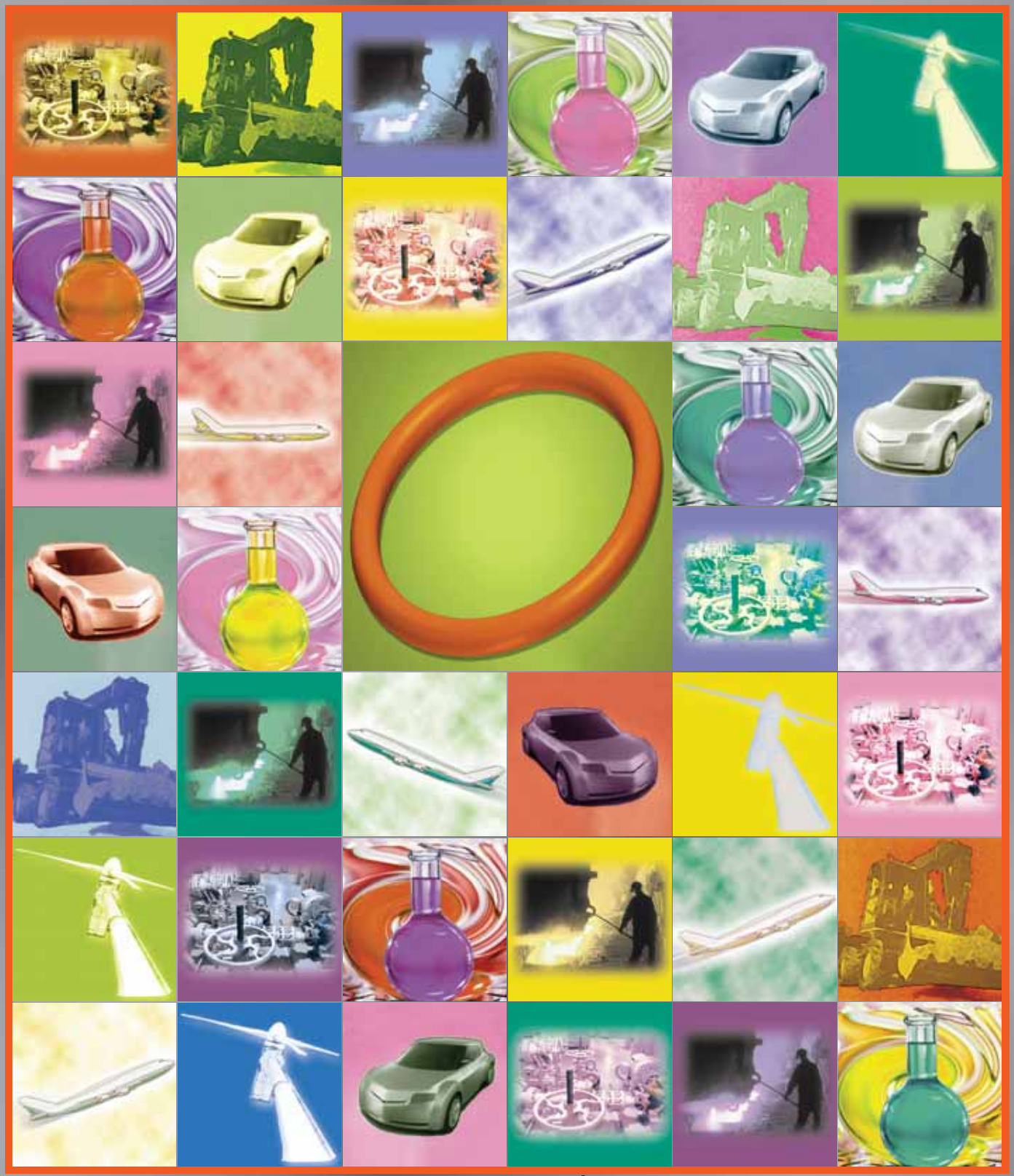
Tec-O-ring®



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Description 1

Advantages 1

Operating conditions 1

Sealing principle 2

Choosing the right dimension 3

Types of fitting 4

- Radial fitting for external seal (cylinder type)
- Radial fitting for internal seal (rod type)
- Fitting with anti-extrusion rings
- Axial fitting under internal pressure
- Axial fitting under external pressure

Fitting gaps 5

Special fitting types 6

- Trapezoidal groove fitting
- Triangular groove fitting
- Floating groove
- Cylinder base sealing

Construction 7 - 8

- Surface condition 7
- Fitting chamfers 7
- Admissible construction gaps 8

Choice of material 9

- Compression set
- Elastomer hardness
- Influence of temperature
- Influence of fluid in contact

Fitting 9

- Fitting instructions

General characteristics of elastomer 10-11

NBR - FKM - HNBR - AU/EU 10

EPDM - FVMQ - VMQ - FFKM 11

List of combinations User's guide 12 - 13 - 14

NBR - FKM - HNBR - AU/EU 12

EPDM - FVMQ - VMQ - FFKM 13

IIR - CR - ACM - CSM - NR - TFE/P - TPT 14

Other materials used in the manufacture of O-rings 15

PTFE - FEP - PFA

Product quality 16

Dimension controls on Tecring® seals 16

Control of Tecring® seal appearance 17

Preferred standard dimensions 18 - 19

Causes of seal destruction 20

Storage 20

Description

O-rings - circular rings with a round cross-section - are often the simplest and most cost-effective sealing system for static applications.

Under certain conditions, they can also be used for dynamic applications.

O-rings are defined by internal diameter (dI) and cross section (d2) (cf: figure 1).

EVCO's O-ring range is sold under the trademark TECRING®.

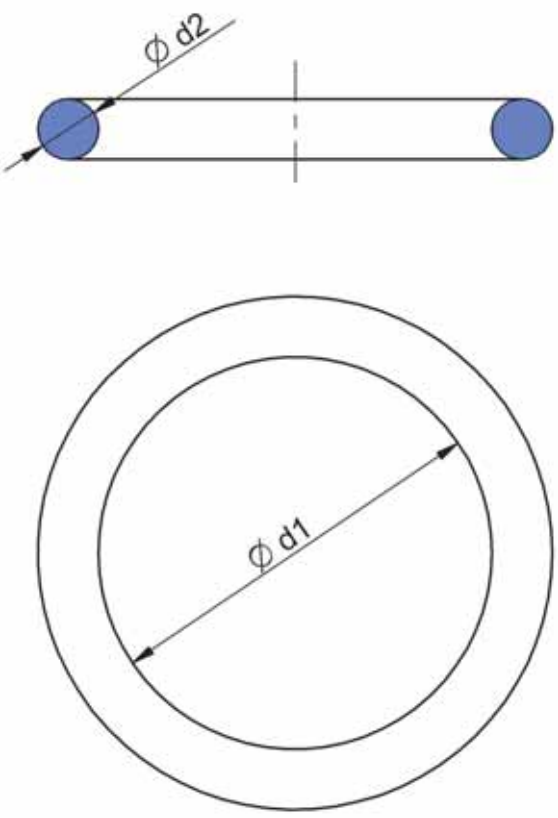


Figure 1

Advantages

- Cost-effective sealing solution,
- Small, simple grooves,
- Easy fitting,
- Wide range of applications (static, dynamic, single and double acting),
- Very wide selection of materials,
- Dimensions compliant with international standards,
- Effective thanks to even distribution of load when pressure is applied.

Operating conditions

Pressure (MPa)	Vacuum > 200
Temperature (°C)	-200 > +320
Speed (m/s)	Static (except specific cases)
Fluids	All
The above operating conditions are considered maximum values, and will vary depending upon material and type of fitting.	

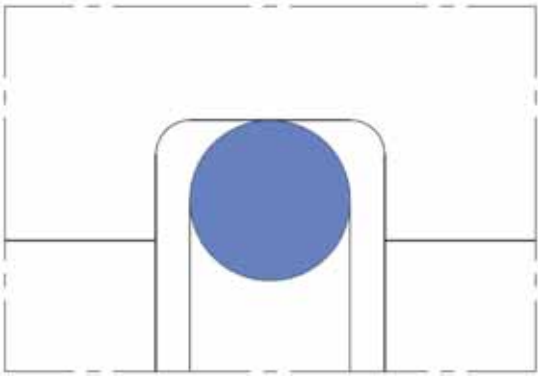
Sealing principle

Sealing is obtained by the initial interference caused by axial or radial deformation of the O-ring. This increases as pressure is applied.

Figures 3-1 / 3-2 / 3-3: O-ring sealing principle.

ic = initial compression strength
P = fluid pressure
tc = total sealing forces

Figure 3-1: Seal in free state



Depending on the application, initial compression of the seal can be between 5 and 25%.

The resulting stresses will vary according to compression percentage, cross section diameter and elastomer used.

