	-11	-31	-21	+21

Werkstoffzulassungen: material approvals:	DVGW DIN EN 549 H3/B2 (-20...+80°C)

Die oben angegebenen Daten sind nach bestem Wissen und mit modernen Laborstandards an genormten Prüfkörpern ermittelt worden. Insbesondere beim Vergleich dieser Daten mit Werten, die an Fertigteilen ermittelt werden, kann es zu Abweichungen kommen.	The above indicated data were determined to the best knowledge according to modern laboratory standards on standardised test specimen. If these data are compared with data which were determined on finished parts it may come to variations.