

AUTOMOTIVE | AEROSPACE | FOOD & BEVERAGE | FLUID TECHNOLOGIES | MOBILE MACHINERY

# FRANCEJOINT

SEALING SYSTEMS



**QUAD'RINGS**  
X'RINGS





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SEALING SYSTEMS

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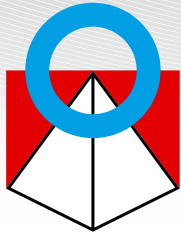
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**Site n°1:** Compression Molding – Injection Molding  
– Water Jet Cutting – Finition – Quality Control –  
Logistics

**Site N°2:** Administrative Area – Research &  
Development – Machining – Tooling



**FRANCEJOINT**  
SEALING SYSTEMS

Since 1981, FRANCE JOINT – SEALING SYSTEMS has been designing, manufacturing and distributing seals and precision rubber parts for its customers for whom quality is a determining factor.

**Faced with tough competition among the big decision-makers of the industrial world, FRANCE JOINT has responded with innovation, research and development, experience in Best-Cost manufacturing, and a consistently high level of quality, thanks to certificates ISO 9001 and ISO/TS 16949.**

Today, FRANCE JOINT is working in close collaboration with its customers, meeting challenges head on with success. Automotive, Aeronautics, Mobile hydraulics, Beverages & Foods, Fluid engineering industries... every solution emerges from a uniquely individual partnership, constantly fostered and renewed.

Our prime objective, based on unrivalled quality, is to find

the most suitable solutions for ensuring that you will stand out in what has become an extremely competitive domain. Our position of excellence has led us since the birth of our company to acquire the tools necessary to anticipate and prevent risks and maximize our service; the ultimate objective being of course to help you keep ahead of developments in this more and more technological market.



AUTOMOTIVE



AERONAUTICS



BEVERAGES & FOODS



FLUID ENGINEERING



MOBILE HYDRAULICS



Compression molding



Injection molding



Machining / Tooling



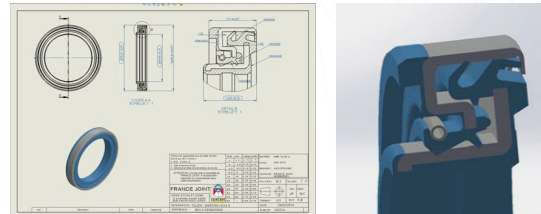
Logistics / Packaging

## RESEARCH & DEVELOPMENT

Innovation, reliability, safety, minimization of risk: your expectations are our daily concern. To get from the idea to the finished product demands firm managerial control over a wide range of projects in addition to expertise in manufacturing.

FRANCE JOINT's contributors, who are as much inventors as technicians, get the best of fully automated, state-of-the-art technology that takes them from drawing-board to prototype and finally to assembly line. From writing specifications to putting on a major technical event through designing (3D Solidwrks software) and testing for validation and compliance, FRANCE JOINT engineering works hand in hand with you to find the best solutions guaranteeing the level of expected performance.

More than 1000 compounds integrating elastomers, PTFE materials, Polyurethane, or even thermoplastics, as many solutions vis-a-vis the new most complex requirements which will put you in pole position today so that we can all be winners tomorrow. FRANCE JOINT puts in place qualifications in order to examine the behavior of its seals according to various parameters intervening on frictions, pressures, temperatures, speeds, strokes, leakages...



## QUALITY IN OUR CONCERNS

Several certificates obtained, ISO 9001, and ISO/TS16949, testify to the quality department's commitment to constant progress at every level of the company, at all stages of the realization, particularly where continual improvement is what has made FRANCE JOINT the name it is today.

Ambitious with customer satisfaction a priority, FRANCE JOINT has thus obtained the most powerful methods (PPAP, AMDEC, value analysis, Audits, MRP, 8D analysis, SPC, R&R ...) in order to optimize simultaneously the capacity of machines and processes, operational manpower performances, organizational methods, and finally, product and financial results.

FRANCE JOINT guarantees the best technology and pursues its daily objectives of a "Zero defects" production, through physico chemical controls (rheometer, spectrometer, durometer...), through dimensional and final aspects (unit controlling equipment, 3D camera ...). This is because the search for competitiveness is as important as the search for continuous improvement.



3D test device



## ○ X'RINGS

### 1. Description

X'Rings are four-lobed double-acting seals used in static and dynamic applications. Usually made from EPDM, FKM, NBR, VMQ and other types of materials, they provide a better sealing and lower friction than conventional O'Rings.

### 2. Materials

#### 2.1 RUBBERS

The table below provides an overview of the different rubber families.

ABBREVIATION ISO 1629 ASTM 1418	FRANCE JOINT CODE	CHEMICAL NAME
ACM	B	Polyacrylate
AEM	V	Ethylene acrylate rubber
EPDM	C	Ethylene Propylene Diene Monomer rubber
FFKM	FF	Perfluorinated rubber
FKM	G	Fluorinated rubber
FVMQ	FS	Fluorosilicone rubber
HNBR	HK	Hydrogenated Nitrile Butadiene rubber
NBR	K	Nitrile Butadiene rubber
NR	N	Natural rubber
PVMQ	PS	Silicone rubber: Polysiloxane – Phenyl – Vinyl – Methyl
VMQ	F	Silicone rubber: Polysiloxane – Vinyl – Methyl

## ● **ACM** (Polyacrylate)

Polymers containing ethyl acrylate (or butyl acrylate) have a small amount of monomer, which is necessary for cross-linking; ACM is a material with better heat resistance than NBR. It is often used for automatic gearboxes.

<b>Chemical resistance</b>	Mineral oils (motor oils, gear box oils, ATF oils) Atmospheric and ozone agents
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<b>Compatibility issue</b>	Glycol-based brake fluids (Dot 3 & 4) Aromatic and chlorinated hydrocarbons Water and steam Acids, alkalis and amines
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<b>Temperature range</b>	-25°C / +150°C (short-term peak at +160°C) -35°C / +150°C with particular ACMs
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## ● **AEM** (ethylene acrylate rubber)

As a methyl acrylate and ethylene copolymer, AEM is considered to be better resistant to heat than ACM. Its characteristics make it an intermediary between the ACM and FKM.

<b>Resistance to chemicals</b>	Cooling fluids Aggressive mineral oils Atmospheric agents Water
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<b>Compatibility issue</b>	Aromatic solvents Strong acids Brake fluids Gearbox oils ATF oils
----------------------------	---

<b>Temperature range</b>	-40°C/+150°C
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## ● **EPDM** (Ethylene Propylene Diene Monomer rubber)

As an Ethylene Propylene Diene Monomer copolymer, EPDM is commonly used for hot water taps, cooling systems, brake systems, dishwashers and washing machines.

<b>Chemical resistance</b>	Hot water and steam up to +150°C Glycol-based brake fluids (Dot 3 & 4) and silicone-based brake fluids (Dot 5) Organic and inorganic acids Cleaning agents, sodium and potassium alkalis Hydraulic fluids (HFD-R) Silicone oils and greases Polar solvents (alcohols, ketones and esters) Atmospheric and ozone agents
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<b>Compatibility issue</b>	Mineral oils and greases Hydrocarbons Low impermeability to gas
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<b>Temperature range</b>	-45°C / +150°C (short-term peak at +175°C)
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## FFKM (perfluorinated rubber)

FFKM has the best resistance to high temperatures and an excellent chemical inertia. This FKM-based rubber is very often used for high-temperature hydraulic and pneumatic systems, industrial valves, injection/fuel systems, motor seals and high-vacuum systems.

### Resistance to chemicals

Aliphatic and aromatic hydrocarbons  
Polar solvents (ketones, esters and ethers)  
Organic and inorganic acids  
Water and steam  
High-vacuum system

### Compatibility issue

Coolants (R11, R12, R13, R113, R114, etc.)  
PFPE

### Temperature range

-15°C/+320°C

## FKM (fluorinated rubber)

Depending on their structure and fluorine content, fluoroelastomers can vary in terms of chemical resistance and resistance to cold. This FKM-based rubber is very often used for high-temperature hydraulics and pneumatics, for industrial valves, injection/fuel systems, motor seals and high-vacuum systems.

### Resistance to chemicals

Mineral oils and greases, ASTM n°1, IRM 902 and IRM 903 oils.  
Fire-resistant liquids (HFD)  
Silicone oils and greases  
Mineral and vegetable oils and greases  
Aliphatic hydrocarbons (propane, butane, petroleum)  
Aromatic hydrocarbons (benzene, toluene)  
Chlorinated hydrocarbons (trichlorethylene)  
Fuel (including high alcohol content)  
Atmospheric and ozone agents

### Compatibility issue

Glycol-based brake fluids  
Ammonia gas  
Organic acids with a low molecular weight (formic and acetic acids)

### Temperature range

-20°C / +200°C (short-term peak at +230°C)  
-40°C / +200°C with particular FKMs

## FVMQ (fluorosilicone rubber)

The FVMQ has mechanical and physical properties that are very similar to those of VMQ. However, the FVMQ offers better resistance to fuels and mineral oils. However, resistance to hot air is not as good as that of VMQ.

### Resistance to chemicals

Aromatic mineral oils (IRM 903 oil)  
Fuels  
Aromatic hydrocarbons with low molecular weights  
(benzene, toluene)

### Temperature range

-70°C/+175°C



## ● **HNBR** (Hydrogenated Nitrile Butadiene Rubber)

This HNBR-based elastomer is obtained through selective hydrogenation of the NBR's butadiene groups. It is commonly used for power-assisted steering and for air conditioning.

### Chemical resistance

Aliphatic hydrocarbons  
Mineral and vegetable oils and greases  
Fire-resistant fluids (HFA, HFB and HFC)  
Diluted acids, saline solutions and bases for operation at an average temperature  
Water and steam up to +150°C  
Atmospheric and ozone agents

### Compatibility issue

Chlorinated hydrocarbons  
Polar solvents (ketones, esters and ethers)  
Strong acids

### Temperature range

-30°C / +150°C (short-term peak at +160°C)  
-40°C / +150°C with particular HNBRs

## ● **NBR** (Nitrile Butadiene Rubber)

Nitrile rubber (NBR) is the general term for acrylonitrile-butadiene copolymer. The ACN content can vary between 18% and 50%. While the acrylonitrile content is important, the resistance to oil and fuel is more so. Conversely, the elasticity and compression set are not as good. The NBR has good mechanical properties and good wear resistance. However, its resistance to atmospheric agents and the ozone is relatively low.

### Resistance to chemicals

Aliphatic hydrocarbons (propane, butane, petroleum, diesel fuel)  
Mineral oils and greases  
Fire-resistant fluids (HFA, HFB and HFC)  
Diluted acids, low-temperature alkaline and saline solutions  
Water (up to +100°C max)

### Compatibility issue

Fuels with high aromatic content  
Aromatic hydrocarbons (benzene)  
Chlorinated hydrocarbons (trichlorethylene)  
Polar solvents (ketone, acetone, acetic acid, ethylene-ester)  
Strong acids  
Glycol-based brake fluids  
Atmospheric and ozone agents

### Temperature range

-30°C / +100°C (short-term peak at +120°C)  
-40°C / +100°C with particular NBRs

## ● **VMQ** (silicone rubber: Methyl Vinyl Polysiloxane)

This FVMQ-based rubber is very often used in fuel systems.