Figure 3-2: Compressed seal

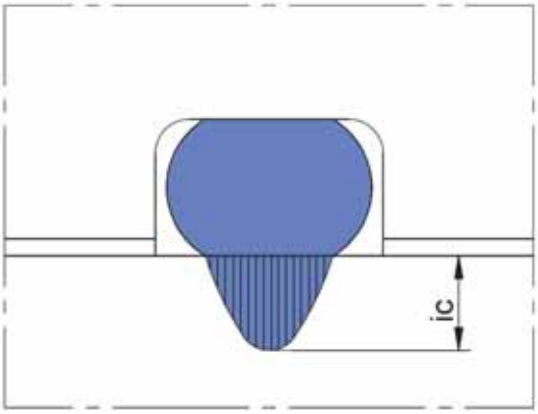
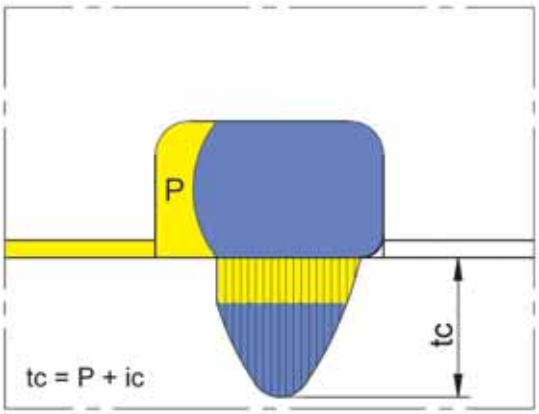
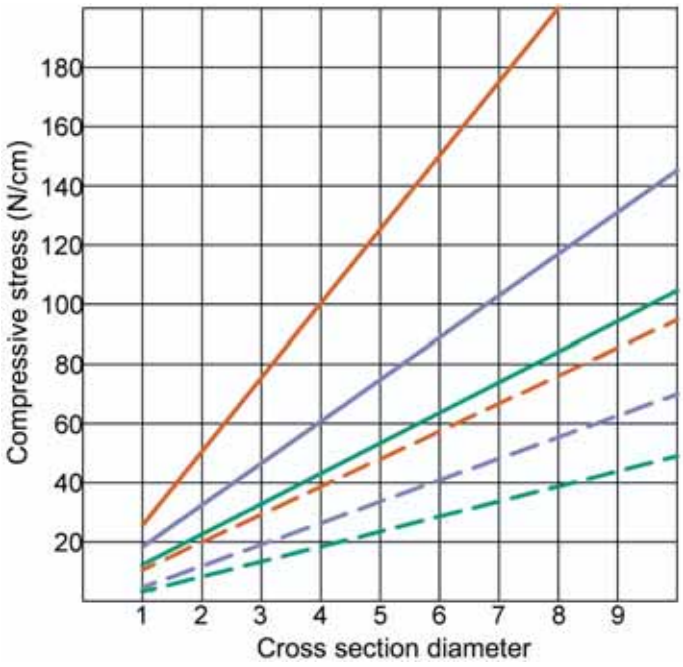


Figure 3-3: Seal subject to pressure





Choosing the right dimension

Cross Section	Japanese standard JIS 2401	French standard SF	British standard BS 1806	American standard AS 568 A	Swedish standard SMS 1586	International standard ISO 3601/1	German standard DIN 3771/1	Preferred metric dimensions
1								•
1,5								•
1,6					•			
1,78			•	•				
1,8						•	•	
1,9	•	•						
2								•
2,4	•				•			
2,5								•
2,62			•	•				
2,65						•	•	
2,7		•						
3					•			•
3,1	•							
3,5	•							•
3,53			•	•				
3,55						•	•	
3,6		•						
4								•
4,5								•
5								•
5,3						•	•	
5,34		•	•	•				
5,5								•
5,7	•				•			
6								•
6,99		•	•	•				
7						•	•	•
8								•
8,4	•				•			
10								•
12								•
14								•
16								•
18								•
20								•

Correct O-ring size is crucial to optimal performance. Using an O-ring with a small internal diameter and a large cross-section, or vice-versa, is to be avoided (cf: Figure 4).

Depending on the application, the O-ring has to be stretched or compressed to a given extent in its groove. Nominal values are given on page 6.

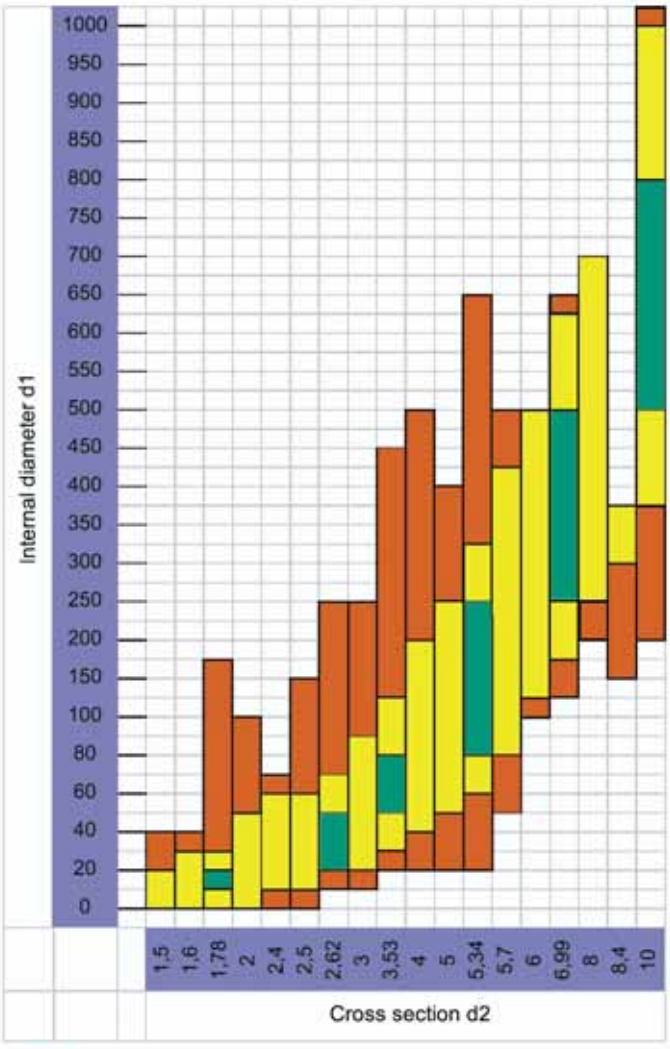


Figure 4

Recommended dimensions

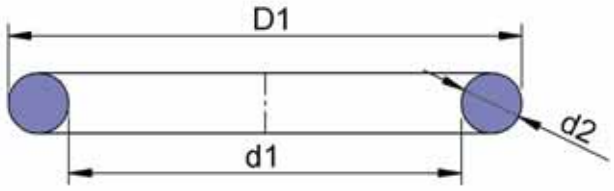
Possible dimensions

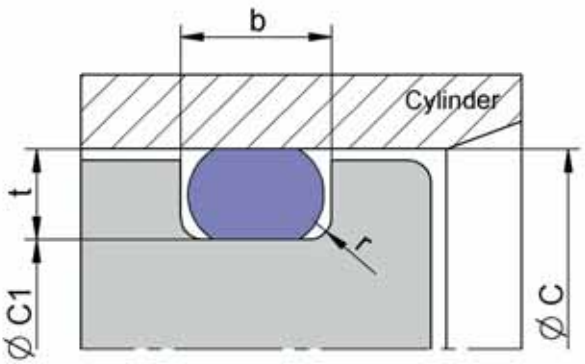
Existing, though seldom used, dimensions

Figure 3 (left): cross section standards

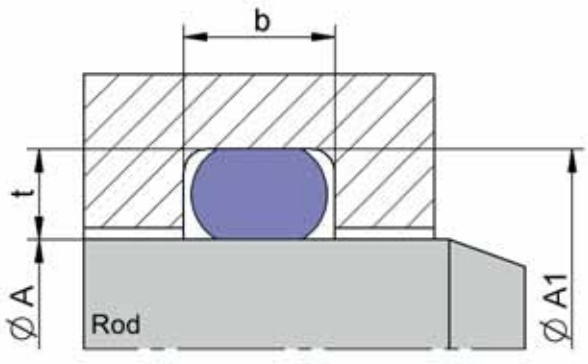
Types of fitting

Different types of fitting are possible. The most frequently used appear on this page. Some special fitting types are outlined on page 6.

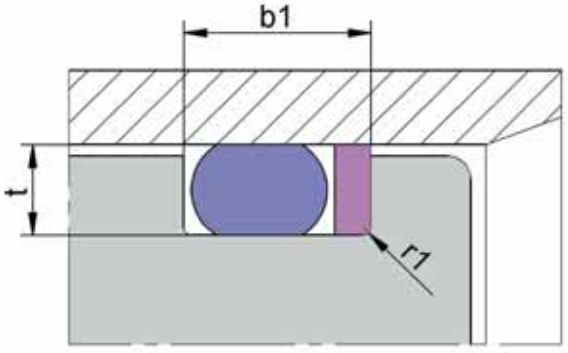




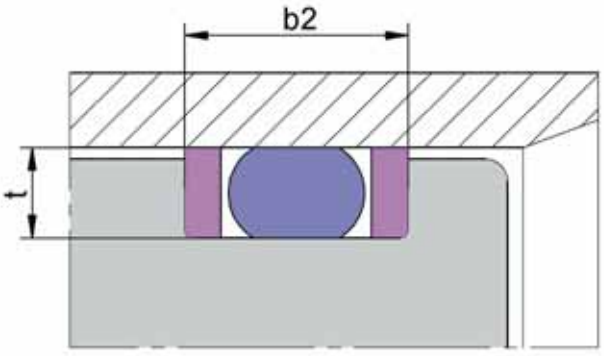
Radial fitting for external seal (cylinder type)
Min dI = 0,95.CI Max dI = 0,99.CI



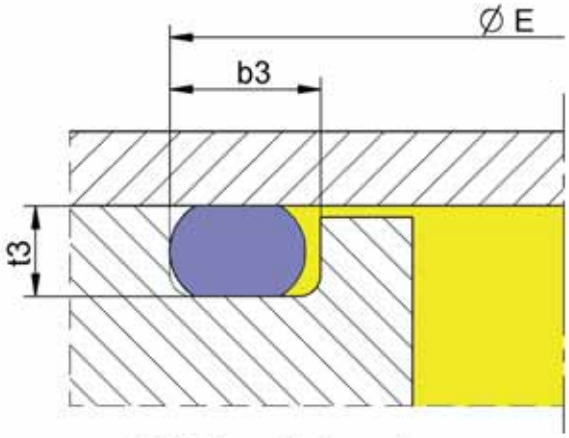
Radial fitting for internal seal (rod type)
Min DI = 1,01.AI Max DI = 1,03.AI



