



We make it *possible*



**HUTCHINSON®**

**Precision Sealing**



HUTCHINSON®

We make it *possible*

# CATALOGUE

## Precision Sealing

In-house Manufacturing, Authentic Sealing

# TABLE OF CONTENTS

<b>1 - DEFINITION-GENERAL INFORMATION</b>	<b>6</b>	<b>5 - INSTRUCTIONS FOR THE DIFFERENT TYPES OF INSTALLATION</b>	<b>20</b>
1.1 - O-Rings	6	5.1 - Static applications	20
1.2 - Elastomers	6	5.1.1 - Groove dimensions and shape	20
		5.1.2 - Clearance and extrusion	20
<b>2 - HOW DOES AN O-RING WORK?</b>	<b>7</b>	5.1.3 - Surface finish	21
2.1 - Operational Principle of the O-Ring	7	5.2 - Dynamic applications with reciprocating movement	22
2.2 - Influence Of Compound Characteristics on Seal Function	7	5.2.1 - Groove dimensions and shape	22
2.2.1 - Compression Set	7	5.2.2 - Clearance and extrusion	22
2.2.2 - Hardness	7	5.2.3 - Anti-extrusion washer	22
2.2.3 - Temperature performance	8	5.2.4 - Surface finish	22
2.2.4 - The impact of fluid type	8	5.3 - Low speed rotary applications	23
2.2.5 - Certification	8	5.4 - Floating installations	23
<b>3 - RECOMMENDATIONS FOR THE SELECTION OF COMPOUNDS</b>	<b>9</b>	<b>6 - RECOMMENDATIONS FOR ASSEMBLY</b>	<b>24</b>
3.1 - Standard compounds in stock	9	6.1 - Chamfers	24
3.2 - Non-standard compounds	9	6.2 - O-ring installation recommendations	24
3.3 - User guide	10	6.3 - Automated installation	25
3.4 - Chemical compatibility table	14	6.4 - O-ring lubrication and surface treatments	25
<b>4 - TYPES OF O-RING INSTALLATION</b>	<b>18</b>	<b>7 - STORAGE AND PRESERVATION OF O-RINGS</b>	<b>26</b>
4.1 - Volume of the groove	18	<b>8 - GENERAL QUALITY</b>	<b>27</b>
4.2 - Deflection of the seal	18	8.1 - General information	27
4.3 - Groove width and depth	18	8.2 - Control characteristics	27
4.4 - Inside diameter of the seal	18	8.3 - Surface finish	28
4.5 - Cross-section diameter	19	<b>9 - LIST OF DIMENSIONS</b>	<b>29</b>
		9.1 - Assembly recommendations	29
		Fitting O-rings in cylinders	29
		Fitting O-rings onto pistons	47

## B - FOUR-LIPS SEALS

<b>1 - GENERAL INFORMATION</b>	<b>57</b>	<b>5 - DIMENSIONS &amp; GROOVE SIZES</b>	<b>63</b>
<b>2 - TECHNICAL ADVANTAGES</b>	<b>58</b>	<b>6 - TYPES OF ASSEMBLY</b>	<b>63</b>
2.1 - Reduced friction	58	6.1 - Static applications	63
2.2 - Reduced starting torque	58	6.2 - Dynamic applications	64
2.3 - Reduced size	58	6.3 - Lead chamfers	64
2.4 - Reduced residual film	58	6.4 - Machining tolerances	64
2.5 - Resistance to wear	59	6.5 - Surface condition and protection	64
2.6 - Elimination of twisting	59	6.6 - Reciprocating applications	65
2.7 - Position of the land area	59	6.7 - Rotary applications	65
		6.8 - Extrusion	65
<b>3 - SELECTION OF FOUR-LIPS SEALS</b>	<b>59</b>	<b>9 - DIMENSION TABLES</b>	<b>66</b>
3.1 - Surface treatments	59		
3.2 - Standard compounds for four-lips seals	60		
<b>4 - TEMPERATURE RANGE</b>	<b>62</b>		

## C - BONDED SEALS

<b>1 - DEFINITION-GENERAL INFORMATION</b>	<b>76</b>	<b>4 - LIST OF DIMENSIONS</b>	<b>80</b>
1.1 - Auto-centralising bonded seal	76		
<b>2 - ASSEMBLY</b>	<b>77</b>	<b>5 - NON-STANDARD PARTS</b>	<b>82</b>
2.1 - Torque loading	77	5.1 - Conditions of assembly for non self-centralising bonded seals	82
<b>3 - RECOMMENDATIONS FOR SELECTING BONDED SEALS</b>	<b>78</b>		
3.1 - Metal washer	78		
3.2 - Surface treatments	78		
3.3 - Rubber compound			

## D - OUR COMMITMENT FOR EXCELLENCE

<b>1 - DESIGNER &amp; MANUFACTURER OF YOUR FUTURE SEALING SOLUTIONS</b>	<b>84</b>	<b>4 - A BROAD NETWORK OF DISTRIBUTORS</b>	<b>87</b>
<b>2 - TAILOR-MADE SOLUTIONS</b>	<b>85</b>	<b>5 - HOW TO REQUEST A PRODUCT?</b>	<b>88</b>
<b>3 - SUBSIDIARIES IN THE WORLD</b>	<b>86</b>		

### RECOMMENDATIONS

*We advise you to carefully read the recommendations for assembly set out in this catalogue. Our technical services are at your disposal for any further information you may need. Please contact us for any special conditions not described in this catalogue.*





We make it *possible*

**In-house Manufacturing, Authentic Sealing**

# O-Rings



**HUTCHINSON®**

**Precision Sealing**

# 1 - DEFINITION - GENERAL INFORMATION

## 1.1 - O-RINGS

The "O-Ring" seal is a circular ring with a round cross-section. It is the simplest of sealing systems, combining:

- maximum effectiveness,
- small space requirements,
- low cost and
- complete symmetry, reducing the risk of incorrect installation.

The O-Ring may be used:

- in either static or dynamic applications (low speed rotation or oscillating movement)
- for applications ranging from cryogenics to high temperatures.
- at pressures ranging from High Vacuum up to 2,000 bars.

The O-Ring's shape-conforming characteristics, due to its rubber composition and circular cross-section, provide ever greater levels of sealing when pressures increase, while requiring minimal initial deflection.

The O-Ring fits into simple grooves which are easily machined.

Its profile enables it to be used in the smallest of spaces.

International standards make it possible to guide users towards the most commonly used dimensions, generally kept in stock.

## 1.2 - ELASTOMERS

Within increasingly demanding technical environments, where standards, certifications and regulations multiply, the LJF® O-Ring Division and our laboratory offers you its expertise and guarantees you the best compound characteristics.

The manufacture of our compounds is carried out under the responsibility of our laboratory. This expertise guarantees the behaviour, performance, durability and characteristics of all our compounds.

Production monitoring, ensured by our laboratory team, is integrated into our organisation and guarantees you the repeatability of our elastomers' performance.

In order to make the best possible use of the sealing characteristics offered by the O-Ring, it is vital to select the correct compound and use it in an assembly in accordance with the recommendations of use:

- fluid to seal
- pressure
- temperature
- static or dynamic application

This guide is to assist designers and engineers make good choices.

It is however, recommended that tests are run to validate the selected product.



*Our ISO 9001 and ISO/TS 16949 certifications*

As regards developments, the LJF® O-Ring Division and our laboratory recently developed innovations pertaining to elastomers' behaviour in extreme temperature conditions. We have over 150 special elastomer compounds (NBR - EPDM - HNBR - FKM - AEM - ACM - IIR - CR - Q - FMVQ - FFKM). These are monitored, optimised and made available for your applications. Many of our compounds are officially approved, certified and recommended by both industrial and automotive customers. Included amongst these many approvals are compounds for drinking water and gas supply.