### Chemical resistance

Animal and vegetable oils and greases  
Water for operation at an average temperature  
Diluted saline solutions  
Atmospheric and ozone agents

### Compatibility issue

Superheated steam up to +120°C  
Chlorinated hydrocarbons with a low molecular weight (trichlorethylene)  
Aromatic hydrocarbons (benzene, toluene)  
Atmospheric and ozone agents

### Temperature range

-60°C / +200°C (short-term peak at +230°C)

## 2.2 CHEMICAL COMPATIBILITY

A "Chemical compatibility guide" catalogue can be downloaded from our website: [www.francejoint.com](http://www.francejoint.com)

You can also use our online "**Chemical compatibility**" tool free of charge.

These two tools enable you to measure the behaviour of our materials that come into contact with the majority of existing fluids. The data displayed is the result of rigorous testing at the ambient temperature and takes previous publications into consideration. Test results are not fully representative because of the specific features of your application. The tests performed actually do not consider additives and impurities that may exist under actual conditions of use, nor the potential elevation of temperatures. Other parameters can also alter the behaviour of our materials, such as the hardness, persistence, abrasion, etc. We therefore recommend performing your own tests to verify the compatibility of our materials depending on your specific application. Our technical team can provide you with any additional information.

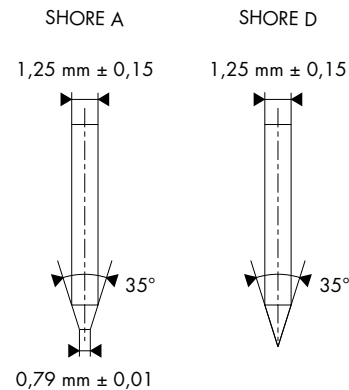
## 2.3 PHYSICAL PROPERTIES

### a. Hardness

Hardness is the major feature that defines resilient materials. The hardness test is carried out using testing devices that display the results as Shore A, Shore D or in IRHD. The majority of X'Rings are Shore A +/-5 tested (IRHD for specific cases). The test must be carried out at 23°C +/-2, at the earliest 16 hours after the last vulcanisation on specimen that have not been subjected to mechanical stress in the meantime. Test conditions must be included in the test report.

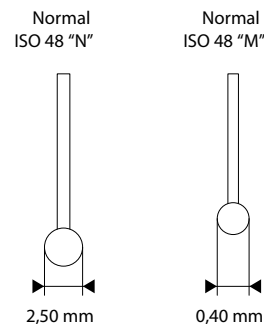
#### In Shore A / Shore D

- Test on specimen only
- Min. thickness: 6.00 mm
- Min. diameter: 30.00 mm
- Duration of entry: 3 seconds
- Standards applied:  
ISO 868 / ISO 7619 / ASTM D 2240



#### In IRHD DIDC

- Tests on specimen and finished parts
- Thickness of 1.50 to 2.50 mm with operating mode "M"
- Thickness of 8.00 to 10.00 mm with operating mode "N"
- Duration of entry: 30 seconds
- Standards applied:  
ISO 48 / ASTM 1414 / ASTM 1415



### b. Compression Set (CS)

The Compression Set (CS) is a method that measures the ability of rubbers to maintain their elastic properties at specific temperatures following prolonged compression under consistent deformation, in line with standards ISO 815 / ASTM D 395.

**THE CS IS MEASURED AS FOLLOWS:**

$$CS \% = \frac{(e0 - e2)}{(e0 - e1)} \times 100$$

**WHERE:**

- e0: initial thickness of the X'Ring
- e1: thickness under compression with specified conditions (temperature, fluid, duration, deformation rate)
- e2: thickness after tension release

**IMPORTANT**

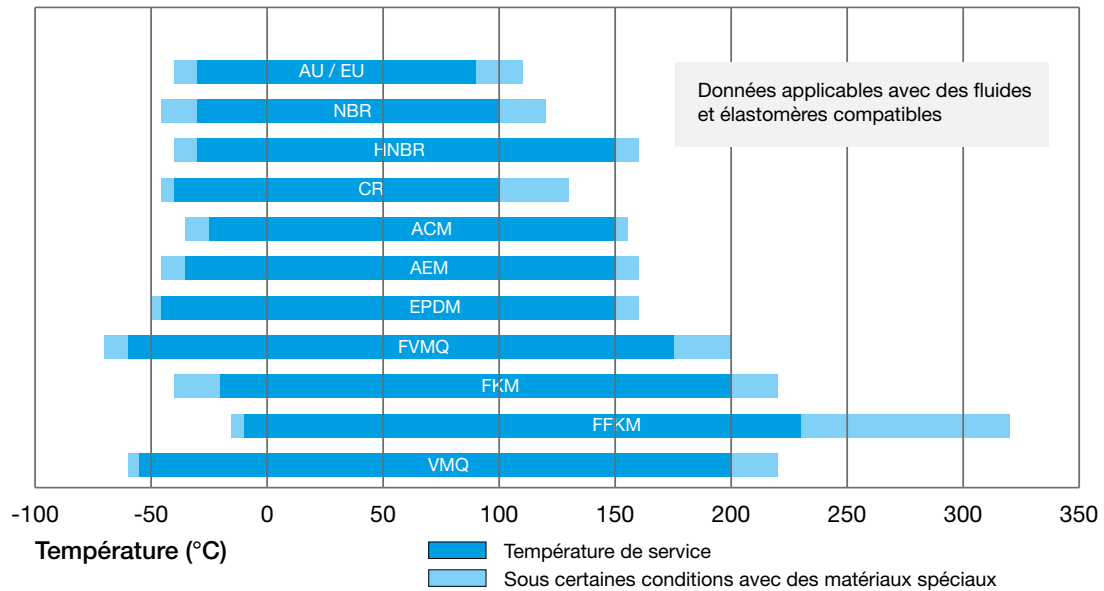
e2 = e0; the material has perfect elasticity  
 e2 = e1; the material has a complete permanent plastic deformation  
 The lower the CS, the better the rubber's elasticity.

### c. Tensile strength, elongation at break, modulus of elasticity 100% to 300%

Usually expressed in MPa for tensile strength and the modulus of elasticity and in % for the elongation at break, the values are obtained according to ISO 37 / ASTM D 412. Once placed between the jaws of the measuring device, the specimen is stretched at a constant speed (approximately 500 mm/min) until it breaks completely. This test characterises the physical properties of rubbers and allows us to understand their limits in terms of resistance to stress, stretching when the seals are stretch-fitted and resistance to extrusion.

### d. Temperature resistance

The temperature strongly influences the physical properties of materials. The graph below sets out the temperature limits for each material. However, we can provide custom-made compounds depending on your needs (e.g. NBR or FKM capable of withstanding temperatures of -40°C)



### e. Volume change

Chemical resistance is a decisive criteria when it comes to selecting an appropriate material. That's why it is essential to be aware of the liquids or gases used in the application, as this will affect the operation of the material as well as the service temperature.

Moreover, hardening or softening, loss of stiffness or elasticity, loss of tension, deformation relaxation and changes in volume through swelling or shrinkage can be ascertained using the volume change test, in line with standards ISO 1817 / ASTM D 471.

These tests are carried out either in the actual application environment or using standardised liquid tests (ASTM no. 1, IRM 902 and IRM 903 oils, ASTM fuels A to C).

## 3. Operating principle

### 3.1 ELONGATION E% – COMPRESSION C%

For the outer radial sealing (piston sealing), the X'Ring is stretch-fitted and must therefore be stretched on its groove. The X'Ring elongation values are applied depending on the inside diameter  $\varnothing d1$ :

- 6% if  $\varnothing d1 > 50.00$  mm
- 8% if  $\varnothing d1 \leq 50.00$  mm

For the inner radial sealing (rod sealing), the X'Ring is stretch-fitted and must therefore be compressed on its groove. The X'Ring compression rate must be less than 3%, whatever the type of application.

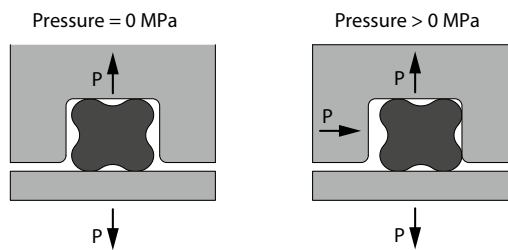
If the maximum elongation or compression values are exceeded, X'Ring thickness  $\varnothing d2$  of the ring will drop too much (stretching) or will rise too much (compression), which will affect the life span of the system.

### 3.2 TIGHTNESS S%

The tightening is a determining element to guarantee optimal sealing. It is obtained by suitably sizing the groove that receives the X'Ring. The resulting initial compression results in an elastic reaction in the X'Ring on the areas to be made watertight and, in this way, creates automatic sealing, even if the fluid is not pressurised.

The tightening rates that should not be exceeded depend on the type of application:

- In static sealing: 8% to 25%
- In dynamic sealing: 6% to 18%



## 4. Tolerances applied to X'Rings

### 4.1 TOLERANCES ON THE INSIDE DIAMETER $\varnothing d1$ FOR X'RINGS

The tolerances on the inside diameters  $\varnothing d1$  set out in the table below relate to standard ISO 3601-1:2008 and are applicable to X'Rings.