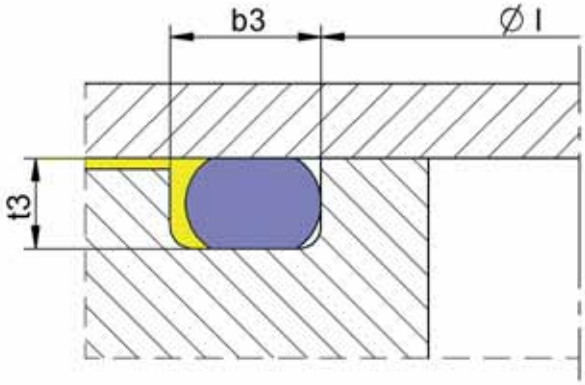
Radial fitting with 1 anti-extrusion ring



Radial fitting with 2 anti-extrusion rings



Axial fitting under internal pressure
Min DI = E Max DI = 1,03.E



Axial fitting under external pressure
min dI = 0,97.I max dI = I

Fitting gaps

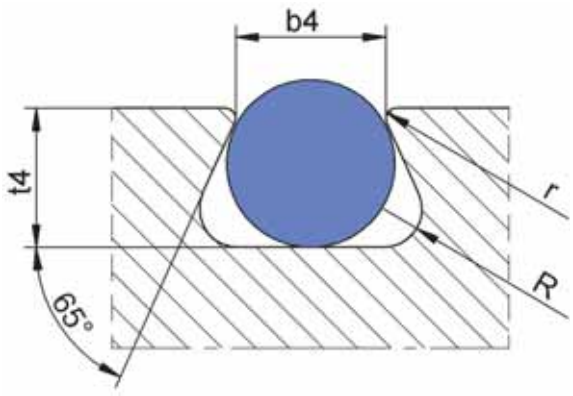
Recommended dimensions

Cross section	Radial fitting						Axial fitting		Groove radius	
	Groove height			Groove thickness			Groove height	Groove thickness		
	Static	Dynamic								
		Hydraulic	Pneumatic	W'out anti-extrusion rings	With 1 anti-extrusion ring	With 2 anti-extrusion rings			W'out anti-extrusion rings	With anti-extrusion rings
d2	**t (+0,05)**	**t (+0,05)**	**t (+0,05)**	**b (+0,2)**	**b1 (+0,2)**	**b2 (+0,2)**	**t3 (+0,05)**	**b3 (+0,2)**	**r**	**r1**
1	0,8			1,3			0,8	1,4	0,2	
1,5	1,2			1,9			1,1	2,0	0,3	
1,6	1,3			2,1			1,2	2,2	0,3	
1,78/1,8	1,4	1,5	1,5	2,3	3,7	5,1	1,3	2,4	0,4	0,2
1,9	1,5	1,6	1,6	2,5	3,9	5,3	1,4	2,6	0,4	0,2
2	1,6	1,8	1,8	2,6	4,0	5,4	1,5	2,8	0,4	0,2
2,4	1,9	2,1	2,2	3,1	4,5	5,9	1,8	3,3	0,5	0,2
2,5	2,0	2,2	2,3	3,3	4,7	6,1	1,9	3,5	0,5	0,3
2,62/2,65	2,1	2,3	2,4	3,4	4,8	6,2	2,0	3,7	0,5	0,3
2,7	2,2	2,4	2,5	3,6	5,0	6,4	2,0	3,8	0,5	0,3
3	2,4	2,6	2,8	4,0	5,4	6,8	2,3	4,2	0,6	0,3
3,1	2,5	2,7	2,9	4,1	5,5	6,9	2,4	4,4	0,6	0,3
3,5	2,8	3,1	3,2	4,6	6,0	7,4	2,7	4,9	0,7	0,4
3,53/3,55	2,9	3,1	3,3	4,7	6,1	7,5	2,7	5,0	0,7	0,4
3,6	2,9	3,2	3,3	4,8	6,2	7,6	2,7	5,1	0,7	0,4
4	3,3	3,5	3,7	5,3	7,0	8,7	3,1	5,7	0,8	0,4
4,5	3,7	4,0	4,2	6,0	7,7	9,4	3,5	6,3	0,9	0,5
5	4,1	4,4	4,7	6,7	8,4	10,1	3,9	7,0	1,0	0,5
5,3/5,34	4,4	4,7	5,0	7,1	8,8	10,5	4,2	7,5	1,1	0,5
5,5	4,5	4,9	5,1	7,4	9,1	10,8	4,3	7,8	1,1	0,6
5,7	4,7	5,0	5,3	7,6	9,3	11,0	4,5	8,1	1,1	0,6
6	5,0	5,3	5,6	8,0	9,7	11,4	4,7	8,5	1,2	0,6
6,99/7	5,8	6,2	6,6	9,4	11,9	14,4	5,5	9,9	1,4	0,7
8	6,7	7,1	7,6	10,8	13,3	15,8	6,4	11,3	1,6	0,8
8,4	7,1	7,5	7,9	11,3	13,8	16,3	6,7	11,8	1,7	0,8
10	8,5	8,9	9,5	13,5	16,0	18,5	8,2	14,0	2,0	1,0
12	10,3	10,7	11,4	16,1	18,6	21,1	10,0	16,6	2,4	1,2
14	12,2			18,7			11,9	19,1	2,8	
16	14,1			21,3			13,9	21,6	3,2	
18	16,0			23,7			15,9	23,9	3,6	
20	18,0			26,2			18,0	26,2	4,0	

The values indicated are calculated on the basis of medium hardness 70 Sh A (+/-10) O-rings used in fluid and temperature conditions that limit volume increase (<15% for static applications and <10% for dynamic applications).

Special fitting types

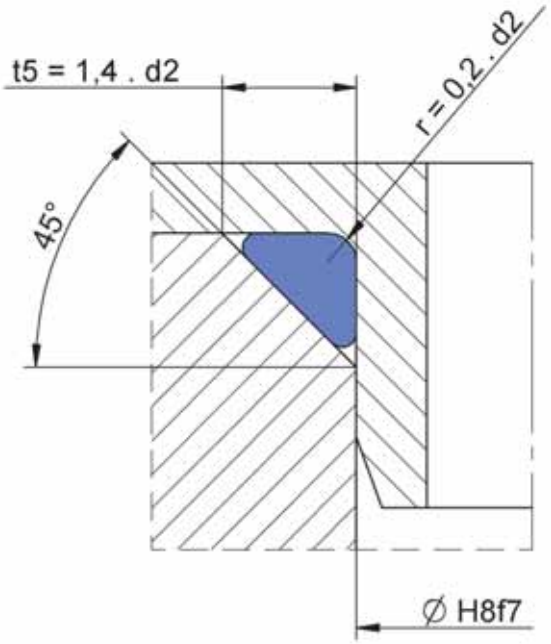
Figure 6: Trapezoidal groove fitting



d2	b4 (+/-0,05)	t4 (-0,05)	R	r max.
3,53/3,55	3,2	2,8	0,7	0,4
5,3/5,34	4,95	4,4	1,1	0,5
6,99/7	6,55	5,95	1,4	0,7
8,4	7,9	7,25	1,7	0,8

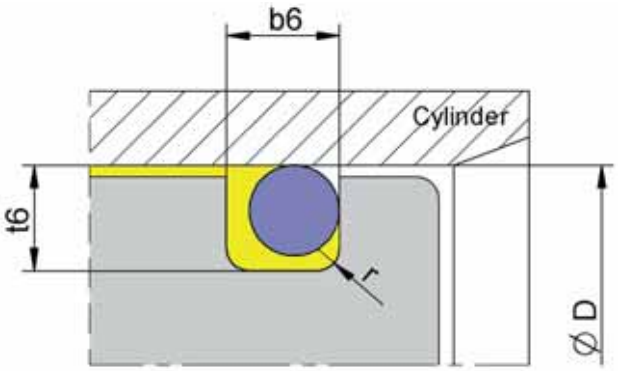
This type of groove keeps the O-ring in place whilst the component in which it is fitted is in motion or being used.

Figure 7 : Triangular groove fitting



This type of groove is often used for lid sealing. The temperature and / or fluid in contact must not cause a volume increase of >10%.

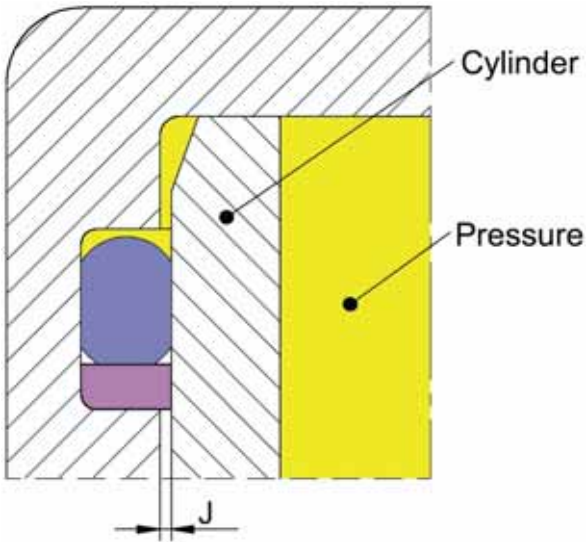
Figure 8 : Floating groove



d2	b6 (+/-0,05)	t6 (-0,05)	R	r max.
2,62/2,65	3	2,75	0,5	0,3
3,53/3,55	4	3,7	0,7	0,4
5,3/5,34	6	5,5	1,1	0,5
6,99/7	7,9	7,2	1,4	0,7

This type of groove is often used for piston sealing (horizontal movement). Friction generated is very limited, but it must allow a small amount of air to be freed under pressure (seal placement). The O-ring's external diameter must be between 2 and 5% greater than that of the cylinder (D).