Hutchinson monitors and regulates all our compound developments and activities in accordance with "Reach" regulations health and safety.

# 2 - HOW DOES AN O-RING WORK?

## 2.1 - OPERATIONAL PRINCIPLE OF THE O-RING

When an O-Ring fitted into a groove is subject to the pressure of a fluid, it compresses itself against the seating surface that is located on the opposite side of the source of pressure. The seal acts as a wedge in the angle that exists between contact surfaces a and b.

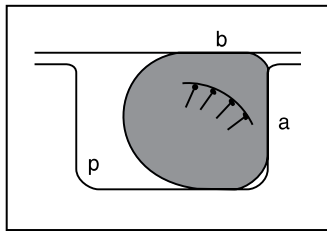
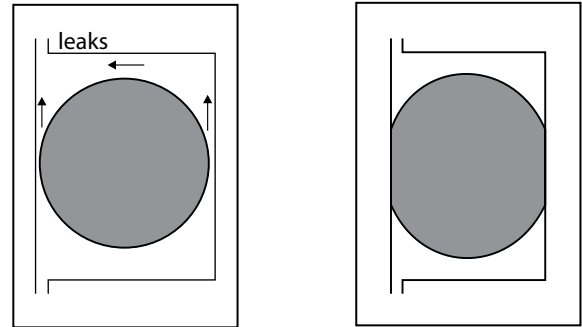


Figure 1

The seal's shape changes according to the pressure; as the pressure  $p$  increases, the contact forces at locations a and b will also increase.

The seal is usually fitted in its groove with an initial deflection (the depth of the groove is smaller than the cross-section diameter of the seal). The contact forces caused by the change in the seal's shape make it possible to maintain the seal's effectiveness when the pressure of the fluid is either low or non-existent since, in this case, the pressure does not press the seal against the sealing areas.



without initial deflection

with initial deflection

Figure 2

## 2.2 - INFLUENCE OF COMPOUND CHARACTERISTICS ON SEAL FUNCTION

### 2.2.1 - Compression Set

The different rubber compounds which are available to our customers were specially formulated for O-Ring applications.

Indeed, the "elastic" properties of the rubber compound which make it possible to maintain the sealing properties at low pressures can vary with time, temperature and the effects of the fluid on the seal.

Compression set (CS) is measured according to the figure below:

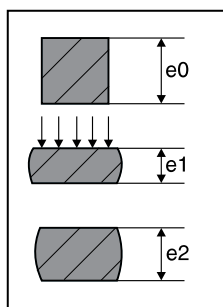


Figure 3

initial width of the sample

compression R deformation in specific conditions (time, temperature, fluid, relaxation)

removal of the compression R elastic return

- perfectly elastic body  $e2 = e0$
- full creep  $e2 = e1$

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

The lower the CS value, the higher the rubber's performance as a sealant.

CS tests may be carried out according to various specifications and standards (ex: ISO 815).

### 2.2.2 - HARDNESS

At high pressures, the seal's change in shape can result in extrusion.

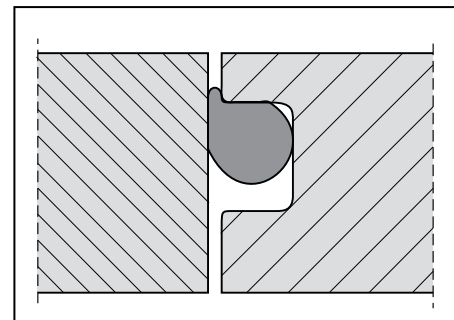


Figure 4

Seal extrusion: The rubber compound moves into the mechanical gap.

When the hardness of the seal is increased, its resistance to extrusion is also increased. The same is true, however, for the assembly effort required to deflect the seal in its groove.



### 2.2.3 - TEMPERATURE-RELATED BEHAVIOUR

#### ● LOW TEMPERATURES

At low temperatures, a slight contraction of the rubber, in combination with hardening, may cause leakage in a system. Compared to metals, rubber compounds have a high thermal expansion coefficient. These phenomena should particularly be taken into account when gasses are involved and when the initial deflection of the components is low.

**N.B:** The hardening of rubber compounds in low temperatures is a reversible phenomenon. In other words, the rubber fully regains its initial characteristics when the temperature increases again.

#### ● HIGH TEMPERATURES

It should be noted that an increase in temperature can change the characteristics of the rubber (decrease in hardness, increase in compression set, leading to possible extrusion). At high temperatures, the recommended groove sizes are quite adequate to handle the expansion of the rubber compound (very small variations in volume).

#### WARNING

There will be no degradation in the rubber compound if maximum admissible temperatures are not exceeded. If the operational temperatures are too high, an irreversible drop in the compound's performance will result: The rubber will harden, lose elasticity and compression set capability.

### 2.2.4- THE IMPACT OF FLUID TYPE

#### ● SWELLING

If the rubber swells too much the following may occur:  
 - change in the characteristics of the rubber (reduction in hardness and in mechanical resilience) and risk of extrusion.  
 In the case of static applications, a swelling up to approximately 30% of the seal's volume may be acceptable.  
 In the case of dynamic applications, a swelling of up to 8 to 10% in volume is considered acceptable in most applications.

#### ● EXTRACTION

In general, dynamic applications are more sensitive to this phenomenon as, due to friction issues, the level of initial deflection is lower than that used for static applications.  
 If doubt exist about the influence of a particular fluid, it is best to carry out preliminary testing.

If the swelling is negative (reduction in the volume of the seal caused by the extraction of plasticizers from the rubber), this may result in:  
 - a change in the characteristics of the rubber (reduced elasticity, increased hardness and compression set).  
 - risk of leakage caused by a reduction in the cross-section of the seal, and hence of the deflection of the seal in its groove.

#### ● CHEMICAL ATTACK

Chemical incompatibility unrelated to volume, may cause a change in the rubber compound's characteristics over time. The most common effects on seals are:  
 - a change in hardness  
 - cracks  
 - an increase in compression set



Technical Support at your disposal

In addition to the points set out above, please contact us regarding the following:  
 Resistance to cold water, hot water and steam  
 Resistance to oils  
 Resistance to greases  
 Resistance to vegetable and animal oils and greases  
 Resistance to brake fluids  
 Resistance to fuels  
 Resistance to solvents  
 Resistance to acids  
 Resistance to bases  
 Resistance to ageing and weather conditions  
 Compatibility with foodstuffs  
 Electrical properties  
 Resistance to vacuums  
 Resistance to pressure

### 2.2.5- CERTIFICATION

O-Rings in contact with drinking water, foodstuffs, pharmaceuticals, gases, etc., are certified by authorised bodies (KIWA, WRAS, KTW, NSF, ACS, etc.).

There are also special **certifications for substances in contact with foodstuffs** (Please contact us for clarification).

Compounds	KIWA	WRAS	KTW	NSF	ACS	EN 681.1	BGA	W534	W270	DM174
7PD1612		X	X	X	X		X			
7EP1197	X	X	X	X	X	X		X	X	X
EP856		X	X		X			X	X	
6EP1862		X								X

Drinking water certifications

# 3 - RECOMMENDATIONS FOR THE SELECTION OF COMPOUNDS

The compound should be chosen according to the following information :

## a) For the type of elastomer:

- nature of the fluid(s) in contact
- temperatures in continuous and peak service (at seal level)
- nature of the materials in contact

## b) For hardness

- service pressure
- type of use

## 3.1 - STANDARD COMPOUNDS IN STOCK

Four compounds are selected as standard for most applications.

Nitrile	(NBR)	hardness 70	PB 701
Nitrile	(NBR)	hardness 80	PC 851
Ethylene Propylene	(EPDM)	hardness 85	EP 851
Fluorocarbon	(FKM)	hardness 80	DF 801

The majority of parts available in stock exist in these four compounds and comply with different European norms (see the Dimensions section).