THE FORMULA BELOW PROVIDES THE TOLERANCES TO BE APPLIED ON THE INSIDE DIAMETER  $\varnothing d1$  OF THE X'RING.

$$\text{Tolerance on } \varnothing d1 = \pm [(d1^{0.95} \times 0.009) + 0.11]$$

Inside diameter Ød1	Tolerances
0.74 < Ød1 ≤ 1.78	± 0.12
1.78 < Ød1 ≤ 3.00	± 0.13
3.00 < Ød1 ≤ 4.20	± 0.14
4.20 < Ød1 ≤ 5.50	± 0.15
5.50 < Ød1 ≤ 6.75	± 0.16
6.75 < Ød1 ≤ 8.10	± 0.17
8.10 < Ød1 ≤ 9.50	± 0.18
9.50 < Ød1 ≤ 10.69	± 0.19
10.69 < Ød1 ≤ 12.00	± 0.20
12.00 < Ød1 ≤ 13.30	± 0.21
13.30 < Ød1 ≤ 14.80	± 0.22
14.80 < Ød1 ≤ 16.00	± 0.23
16.00 < Ød1 ≤ 17.30	± 0.24
17.30 < Ød1 ≤ 18.72	± 0.25
18.72 < Ød1 ≤ 20.22	± 0.26
20.22 < Ød1 ≤ 21.50	± 0.27
21.50 < Ød1 ≤ 23.00	± 0.28
23.00 < Ød1 ≤ 24.20	± 0.29
24.20 < Ød1 ≤ 25.50	± 0.30
25.50 < Ød1 ≤ 27.00	± 0.31
27.00 < Ød1 ≤ 28.24	± 0.32
28.24 < Ød1 ≤ 29.70	± 0.33
29.70 < Ød1 ≤ 31.12	± 0.34
31.12 < Ød1 ≤ 32.50	± 0.35
32.50 < Ød1 ≤ 34.00	± 0.36
34.00 < Ød1 ≤ 35.20	± 0.37
35.20 < Ød1 ≤ 37.00	± 0.38
37.00 < Ød1 ≤ 38.00	± 0.39
38.00 < Ød1 ≤ 39.40	± 0.40
39.40 < Ød1 ≤ 40.87	± 0.41
40.87 < Ød1 ≤ 42.30	± 0.42
42.30 < Ød1 ≤ 43.70	± 0.43
43.70 < Ød1 ≤ 45.30	± 0.44
45.30 < Ød1 ≤ 46.99	± 0.45
46.99 < Ød1 ≤ 48.00	± 0.46
48.00 < Ød1 ≤ 49.30	± 0.47
49.30 < Ød1 ≤ 50.80	± 0.48
50.80 < Ød1 ≤ 52.30	± 0.49
52.30 < Ød1 ≤ 53.57	± 0.50
53.57 < Ød1 ≤ 55.00	± 0.51
55.00 < Ød1 ≤ 56.52	± 0.52
56.52 < Ød1 ≤ 58.00	± 0.53
58.00 < Ød1 ≤ 59.30	± 0.54
59.30 < Ød1 ≤ 61.00	± 0.55
61.00 < Ød1 ≤ 62.30	± 0.56
62.30 < Ød1 ≤ 64.00	± 0.57
64.00 < Ød1 ≤ 65.10	± 0.58
65.10 < Ød1 ≤ 66.60	± 0.59
66.60 < Ød1 ≤ 67.95	± 0.60
67.95 < Ød1 ≤ 69.40	± 0.61
69.40 < Ød1 ≤ 71.00	± 0.62
71.00 < Ød1 ≤ 72.39	± 0.63
72.39 < Ød1 ≤ 74.00	± 0.64
74.00 < Ød1 ≤ 75.57	± 0.65
75.57 < Ød1 ≤ 77.00	± 0.66
77.00 < Ød1 ≤ 78.50	± 0.67
78.50 < Ød1 ≤ 79.60	± 0.68
79.60 < Ød1 ≤ 81.00	± 0.69
81.00 < Ød1 ≤ 82.50	± 0.70
82.50 < Ød1 ≤ 84.00	± 0.71
84.00 < Ød1 ≤ 86.00	± 0.72
86.00 < Ød1 ≤ 87.00	± 0.73
87.00 < Ød1 ≤ 88.49	± 0.74
88.49 < Ød1 ≤ 90.00	± 0.75
90.00 < Ød1 ≤ 91.44	± 0.76
91.44 < Ød1 ≤ 93.00	± 0.77
93.00 < Ød1 ≤ 94.30	± 0.78
94.30 < Ød1 ≤ 96.00	± 0.79
96.00 < Ød1 ≤ 97.50	± 0.80
97.50 < Ød1 ≤ 99.00	± 0.81
99.00 < Ød1 ≤ 100.50	± 0.82
100.50 < Ød1 ≤ 101.60	± 0.83

Inside diameter Ød1	Tolerances
101.60 < Ød1 ≤ 103.00	± 0.84
103.00 < Ød1 ≤ 104.50	± 0.85
104.50 < Ød1 ≤ 106.00	± 0.86
106.00 < Ød1 ≤ 107.54	± 0.87
107.54 < Ød1 ≤ 109.00	± 0.88
109.00 < Ød1 ≤ 110.49	± 0.89
110.49 < Ød1 ≤ 112.00	± 0.90
112.00 < Ød1 ≤ 113.67	± 0.91
113.67 < Ød1 ≤ 115.00	± 0.92
115.00 < Ød1 ≤ 116.84	± 0.93
116.84 < Ød1 ≤ 118.00	± 0.94
118.00 < Ød1 ≤ 119.30	± 0.95
119.30 < Ød1 ≤ 121.00	± 0.96
121.00 < Ød1 ≤ 123.00	± 0.97
123.00 < Ød1 ≤ 123.83	± 0.98
123.83 < Ød1 ≤ 126.00	± 0.99
126.00 < Ød1 ≤ 126.72	± 1.00
126.72 < Ød1 ≤ 129.00	± 1.01
129.00 < Ød1 ≤ 129.77	± 1.02
129.77 < Ød1 ≤ 131.50	± 1.03
131.50 < Ød1 ≤ 132.72	± 1.04
132.72 < Ød1 ≤ 134.30	± 1.05
134.30 < Ød1 ≤ 135.76	± 1.06
135.76 < Ød1 ≤ 138.00	± 1.07
138.00 < Ød1 ≤ 138.94	± 1.08
138.94 < Ød1 ≤ 140.50	± 1.09
140.50 < Ød1 ≤ 142.00	± 1.10
142.00 < Ød1 ≤ 144.00	± 1.11
144.00 < Ød1 ≤ 145.00	± 1.12
145.00 < Ød1 ≤ 147.00	± 1.13
147.00 < Ød1 ≤ 148.00	± 1.14
148.00 < Ød1 ≤ 149.23	± 1.15
149.23 < Ød1 ≤ 151.00	± 1.16
151.00 < Ød1 ≤ 152.50	± 1.17
152.50 < Ød1 ≤ 154.00	± 1.18
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167.50 < Ød1 ≤ 169.00	± 1.28
169.00 < Ød1 ≤ 170.69	± 1.29
170.69 < Ød1 ≤ 172.00	± 1.30
172.00 < Ød1 ≤ 173.87	± 1.31
173.87 < Ød1 ≤ 175.00	± 1.32
175.00 < Ød1 ≤ 177.00	± 1.33
177.00 < Ød1 ≤ 178.00	± 1.34
178.00 < Ød1 ≤ 179.50	± 1.35
179.50 < Ød1 ≤ 181.00	± 1.36
181.00 < Ød1 ≤ 182.50	± 1.37
182.50 < Ød1 ≤ 184.00	± 1.38
184.00 < Ød1 ≤ 186.00	± 1.39
186.00 < Ød1 ≤ 187.00	± 1.40
187.00 < Ød1 ≤ 189.00	± 1.41
189.00 < Ød1 ≤ 190.00	± 1.42
190.00 < Ød1 ≤ 192.00	± 1.43
192.00 < Ød1 ≤ 193.00	± 1.44
193.00 < Ød1 ≤ 195.00	± 1.45
195.00 < Ød1 ≤ 196.22	± 1.46
196.22 < Ød1 ≤ 198.00	± 1.47
198.00 < Ød1 ≤ 199.10	± 1.48
199.10 < Ød1 ≤ 201.00	± 1.49
201.00 < Ød1 ≤ 202.57	± 1.50
202.57 < Ød1 ≤ 204.00	± 1.51
204.00 < Ød1 ≤ 206.00	± 1.52
206.00 < Ød1 ≤ 207.00	± 1.53
207.00 < Ød1 ≤ 208.50	± 1.54
208.50 < Ød1 ≤ 210.00	± 1.55

Inside diameter Ød1	Tolerances
210.00 < Ød1 ≤ 212.00	± 1.56
212.00 < Ød1 ≤ 213.00	± 1.57
213.00 < Ød1 ≤ 214.50	± 1.58
214.50 < Ød1 ≤ 216.00	± 1.59
216.00 < Ød1 ≤ 218.00	± 1.60
218.00 < Ød1 ≤ 219.00	± 1.61
219.00 < Ød1 ≤ 221.00	± 1.62
221.00 < Ød1 ≤ 222.00	± 1.63
222.00 < Ød1 ≤ 224.00	± 1.64
224.00 < Ød1 ≤ 226.00	± 1.65
226.00 < Ød1 ≤ 227.00	± 1.66
227.00 < Ød1 ≤ 228.19	± 1.67
228.19 < Ød1 ≤ 230.00	± 1.68
230.00 < Ød1 ≤ 232.00	± 1.69
232.00 < Ød1 ≤ 233.00	± 1.70
233.00 < Ød1 ≤ 234.32	± 1.71
234.32 < Ød1 ≤ 236.00	± 1.72
236.00 < Ød1 ≤ 237.50	± 1.73
237.50 < Ød1 ≤ 239.00	± 1.74
239.00 < Ød1 ≤ 240.67	± 1.75
240.67 < Ød1 ≤ 242.00	± 1.76
242.00 < Ød1 ≤ 244.00	± 1.77
244.00 < Ød1 ≤ 246.00	± 1.78
246.00 < Ød1 ≤ 247.00	± 1.79
247.00 < Ød1 ≤ 249.00	± 1.80
249.00 < Ød1 ≤ 250.00	± 1.81
250.00 < Ød1 ≤ 252.00	± 1.82
252.00 < Ød1 ≤ 253.00	± 1.83
253.00 < Ød1 ≤ 254.50	± 1.84
254.50 < Ød1 ≤ 256.00	± 1.85
256.00 < Ød1 ≤ 258.00	± 1.86
258.00 < Ød1 ≤ 259.00	± 1.87
259.00 < Ød1 ≤ 261.00	± 1.88
261.00 < Ød1 ≤ 263.00	± 1.89
263.00 < Ød1 ≤ 264.00	± 1.90
264.00 < Ød1 ≤ 266.00	± 1.91
266.00 < Ød1 ≤ 267.00	± 1.92
267.00 < Ød1 ≤ 269.00	± 1.93
269.00 < Ød1 ≤ 270.00	± 1.94
270.00 < Ød1 ≤ 272.00	± 1.95
272.00 < Ød1 ≤ 273.00	± 1.96
273.00 < Ød1 ≤ 274.50	± 1.97
274.50 < Ød1 ≤ 276.00	± 1.98
276.00 < Ød1 ≤ 278.00	± 1.99
278.00 < Ød1 ≤ 279.30	± 2.00
279.30 < Ød1 ≤ 281.00	± 2.01
281.00 < Ød1 ≤ 283.00	± 2.02
283.00 < Ød1 ≤ 284.00	± 2.03
284.00 < Ød1 ≤ 286.00	± 2.04
286.00 < Ød1 ≤ 287.00	± 2.05
287.00 < Ød1 ≤ 289.00	± 2.06
289.00 < Ød1 ≤ 290.00	± 2.07
290.00 < Ød1 ≤ 291.47	± 2.08
291.47 < Ød1 ≤ 293.00	± 2.09
293.00 < Ød1 ≤ 295.00	± 2.10
295.00 < Ød1 ≤ 297.00	± 2.11
297.00 < Ød1 ≤ 297.80	± 2.12
297.80 < Ød1 ≤ 299.30	± 2.13
299.30 < Ød1 ≤ 301.00	± 2.14
301.00 < Ød1 ≤ 303.00	± 2.15
303.00 < Ød1 ≤ 304.00	± 2.16
304.00 < Ød1 ≤ 306.00	± 2.17
306.00 < Ød1 ≤ 307.00	± 2.18
307.00 < Ød1 ≤ 309.00	± 2.19
309.00 < Ød1 ≤ 310.50	± 2.20
310.50 < Ød1 ≤ 312.00	± 2.21
312.00 < Ød1 ≤ 314.00	± 2.22
314.00 < Ød1 ≤ 315.00	± 2.23
315.00 < Ød1 ≤ 316.87	± 2.24
316.87 < Ød1 ≤ 318.00	± 2.25
318.00 < Ød1 ≤ 319.50	± 2.26
319.50 < Ød1 ≤ 321.50	± 2.27