Figure 9 : Cylinder base sealing



This type of groove is recommended for cylinder base sealing, as potential cylinder expansion will reduce the gap (J).

Construction

Surface finish (cf: table below)

The high elasticity of Tecring® seals compensates for minor geometric defects in metal elements, and yet they are sensitive to rough surfaces too. Minimal roughness values are listed in the table below.

Application		Contact surface		Groove surfaces	
Sealing	Fluid	Ra	Rmax	Ra	Rmax
Static	Water, oil	1,6	10	1,6	10
Static	Water, oil (pulsed pressure)	0,8	6,3	0,8	6,3
Static	Air, neutral gases, natural gas, fuels	0,8	6,3	0,8	6,3
Static	Dangerous rare gases, chlorofluorocarbons	0,3	2	0,3	2
Static	Cryogenic vacuum	0,2	1	0,2	1
Dynamic	Water, oil	0,4	3	1,6	10
Dynamic	Air, neutral gases, natural gas, oil	0,3	2	0,8	6,3
Dynamic	Dangerous rare gases, Chlorofluorocarbons	0,2	1	0,3	2
Dynamic	Cryogenics	0,1	0,83	0,2	1

Fitting chamfers

So as to avoid damaging the seals during assembly, polished-angle bevel leads must be included (cf: Figure 10).

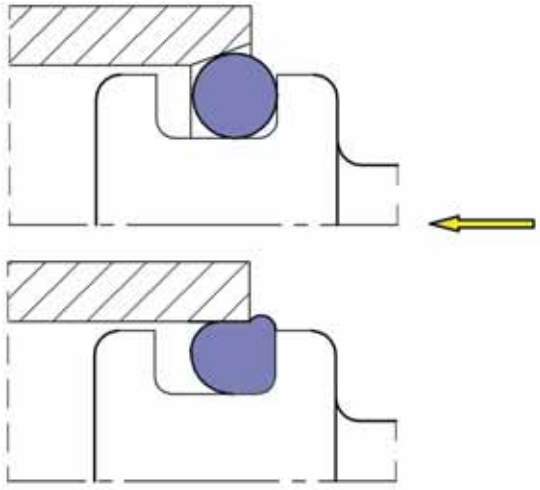
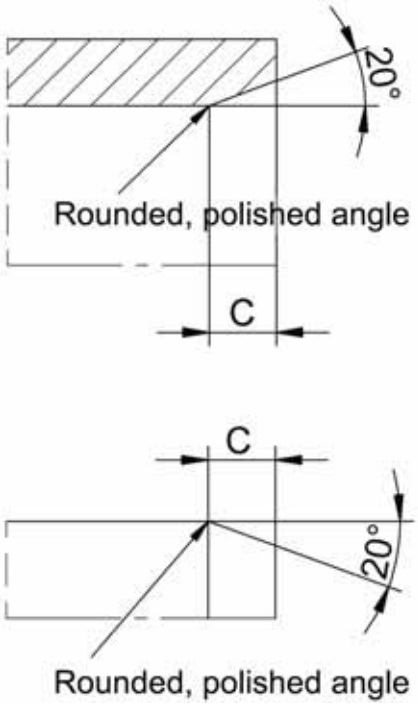


Figure 10



Chamfer dimensions

d2	C	d2	C
<2	2	<6	4
<3	2,5	<7	4,5
<4	3	<10	5
<5	3,5	Au dela	0,5 - d2

d2 = Tecring® seal section d2

Construction (cont.)

Admissible construction gaps

When construction gaps are too great, the seal is damaged by extrusion (cf: Figure 11). Admissible gaps will depend on the d2 cross-section diameter, pressure, material hardness and temperature.

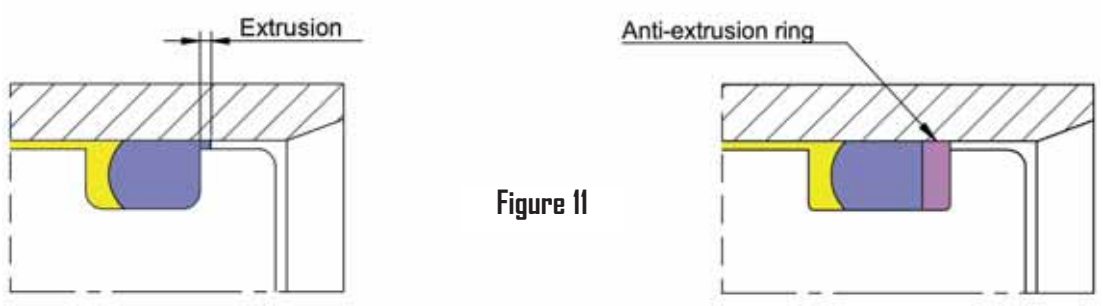


Figure 11

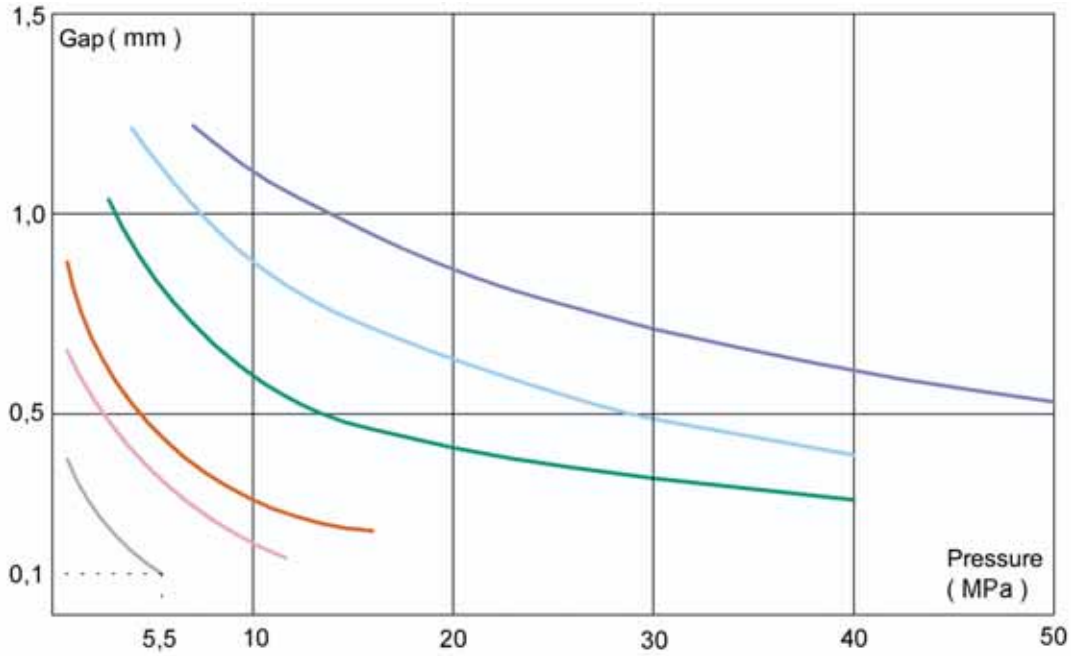


Figure 12: Extrusion comparison between different solutions

Test conditions:
Cross-section diameter: 7mm
Temperature: 23°C
Hydraulic oil HLP 46

Example: A 7mm section NBR 6906 O-ring used at 5.5 MPa, max admissible gap: 0.1 mm.
NB: The maximum admissible gap is reduced proportionate to the cross section (cross section of 7 mm / gap 0.1 mm, cross section 3.5 mm / gap 0.05 mm)

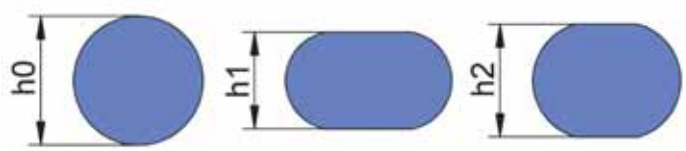
- NBR 6906 (70 Sh.A) O-ring
- NBR 6928 (80 Sh.A) O-ring
- NBR 6910 (90 Sh.A) O-ring
- NBR 6906 (70 Sh.A) O-ring with PTFE 10507 anti-extrusion ring
- Dynathan® 8318 O-ring or NBR 6906 (70 Sh.A) O-ring with Dynathan® 8318 anti-extrusion ring
- NBR 6906 (70 Sh.A) O-ring with POM 15201 anti-extrusion ring

Choice of material

Compression set (DRC)

In order to perform properly, the O-ring must maintain its elasticity as long as possible regardless of extreme and changing conditions of use. Compression set measurement allows this elasticity to be characterised. The compression set reading must be as low as possible (Figure 13).

h0 = cross-section diameter
h1 = compressed section height (25%)
h2 = height 30 mins after load removed.



$$DRC\ (\%) = 100 \cdot \frac{h0 - h2}{h0 - h1}$$

Figure 13

Elastomer hardness

Extrusion is one of the main causes of O-ring destruction (cf: page 8). The harder the elastomer, the greater the O-ring's resistance to extrusion.
However, choosing a harder ring is not always the best solution (higher compression set and compression stresses, cf: page 4).
It is better to choose a medium hardness ring and add an anti-extrusion ring.