See 3.3 for the characteristics of these compounds.

Selection criteria when choosing one of our four standard materials.

Fluid	Temperature continuous peak	- 40° C - 40° C	- 20° C - 25° C	+ 70° C + 100° C	+ 100° C + 125° C	+ 125° C + 150° C	+ 150° C + 175° C	+ 200° C + 250° C
	Water - Steam Coolant		EP 851	EP 851 PB 701 PC 851 DF 801	EP 851 PB 701 PC 851 DF 801	EP 851 DF 801	EP 851 DF 801	EP 851
Compressed air			PB 701 PC 851 DF 801	PB 701 PC 851 DF 801	DF 801	DF 801	DF 801	DF 801
Mineral oils Petroleum products			PB 701 PC 851 DF 801	PB 701 PC 851 DF 801	PB 701 PC 851 DF 801	DF 801	DF 801	DF 801

Note: Maximum service pressure in dynamic applications for PB 701: 80 bars; for higher pressures use PC 851.

## 3.2 - NON-STANDARD COMPOUNDS

Hutchinson Precision Sealing offers a wide range of rubber compounds in order to meet specific requirements.

The following user guide will enable you to choose the best compound for your application.

We make over 150 different rubber compounds. This guide shows those more widely used by our customers.

A Chemical compatibility chart is included for your guidance.

### 3.3 - USER GUIDE

APPLICATION TYPE	ELASTOMER	GENERAL CHARACTERISTICS OF THE RUBBER	REFERENCE OF THE RUBBER	APPROVALS AND CERTIFICATION	COLOUR	HARDNESS IRHD
<ul style="list-style-type: none"> <li>Hydraulic and pneumatic</li> <li>Valves and fittings water and mineral gas</li> <li>Mineral oil and fuel circuits</li> </ul>	NBR (Nitrile)	Good resistance to <ul style="list-style-type: none"> <li>mineral oils</li> <li>domestic gas</li> <li>water up to 70° C</li> <li>fuels</li> <li>aliphatic solvents</li> </ul> Poor resistance to <ul style="list-style-type: none"> <li>atmospheric agents</li> <li>acids</li> <li>brake fluids</li> </ul> Good mechanical characteristics	5PD1883		Black	54
			6PB1729	Gas EN 549 - B1	Black	61
			6PB2053	Protected against ozone - Resistance to fuels	Black	62
			6PB2064	Resistance to gasoil - Protected against ozone	Blue	62
			<b>PB701</b>	Resistance to fuels - Gas EN 549 - B2	Black	68
			7PB1860	Self-lubricating - Protected against ozone	Black	68
			7PB1871	Protected against ozone - Gas - DIN 3535 - 3	Black	69
			7PB496	Resistance to heat + oil - Gas EN 549 - B2	Black	70
			7PD1630	Resistance to cold	Black	70
			7PD1612	Drinking water - Gas	Black	75
			8PB1390	Resistance to heat - oil	Black	75
			<b>PC851</b>	Gas EN 549 - B1	Black	79
			PD853	Resistance to cold temperatures	Black	80
			9PC1708		Black	88
				NBR (PVC)	Same as Nitrile Higher resistance to fuels	6P1863
	8PA1393	NBR/PVC - Protected against ozone	Black			77
<ul style="list-style-type: none"> <li>Valves and fittings hot water</li> <li>Coolant circuit</li> <li>Brake circuit</li> <li>Circuit breakers SF6</li> </ul>	EPDM (Ethylene Propylene)	Very good resistance to: <ul style="list-style-type: none"> <li>water, steam and water-based solutions in general</li> <li>synthetic brake fluids</li> <li>atmospheric agents</li> </ul> Poor resistance to <ul style="list-style-type: none"> <li>mineral oils and hydrocarbons</li> </ul> Good resistance to cold Relatively good mechanical behaviour	6EP1862	Drinking water Germany	Black	55
			6EP1713	Self-lubricating	Black	57
			6EP1385		Black	62
			7EP1722	Self-lubricating	Black	67
			EP7010		Black	72
			7EP1197	Drinking water GB - Germany- US - France	Black	72
			7EP1726		Black	72
			7EP2106	Colour	Purple	70
			8EP2058	Colour	Mauve	79
			8EP2147	Colour - Air conditioning	Purple	79
			<b>EP851</b>		Black	83
			EP856	Drinking water GB - Germany- France	Black	83
			9EP2094		Black	91
			<ul style="list-style-type: none"> <li>Hydraulic and pneumatic high temperature</li> <li>Industrial valves and fittings</li> <li>Injection carburation</li> <li>Engine seals</li> <li>Hard vacuum</li> </ul>	FKM (Fluorocarbon)	Very good resistance to: <ul style="list-style-type: none"> <li>heat</li> <li>mineral oils</li> <li>domestic gas</li> <li>atmospheric agents</li> <li>fuels</li> <li>aromatic and aliphatic solvents</li> </ul> Good resistance to <ul style="list-style-type: none"> <li>chemical substances in general</li> <li>acids</li> </ul> Poor resistance to <ul style="list-style-type: none"> <li>bases</li> <li>brake fluids</li> </ul> Limited resistance to cold Relatively good mechanical behaviour Good impermeability	DF651
6DF2060	Colour	Green				63
6DF1882	Resistance to cold	Green				64
6DF2129	Resistance to fuels containing alcohol	Black				67
DF701	Gas EN 549 - E1	Black				66
7DF2067	Colour	Green				71
7DF2116	Colour - Resistance to low temperatures	Blue				75
7DF1719	Resistance to cold	Black				74
7DF2148	Resistance to low temperatures	Black				
7DF2075	Resistance to cold	Green				77
<b>DF801</b>	Gas EN 549 - E1	Black				78
DF851		Black				83
8DF1872	Colour	Purple				77
DF901	Gaseous oxygen	Black				90
<ul style="list-style-type: none"> <li>Automatic gear box</li> </ul>	ACM (Polyacrylate)	Good resistance to <ul style="list-style-type: none"> <li>aggressive mineral oils</li> <li>atmospheric agents</li> <li>heat</li> </ul> Poor resistance to <ul style="list-style-type: none"> <li>fuels</li> <li>water</li> <li>limited resistance to cold</li> </ul> Average mechanical behaviour				DA 65
			6DA1865		Black	64
			7DA1163		Black	67
			8DA1398		Black	70
			DA80	Gas EN 549 - C1	Black	74
<ul style="list-style-type: none"> <li>Sensors</li> </ul>	AEM		6DE2142	Without DOTG - Self-lubricating	Black	60
			7DE2138	Without DOTG	Black	73
			7DE2144	Without DOTG - AEM resistance to cold	Black	73