Inside diameter Ød1	Tolerances	Inside diameter Ød1	Tolerances	Inside diameter Ød1	Tolerances
321.50 < Ød1 ≤ 323.00	± 2.28	405.00 < Ød1 ≤ 406.00	± 2.81	489.00 < Ød1 ≤ 490.00	± 3.34
323.00 < Ød1 ≤ 325.00	± 2.29	406.00 < Ød1 ≤ 408.00	± 2.82	490.00 < Ød1 ≤ 492.00	± 3.35
325.00 < Ød1 ≤ 326.00	± 2.30	408.00 < Ød1 ≤ 409.00	± 2.83	492.00 < Ød1 ≤ 494.00	± 3.36
326.00 < Ød1 ≤ 328.00	± 2.31	409.00 < Ød1 ≤ 411.00	± 2.84	494.00 < Ød1 ≤ 495.00	± 3.37
328.00 < Ød1 ≤ 329.00	± 2.32	411.00 < Ød1 ≤ 413.00	± 2.85	495.00 < Ød1 ≤ 497.00	± 3.38
329.00 < Ød1 ≤ 331.00	± 2.33	413.00 < Ød1 ≤ 414.00	± 2.86	497.00 < Ød1 ≤ 498.00	± 3.39
331.00 < Ød1 ≤ 332.00	± 2.34	414.00 < Ød1 ≤ 416.00	± 2.87	498.00 < Ød1 ≤ 500.00	± 3.40
332.00 < Ød1 ≤ 334.00	± 2.35	416.00 < Ød1 ≤ 417.00	± 2.88	500.00 < Ød1 ≤ 504.00	± 3.41
334.00 < Ød1 ≤ 335.90	± 2.36	417.00 < Ød1 ≤ 419.00	± 2.89	504.00 < Ød1 ≤ 505.00	± 3.43
335.90 < Ød1 ≤ 337.00	± 2.37	419.00 < Ød1 ≤ 421.00	± 2.90	505.00 < Ød1 ≤ 506.81	± 3.44
337.00 < Ød1 ≤ 339.00	± 2.38	421.00 < Ød1 ≤ 422.00	± 2.91	506.81 < Ød1 ≤ 508.00	± 3.45
339.00 < Ød1 ≤ 340.00	± 2.39	422.00 < Ød1 ≤ 424.00	± 2.92	508.00 < Ød1 ≤ 510.00	± 3.46
340.00 < Ød1 ≤ 342.00	± 2.40	424.00 < Ød1 ≤ 425.00	± 2.93	510.00 < Ød1 ≤ 515.00	± 3.47
342.00 < Ød1 ≤ 343.00	± 2.41	425.00 < Ød1 ≤ 427.00	± 2.94	515.00 < Ød1 ≤ 516.00	± 3.50
343.00 < Ød1 ≤ 345.00	± 2.42	427.00 < Ød1 ≤ 428.00	± 2.95	516.00 < Ød1 ≤ 523.00	± 3.51
345.00 < Ød1 ≤ 347.00	± 2.43	428.00 < Ød1 ≤ 430.00	± 2.96	523.00 < Ød1 ≤ 524.50	± 3.55
347.00 < Ød1 ≤ 348.00	± 2.44	430.00 < Ød1 ≤ 432.00	± 2.97	524.50 < Ød1 ≤ 530.00	± 3.56
348.00 < Ød1 ≤ 350.00	± 2.45	432.00 < Ød1 ≤ 433.00	± 2.98	530.00 < Ød1 ≤ 532.21	± 3.60
350.00 < Ød1 ≤ 351.00	± 2.46	433.00 < Ød1 ≤ 435.00	± 2.99	532.21 < Ød1 ≤ 538.00	± 3.61
351.00 < Ød1 ≤ 353.00	± 2.47	435.00 < Ød1 ≤ 436.00	± 3.00	538.00 < Ød1 ≤ 540.00	± 3.65
353.00 < Ød1 ≤ 354.00	± 2.48	436.00 < Ød1 ≤ 438.00	± 3.01	540.00 < Ød1 ≤ 544.00	± 3.66
354.00 < Ød1 ≤ 356.00	± 2.49	438.00 < Ød1 ≤ 439.30	± 3.02	544.00 < Ød1 ≤ 545.00	± 3.68
356.00 < Ød1 ≤ 358.00	± 2.50	439.30 < Ød1 ≤ 441.00	± 3.03	545.00 < Ød1 ≤ 549.00	± 3.69
358.00 < Ød1 ≤ 359.00	± 2.51	441.00 < Ød1 ≤ 443.00	± 3.04	549.00 < Ød1 ≤ 552.00	± 3.71
359.00 < Ød1 ≤ 361.00	± 2.52	443.00 < Ød1 ≤ 444.00	± 3.05	552.00 < Ød1 ≤ 553.00	± 3.73
361.00 < Ød1 ≤ 362.00	± 2.53	444.00 < Ød1 ≤ 446.00	± 3.06	553.00 < Ød1 ≤ 555.00	± 3.74
362.00 < Ød1 ≤ 364.00	± 2.54	446.00 < Ød1 ≤ 447.00	± 3.07	555.00 < Ød1 ≤ 557.61	± 3.75
364.00 < Ød1 ≤ 365.00	± 2.55	447.00 < Ød1 ≤ 449.00	± 3.08	557.61 < Ød1 ≤ 560.00	± 3.77
365.00 < Ød1 ≤ 367.00	± 2.56	449.00 < Ød1 ≤ 451.00	± 3.09	560.00 < Ød1 ≤ 569.00	± 3.78
367.00 < Ød1 ≤ 369.00	± 2.57	451.00 < Ød1 ≤ 452.00	± 3.10	569.00 < Ød1 ≤ 570.00	± 3.84
369.00 < Ød1 ≤ 370.00	± 2.58	452.00 < Ød1 ≤ 454.00	± 3.11	570.00 < Ød1 ≤ 575.00	± 3.85
370.00 < Ød1 ≤ 372.00	± 2.59	454.00 < Ød1 ≤ 455.00	± 3.12	575.00 < Ød1 ≤ 579.00	± 3.88
372.00 < Ød1 ≤ 373.00	± 2.60	455.00 < Ød1 ≤ 457.00	± 3.13	579.00 < Ød1 ≤ 580.00	± 3.90
373.00 < Ød1 ≤ 374.50	± 2.61	457.00 < Ød1 ≤ 459.00	± 3.14	580.00 < Ød1 ≤ 582.68	± 3.91
374.50 < Ød1 ≤ 376.00	± 2.62	459.00 < Ød1 ≤ 460.00	± 3.15	582.68 < Ød1 ≤ 590.00	± 3.92
376.00 < Ød1 ≤ 378.00	± 2.63	460.00 < Ød1 ≤ 462.00	± 3.16	590.00 < Ød1 ≤ 596.27	± 3.97
378.00 < Ød1 ≤ 379.30	± 2.64	462.00 < Ød1 ≤ 463.00	± 3.17	596.27 < Ød1 ≤ 600.00	± 4.01
379.30 < Ød1 ≤ 381.00	± 2.65	463.00 < Ød1 ≤ 465.00	± 3.18	600.00 < Ød1 ≤ 608.00	± 4.03
381.00 < Ød1 ≤ 383.00	± 2.66	465.00 < Ød1 ≤ 467.00	± 3.19	608.00 < Ød1 ≤ 615.00	± 4.08
383.00 < Ød1 ≤ 384.00	± 2.67	467.00 < Ød1 ≤ 468.00	± 3.20	615.00 < Ød1 ≤ 623.00	± 4.12
384.00 < Ød1 ≤ 386.00	± 2.68	468.00 < Ød1 ≤ 470.00	± 3.21	623.00 < Ød1 ≤ 630.00	± 4.17
386.00 < Ød1 ≤ 387.00	± 2.69	470.00 < Ød1 ≤ 471.00	± 3.22	630.00 < Ød1 ≤ 633.48	± 4.22
387.00 < Ød1 ≤ 389.00	± 2.70	471.00 < Ød1 ≤ 473.00	± 3.23	633.48 < Ød1 ≤ 640.00	± 4.24
389.00 < Ød1 ≤ 391.00	± 2.71	473.00 < Ød1 ≤ 475.00	± 3.24	640.00 < Ød1 ≤ 647.07	± 4.28
391.00 < Ød1 ≤ 392.00	± 2.72	475.00 < Ød1 ≤ 476.00	± 3.25	647.07 < Ød1 ≤ 650.00	± 4.32
392.00 < Ød1 ≤ 394.00	± 2.73	476.00 < Ød1 ≤ 478.00	± 3.26	650.00 < Ød1 ≤ 658.88	± 4.34
394.00 < Ød1 ≤ 395.00	± 2.74	478.00 < Ød1 ≤ 479.00	± 3.27	658.88 < Ød1 ≤ 670.00	± 4.40
395.00 < Ød1 ≤ 397.00	± 2.75	479.00 < Ød1 ≤ 481.00	± 3.28	670.00 < Ød1 ≤ 683.00	± 4.47
397.00 < Ød1 ≤ 398.00	± 2.76	481.00 < Ød1 ≤ 482.00	± 3.29	683.00 < Ød1 ≤ 732.50	± 4.55
398.00 < Ød1 ≤ 400.00	± 2.77	482.00 < Ød1 ≤ 484.00	± 3.30	732.50 < Ød1 ≤ 782.00	± 4.85
400.00 < Ød1 ≤ 402.00	± 2.78	484.00 < Ød1 ≤ 486.00	± 3.31	782.00 < Ød1 ≤ 836.50	± 5.15
402.00 < Ød1 ≤ 403.00	± 2.79	486.00 < Ød1 ≤ 487.00	± 3.32	836.50 < Ød1 ≤ 940.50	± 5.49
403.00 < Ød1 ≤ 405.00	± 2.80	487.00 < Ød1 ≤ 489.00	± 3.33	940.50 < Ød1 ≤ 1044.00	± 6.12

## 4.2 TOLERANCES ON SECTION Ød2 FOR X'RINGS

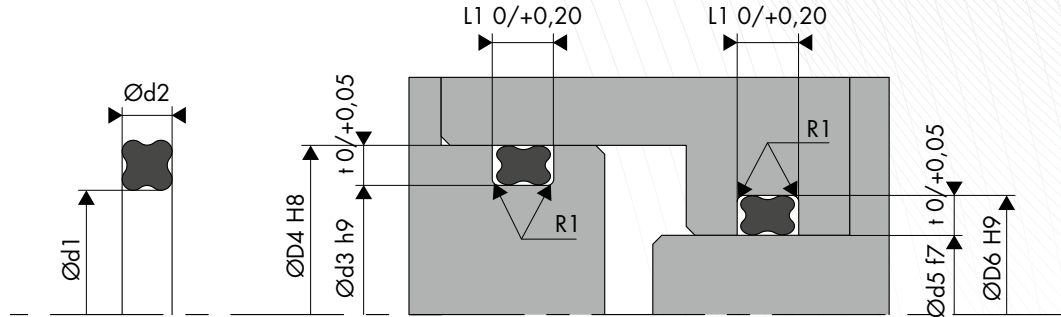
The tolerances on X'Rings thickness Ød2 set out in the table below relate to standard ISO 3601-1:2008 and are applicable to X'Rings.