Influence of high temperatures

- Increase in volume by dilation, grooves generally designed for high temperatures, but beware of temperatures in excess of 200°C.
- Decrease in hardness, ie: extrusion resistance.
- Increase in compression set.
- Changes in properties linked to high temperatures can sometimes be irreversible.

Influence of low temperatures

- Removal of the material, which may cause a leak in the event of insufficient initial tightening.
- Increase in hardness, which can pose problems for gas or high-fluidity liquid seals.
- Changes in properties linked to high temperatures are reversible.

Influence of fluid in contact

The fluid in contact can cause volume increase or detachment of material. This brings with it similar risks to those associated with temperature (reduction in hardness, increase in compression set, etc...).

A 20 to 25% increase in volume can be tolerated for static applications. For dynamic applications, any volume increase above 10% must be avoided.
Apart from volume increase and material detachment, the fluids in contact can cause the material to deteriorate (crazing, dissolution, disintegration).

Fitting

Fitting instructions

Careless assembly will compromise the functioning and / or service life of the O-ring. Attention should be paid to the following:

- Is the assembly site clean?
- Have the metal parts been deburred and cleaned of chips and other impurities?
- Are all recommended bevel leads and round-offs respected?
- If assembly tools are used, are they clean and deburred?
- If the seal passes a screw thread during fitting, is it covered?
- Are the parts lubricated with an oil or grease that is compatible with the seal material?

General characteristics of elastomer

NBR (nitrile rubber)

NBR combinations are the mist widely used in the seal business, thanks to their good mechanical characteristics and their resistance to petroleum products.

Resistant to :
Mineral, vegetable and animal oils and greases, HFA, HFC and HFC fluids, fuel oil n° 4, aliphatic hydrocarbons and diesel.

Not resistant to :
Aromatic and chlorinated hydrocarbons, HFD fluids, polar solvents, glycol-based brake fluids, ozone and ultra-violet.

Applications :
Hydraulics and pneumatics, mineral water and gas valve fittings, fuel circuits.

Continuous temperatures in dry air	-30 à +100°C
Possible hardness ranges	40 à 90 Sh.A
Average tensile strength	12,5 MPa
Average stretch at break	300%
Compression set estimate	Good

HNBR (hydrogenated nitrile rubber)

The mechanical characteristics and heat resistance of these combinations are higher than those of NBR.

Resistant to :
Mineral, vegetable and animal oils and greases, HFA, HFC and HFC fluids, fuel oil n° 4, aliphatic hydrocarbons and diesel.

Not resistant to :
Aromatic and chlorinated hydrocarbons, HFD fluids, polar solvents, glycol-based brake fluids, ozone and ultra-violet.

Applications :
Hydraulics, air conditioning, power steering systems.

Continuous temperatures in dry air	-30 à +150°C
Possible hardness ranges	50 à 95 Sh.A
Average tensile strength	15 MPa
Average stretch at break	300%
Compression set estimate	Excellent

FPM (fluorocarbon elastomers)

These combinations offer good resistance to corrosive products and to high temperatures. Their permeability qualities are good, but have limited resistance to cold.

Resistant to :
Mineral and vegetable oils and greases and certain HFD fluids.

Not resistant to :
Polar solvents, Skydrol® type fluids, glycol-based brake fluids and water above 80°C.

Applications :
High temperature hydraulics and pneumatics, car engines, carburetion, industrial valves and fittings, high-vacuum seals, etc...

Continuous temperatures in dry air	-20 à +200°C
Possible hardness ranges	50 à 95 Sh.A
Average tensile strength	10 MPa
Average stretch at break	150%
Compression set estimate	Good

AU/EU (Polyurethane)

Exceptional mechanical characteristics. Their resistance to oils and wear make them a number one choice in hydraulics.

Resistant to :
Huiles et graisses minérales, hydrocarbures aliphatiques, eau (base polyéthers).

Not resistant to :
Aromatic and chlorinated hydrocarbons, acids, bases, solvents, brake fluids.

Applications :
Hydraulics and anti-abrasion.

Continuous temperatures in dry air	-30 à +100°C
Possible hardness ranges	40 à 90 Sh.A
Average tensile strength	20 MPa
Average stretch at break	300%
Compression set estimate	Good

EPDM (polypropylene ethylene)

These combinations are widely used for applications in contact with water, and offer excellent resistance to atmospheric conditions and ageing.

Resistant to :

Hot water, steam, lye, HFC and some Skydrol HFD fluids, glycol-based brake fluids and polar solvents.

No resistant to :

Mineral grease and oils and aliphatic, aromatic and chlorinated hydrocarbons.

Applications :

Cooling and breaking circuits, hot water and steam valves and fittings, electrical devices, etc...

Continuous temperatures in dry air	-50 à +150°C
Possible hardness ranges	30 à 85 Sh.A
Average tensile strength	10 MPa
Average stretch at break	300%
Compression set estimate	Medium

VMQ (Silicon)

These polymers are primarily distinguished by their high resistance to temperature, dielectric properties and non-toxicity (general case).

Resistant to :

Atmospheric agents, water to 80°C, alcohols, mineral oils (medium resistance).

Not resistant to :

Fuels and chemical products in general.

Applications :

Electrical and electrical household appliances, agro-foods industry, compressors, etc...

Continuous temperatures in dry air	-60 à +200°C
Possible hardness ranges	40 à 80 Sh.A
Average tensile strength	7,5 MPa
Average stretch at break	350%
Compression set estimate	Good

FMVQ (Fluorosilicone)

Fluorosilicones are much more resistant to volume increase in mineral and synthetic oils than silicones are, and can be used over a wide range of temperatures. Their mechanical behaviour is poor.

Resistant to :

Mineral oils and hydrocarbons, atmospheric agents.

Applications :

Aeronautic industry, carburetion, etc...

Continuous temperatures in dry air	-80 à +175°C
Possible hardness ranges	40 à 80 Sh.A
Average tensile strength	5 MPa
Average stretch at break	250%
Compression set estimate	Good

FFKM (Dynalast®)

These elastomers possess unparalleled properties:

- Almost universal chemical resistance,
- Resistance to very high temperatures,
- Resistance to atmospheric agents,
- Good impermeability, even at high temperatures.

Applications :

Given their high price, Dynalasts are used in extreme application conditions, when no other elastomer is suitable.

Continuous temperatures in dry air	-10 à +300°C
Possible hardness ranges	60 à 90 Sh.A
Average tensile strength	15 MPa
Average stretch at break	150%
Compression set estimate	Good

Other families of elastomers:

- CR (polypropylene)
- IIR (butyl)
- ACM (polyacrylate)
- SBR (styrene-butadiene)
- NR (natural rubber)

List of combinations - User's guide

Quality	Temperatures		Hardness						
NBR (N)	°C		50-A	60-A	70-A	75-A	80-A	85-A	90-A
Standard	-30	+110	6902	6949	6906	6907	6928	6909	6910
DVGW (natural gas / DE)	-30	+110		C904	C942	C923	C937		
KTW (drinking water / DE)	-30	+110			E946				
ACS (drinking water / F)	-30	+110			6960		6908		
FDA (contact with food / US)	-30	+110			6956		6965		
WRC (drinking water / GB)	-30	+110			C936				
For low temperatures	-50	+110			6912				
Improved resistance to fuels	-30	+110			6911				
Contains a lubricant	-30	+110					6944		

FKM (V)	°C		60-A	70-A	75-A	80-A	85-A	90-A	95-A
Standard	-20	+200		7705	7707	7709		7711	
Standard with distinctive colour	-20	+200		7706		7710		7712	
DVGW (natural gas / DE)	-20	+200	7758	7723	7746				
BAM (oxygen / DE)	-20	+200				7747			
FDA (contact with food / US)	-20	+200		7741					
Extreme chemical resistance - Extrachim	-20	+200			7743				
Low compression set	-20	+200			7763				
Resistant to explosive decompression	-20	+200					7762		7752
For low temperatures	-40	+200			7744				
Chemical resistance and low temperatures	-40	+200			7728				
Resistance to steam	-20	+200		7721					
Contains a lubricant	-20	+200			7727				

HNBR (H)	°C		70-A	80-A	90-A	95-A			
Standard	-20	+150	7104	7106	7107				
Standard with distinctive colour	-20	+150	7108						
DVGW (natural gas / DE)	-20	+150	7109						
FDA (contact with food / US)	-20	+150	7110						
Resistant to explosive decompression	-20	+150				7111			

PU (U)	°C		92-A						
CPU	-35	+100	8318						
TPU	-30	+110	8315						

Certain combinations have more than one national certifications (eg: DVGW + KTW + FDA + ACS)
Please contact us for more details.