REFERENCE OF THE RUBBER	TEMPERATURE			COMPRESSION SET CONDITION	COMPRESSION SET %	VARIATION VOLUME OIL 1 70 hrs at 100°	VARIATION VOLUME OIL 1 IRM 903	ASTM D 2000	NFT CORRESPONDENCE 47503
	Min.	Max. continuous	Max. peak						
5PD1883	- 30	100	120	24 hrs at 100°C	15	- 10	+ 3	5 BG 510 A14 B14 E034 Hardness 55	
6PB1729	- 30	100	120	24 hrs at 100°C	12	- 6	+ 8	5 BG 614 B14 E014 E034	
6PB2053	- 25	100	120	24 hrs at 100°C	12	- 10	- 3	5 BK 610 A14 B14	
6PB2064	- 30	100	120	24 hrs at 100°C	12	- 6	- 4	5 BG 614 A14 B14 E014 E034	
<b>PB701</b>	- 30	100	120	24 hrs at 100°C	12	- 9	0	5 BG 714 A14 B14 E014 E034	NBR 70 TR1
7PB1860	- 30	100	120	24 hrs at 100°C	11	- 6	+ 11	5 BG 714 A14 B14 E034	
7PB1871	- 35	90	120	24 hrs at 100°C	12	- 7	+ 12	5 BG 714 A14 B14 E014 E034	
7PB496	- 30	110	130	24 hrs at 100°C	10	- 4	+ 8	3 CH 717 A25 B14 E016 E036	
7PD1630	- 45	100	130	24 hrs at 100°C	12	- 7	+ 15	5 BG 714 A14 B14 E014 E034	NBR 70 TR3
7PD1612	- 30	100	130	24 hrs at 125°C	10	- 2	+ 16	2 CH 708 A25 B14 E015 E035	
8PB1390	- 30	110	130	24 hrs at 100°C	12	- 2	+ 15	3 CH 717 A25 B14 E016 Z1 = hardness 75 according to ASTM D1415	
<b>PC851</b>	- 30	100	120	24 hrs at 100°C	15	- 7	+ 8	6 BG 814 A14 B14 E0 14 E034	NBR 80 TR1
PD853	- 45	90	120	24 hrs at 100°C	15	- 8	+ 12	6 BG 814 A14 B14 E014 E034	NBR 80 TR2
9PC1708	- 25	90	120	24 hrs at 100°C	15	- 5	+ 10	6 BG 910 A14 B14 E014 E034	NBR 90 TR2
6P1863	- 30	90	120	24 hrs at 100°C	20	- 12	- 5	2 BE 610 C12 F17	
8PA1393	- 30	90	120	24 hrs at 100°C	20	- 11	- 3	2 BE 814 C12	
6EP1862	- 55	130	175	24 hrs at 150°C	20	NR	NR	2 DA 510 A26 B36 EA14 F19 Z1 = hardness 55 according to ASTM D1415	
6EP1713	- 55	120	160	24 hrs at 150°C	20	NR	NR	2 DA 510 B36 EA14 F19 Z1 = hardness 55 according to ASTM D1415	
6EP1385	- 55	130	175	24 hrs at 150°C	18	NR	NR	3 DA 610 A26 B36 EA14 F19	
7EP1722	- 50	125	165	24 hrs at 150°C	20	NR	NR	3 DA 610 A26 B36 EA14 F19 Z1 = hardness 65 according to ASTM D1415	
EP7010	- 50	140	175	24 hrs at 150°C	12	NR	NR	3 DA 710 A26 B36 EA14 F19	EPDM 70
7EP1197	- 50	140	175	24 hrs at 150°C	12	NR	NR	3 DA 710 A26 B36 EA14 F19	
7EP1726	- 50	110	150	24 hrs at 125°C	25	NR	NR	5 CA 714 A25 B35 EA14 F17	
7EP2106	- 50	140	170	24 hrs at 150°C	15	NR	NR	3 DA 710 A26 B36 EA14 F19	
8EP2058	- 50	140	175	24 hrs at 150°C	10	NR	NR	3 DA 810 A26 B36 EA14 F19	
8EP2147	- 50	140	170	24 hrs at 150°C	12	NR	NR	3 DA 810 A26 B36 F19	
<b>EP851</b>	- 50	140	175	24 hrs at 150°C	12	NR	NR	3 DA 814 A26 B36 EA14 F19	EPDM 80
EP856	- 50	140	175	24 hrs at 150°C	12	NR	NR	3 DA 814 A26 B36 EA14 F19	
9EP2094	- 45	140	170	24 hrs at 150°C	12	NR	NR	3 DA 810 A26 B36 F19 Z1 = hardness 90 according to ASTM D1415 Z2 = 70 % min. elongation at break according to ASTM D412	
DF651	- 30	200	250	72 hrs at 200°C	22	0 *	+ 3 *	6 HK 610 A1-10 B38 EF31 F15	
6DF2060	- 30	200	250	72 hrs at 200°C	20	0 *	+ 3 *	6 HK 610 A1-10 B38 EF31 F15 Z = Hardness 65+/-5 according to ASTM D1415	
6DF1882	- 30	200	250	72 hrs at 200°C	20	0 *	+ 2 *	6 HK 610 A1-10 B38 EF31 F15 Z1 = Hardness 65+/-5 according to ASTM D1415 Z2 = TR10 according to ASTM D1329: -18°C min.	
6DF2129	- 25	200	250	72 hrs at 200°C	25	0 *	+ 2 *	6 HK 610 A1-10 B38 EF31 F15	
DF701	- 25	200	250	72 hrs at 200°C	20	0 *	+ 2 *	6 HK 710 A1-10 B38 EF31 F15	
7DF2067	- 25	200	250	72 hrs at 200°C	20	0 *	+ 2 *	6 HK 710 A1-10 B38 EF31 F15	
7DF2116	- 35	200	250	72 hrs at 200°C	20	0 *	+ 2 *	6 HK 710 A1-10 B38 EF31 F15 Z1 = Hardness 75+/-5 according to ASTM D1415 Z2 = TR10 according to ASTM D1329: -18°C min.	
7DF1719	- 30	200	250	72 hrs at 200°C	22	0 *	+ 2 *	6 HK 710 A1-10 B38 EF31 F15 Z1 = Hardness 75+/-5 according to ASTM D1415 Z2 = TR10 according to ASTM D1329: -18°C min.	
7DF2148	- 35	200	250	72 hrs at 200°C	18	0 *	+ 2 *	6 HK 710 A1-10 B38 EF31 F15 Z1 = Hardness 75+/-5 according to ASTM D1415 Z2 = TR10 according to ASTM D1329: -18°C min.	
7DF2075	- 30	200	250	72 hrs at 200°C	23	0 *	+ 2 *	6 HK 710 A1-10 B38 EF31 F15 Z1 = Hardness 75+/-5 according to ASTM D1415 Z2 = TR10 according to ASTM D1329: -18°C min.	
<b>DF801</b>	- 25	200	250	72 hrs at 200°C	18	0 *	+ 2 *	6 HK 814 A1-10 B38 EF31 F15	FKM 80
DF851	- 25	200	250	72 hrs at 200°C	20	0 *	+ 2 *	6 HK 814 A1-10 B38 EF31 F15 Z1 = Hardness 85+/-5 according to ASTM D1415	
8DF1872	- 25	200	250	72 hrs at 200°C	20	0 *	+ 2 *	6 HK 710 A1-10 B38 EF31 F15 Z1 = Hardness 75+/-5 according to ASTM D1415	
DF901	- 25	200	250	72 hrs at 200°C	20	0 *	+ 2 *	7 HK 910 A1-10 B38 EF31	
DA 65	- 20	150	175	24 hrs at 150°C	35	0 *	+ 13 *	2 DH 609 A26 B36 E016 E036 F14	
6DA1865	- 20	150	175	24 hrs at 150°C	30	- 2 *	+ 12 *	2 DH 609 A26 B36 E016 E036 F14 Z1 = Hardness 65+/-5 according to ASTM D1415	
7DA1163	- 25	150	175	24 hrs at 150°C	35	- 5 *	+ 7 *	3 DH 710 A26 B36 E016 E036 F13	
8DA1398	- 25	150	175	24 hrs at 150°C	35	- 3 *	+ 10 *	3 DH 710 A26 B36 E016 E036 F13	ACM 70
DA80	- 20	150	175	24 hrs at 150°C	35	0 *	+ 11 *	3 DH 710 A26 B36 E016 E036 F13 Z1 = Hardness 75+/-5 according to ASTM D1415	
6DE2142	- 35	155	175	70 hrs at 150°C	18	- 3 *	+ 28 *	4 EE 608 A47 B37 B46 E016 E036 F17	
7DE2138	- 40	160	180	70 hrs at 150°C	18	0 *	+ 30 *	4 EE 710 A47 B37 B46 E016 E036 F17	
7DE2144	- 45	160	180	70 hrs at 150°C	18	- 2 *	+ 40 *	4 EE 710 A47 B37 B46 E016 E036 F17	