X'Ring thickness Ød2	Tolerances	X'Ring thickness Ød2	Tolerances
1.02	± 0.08	2.62	± 0.09
1.27	± 0.08	3.53	± 0.10
1.52	± 0.08	5.33	± 0.13
1.78	± 0.08	6.99	± 0.15

## 5. Static sealing

### 5.1 INSTALLATION DIMENSIONS - RECTANGULAR GROOVE WITH RADIAL DEFORMATION

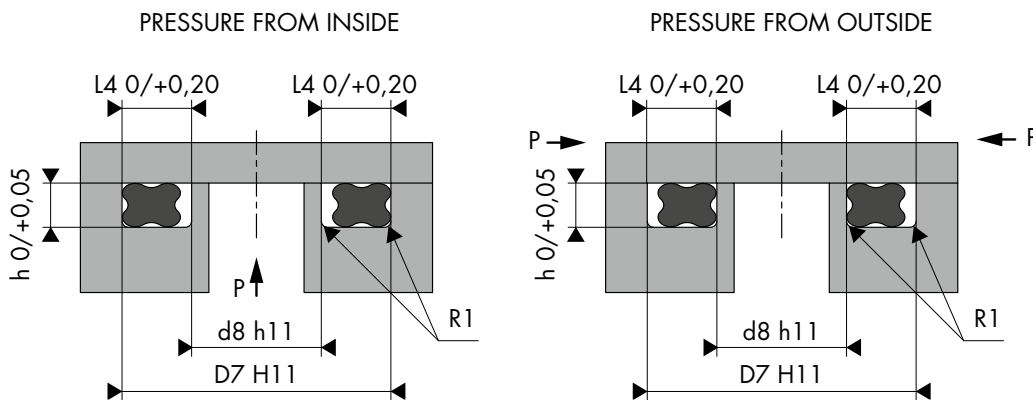
The X'Ring used in static applications must be fitted in a rectangular groove with a depth and width defined according to the X'Ring section, in line with the table below.



X'Ring thickness Ød2	Groove depth t0/+0,05	Groove width L1 0/+0,20	Groove radius R1	Radial extrusion gap F/2
1.02	0.75	1.20	0.10	0.03
1.27	0.90	1.40	0.10	0.03
1.52	1.15	1.70	0.20	0.04
1.78	1.40	2.00	0.20	0.05
2.62	2.25	3.00	0.30	0.08
3.53	3.10	4.00	0.40	0.08
5.33	4.75	6.00	0.40	0.10
6.99	6.20	8.00	0.60	0.10

### 5.2 INSTALLATION DIMENSIONS - RECTANGULAR GROOVE WITH AXIAL DEFORMATION

The X'Ring ensures the sealing of flanges or covers that are subject to axial deformation. The groove dimensions are determined according to the X'Ring thickness.

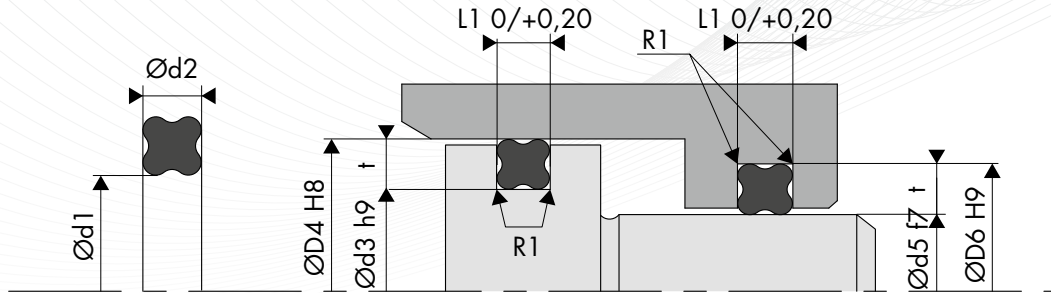


X'Ring thickness Ød2	Groove depth h 0/+0,05	Groove width L4 0/+0,20	Groove radius R1	Radial extrusion gap F/2
1.02	0.75	1.20	0.10	0.03
1.27	0.90	1.40	0.10	0.03
1.52	1.15	1.70	0.20	0.04
1.78	1.40	2.00	0.20	0.05
2.62	2.25	3.00	0.30	0.08
3.53	3.10	4.00	0.40	0.08
5.33	4.75	6.00	0.40	0.10
6.99	6.20	8.00	0.60	0.10

## 6. Dynamic sealing

### 6.1 INSTALLATION DIMENSIONS - HYDRAULIC WITH AXIAL MOVEMENTS - RECTANGULAR GROOVE WITH RADIAL DEFORMATION

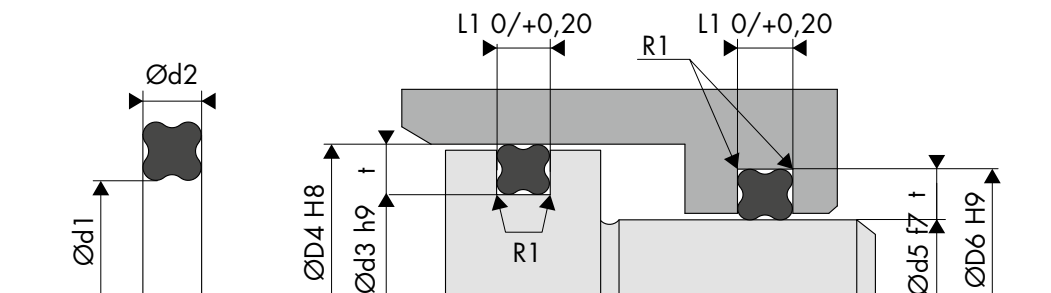
The X'Ring used in dynamic linear applications must be fitted in a rectangular groove with a depth and width defined according to the X'Ring thickness, in line with the table below.



X'Ring thickness $\varnothing d2$	Groove depth $t \pm 0.05$	Groove width $L1 \ 0/+0.20$	Groove radius $R1$	Radial extrusion gap $F/2$
1.02	0.80	1.20	0.10	0.03
1.27	1.00	1.40	0.10	0.03
1.52	1.25	1.70	0.20	0.04
1.78	1.50	2.00	0.20	0.05
2.62	2.30	3.00	0.30	0.08
3.53	3.20	4.00	0.40	0.08
5.33	4.90	6.00	0.40	0.10
6.99	6.40	8.00	0.60	0.10

### 6.2 INSTALLATION DIMENSIONS - HYDRAULIC WITH ROTATING MOVEMENTS - RECTANGULAR GROOVE WITH RADIAL DEFORMATION

The X'Ring used in dynamic rotating applications must be fitted in a rectangular groove with a depth and width defined according to the X'Ring thickness, in line with the table below.



X'Ring thickness $\varnothing d2$	Groove depth $t \pm 0.05$	Groove width $L1 \ 0/+0.20$	Groove radius $R1$	Radial extrusion gap $F/2$
1.02	0.80	1.20	0.10	0.03
1.27	1.00	1.40	0.10	0.03
1.52	1.25	1.70	0.20	0.04
1.78	1.50	2.00	0.20	0.05
2.62	2.30	3.00	0.30	0.08
3.53	3.20	4.00	0.40	0.08
5.33	4.90	6.00	0.40	0.10
6.99	6.40	8.00	0.60	0.10



## 7. Chamfers and radius

Given that the X'Rings are fitted pre-tightened, the chamfer lengths and rounded cutting edges must fit with the table below.

X'Ring thickness Ød2	Radius R1	Max radius R2	Chamfer C	
			15°	20°
1.02	0.10	0.20	2.00	1.50
1.27	0.10	0.20	2.00	1.50
1.52	0.20	0.20	2.50	2.00
1.78	0.20	0.20	2.50	2.00
2.62	0.30	0.20	3.00	2.50
3.53	0.40	0.20	3.50	3.00
5.33	0.40	0.20	4.00	3.50
6.99	0.60	0.20	5.00	4.00

## 8. Surface roughness

We recommend using steel or non-porous cast iron to make the tubes and rods. For dynamic applications, brass, untreated stainless steel and aluminium are not as hard and are therefore not recommended, as they would be subjected to a lot of wear.

The sealing must be of a high quality due to the roughness. The surface roughness of grooves improves during alternating pressures.

Type of application	Type of surface	Ra µm	Rz µm	Rmax µm
<b>Radial - Static</b>	<b>Under non-pulsating pressure</b>			
	Mating surface (rod and cylinder)	1.6	6.3	10.0
	Groove diameter and groove flanks	1.6	6.3	10.0
	<b>Under pulsating pressure</b>			
	Mating surface (rod and cylinder)	0.8	3.2	5.0
<b>Radial - Dynamic</b>	Groove diameter and groove flanks	1.6	6.3	10.0
	Mating surface (rod and cylinder)	0.4	1.6	2.5
	Groove diameter and groove flanks	0.8	3.2	5.0
<b>Axial - Static</b>	Clamping surface	1.6	6.3	10.0
	Groove flanks	1.6	6.3	10.0