Standard materials
Approved materials
Special materials

List of combinations - User's guide

Quality	Temperature		Hardness						
EPDM (E)	°C		60-A	70-A	80-A	90-A			
Standard	-40	+120	6802	6803	6805	6830			
KTW (drinking water / DE)	-40	+120	6829	6823	6813				
ACS (drinking water / F)	-40	+120		6824	6831				
FDA (contact with food / US)	-40	+120	6826	6825	6827				
WRC (drinking water / GB)	-40	+120		6828					
Resistance to steam	-60	+150		6806	6807				
Highly resistant to steam - Ultrasteam	-50	+200			6832				

FMVQ (SF)	°C		60-A	70-A	80-A				
Standard with distinctive colour	-60	+180	8201	8203	8206				
Contains a lubricant	-60	+180			8209				

VMQ (S)	°C		50-A	60-A	70-A	80-A			
Standard with distinctive colour	-60	+200	8002	8003	8004	8005			
DVGW (natural gas / DE)	-60	+200		8012	8036				
KTW (drinking water / DE)	-60	+200		8011	8032				
FDA (contact with food / US)	-60	+200	8038	8037	8020				
WRC (drinking water / GB)	-60	+200		8039					
For very low temperatures	-100	+180		8041					
For very high temperatures	-50	+280			8030				

FFKM Dynalast (D)	°C		70-A	80-A	90-A				
Standard	-20	+270	8905	8904					
Standard with distinctive colour	-20	+270	8906						
FDA (contact with food / US)	-15	+260		8914					
Enhanced chemical resistance	-15	+250		8907					
Resistance to steam	-15	+260		8908					
Paints industry	-15	+260		8909					
Resistance to very high temperatures	-15	+320		8910					
Resistance to explosive decompression	-15	+260			8912				
Contains a lubricant	-20	+270		8915					
Semi-conductor industry	-15	+310	8916						

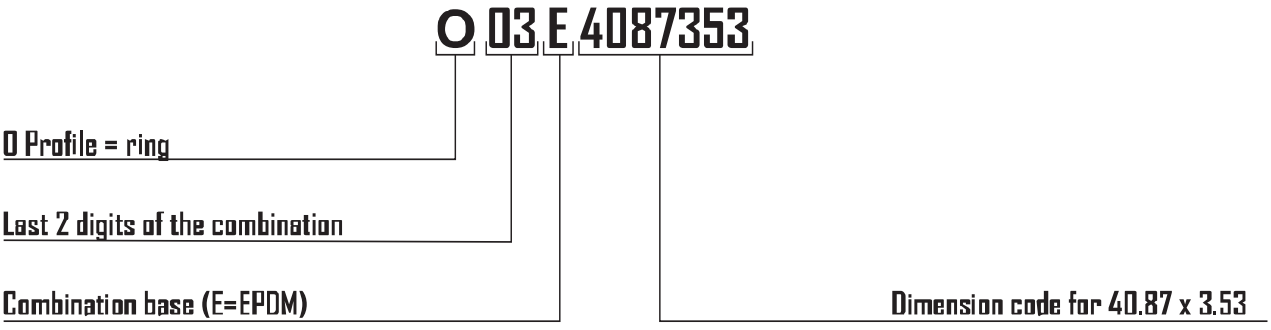
Certain combinations have more than one national certifications (eg: DVGW + KTW + FDA + ACS)
Please contact us for more details.

Standard materials
Approved materials
Special materials

List of combinations - User's guide

Quality	Temperature		Hardness						
IIR (B)	°C		70-A	80-A					
Standard	-30	+110	6402	6401					
FDA (contact with food / US)	-30	+110	6403						
CR (CR)	°C		70-A	80-A					
Standard	-40	+110	7205	7209					
Enhanced resistance to chlorofluorocarbons (CFC 12)	-40	+110	7212						
NR (CN)	°C		45-A	65-A	80-A				
Standard	-20	+80	6003	6011	6012				
TFE/P (A)	°C		60-A	70-A	80-A	90-A	95-A		
Standard Aflas	0	+200	9007	9001	9004	9003			
Enhanced Aflas temperatures FA-100H	-10	+250		9005	9002		9006		
TPT (TP)	°C		70-A	80-A	90-A				
Fluorel II	-5	+220	9101	8102	9103				

Sample description: O-ring 40.87 x 3.53, material: EPDM, standard, 70 Sh (6803 combination)



Certain combinations have more than one national certifications (eg: DVGW + KTW + FDA + ACS)
Please contact us for more details.

Standard materials
Approved materials
Special materials

Other materials used in the manufacture of O-rings

Quality	Temperature		Hardness						
PFTE (T)	°C		55-D	60-D	65-D				
No-load - solid	-200	+260	10102						
Carbon load	-200	+280			10301				
Ekonol load	-200	+300		10602					
FEP (DF...)(1)	°C		70-A*	75-A*	58-D**				
No-load - solid	-100	+205			11204				
Silicon core, FEP coated	-60	+200	11201			* Dureté de l'âme			
Viton core, FEP coated	-20	+180		11202		** Dureté de l'enveloppe			
PFA (DPF...)(1)	°C		70-A*	75-A*	60-D**				
No-load - solid	-200	+280			11101				
Silicon core, PFA coated	-60	+260	11102			* Dureté de l'âme			
Viton core, PFA coated	-20	+220		11103		** Dureté de l'enveloppe			
Stainless steel rolled strip, PFA coated	-200	+260			11105				

(1) **For descriptions of these material types, please contact us**

Certain combinations have more than one national certifications (eg: DVGW + KTW + FDA + ACS)
Please contact us for more details.

Registered trademarks:
Extrachim®, Ultrasteam®, Dynalast®, Tecaring® (FVQM).
Viton® (DUPONT), Aflas® (ASAHI Glass), Fluorel® (DYNEON), Ekonol® (SOHIO).

Standard materials
Approved materials
Special materials

Product quality

Tecring® seals are subject to various controls during the production process to ensure only high-quality parts go into stock.

- Raw materials selected in collaboration with leading manufacturers.
- Respect of formulations developed specifically for the Tecring® range.
- Control over manufacture of mould tooling.
- Control over mould, finishing and post-baking processes.
- Respect for control procedures.
- Particular attention paid to packaging.

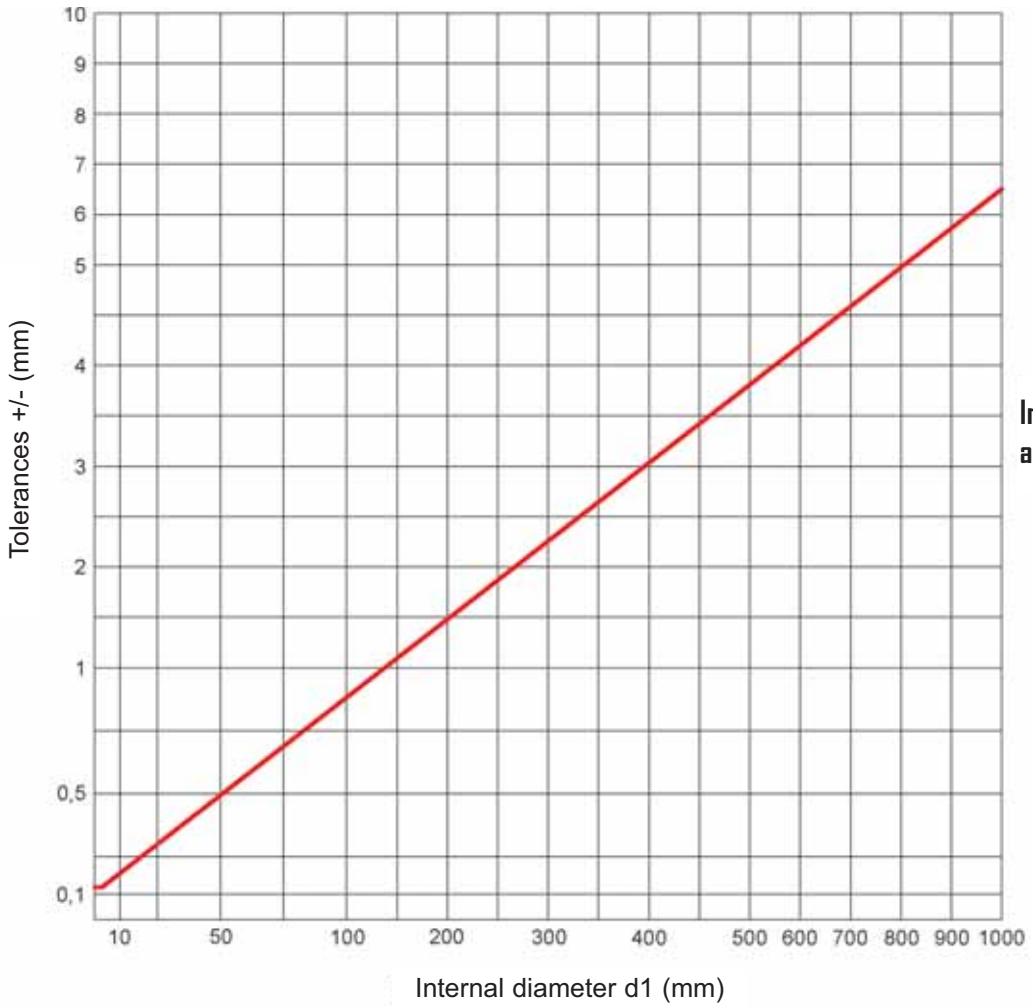
The purpose of all of this is to reduce risks as much as possible and guarantee compliance with customer requirements of Tecring seals long-term.

Dimension controls on Tecring® seals

Our Tecring® seals must meet material, dimensional tolerance and appearance standards. These characteristics are assessed according to prevailing international standards.