NR = No resistance \* Tested at 150°C

APPLICATION TYPE	ELASTOMER	GENERAL CHARACTERISTICS OF THE RUBBER	REFERENCE OF THE RUBBER	SPECIFICITY AND CERTIFICATIONS	COLOUR	HARDNESS IRHD
<ul style="list-style-type: none"> <li>Power steering</li> <li>Air conditioning</li> </ul>	HNBR (Hydrogenated nitrile)	<p>Good resistance to</p> <ul style="list-style-type: none"> <li>- aggressive mineral oils</li> <li>- atmospheric agents</li> <li>- water, steam</li> <li>- diluted bases</li> </ul> <p>Poor resistance to</p> <ul style="list-style-type: none"> <li>- fuels</li> <li>- brake fluids</li> </ul> <p>Very good mechanical characteristics</p> <p>Resistance to abrasion</p>	6DT2078	Self-lubricating - Improved resistance to oils	Black	62
			7DT1870	Gas EN 549 - C 1	Yellow	65
			7DT1877	Improved resistance to oils	Reddish-brown	70
			7DT1743		Green	71
			7DT1593	HNBR 70 according to standard NFT 47503	Black	72
			7DT2072	Resistance to cold	Black	72
			7DT2074	Self-lubricating - Improved resistance to oils	Reddish-brown	72
			7DT2091	Resistance to cold	Green	72
			7DT2146	Colour - Gas EN 549 H3B2 + EN682	Yellow	70
			7DT1730		Brown	75
			7DT2080	Self-lubricating	Brown	75
			8DT1724		Black	82
9DT1889	Improved resistance to oils	Green	90			
<ul style="list-style-type: none"> <li>Steam</li> <li>Hard vacuum</li> </ul>	IIR (Butyl)	<p>Very good resistance to:</p> <ul style="list-style-type: none"> <li>- water and steam</li> <li>- atmospheric agents</li> </ul> <p>Good chemical resistance to water-based solutions in general</p> <p>Poor resistance to</p> <ul style="list-style-type: none"> <li>- mineral oils and hydrocarbons</li> </ul> <p>Very good impermeability to gas</p> <p>Relatively poor mechanical behaviour</p>	D706	Resistance to heat	Black	68
<ul style="list-style-type: none"> <li>Refrigeration industry</li> <li>Ventilation circuits</li> </ul>	CR (Polychloroprene)	<p>Good resistance to</p> <ul style="list-style-type: none"> <li>- mineral oils</li> <li>- atmospheric agents</li> </ul> <p>Average resistance to</p> <ul style="list-style-type: none"> <li>- mineral oils</li> <li>- water up to 70° C</li> <li>- brake fluids</li> </ul> <p>Poor resistance to</p> <ul style="list-style-type: none"> <li>- fuels</li> <li>- steam</li> </ul> <p>Good mechanical characteristics</p>	6N1851		Black	62
			7N1747	Resistance to heat CR 70 according to NFT 47503	Black	72
<ul style="list-style-type: none"> <li>Compressors</li> <li>Electrical appliances</li> <li>Electrical industry</li> </ul>	Q (Silicon)	<p>Very good resistance to:</p> <ul style="list-style-type: none"> <li>- heat</li> <li>- atmospheric agents</li> <li>- water up to 100° C</li> <li>- cold</li> </ul> <p>Average resistance to</p> <ul style="list-style-type: none"> <li>- mineral oils</li> <li>- domestic gas</li> </ul> <p>Poor resistance to fuels</p> <p>High permeability</p> <p>Poor mechanical behaviour</p>	SL1000	Q 70 - NFT 47503	Grey	74
			SL1002	Gas EN 549 - E 2 VMQ 60 according to NFT 47503	Red	63
			SL1010		Grey	55
			6SL2136	Contact with foodstuffs	White	63
			6SL2141	Resistance to heat	Black	69
			7SL1746	Q 70 - NFT 47503	Red	73
<ul style="list-style-type: none"> <li>Carburation</li> </ul>	MFQ (Fluorosilicone)	<p>Very good resistance to:</p> <ul style="list-style-type: none"> <li>- cold</li> <li>- mineral oils and hydrocarbons</li> <li>- atmospheric agents</li> <li>- heat</li> </ul> <p>Poor mechanical behaviour</p>	7SF2081		Yellow	75

**NOTE:** Most of these rubber compounds are certified with vehicle manufacturers.

REFERENCE OF THE RUBBER	TEMPERATURE			COMPRESSION SET CONDITION	COMPRESSION SET %	VARIATION VOLUME OIL 1 70 hrs at 100°	VARIATION VOLUME OIL 1 IRM 903	ASTM D 2000
	Min.	Max. continuous	Max. peak					
6DT2078	- 30	130	170	72 hrs at 150°C	22	- 3 *	+ 10 *	4 DH 614 B36 E016 E036
7DT1870	- 30	130	170	72 hrs at 150°C	27	- 1 *	+ 18 *	3 DH 710 A26 B16 E016 E036 Z1 Z2 Z1 = min. tensile strength of 15 MPa according to ASTM D412 Z2 = not brittle after 3min at -40°C according to ASTM D 2137
7DT1877	- 30	125	165	72 hrs at 150°C	22	- 5 *	+ 5 *	3 DH 710 A26 B16 E016 E036 Z1 Z2 Z3 Z1 = tensile strength of 18 MPa min. according to ASTM D412 Z2 = not brittle after 3min at -40°C according to ASTM D 2137 Z3 = Variation in volume after immersion in IRM 903 oil according to ASTM D471: +10% Max.
7DT1743	- 30	130	170	72 hrs at 150°C	27	- 1 *	+ 18 *	3 DH 710 A26 B16 E016 E036 Z1 Z2 Z1 = tensile strength of 18 MPa min. according to ASTM D412 Z2 = not brittle after 3min at -40°C according to ASTM D 2137
7DT1593	- 30	130	170	72 hrs at 150°C	25	+ 1 *	+ 19 *	3 DH 710 A26 B16 E016 E036 Z1 Z2 Z1 = tensile strength of 18 MPa min. according to ASTM D412 Z2 = not brittle after 3min at -40°C according to ASTM D 2137
7DT2072	- 50	130	160	72 hrs at 150°C	34	- 3 *	+ 20 *	3 DH 710 A26 B16 E016 E036 Z1 = tensile strength of 18 MPa min. according to ASTM D412 Z2 = TG according to ISO 11357: -35°C min.
7DT2074	- 30	125	165	72 hrs at 150°C	24	- 5 *	+ 5 *	3 DH 710 A26 B16 E016 E036 Z1 Z2 Z3 Z1 = tensile strength of 20 MPa min. according to ASTM D412 Z2 = not brittle after 3min at -40°C according to ASTM D 2137 Z3 = Variation in volume after immersion in IRM 903 oil according to ASTM D471: +10% Max.
7DT2091	- 45	130	170	72 hrs at 150°C	25	- 4 *	+ 19 *	3 DH 710 A26 B16 E016 E036 Z1 = TG according to ISO 11357: -35°C min.
7DT2146	- 50	130	160	72 hrs at 150°C	27	- 5 *	+ 15 *	3 DH 710 A26 B16 E016 E036
7DT1730	- 30	130	170	72 hrs at 150°C	27	- 1 *	+ 17 *	3 DH 710 A26 B16 E016 E036 hardness 75 Z1 = tensile strength of 18 MPa min. according to ASTM D412 Z2 = not brittle after 3min at -40°C according to ASTM D 2137
7DT2080	- 30	130	170	72 hrs at 150°C	29	- 2 *	+ 15 *	3 DH 710 A26 B16 E016 E036 hardness 75
8DT1724	- 30	130	170	72 hrs at 150°C	22	- 1 *	+ 17 *	4 DH 820 A26 B16 E016 E036 Z1 Z2 Z1 = tensile strength of 20 MPa min. according to ASTM D412 Z2 = not brittle after 3min at -40°C according to ASTM D 2137
9DT1889	- 30	125	165	72 hrs at 150°C	24	- 3 *	+ 5 *	3 DH 920 A26 B16 E016 E036 Z1 Z2 Z1 = not brittle after 3min at -40°C according to ASTM D 2137 Z2 = Variation in volume after immersion in IRM 903 oil according to ASTM D471: +10% Max.
D706	- 45	125	175	24 hrs at 125°C	10	+ 50	NR	2 DA 710 A26 B36
6N1851	- 45	90	125	24 hrs at 100°C	20	+ 2	+ 65	3 BC 614 A14 B14 E014 E034 F17
7N1747	- 45	90	125	24 hrs at 100°C	15	+ 5	+ 60	3 BC 710 A14 B14 E014 E034 F17
SL1000	- 70	200	225	72 hrs at 150°C	15	+ 6 *	+ 35 *	5 GE 706 B37 EA14 E016 E036 F19
SL1002	- 60	200	225	72 hrs at 150°C	20	+ 4 *	+ 38 *	5 GE 606 A19 B37 EA14 E016 E036 F19
SL1010	- 60	200	225	72 hrs at 150°C	20	+ 6 *	+ 40 *	5 GE 506 A19 B37 EA14 E016 E036 F19
6SL2136	- 70	200	225	72 hrs at 150°C	28	+ 6 *	+ 50 *	5 GE 606 B37 EA14 E016 E036 F19
6SL2141	- 70	225	250	72 hrs at 150°C	5	+ 5 *	+ 45 *	5 GE 606 A19 B37 EA14 E016 E036 F19
7SL1746	- 70	200	225	72 hrs at 150°C	10	+ 6 *	+ 35 *	5 GE 706 B37 EA14 E016 E036 F19
7SF2081	- 60	175	200	72 hrs at 150°C	9	0 *	+ 3 *	2 FK 606 A19 EF31 E036 F19 Z1. Z1 = Hardness 70+/-5 according to ASTM D1415