## 9. Dimensions

Part number	Standard	Inside diameter Ød1	X'Ring thickness Ød2
001.QR001	001	2.90	1.78
001.QR002	002	3.68	1.78
001.QR003	003	4.47	1.78
001.QR03A	03A	4.62	1.78
001.QR004	004	5.28	1.78
001.QR04A	04A	5.70	1.78
001.QR005	005	6.07	1.78
001.QR05A	05A	6.65	1.78
001.QR006	006	7.65	1.78
001.QR06A	06A	8.70	1.78
001.QR007	007	9.25	1.78
001.QR07A	07A	9.70	1.78
001.QR113	113	10.82	1.78
001.QR114	114	12.42	1.78
001.QR115	115	14.00	1.78
001.QR116	116	15.60	1.78
001.QR117	117	17.17	1.78
001.QR118	118	18.77	1.78
001.QR119	119	20.35	1.78
001.QR120	120	21.95	1.78
001.QR121	121	23.52	1.78
001.QR122	122	25.12	1.78
001.QR123	123	26.70	1.78
001.QR124	124	28.30	1.78
001.QR125	125	29.87	1.78
001.QR137	137	63.22	1.78
001.QR008	008	9.19	2.62
001.QR08A	08A	9.80	2.62
001.QR009	009	10.77	2.62
001.QR09A	09A	11.70	2.62
001.QR010	010	12.37	2.62
001.QR10A	10A	12.80	2.62
001.QR10B	10B	13.70	2.62
001.QR011	011	13.94	2.62
001.QR11A	11A	14.70	2.62
001.QR012	012	15.54	2.62
001.QR013	013	17.12	2.62
001.QR13A	13A	17.75	2.62
001.QR014	014	18.72	2.62
001.QR14A	14A	19.60	2.62
001.QR217	217	20.30	2.62
001.QR218	218	21.89	2.62
001.QR219	219	23.47	2.62
001.QR220	220	25.07	2.62
001.QR221	221	26.64	2.62
001.QR222	222	28.24	2.62
001.QR223	223	29.82	2.62
001.QR224	224	31.42	2.62
001.QR225	225	32.99	2.62
001.QR226	226	34.60	2.62
001.QR227	227	36.17	2.62
001.QR228	228	37.77	2.62
001.QR229	229	39.34	2.62
001.QR230	230	40.94	2.62
001.QR231	231	42.52	2.62
001.QR261	261	139.37	2.62
001.QR015	015	18.64	3.53
001.QR016	016	20.22	3.53

Part number	Standard	Inside diameter Ød1	X'Ring thickness Ød2
001.QR16A	16A	20.90	3.53
001.QR017	017	21.82	3.53
001.QR018	018	23.39	3.53
001.QR18A	18A	23.99	3.53
001.QR019	019	24.99	3.53
001.QR19A	19A	25.90	3.53
001.QR020	020	26.57	3.53
001.QR20A	20A	27.57	3.53
001.QR021	021	28.17	3.53
001.QR022	022	29.74	3.53
001.QR023	023	31.34	3.53
001.QR23A	23A	32.04	3.53
001.QR024	024	32.92	3.53
001.QR24A	24A	33.80	3.53
001.QR025	025	34.52	3.53
001.QR026	026	36.09	3.53
001.QR027	027	37.69	3.53
001.QR323	323	40.87	3.53
001.QR324	324	44.05	3.53
001.QR325	325	47.22	3.53
001.QR326	326	50.39	3.53
001.QR327	327	53.57	3.53
001.QR328	328	56.75	3.53
001.QR329	329	59.92	3.53
001.QR330	330	63.09	3.53
001.QR331	331	66.27	3.53
001.QR332	332	69.44	3.53
001.QR333	333	72.62	3.53
001.QR334	334	75.80	3.53
001.QR335	335	78.97	3.53
001.QR336	336	82.15	3.53
001.QR337	337	85.32	3.53
001.QR338	338	88.49	3.53
001.QR339	339	91.67	3.53
001.QR340	340	94.84	3.53
001.QR341	341	98.02	3.53
001.QR342	342	101.20	3.53
001.QR348	348	120.25	3.53
001.QR363	363	183.74	3.53
001.QR028	028	37.47	5.33
001.QR28A	28A	39.64	5.33
001.QR029	029	40.64	5.33
001.QR29A	29A	41.80	5.33
001.QR030	030	43.82	5.33
001.QR30A	30A	45.04	5.33
001.QR30B	30B	45.84	5.33
001.QR031	031	46.99	5.33
001.QR31A	31A	47.80	5.33
001.QR032	032	50.17	5.33
001.QR32A	32A	52.00	5.33
001.QR033	033	53.34	5.33
001.QR33A	33A	54.50	5.33
001.QR034	034	56.52	5.33
001.QR34A	34A	57.52	5.33
001.QR035	035	59.69	5.33
001.QR35A	35A	61.54	5.33
001.QR036	036	62.87	5.33
001.QR36A	36A	64.59	5.33

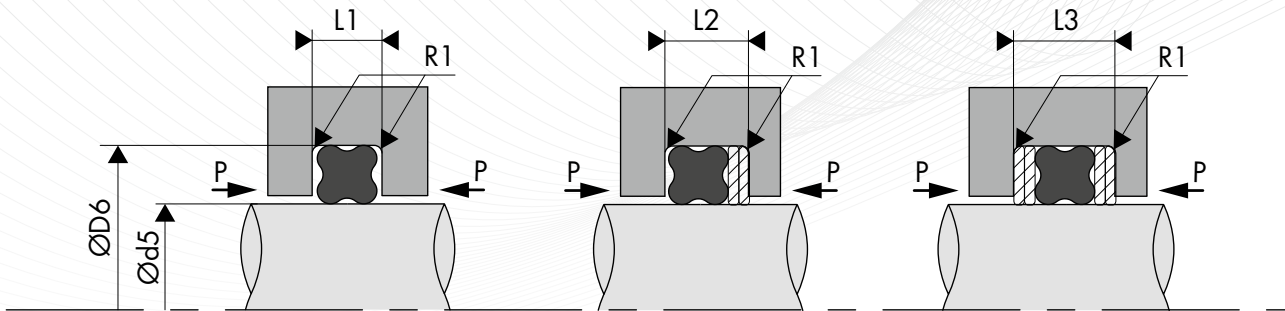
Part number	Standard	Inside diameter Ød1	X'Ring thickness Ød2
001.QR037	037	66.04	5.33
001.QR37A	37A	67.64	5.33
001.QR038	038	69.22	5.33
001.QR38A	38A	70.64	5.33
001.QR039	039	72.39	5.33
001.QR39A	39A	73.84	5.33
001.QR040	040	75.57	5.33
001.QR041	041	78.74	5.33
001.QR41A	41A	80.09	5.33
001.QR042	042	81.92	5.33
001.QR42A	42A	83.39	5.33
001.QR043	043	85.09	5.33
001.QR43A	43A	86.64	5.33
001.QR044	044	88.27	5.33
001.QR44A	44A	89.59	5.33
001.QR045	045	91.44	5.33
001.QR046	046	94.62	5.33
001.QR047	047	97.99	5.33
001.QR048	048	100.97	5.33
001.QR48A	48A	102.34	5.33
001.QR049	049	104.14	5.33
001.QR49A	49A	105.80	5.33
001.QR050	050	107.32	5.33
001.QR051	051	110.49	5.33
001.QR052	052	113.67	5.33
001.QR088	088	113.67	6.99
001.QR52A	52A	115.84	6.99
001.QR053	053	116.84	6.99
001.QR054	054	120.02	6.99
001.QR055	055	123.19	6.99
001.QR056	056	126.37	6.99
001.QR057	057	129.54	6.99
001.QR058	058	132.72	6.99
001.QR059	059	135.89	6.99
001.QR060	060	139.07	6.99
001.QR061	061	142.24	6.99
001.QR062	062	145.42	6.99
001.QR063	063	148.59	6.99
001.QR064	064	151.77	6.99
001.QR64A	64A	155.02	6.99
001.QR065	065	158.12	6.99
001.QR65A	65A	161.02	6.99
001.QR066	066	164.47	6.99
001.QR66A	66A	167.02	6.99
001.QR067	067	170.82	6.99
001.QR67A	67A	173.52	6.99

Part number	Standard	Inside diameter Ød1	X'Ring thickness Ød2
001.QR068	068	177.17	6.99
001.QR68A	68A	180.52	6.99
001.QR069	069	183.52	6.99
001.QR69A	69A	186.02	6.99
001.QR070	070	189.87	6.99
001.QR70A	70A	192.02	6.99
001.QR071	071	196.22	6.99
001.QR71A	71A	199.02	6.99
001.QR072	072	202.57	6.99
001.QR72A	72A	206.80	6.99
001.QR72B	72B	211.02	6.99
001.QR073	073	215.27	6.99
001.QR73A	73A	219.02	6.99
001.QR73B	73B	223.50	6.99
001.QR074	074	227.97	6.99
001.QR74A	74A	231.02	6.99
001.QR74B	74B	235.00	6.99
001.QR075	075	240.67	6.99
001.QR75A	75A	243.02	6.99
001.QR75B	75B	248.00	6.99
001.QR076	076	253.37	6.99
001.QR76A	76A	259.00	6.99
001.QR077	077	266.07	6.99
001.QR77A	77A	273.10	6.99
001.QR078	078	278.77	6.99
001.QR78A	78A	284.00	6.99
001.QR78B	78B	287.50	6.99
001.QR079	079	291.47	6.99
001.QR79A	79A	298.00	6.99
001.QR080	080	304.17	6.99
001.QR80A	80A	310.00	6.99
001.QR081	081	316.87	6.99
001.QR81A	81A	323.50	6.99
001.QR082	082	329.57	6.99
001.QR82A	82A	336.50	6.99
001.QR083	083	342.27	6.99
001.QR83A	83A	348.50	6.99
001.QR084	084	354.97	6.99
001.QR84A	84A	362.50	6.99
001.QR085	085	367.67	6.99
001.QR85A	85A	374.00	6.99
001.QR086	086	380.37	6.99
001.QR86A	86A	387.50	6.99
001.QR087	087	393.07	6.99
001.QR87A	87A	401.00	6.99

Other dimensions can be made, please ask us.

## 10. Preferential back-up ring dimensions

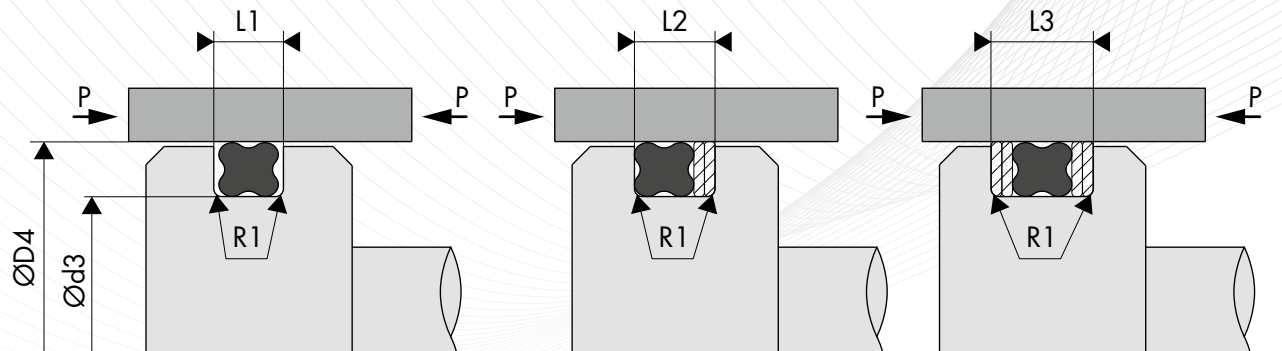
### 10.1 INNER SEALING - DYNAMIC APPLICATION (ALTERNATING) WITH BECA 012 ROD BACK-UP RING