From (mm)	To (mm)	Tol. +/- (mm)
-	2,62	0,08
2,63	3,00	0,09
3,01	4,50	0,10
4,51	5,50	0,13
5,51	7,50	0,15
7,51	8,50	0,18
8,51	10,00	0,20

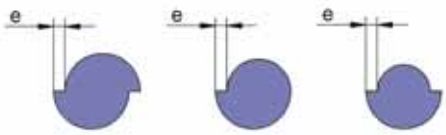
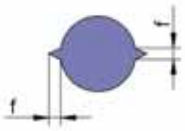
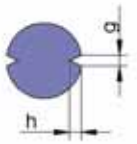
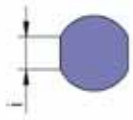
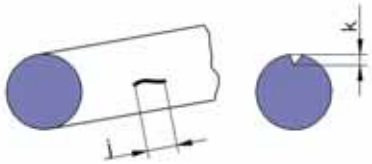
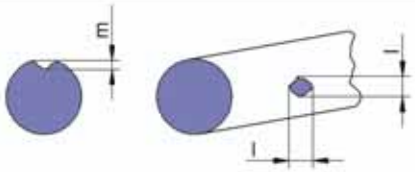
Cross-section diameter (d2) tolerances according to DIN 3771/1



Internal diameter tolerances according to DIN 3771/1

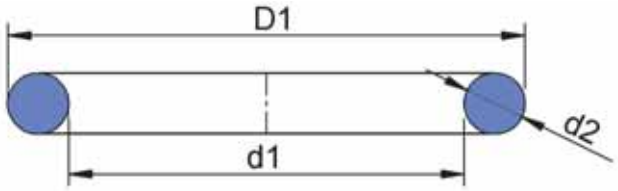
Control of Tecring® seal appearance

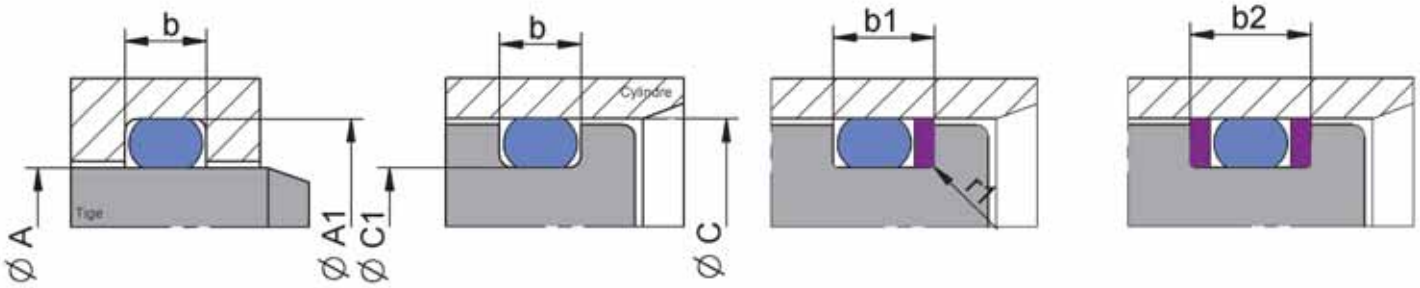
The table below indicates maximum acceptable defect values for appearance tests. These values correspond to grade N of the DIN 3771/1 standard and are compatible with standard industrial applications. We can also quote for more demanding environments (Grade S).

Defect category	Illustration of defects	Symbol	Maximum acceptable limits Grade N (general use) Cross section diameter (d2)				
			0 2,25	2,25 3,15	3,15 4,50	4,50 6,30	6,30 8,00
1 - Misalignment (unevenness)		e	0,08	0,10	0,13	0,15	0,15
2 - Flash (or combination of flash, misalignment or bead)		f	0,10	0,12	0,14	0,16	0,18
3 - Croquage		g	0,18	0,27	0,36	0,53	0,70
		h	0,08	0,08	0,10	0,10	0,13
4 - Flat deburring (or circularity defect)		i	Circularity defect due to deburring may be permitted if it progressively connects with the rest of the surface. The cross section (d2) must be within these tolerances.				
5 - Twist (radial twist not permitted)		j	(0,05 * dl) if greater than :				
			1,50	1,50	6,50	6,50	6,50
		k	0,08	0,08	0,08	0,08	0,08
6 - Absence of material (including on sealing surface)		l	0,60	0,80	1,00	1,30	1,70
		m	0,08	0,08	0,10	0,10	0,13
7 - Foreign bodies	•	•	Not permitted				

Preferred standard dimensions

Selection of Tecring® O-rings for rods and cylinders, radial fitting, static seals.





Fitting		Seal ref.	Seal Dimensions		AE ring ref	AE ring dimensions				Groove seat dimensions		Groove width			Radius
Rod A g6	Bore C H8	BS	d1	d2		d	S	T	t	A1	C1	b	b1	b2	r1
	6	006	2,9	1,78	EBA006	3,18	1,5	1,4	1,4		3,2	2,3	3,7	5,1	0,2
4		007	3,69	1,78	EBA007	3,97	1,5	1,4	1,4	6,8		2,3	3,7	5,1	0,2
5	8	008	4,47	1,78	EBA008	4,75	1,5	1,4	1,4	7,8	5,2	2,3	3,7	5,1	0,2
6	10	010	6,07	1,78	EBA010	6,35	1,5	1,4	1,4	8,8	7,2	2,3	3,7	5,1	0,2
8		011	7,65	1,78	EBA011	7,93	1,5	1,4	1,4	10,8		2,3	3,7	5,1	0,2
	12	012	9,25	1,78	EBA012	9,53	1,5	1,4	1,4		9,2	2,3	3,7	5,1	0,2
10	14	013	10,82	1,78	EBA013	11,1	1,5	1,4	1,4	12,8	11,2	2,3	3,7	5,1	0,2
12	15	014	12,42	1,78	EBA014	12,7	1,5	1,4	1,4	14,8	12,2	2,3	3,7	5,1	0,2
14	16	015	14	1,78	EBA015	14,28	1,5	1,4	1,4	16,8	13,2	2,3	3,7	5,1	0,2
15	18	016	15,6	1,78	EBA016	15,88	1,5	1,4	1,4	17,8	15,2	2,3	3,7	5,1	0,2
16		016	15,6	1,78	EBA016	15,88	1,5	1,4	1,4	18,8		2,3	3,7	5,1	0,2
	20	017	17,17	1,78	EBA017	17,45	1,5	1,4	1,4		17,2	2,3	3,7	5,1	0,2
18	22	018	18,77	1,78	EBA018	19,05	1,5	1,4	1,4	20,8	19,2	2,3	3,7	5,1	0,2
	25	020	21,95	1,78	EBA020	22,23	1,5	1,4	1,4		22,2	2,3	3,7	5,1	0,2
20		117	20,29	2,62	EBA117	20,61	2,3	1,4	2,1	24,2		3,4	4,8	6,2	0,3
22		118	21,89	2,62	EBA118	22,21	2,3	1,4	2,1	26,2		3,4	4,8	6,2	0,3
	28	119	23,47	2,62	EBA119	23,79	2,3	1,4	2,1		23,8	3,4	4,8	6,2	0,3
25	30	120	25,07	2,62	EBA120	25,39	2,3	1,4	2,1	29,2	25,8	3,4	4,8	6,2	0,3
	32	121	26,64	2,62	EBA121	26,96	2,3	1,4	2,1		27,8	3,4	4,8	6,2	0,3
28		122	28,24	2,62	EBA122	28,56	2,3	1,4	2,1	32,2		3,4	4,8	6,2	0,3
30	35	123	29,82	2,62	EBA123	30,14	2,3	1,4	2,1	34,2	30,8	3,4	4,8	6,2	0,3
32		124	31,42	2,62	EBA124	31,74	2,3	1,4	2,1	36,2		3,4	4,8	6,2	0,3
35	40	126	34,59	2,62	EBA126	34,91	2,3	1,4	2,1	39,2	35,8	3,4	4,8	6,2	0,3
36	42	127	36,17	2,62	EBA127	36,49	2,3	1,4	2,1	40,2	37,8	3,4	4,8	6,2	0,3
	45	129	39,34	2,62	EBA129	39,66	2,3	1,4	2,1		40,8	3,4	4,8	6,2	0,3
40	48	223	40,87	3,53	EBA223	41,3	3,1	1,4	2,9	45,8	42,2	4,7	6,1	7,5	0,4
42		223	40,87	3,53	EBA223	41,3	3,1	1,4	2,9	47,8		4,7	6,1	7,5	0,4
45	50	224	44,04	3,53	EBA224	44,47	3,1	1,4	2,9	50,8	44,2	4,7	6,1	7,5	0,4
	52	224	44,04	3,53	EBA224	44,47	3,1	1,4	2,9		46,2	4,7	6,1	7,5	0,4
48	55	225	47,22	3,53	EBA225	47,65	3,1	1,4	2,9	53,8	49,2	4,7	6,1	7,5	0,4
50		226	50,39	3,53	EBA226	50,82	3,1	1,4	2,9	55,8		4,7	6,1	7,5	0,4
52		226	50,39	3,53	EBA226	50,82	3,1	1,4	2,9	57,8		4,7	6,1	7,5	0,4