NR = No resistance \* Tested at 150°C

## 3.4 - CHEMICAL COMPATIBILITY TABLE

### REMARKS

Please note that operational conditions (temperature, pressure, friction, etc...), as well as combinations of several substances can modify, sometimes to a great extent, the aggressiveness of the fluids which are in contact with the seals.

It is therefore recommended that tests be conducted before a final selection is made.

(FOOD GRADE): Chemical substances whose name is followed by: "(food grade)" are those in contact with which it may be necessary to use a compound effectively meeting the "food grade" criteria. Please consult our services for applications of this type.

\* : All elastomers are affected by the presence of these substances: the specified product families are those whose resistance is the least poor.

See...: This concerns identical chemical substances, the tow designations being synonymous.

→ : When going to press with this document, we did not have the necessary information to recommended a family of elastomers.

Please contact us regarding these substances.

### ELASTOMERIC CODES

P = Nitrile (NBR)  
 N = Polychloroprene (CR)  
 DA = Polyacrylate (ACM)  
 DT = Hydrogenated Nitrile (HNBR)  
 DF = Fluorocarbon (FPM)  
 BU = Butyl (IIR)  
 EP = Ethylene Propylene (EPDM)  
 S = SBR  
 SL = Silicone (Q)  
 SF = Fluorosilicone (MFQ)  
 U = Polyurethane (AU-EU)  
 DC = Epichlorohydrin (ECO)

SUBSTANCE	Elastomer Group	SUBSTANCE	Elastomer Group
<b>A</b>			
Acetaldehyde.....	EP - SL	» Hydrofluoric.....	DF - EP
Acetamide.....	EP - BU - SL	» Fluoroacetic.....	EP - N
Aluminium acetate .....	EP	» Fluorosilicic.....	EP - N - P
» Amyl.....	→	» Formic.....	EP - S - N
» Benzyl.....	→	» Gallic.....	DF - SF
» Butyl diethylene glycol .....	See butyl diglycol acetate	» lactic.....	EP - S - P - N
» Butyl carbitol.....	EP - BU	» Maleic.....	DF - S
» Butyldiglycol.....	EP - BU	» Malic.....	P - N - S - SL
» Butyl cellosolve .....	See butyl glycol acetate	» Methacrylic.....	EP - N - DF
» Butyl.....	EP	» Methylacrylic.....	See Methacrylic acid
» Butyl glycol.....	EP - BU	» Muriatic.....	See hydrochloric acid
» Carbitol.....	See Diethylene glycol acetate	» Naphtenic.....	DF - P
» Cellosolve.....	See Ethyl glycol acetate	» Naphtoic.....	DF - P - SF
» Copper.....	EP - S - BU	» Nitric (diluted) .....	DF - EP
» Cyclohexyle .....	EP - BU	» Oleic.....	EP - P - DF
» Diethylene glycol .....	EP - N - P - DF	» Oxalic.....	EP - P - DF
» Diglycol.....	See diethylene-glycol acetate	» Palmitic.....	PB - N - EP
» Ethyl glycol.....	EP - BU	» Perchloric.....	EP - DF
» Dethyl.....	EP	» Phosphoric 20% .....	EP - DF
» Ethylene glycol.....	EP - BU	» Phosphoric 45% .....	EP
» Ethyl glycol.....	EP - BU	» Pure phosphoric.....	EP
» Glycol.....	See ethylene glycol acetate	» Picric in a solution .....	P - S - EP
» Isopropyl.....	EP - BU	» Pure picric.....	DF
» Methyl.....	EP - BU	» Propionic.....	BU - EP - DF
» Nickel.....	EP - S	» Prussic.....	See hydrocyanic acid
» Octyl.....	EP	» Pyroligneous.....	EP - N
» Potassium.....	EP - S - BU	» Salicylic.....	EP - P - S - DF
» Lead.....	EP - BU - S	» Stearic.....	EP - P - N
» Propyl.....	EP - BU	» Hydrosulfuric.....	EP - P
» Sodium.....	EP - S - BU	» Sulfurous.....	DF
» Vinyl.....	EP - BU	» Diluted sulfuric.....	EP - DF
» Zinc.....	EP - BU - S	» Sulfuric 60%.....	DF
Ethyl acetoacetate.....	EP - BU	» Tannic.....	EP - P - N - DF
Acetone.....	EP - S	» Tartaric.....	PB - EP - N - DF
Acetonitrile.....	N - EP - BU	» Trichloroacetic.....	EP - P - N
Acetophenone.....	EP - BU	Acrolein.....	EP - BU
Butyl aceto-ricinoleate or Butyl acetyl ricinoleate.....	EP - BU	* Butyl acrylate.....	EP - BU
Ethyl acetyl-acetate.....	See ethyl acetoacetate	» Cellosolve.....	See ethyl glycol acrylate
Acetylene.....	P - EP - DF	» Ethyl.....	EP - BU
Glacial acetic acid.....	EP - SL	» Ethylene glycol.....	EP - BU
» Acetic 30%.....	EP - N - SL	» ethylglycol.....	EP - BU
» Acrylic.....	DF	» methyl.....	EP - BU
» Adipic.....	P - SF	* Acrylonitrile.....	S - N
» Arsenic.....	EP - P - N - DF	Octyl adipate.....	PB - SF
» Benzoic.....	DF - SF - SL	Amyl alcohol.....	EP - BU - P
» Boric.....	EP - P - SL - DF	» Benzyl.....	DF - EP - BU - SF
» Hydrobromic.....	EP - DF - DF 200	» Butyl.....	EP - P - DF - S
» Butyric.....	EP	» Denatured.....	See methyl alcohol
» Carbonic.....	See carbonic anhydride	» Ethyl.....	EP - P - DF - S
» Chloroacetic.....	EP - N - DF	» Hexyl.....	PB - DF - S - EP
» Hydrochloric 37%.....	EP - DF	» Isobutyl.....	See butyl alcohol
» Chloropropionic.....	EP - BU - DF	» Isopropyl.....	See propyl alcohol
» Chromic.....	EP	» Methyl.....	EP - P - N - S
» Citric.....	All elastomers	» Octyl.....	DF - EP
» Hydrocyanic.....	P - EP - DF	» Ordinary.....	See ethyl alcohol
» cyclohexane carboxylic....	See naphthenic acid	» Propyl.....	EP - S - P
» Dichloroacetic.....	EP - DF	Acetic aldehyde.....	See acetaldehyde
» Fluoroboric.....	EP - P - N - S	» Acrylic.....	See acrolein
		» Benzoic.....	See benzaldehyde
		» Ethyl.....	See acetaldehyde
		Formic aldehyde.....	See formaldehyde
		» Hexyl.....	See hexanal
		Aluns.....	EP - S - P
		Ammonia (cold gas).....	EP - BU - P - SL - DT
		Ammonia (hot gas).....	EP - SL - BU - DT