Part number	X'Ring dimensions	Rod diameter	Groove diameter	Groove width			Radius	Back-up ring
		Ød5 f7	ØD6 H9	L1 0/+0.20	L2 0/+0.20	L3 0/+0.20	R1	Part number BECA 012 Rod
001.QR003	4.47 x 1.78	4.00	7.00	2.00	3.40	4.80	0.20	012.004007
001.QR004	5.28 x 1.78	5.00	8.00	2.00	3.40	4.80	0.20	012.005008
001.QR005	6.07 x 1.78	6.00	9.00	2.00	3.40	4.80	0.20	012.006009
001.Q82178	8.20 x 1.78	8.00	11.00	2.00	3.40	4.80	0.20	012.008011
001.Q10226	10.20 x 2.62	10.00	14.60	3.00	4.40	5.80	0.30	012.010146
001.QR010	12.37 x 2.62	12.00	16.60	3.00	4.40	5.80	0.30	012.012166
001.QR011	13.94 x 2.62	14.00	18.60	3.00	4.40	5.80	0.30	012.014186
001.QR11A	14.70 x 2.62	15.00	19.60	3.00	4.40	5.80	0.30	012.015196
001.Q16226	16.20 x 2.62	16.00	20.60	3.00	4.40	5.80	0.30	012.016206
001.Q18235	18.20 x 3.53	18.00	24.40	4.00	5.40	6.80	0.40	012.018244
001.QR016	20.22 x 3.53	20.00	26.40	4.00	5.40	6.80	0.40	012.020264
001.QR017	21.82 x 3.53	22.00	28.40	4.00	5.40	6.80	0.40	012.022284
001.QR019	24.99 x 3.53	25.00	31.40	4.00	5.40	6.80	0.40	012.025314
001.QR021	28.17 x 3.53	28.00	34.40	4.00	5.40	6.80	0.40	012.028344
001.QR022	29.74 x 3.53	30.00	36.40	4.00	5.40	6.80	0.40	012.030364
001.QR023	31.34 x 3.53	32.00	38.40	4.00	5.40	6.80	0.40	012.032384
001.QR025	34.52 x 3.53	35.00	41.40	4.00	5.40	6.80	0.40	012.035414
001.QR026	36.09 x 3.53	36.00	42.40	4.00	5.40	6.80	0.40	012.036424
001.QR029	40.64 x 5.33	40.00	49.80	6.00	7.70	9.40	0.40	012.040498
001.QR029	40.64 x 5.33	42.00	51.80	6.00	7.70	9.40	0.40	012.042518
001.Q45253	45.20 x 5.33	45.00	54.80	6.00	7.70	9.40	0.40	012.045548
001.QR031	46.99 x 5.33	48.00	57.80	6.00	7.70	9.40	0.40	012.048578
001.QR032	50.17 x 5.33	50.00	59.80	6.00	7.70	9.40	0.40	012.050598
001.QR032	50.17 x 5.33	52.00	61.80	6.00	7.70	9.40	0.40	012.052618
001.QR033	53.34 x 5.33	55.00	64.80	6.00	7.70	9.40	0.40	012.055648
001.QR034	56.52 x 5.33	56.00	65.80	6.00	7.70	9.40	0.40	012.056658
001.QR035	59.69 x 5.33	60.00	69.80	6.00	7.70	9.40	0.40	012.060698
001.QR036	62.87 x 5.33	63.00	72.80	6.00	7.70	9.40	0.40	012.063728
001.QR037	66.04 x 5.33	65.00	74.80	6.00	7.70	9.40	0.40	012.065748
001.QR038	69.22 x 5.33	70.00	79.80	6.00	7.70	9.40	0.40	012.070798

Part number	X'Ring dimensions	Rod diameter	Groove diameter	Groove width			Radius	Back-up ring
		Ød5 f7	ØD6 H9	L1 0/+0.20	L2 0/+0.20	L3 0/+0.20	R1	Part number BECA 012 Rod
001.QR040	75.57 x 5.33	75.00	84.80	6.00	7.70	9.40	0.40	012.075848
001.QR041	78.74 x 5.33	80.00	89.80	6.00	7.70	9.40	0.40	012.080898
001.QR043	85.09 x 5.33	85.00	94.80	6.00	7.70	9.40	0.40	012.085948
001.QR045	91.44 x 5.33	90.00	99.80	6.00	7.70	9.40	0.40	012.090998
001.QR048	100.97 x 5.33	100.00	109.80	6.00	7.70	9.40	0.40	012.1001098
001.QR049	104.14 x 5.33	105.00	114.80	6.00	7.70	9.40	0.40	012.1051148
001.QR051	110.49 x 5.33	110.00	119.80	6.00	7.70	9.40	0.40	012.1101198
001.QR053	116.84 x 6.99	115.00	127.80	8.00	10.50	13.00	0.60	012.1151278
001.QR054	120.02 x 6.99	120.00	132.80	8.00	10.50	13.00	0.60	012.1201328
001.QR056	126.37 x 6.99	125.00	137.80	8.00	10.50	13.00	0.60	012.1251378
001.QR057	129.54 x 6.99	130.00	142.80	8.00	10.50	13.00	0.60	012.1301428
001.QR059	135.89 x 6.99	135.00	147.80	8.00	10.50	13.00	0.60	012.1351478
001.QR060	139.07 x 6.99	140.00	152.80	8.00	10.50	13.00	0.60	012.1401528
001.QR063	148.59 x 6.99	150.00	162.80	8.00	10.50	13.00	0.60	012.1501628
001.Q16056	160.50 x 6.99	160.00	172.80	8.00	10.50	13.00	0.60	012.1601728
001.QR067	170.82 x 6.99	170.00	182.80	8.00	10.50	13.00	0.60	012.1701828
001.QR068	177.17 x 6.99	180.00	192.80	8.00	10.50	13.00	0.60	012.1801928
001.QR070	189.87 x 6.99	190.00	202.80	8.00	10.50	13.00	0.60	012.1902028
001.QR072	202.57 x 6.99	200.00	212.80	8.00	10.50	13.00	0.60	012.2002128
001.QR073	215.27 x 6.99	210.00	222.80	8.00	10.50	13.00	0.60	012.2102228
001.QR073	215.27 x 6.99	220.00	232.80	8.00	10.50	13.00	0.60	012.2202328
001.QR074	227.97 x 6.99	230.00	242.80	8.00	10.50	13.00	0.60	012.2302428
001.QR075	240.67 x 6.99	240.00	252.80	8.00	10.50	13.00	0.60	012.2402528
001.QR076	253.37 x 6.99	250.00	262.80	8.00	10.50	13.00	0.60	012.2502628
001.QR078	278.77 x 6.99	280.00	292.80	8.00	10.50	13.00	0.60	012.2802928
001.QR080	304.17 x 6.99	300.00	312.80	8.00	10.50	13.00	0.60	012.3003128
001.QR081	316.87 x 6.99	320.00	332.80	8.00	10.50	13.00	0.60	012.3203328
001.QR084	354.97 x 6.99	350.00	362.80	8.00	10.50	13.00	0.60	012.3503628
001.QR084	354.97 x 6.99	360.00	372.80	8.00	10.50	13.00	0.60	012.3603728
001.Q40526	405.26 x 6.99	400.00	412.80	8.00	10.50	13.00	0.60	012.4004128

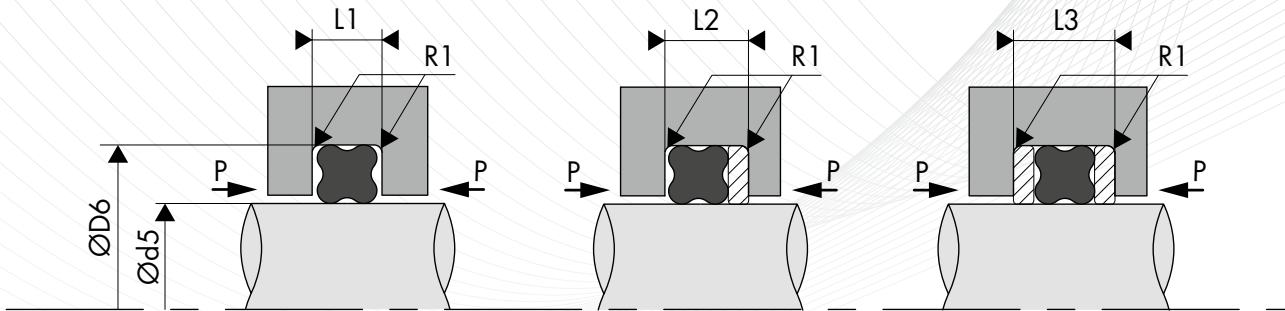
## 10.2 OUTER SEALING - DYNAMIC APPLICATION (ALTERNATING) WITH BECA 012 PISTON BACK-UP RING



Part number	X'Ring Dimensions	Bore diameter	Groove diameter	Groove width			Radius	Back-up ring
		ØD4 H8	Ød3 h9	L1 0/+0.20	L2 0/+0.20	L3 0/+0.20	R1	Part number BECA 012 Piston
001.257178	2.57 x 1.78	6.00	3.00	2.00	3.40	4.80	0.20	012.006003
001.QR003	4.47 x 1.78	8.00	5.00	2.00	3.40	4.80	0.20	012.008005
001.QR005	6.07 x 1.78	10.00	7.00	2.00	3.40	4.80	0.20	012.010007
001.Q82178	8.20 x 1.78	12.00	9.00	2.00	3.40	4.80	0.20	012.012009
001.QR050	10.82 x 1.78	14.00	11.00	2.00	3.40	4.80	0.20	012.014011
001.Q10226	10.20 x 2.62	15.00	10.40	3.00	4.40	5.80	0.30	012.015104
001.QR009	10.77 x 2.62	16.00	11.40	3.00	4.40	5.80	0.30	012.016114
001.QR010	12.37 x 2.62	18.00	13.40	3.00	4.40	5.80	0.30	012.018134
001.QR11A	14.70 x 2.62	20.00	15.40	3.00	4.40	5.80	0.30	012.020154
001.Q16226	16.20 x 2.62	22.00	17.40	3.00	4.40	5.80	0.30	012.022174
001.Q18235	18.20 x 3.53	25.00	18.60	4.00	5.40	6.80	0.40	012.025186
001.QR017	21.82 x 3.53	28.00	21.60	4.00	5.40	6.80	0.40	012.028216
001.QR018	23.39 x 3.53	30.00	23.60	4.00	5.40	6.80	0.40	012.030236
001.QR019	24.99 x 3.53	32.00	25.60	4.00	5.40	6.80	0.40	012.032256
001.QR021	28.17 x 3.53	35.00	28.60	4.00	5.40	6.80	0.40	012.035286
001.QR024	32.92 x 3.53	40.00	33.60	4.00	5.40	6.80	0.40	012.040336
001.QR025	34.52 x 3.53	42.00	35.60	4.00	5.40	6.80	0.40	012.042356
001.QR027	37.69 x 3.53	45.00	38.60	4.00	5.40	6.80	0.40	012.045386
001.QR028	37.47 x 5.33	48.00	38.20	6.00	7.70	9.40	0.40	012.048382
001.Q39253	39.20 x 5.33	50.00	40.20	6.00	7.70	9.40	0.40	012.050402
001.QR029	40.64 x 5.33	52.00	42.20	6.00	7.70	9.40	0.40	012.052422
001.QR030	43.82 x 5.33	55.00	45.20	6.00	7.70	9.40	0.40	012.055452
001.QR032	50.17 x 5.33	60.00	50.20	6.00	7.70	9.40	0.40	012.060502
001.QR033	53.34 x 5.33	63.00	53.20	6.00	7.70	9.40	0.40	012.063532
001.QR033	53.34 x 5.33	65.00	55.20	6.00	7.70	9.40	0.40	012.065552
001.QR035	59.69 x 5.33	70.00	60.20	6.00	7.70	9.40	0.40	012.070602
001.QR036	62.87 x 5.33	75.00	65.20	6.00	7.70	9.40	0.40	012.075652
001.QR038	69.22 x 5.33	80.00	70.20	6.00	7.70	9.40	0.40	012.080702
001.QR040	75.57 x 5.33	85.00	75.20	6.00	7.70	9.40	0.40	012.085752
001.QR041	78.74 x 5.33	90.00	80.20	6.00	7.70	9.40	0.40	012.090802
001.QR043	85.09 x 5.33	95.00	85.20	6.00	7.70	9.40	0.40	012.095852