Fitting		Seal ref.	Seal Dimensions		AE ring ref	AE ring dimensions				Groove seat dimensions		Groove width			Radius
Rod A g6	Bore C H8	BS	d1	d2		d	S	T	t	A1	C1	b	b1	b2	r1
55	60	227	53,57	3,53	EBA227	54	3,1	1,4	2,9	60,8	54,2	4,7	6,1	7,5	0,4
56	63	228	56,74	3,53	EBA228	57,17	3,1	1,4	2,9	61,8	57,2	4,7	6,1	7,5	0,4
	65	228	56,74	3,53	EBA228	57,17	3,1	1,4	2,9		59,2	4,7	6,1	7,5	0,4
60		229	59,92	3,53	EBA229	60,35	3,1	1,4	2,9	65,8		4,7	6,1	7,5	0,4
63	70	230	63,09	3,53	EBA230	63,52	3,1	1,4	2,9	68,8	64,2	4,7	6,1	7,5	0,4
65	75	231	66,27	3,53	EBA231	66,7	3,1	1,4	2,9	70,8	69,2	4,7	6,1	7,5	0,4
70		232	69,44	3,53	EBA232	69,87	3,1	1,4	2,9	75,8		4,7	6,1	7,5	0,4
	80	233	72,62	3,53	EBA233	73,05	3,1	1,4	2,9		74,2	4,7	6,1	7,5	0,4
75		234	75,79	3,53	EBA234	76,22	3,1	1,4	2,9	80,8		4,7	6,1	7,5	0,4
	85	235	78,97	3,53	EBA235	79,4	3,1	1,4	2,9		79,2	4,7	6,1	7,5	0,4
	90	338	78,74	5,34	EBA338	79,38	4,7	1,7	4,4		81,2	7,1	8,8	10,5	0,5
80		339	81,92	5,34	EBA339	82,56	4,7	1,7	4,4	88,8		7,1	8,8	10,5	0,5
85	95	340	85,09	5,34	EBA340	85,73	4,7	1,7	4,4	93,8	86,2	7,1	8,8	10,5	0,5
90	100	342	91,44	5,34	EBA342	92,08	4,7	1,7	4,4	98,8	91,2	7,1	8,8	10,5	0,5
95	105	343	94,62	5,34	EBA343	95,26	4,7	1,7	4,4	103,8	96,2	7,1	8,8	10,5	0,5
100	110	345	100,97	5,34	EBA345	101,61	4,7	1,7	4,4	108,8	101,2	7,1	8,8	10,5	0,5
105	115	346	104,14	5,34	EBA346	104,78	4,7	1,7	4,4	113,8	106,2	7,1	8,8	10,5	0,5
110	120	348	110,49	5,34	EBA348	111,13	4,7	1,7	4,4	118,8	111,2	7,1	8,8	10,5	0,5
115	125	349	113,67	5,34	EBA349	114,31	4,7	1,7	4,4	123,8	116,2	7,1	8,8	10,5	0,5
120	130	351	120,02	5,34	EBA351	120,66	4,7	1,7	4,4	128,8	121,2	7,1	8,8	10,5	0,5
125		353	126,37	5,34	EBA353	127,01	4,7	1,7	4,4	133,8		7,1	8,8	10,5	0,5
130		354	129,54	5,34	EBA354	130,18	4,7	1,7	4,4	138,8		7,1	8,8	10,5	0,5
	135	427	120,02	6,99	EBA427	120,81	6,2	2,5	5,8		123,4	9,4	11,9	14,4	0,6
	140	429	126,37	6,99	EBA429	127,16	6,2	2,5	5,8		128,4	9,4	11,9	14,4	0,6
135	150	432	135,89	6,99	EBA432	136,68	6,2	2,5	5,8	146,6	138,4	9,4	11,9	14,4	0,6
140		433	139,07	6,99	EBA433	139,86	6,2	2,5	5,8	151,6		9,4	11,9	14,4	0,6
	160	435	145,42	6,99	EBA435	146,21	6,2	2,5	5,8		148,4	9,4	11,9	14,4	0,6
150		437	151,77	6,99	EBA437	152,56	6,2	2,5	5,8	161,6		9,4	11,9	14,4	0,6
160	170	438	158,12	6,99	EBA438	158,91	6,2	2,5	5,8	171,6	158,4	9,4	11,9	14,4	0,6
	180	439	164,47	6,99	EBA439	165,26	6,2	2,5	5,8		168,4	9,4	11,9	14,4	0,6
170		440	170,82	6,99	EBA440	171,61	6,2	2,5	5,8	181,6		9,4	11,9	14,4	0,6
	190	441	177,17	6,99	EBA441	177,96	6,2	2,5	5,8		178,4	9,4	11,9	14,4	0,6
180	200	442	183,52	6,99	EBA442	184,31	6,2	2,5	5,8	191,6	188,4	9,4	11,9	14,4	0,6
190		443	189,87	6,99	EBA443	190,66	6,2	2,5	5,8	201,6		9,4	11,9	14,4	0,6
	210	444	196,22	6,99	EBA444	197,01	6,2	2,5	5,8		198,4	9,4	11,9	14,4	0,6
200	220	445	202,57	6,99	EBA445	203,36	6,2	2,5	5,8	211,6	208,4	9,4	11,9	14,4	0,6
210	230	446	215,27	6,99	EBA446	216,06	6,2	2,5	5,8	221,6	218,4	9,4	11,9	14,4	0,6
220		446	215,27	6,99	EBA446	216,06	6,2	2,5	5,8	231,6		9,4	11,9	14,4	0,6
230	240	447	227,97	6,99	EBA447	228,76	6,2	2,5	5,8	241,6	228,4	9,4	11,9	14,4	0,6
240	250	448	240,67	6,99	EBA448	241,46	6,2	2,5	5,8	251,6	238,4	9,4	11,9	14,4	0,6
250		449	253,37	6,99	EBA449	254,16	6,2	2,5	5,8	261,6		9,4	11,9	14,4	0,6
	280	450	266,07	6,99	EBA450	266,86	6,2	2,5	5,8		268,4	9,4	11,9	14,4	0,6
280	300	451	278,77	6,99	EBA451	279,56	6,2	2,5	5,8	291,6	288,4	9,4	11,9	14,4	0,6
300	320	453	304,17	6,99	EBA453	304,96	6,2	2,5	5,8	311,6	308,4	9,4	11,9	14,4	0,6
320		454	316,87	6,99	EBA454	317,66	6,2	2,5	5,8	331,6		9,4	11,9	14,4	0,6
	350	455	329,57	6,99	EBA455	330,36	6,2	2,5	5,8		338,4	9,4	11,9	14,4	0,6
350		457	354,97	6,99	EBA457	355,76	6,2	2,5	5,8	361,6		9,4	11,9	14,4	0,6
360		457	354,97	6,99	EBA457	355,76	6,2	2,5	5,8	371,6		9,4	11,9	14,4	0,6
	400	459	380,37	6,99	EBA459	381,16	6,2	2,5	5,8		388,4	9,4	11,9	14,4	0,6

Causes of seal destruction

Storage

Advice for storage and conservation

As any elastomer part, Tecring® seals are sensitive to certain outside factors, such as light, heat, atmosphere and deformation. Generally speaking, they should be stocked in their original packaging.

- **Light :** avoid extended exposure to direct sunlight or strong artificial light sources.

- **Heat :** Do not stock next to heat sources. Recommended storage temperature: +5 to 25°C.

- **Humidity :** we recommend relative humidity of 40 to 60% for storage.

- **Ozone :** Do not store near to apparatuses discharging ozone. (mercury lamps, high-voltage electrical equipment, spark generators, etc...).

- **Deformation :** Tecring® seals must be stored as freely as possible, piling of packets and folding may cause permanent deformation.

"Our Production"
INTERSEAL

Machining

Compression

Dynalast® Production :
Cylinder Mixing Machine

Dynalast® Production :
Presses in a white room environment

Quality Control facilities

Three dimensional report

Rheometer

Durometer

PRODUCT HIGHLIGHT

Dynalast® Perfluoroelastomers

Dynalast® FFKM is one of the latest developments in the field of perfluoroelastomers.

Dynalast® FFKM combines the elasticity of fluoroelastomers (FKM) with the chemical resistance of polytetrafluoroethylene (PTFE), providing real solutions to the most demanding sealing problems.

The base monomers of Dynalast® FFKM are very expensive and the manufacturing processes very complex, meaning very high production costs, beyond comparison with other elastomers.

WHY CHOOSE DYNALAST® OVER OTHER PERFLUOROELASTOMERS?

♦ Because of the different grades of materials offering optimal performance for a range of applications:

. Specific formulations,
. Variable curing processes,
. Wide range of colours (upon request),
. Hardness range: 60 - 90 Shore A.

♦ Because of the wide range of possible shapes and sizes:

. O-Rings,
. Plates,
. Balls,
. Membranes,
. Specific seals,
. Rubber/ metal composites.

♦ Because of quick delivery.

♦ Because of its excellent value for money.

ADVANTAGES OF DYNALAST® FFKM

As well as having similar elasticity to other elastomers, Dynalast® offers the following advantages :

. More or less identical chemical resistance to PTFE, ie: far higher than that of fluoroelastomers (FKM),

. Maximum temperature : 290°C for continuous operation with a peak temperature of 310°C,

(The table on the third page compares the temperature resistances of the different materials.)

. Excellent resistance to atmospheric agents and ozone,

. Optimal seal with vacuum and high vacuum, even in the presence of high temperatures.

These advantages guarantee the Dynalast® FFKM user reduced maintenance costs and minimise operating losses.

APPLICATIONS

♦ Chemistry:
Dynalast® resists almost all chemical reagents, solvents, ethers, ketones, amines, oxidatives, carburants, acids, bases, etc...
Dynalast® FFKM resists high-temperature steam containing corrosion inhibitors (eg : amines).

♦ Petrochemicals, oil and gas production :
aniline, sulphuric acid, sodium hydroxide, diethanolamine, diethyl formamide, octane, etc...

♦ Pharmaceuticals and cosmetics : amines, acetic acid, nitric acid, aniline, toluene, etc...

♦ Dyes and paints :
ethyl acetate, acetone, methyl ethyl ketone, diethylene dioxide, etc...

♦ The semiconductor industry :
Only Dynalast® FFKM can meet the critical tightness requirements of this industrial sector : high temperatures, high pressures, chemical corrosion, efficient operation where gases are used, contamination prevention : plasma, acids, bases, solvents, ultra-pure deionized water, etc...

♦ Phytosanitary products industry :
xylene, aniline, acetic acid, sulphuric acid, nitric acid, ammonium hydroxide, etc...

♦ Photographic industry :
amyl acetate, acetic acid, etc...

♦ Detergent industry :
benzene, ethyl benzene, sodium hydroxide, etc...

♦ Plastic industry :
amines, aniline, ethyl acetate, ammonium hydroxide, benzene, methylene chloride, styrene, dimethylformamide, etc...