SUBSTANCE	Elastomer Group	SUBSTANCE	Elastomer Group
Ammonia solution .....	See ammonium hydroxide	» Vinylidene .....	DF
Acetic anhydride .....	N - EP	» Zinc .....	EP
» Carbonic .....	EP - S - P - N	Creosotes .....	•
» Chromic .....	DF	Cresols .....	DF - BU
» Maleic .....	DF	Cumene .....	DF - SF
» Sulphurous .....	DF - EP	Cyanamide .....	•
» Sulphuric .....	DF - EP	Methyl cyanide .....	See acetonitrile
Aniline .....	EP - S - DF	» Potassium .....	EP - S - P
Asphalt .....	DF - P	» Sodium .....	EP - S - P
Nitrogen .....	All elastomers, but for impermeability BU - P	Cyclohexane .....	P - DF - DC - SF
		Cyclohexanol .....	N - DF - SF
		Cyclohexanone .....	BU
<b>B</b>		<b>D</b>	
Benzaldehyde .....	EP - BU	D.D.T. di (chloro-4 phenyl 1 trichloro-2,2,2 ethane) .....	BU-EP
Benzene .....	DF - SF	Decahydronaphtalene .....	DF - SF
Benzine .....	See benzene	Decalin See decahydronaphtalene	
Benzyl benzoate .....	DF - SF - EP	Decane .....	P - DF - SF
Butyl benzoate .....	EP - DF - SF	Diacetone .....	EP - BU
Ethyl benzoate .....	EP - DF - SF	Diacetone alcohol .....	EP - BU
Butter (food grade) .....	P - EP - N - SL	Dibromodifluoromethane .....	DF
Sodium bicarbonate .....	P - EP - BU	Dibromoethylene .....	DF
Beer (food grade) .....	P - N - EP - BU	Dibromomethane .....	DF
Carbon dioxide .....	See carbonic anhydride	Dibutylamine .....	•
Amyl borate .....	P - N	Dibutyl "cellosolve" .....	See dibutyl ethylene glycol
Sodium borate .....	EP - P - DF	Dibutyl "carbitol" .....	See dibutyl diethylene glycol
Borax .....	See sodium borate	Dibutyl diethylene glycol .....	EP - BU - S
Hydrogen bromide .....	DF - SF	Dibutyl glycol .....	See dibutyl ethylene glycol
Bromine water .....	DF - SF	Dibutyl phthalate .....	See Butyl phthalate
Bromobenzene .....	DF - SF	Dibutyl sebacate .....	See butyl sebacate
Methyl bromide .....	DF - SF	Dichloroethane .....	DF
Butadiene .....	P - DF	Dichlorobenzene .....	DF
Butane .....	P - DF	Dichlorodifluoromethane .....	DF
Butanol .....	See butyl alcohol	Dichloromethane .....	DF - EP
Butyl amine .....	SL - EP	* Dicyclohexylamine .....	P
Butyl carbitol .....	EP - P - BU	* Diethanolamine .....	P
Butyl cellosolve .....	EP - P - BU	Diethylamine .....	S - C - SL
Butyl glycol .....	EP - BU	Diethyl benzene .....	DF - SF
Butylene .....	DF - P	Diethylene glycol .....	EP - N - S
Butyraldehyde .....	EP - N - BU	Diisobutylene .....	P - DF
		Diisopropylbenzene .....	DF - SF
		Diisopropylcetone .....	EP - BU
<b>C</b>		Dibutyl ethylene glycol .....	EP - S - BU
Caprolactam .....	EP - BU	Dimethylamine .....	S - EP - SL
Ammonium carbonate .....	EP - P - S	Dimethylaniline .....	EP
Calcium carbonate .....	EP - P - S	Dimethylcetone .....	See acetone
Sodium carbonate .....	EP - P - S	Dimethylformamide .....	EP
Carbitol .....	EP - P - BU	Dimethylsulfoxyde .....	EP - S - SL
Cellosolve .....	EP - BU	* Dinitrotoluene .....	DF
Dry chlorine .....	DF - DC	Dioxane .....	EP - BU
Humid chlorine .....	DF - SF - DC	Dioxolane .....	EP
Chloroethane .....	See monochloorethane	Chlorine dioxide .....	DF - EP
Chlorobenzene .....	DF - SF	Dipentane .....	DF - P
Bromochloromethane .....	DF - SF - EP	Biphenyl .....	DF - SF
Ethyl chlorocarbonate .....	DF - SF	Chlorinated biphenyls .....	DF
Chloroform .....	DF - SF	Biphenyl oxide .....	EP - DF
Ethyl chloroformate .....	DF - SF	Carbon disulphide .....	DF - SF
Chloronaphtalene .....	DF - SF	Dowtherm A .....	DF
Chlorotoluene .....	DF		
Acetyl chloride .....	DF - SF	<b>E</b>	
» Aluminium .....	EP - S - P	Water (up to 70°C) .....	S - P - EP
» Ammonium .....	EP - S - P	Water (over 70°C) .....	EP - BU - DT
» Barium .....	EP - S - P	Waste water .....	EP - PB - BU - S
» Benzyl .....	DF - EP - BU - SF	Bleach .....	EP
» Calcium .....	EP - S - P	Oxygenated water .....	EP - DF - SL
» Cobalt .....	EP - S - P	Glycol epichlorohydrine .....	•
» Copper .....	EP	Aliphatic compounds .....	P - N - DF
» Ethyl .....	EP - P - DF	Aromatic compounds (up to 40% aromatics) .....	P - DC - DF - SF
» Ethylene .....	DF - SF - EP	Aromatic compounds (over 40% aromatics) .....	DF - SF
» Ferrous .....	EP - S - N - P	Turpentine oil .....	P - DF - SF
» Isopropyl .....	DF - SF	Ethane .....	P - DF - SF
» Magnesium .....	EP - S - P	Ethanol .....	See ethyl alcohol
» Mercurous .....	EP - S - P	Ethanolamine .....	EP - P - SL
» Mercuric .....	EP - S - P	* Ether .....	EP - BU - PB
» Methyl .....	DF - EP	Acetic ether .....	See ethyl acetate
» Methylene .....	See dichloromethane	Petroleum ether .....	P - DF
» Potassium .....	EP - S - P	Dibenzyl ether .....	EP - BU
» Propyl .....	DF	Dichloroisopropyl ether .....	U - DA
» Propylene .....	DF	Diethyl ether .....	See ether
» Sodium .....	P - EP - S	Isopropyl ether .....	N - P
» Sulphur .....	DF - SF	Ethylbenzene .....	DF - SF
» Nickel .....	EP - S - P		
» Stannous .....	P - S - DF		
» Thionyl .....	DF		
» Vinyl .....	DF - EP		