Part number	X'Ring Dimensions	Bore diameter	Groove diameter	Groove width			Radius	Back-up ring
		ØD4 H8	Ød3 h9	L1 0/+0.20	L2 0/+0.20	L3 0/+0.20	R1	Part number BECA 012 Piston
001.QR045	91.44 x 5.33	100.00	90.20	6.00	7.70	9.40	0.40	012.100902
001.QR046	94.62 x 5.33	105.00	95.20	6.00	7.70	9.40	0.40	012.105952
001.QR048	100.97 x 5.33	110.00	100.20	6.00	7.70	9.40	0.40	012.1101002
001.QR049	104.14 x 5.33	115.00	105.20	6.00	7.70	9.40	0.40	012.1151052
001.QR051	110.49 x 5.33	120.00	110.20	6.00	7.70	9.40	0.40	012.1201102
001.QR052	113.67 x 5.33	125.00	115.20	6.00	7.70	9.40	0.40	012.1251152
001.120533	120.02 x 5.33	130.00	120.20	6.00	7.70	9.40	0.40	012.1301202
001.QR054	120.02 x 6.99	135.00	122.20	8.00	10.50	13.00	0.60	012.1351222
001.QR056	126.37 x 6.99	140.00	127.20	8.00	10.50	13.00	0.60	012.1401272
001.QR059	135.89 x 6.99	150.00	137.20	8.00	10.50	13.00	0.60	012.1501372
001.QR062	145.42 x 6.99	160.00	147.20	8.00	10.50	13.00	0.60	012.1601472
001.QR065	158.12 x 6.99	170.00	157.20	8.00	10.50	13.00	0.60	012.1701572
001.QR066	164.47 x 6.99	180.00	167.20	8.00	10.50	13.00	0.60	012.1801672
001.QR068	177.17 x 6.99	190.00	177.20	8.00	10.50	13.00	0.60	012.1901772
001.QR069	183.52 x 6.99	200.00	187.20	8.00	10.50	13.00	0.60	012.2001872
001.QR071	196.22 x 6.99	210.00	197.20	8.00	10.50	13.00	0.60	012.2101972
001.QR072	202.57 x 6.99	220.00	207.20	8.00	10.50	13.00	0.60	012.2202072
001.QR073	215.27 x 6.99	230.00	217.20	8.00	10.50	13.00	0.60	012.2302172
001.QR074	227.97 x 6.99	240.00	227.20	8.00	10.50	13.00	0.60	012.2402272
001.QR074	227.97 x 6.99	250.00	237.20	8.00	10.50	13.00	0.60	012.2502372
001.QR077	266.07 x 6.99	280.00	267.20	8.00	10.50	13.00	0.60	012.2802672
001.QR078	278.77 x 6.99	300.00	287.20	8.00	10.50	13.00	0.60	012.3002872
001.QR080	304.17 x 6.99	320.00	307.20	8.00	10.50	13.00	0.60	012.3203072
001.QR082	329.57 x 6.99	350.00	337.20	8.00	10.50	13.00	0.60	012.3503372
001.QR086	380.37 x 6.99	400.00	387.20	8.00	10.50	13.00	0.60	012.4003872
001.Q40526	405.26 x 6.99	420.00	407.20	8.00	10.50	13.00	0.60	012.4204072
001.Q43066	430.66 x 6.99	450.00	437.20	8.00	10.50	13.00	0.60	012.4504372
001.Q45606	456.06 x 6.99	480.00	467.20	8.00	10.50	13.00	0.60	012.4804672
001.Q48146	481.46 x 6.99	500.00	487.20	8.00	10.50	13.00	0.60	012.5004872

### 10.3 SHAFT SEALING - DYNAMIC APPLICATION (ROTATING) WITH UNCUT BECA 011 ROD BACK-UP RING



Part number	X'Ring dimensions	Rod diameter	Groove diameter	Groove width			Radius	Back-up ring
		$\varnothing d5$ f7	$\varnothing D6$ H9	L1 0/+0.20	L2 0/+0.20	L3 0/+0.20	R1	Part number BECA 011 Rod
001.QR003	4.47 x 1.78	4.00	7.20	2.00	3.20	4.40	0.20	011.004072
001.QR004	5.28 x 1.78	5.00	8.20	2.00	3.20	4.40	0.20	011.005082
001.Q82178	8.20 x 1.78	8.00	11.20	2.00	3.20	4.40	0.20	011.008112
001.Q10226	10.20 x 2.62	10.00	14.80	2.80	4.00	5.20	0.30	011.010148
001.QR010	12.37 x 2.62	12.00	16.80	2.80	4.00	5.20	0.30	011.012168
001.QR012	15.54 x 2.62	15.00	19.80	2.80	4.00	5.20	0.30	011.015198
001.QR013	17.12 x 2.62	16.00	20.80	2.80	4.00	5.20	0.30	011.016208
001.QR014	18.72 x 2.62	18.00	22.80	2.80	4.00	5.20	0.30	011.018228
001.QR016	20.22 x 3.53	20.00	26.70	3.80	5.40	7.00	0.40	011.020267
001.QR018	23.39 x 3.53	22.00	28.70	3.80	5.40	7.00	0.40	011.022287
001.QR020	26.57 x 3.53	25.00	31.70	3.80	5.40	7.00	0.40	011.025317
001.QR022	29.74 x 3.53	28.00	34.70	3.80	5.40	7.00	0.40	011.028347
001.QR023	31.34 x 3.53	30.00	36.70	3.80	5.40	7.00	0.40	011.030367
001.QR024	32.92 x 3.53	32.00	38.70	3.80	5.40	7.00	0.40	011.032387
001.QR026	36.09 x 3.53	35.00	41.70	3.80	5.40	7.00	0.40	011.035417
001.QR027	37.69 x 3.53	36.00	42.70	3.80	5.40	7.00	0.40	011.036427
001.QR029	40.64 x 5.33	40.00	49.90	6.00	8.00	10.00	0.40	011.040499
001.QR030	43.82 x 5.33	42.00	51.90	6.00	8.00	10.00	0.40	011.042519
001.QR031	46.99 x 5.33	45.00	54.90	6.00	8.00	10.00	0.40	011.045549
001.QR032	50.17 x 5.33	48.00	57.90	6.00	8.00	10.00	0.40	011.048579
001.QR032	50.17 x 5.33	48.00	57.90	6.00	8.00	10.00	0.40	011.048579
001.QR033	53.34 x 5.33	50.00	59.90	6.00	8.00	10.00	0.40	011.050599
001.QR033	53.34 x 5.33	52.00	61.90	6.00	8.00	10.00	0.40	011.052619
001.QR034	56.52 x 5.33	55.00	64.90	6.00	8.00	10.00	0.40	011.055649
001.QR034	56.52 x 5.33	56.00	65.00	6.00	8.00	10.00	0.40	011.05665
001.QR036	62.87 x 5.33	60.00	69.90	6.00	8.00	10.00	0.40	011.060699
001.QR037	66.04 x 5.33	63.00	72.90	6.00	8.00	10.00	0.40	011.063729
001.QR037	66.04 x 5.33	65.00	74.90	6.00	8.00	10.00	0.40	011.065749
001.QR039	72.39 x 5.33	70.00	79.90	6.00	8.00	10.00	0.40	011.070799
001.QR041	78.74 x 5.33	75.00	84.90	6.00	8.00	10.00	0.40	011.075849
001.QR042	81.92 x 5.33	80.00	89.90	6.00	8.00	10.00	0.40	011.080899
001.QR044	88.27 x 5.33	85.00	94.90	6.00	8.00	10.00	0.40	011.085949
001.QR046	94.62 x 5.33	90.00	99.90	6.00	8.00	10.00	0.40	011.090999



Part number	X'Ring dimensions	Rod diameter	Groove diameter	Groove width			Radius	Back-up ring
		Ød5 f7	ØD6 H9	L1 0/+0.20	L2 0/+0.20	L3 0/+0.20	R1	Part number BECA 011 Rod
001.QR047	97.99 x 5.33	95.00	104.90	6.00	8.00	10.00	0.40	011.0951049
001.QR049	104.14 x 5.33	100.00	109.90	6.00	8.00	10.00	0.40	011.1001099
001.QR051	110.49 x 5.33	105.00	114.90	6.00	8.00	10.00	0.40	011.1051149
001.QR053	116.84 x 6.99	110.00	123.30	7.70	10.20	12.70	0.60	011.1101233
001.QR054	120.02 x 6.99	115.00	128.30	7.70	10.20	12.70	0.60	011.1151283
001.QR055	123.19 x 6.99	120.00	133.30	7.70	10.20	12.70	0.60	011.1201333
001.QR057	129.54 x 6.99	125.00	138.30	7.70	10.20	12.70	0.60	011.1251383
001.QR059	135.89 x 6.99	130.00	143.30	7.70	10.20	12.70	0.60	011.1301433
001.QR062	145.42 x 6.99	140.00	153.30	7.70	10.20	12.70	0.60	011.1401533
001.QR065	158.12 x 6.99	150.00	163.30	7.70	10.20	12.70	0.60	011.1501633
001.QR066	164.47 x 6.99	160.00	173.30	7.70	10.20	12.70	0.60	011.1601733
001.QR069	183.52 x 6.99	180.00	193.30	7.70	10.20	12.70	0.60	011.1801933
001.QR072	202.57 x 6.99	200.00	213.30	7.70	10.20	12.70	0.60	011.2002133



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Ph. **+33 (0)2 51 42 13 76** - Fax **+33 (0)2 51 43 61 14**

Email: [contact@francejoint.fr](mailto:contact@francejoint.fr) - Website: [www.francejoint.com](http://www.francejoint.com)

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