SUBSTANCE	Elastomer Group	SUBSTANCE	Elastomer Group
Diisopropylcetone.....	EP - BU	Mineral oils.....	P - DF - N - SF
Ethyl cellulose.....	P - N - EP	Olive oil (food grade).....	P - BU - EP - N
Ethylene.....	P - DF - SF	Castor oil (food grade).....	BU - P - EP - N
Ethylenediamine.....	EP - P - N - SL	Mineral oils for gear boxes.....	DA - DF - DT
Ethylene glycol.....	EP - S - BU	Engine mineral oils.....	P - DF - N - SF
Ethyl glycol.....	See ethylene glycol	Silicon oil/All elastomers, except SL	
Ethyl mercaptan.....	DF	Vegetable oils (food grade).....	P - EP
Ethyl benzene.....	DF - SF	Ester-based synthetic oils	
Ethyl-propyl-acrolein.....	BU	- phosphoric.....	•
<b>F</b>		- sebacic.....	P - DF
Fluorine.....	DF	- silicic.....	N - DF - SF
Fluorobenzene.....	DF - SF	Hydrazine hydrate.....	BU - EP
Fluoro-chloro-ethylene.....	DF	Hydrazine.....	BU - EP
Fluorotrchloromethane.....	DF	Hydrogen.....	All elastomers for
Aluminium fluoride.....	EP - S - N - P	Hydrogen sulphide.....	impermeability: BU - PB
Forane.....	See Freon	Hydroquinone.....	EP - BU - N - DT
Formaldehyde.....	EP - BU - DF - P	Calcium hypochlorite.....	EP - BU - N
Ethyl formate.....	EP - DF	Sodium hypochlorite.....	See bleach
Methyl formate.....	EP - BU - N	Ammonium hydroxide.....	EP - N - BU - DT
Formol.....	See formaldehyde	» Barium.....	EP - N - BU - DT
Freon 11.....	P - DF - N	» Calcium.....	P - EP - N - S - DT
» 12.....	P - N - U - DF	» Magnesium.....	EP - N - BU
» 13.....	EP - P - N - DF	» Potassium.....	EP - N - BU - DT
» 13 b 1.....	EP - P - N - DF	» Sodium.....	EP - N - BU - DT
» 21.....	N		
» 22.....	N		
» 31.....	EP - N - BU	<b>I</b>	
» 32.....	EP - N - BU	Iodoform.....	EP - BU
» 112.....	P - N - DF	Isooctane.....	P - DC - DF
» 113.....	P - N - DF - U	Isophorone.....	EP - BU
» 114.....	P - N - DF - U	<b>J</b>	
» 114 b 2.....	N - DF	Fruit juice (food grade).....	All elastomers
» 115.....	EP - P - N	Sweet juices (food grade).....	All elastomers
» 134 a.....	N - EP - DT	<b>K</b>	
» 142 b.....	N - DF	Kerosene.....	P - DF - DC - SF
» 152 a.....	EP - P - N	Krypton.....	All elastomers, but for impermeability: BU - P
» 218.....	EP - P - N	<b>L</b>	
» 502.....	N - PB - DF	Butyl lactate.....	P
» BF.....	P - N	Ethyl lactate.....	P
» C 316.....	P - N	Milk (food grade).....	P - N - EP - BU
» C 318.....	EP - P - N	<b>M</b>	
» MF.....	P - DF	Butyl maleate.....	EP - BU
» TA.....	EP - P - N - U	Heating oil.....	P - DF - SF
» TC.....	EP - P - N - U	Molasses.....	S - EP - BU
» TF.....	P - N	Sodium metaphosphate.....	EP - BU - P
Fuel oil.....	P - DF - SF	Menthol.....	S
Furan.....	EP	Mercury.....	All elastomers
Furfural.....	EP - BU - N	* Methyl methacrylate.....	SL
* Furfuran.....	EP - BU	Methane.....	P - DC - DF - DT
Furfurol.....	BU - S - EP	Methanal.....	See formaldehyde
<b>G</b>		Methanol.....	See Methyl alcohol
Gas oil.....	P - DF - DC - SF	Methyl butyl ketone.....	EP
Carbonic gas.....	See carbon anhydride	Methyl carbitol.....	•
Coal gas.....	DF - SL - SF	Methyl cellosolve.....	BU - EP
Natural gas.....	P - DF - DC	Methylcyclopentane.....	P - SF - DF
Blast furnace gas.....	DF - P - SL	Methyl ethyl ketone.....	EP - BU
Gelatine (food grade).....	P	Methyl isobutyl carbitol.....	•
Glucose (food grade).....	All elastomers	* Methyl isobutyl ketone.....	EP
Glycerine.....	See glycerol	Monoethanolamine.....	EP - BU - SL
Glycerol.....	EP - S - N - P	Monochlorethane.....	DF - EP - P - SF
Glycol.....	See ethylene glycol	Monochlorobenzene.....	DF - SF
Mineral greases.....	P - N - DF - DC - DT	<b>N</b>	
Animal greases (food grade)....	EP - P - N	Naphta (solvent).....	P - DC - DF - SF
Vegetable greases (food grade)	EP - P - N	Naphtalene.....	DF - U - SF
<b>H</b>		Naphtaline.....	See naphtalene
Helium.....	All elastomers, but for impermeability: BU - P	Aluminium Nitrate.....	S - EP - P
Hexachloroethane.....	DF	Ammonium.....	» EP - P - S
Hexachlorobenzene.....	DF	Calcium.....	» EP - P - S
Hexachlorocyclohexane.....	DF	Ferric.....	S - P - EP
Hexachlorophene.....	DF	Lead Nitrate.....	S - EP - P
Hexafluoroethane.....	•	Potassium.....	» EP - P - S
Sulphur hexafluoride.....	N - EP - BU	Sodium.....	» EP - S - BU
Hexanal.....	EP - BU - SL	Acetic Nitrile.....	See acetonitrile
Hexanol.....	See hexyl alcohol	Acrylic Nitrile.....	See acrylonitrile
Hexane.....	P - DF - N	Ammonium.....	» EP - BU - S
Hexene.....	P - DF - N		
Anilin oil.....	EP - BU		
Anthracene oil.....	DF		
Cotton oil.....	P - EP - SL - DF		
Creosote oil.....	P - EP - BU		
Linseed oil.....	EP - P		

SUBSTANCE	Elastomer Group	SUBSTANCE	Elastomer Group
Nitrobenzene .....	DF - EP	Skydrol 500 B.....	EP - BU
Nitroethane .....	EP - S - BU	Ethyl silicate .....	EP - P - N - DF
Nitromethane .....	EP - S - BU	Sodium silicate .....	EP - P - N - DF
Nitropropane .....	EP - S - BU	Silicones (oils and greases).....	All elastomers, except SL
Nitrotoluene .....	DF	Naphta solvent.....	See naphta
		Lye .....	See sodium hydroxide
<b>O</b>		Sulphur .....	EP - BU - S - DF
Octane .....	P - DF - SF	Butyl stearate .....	P
Butyl oleate.....	P - DF	Diethylene glycol stearate.....	P
Methyl oleate.....	P - DF	Stearin .....	S - EP - P - N
Ethyl oxalate .....	→	Styrene .....	DF - SF
Carbon oxide .....	P - EP - BU	Styrolene .....	See Styrene
Diphenyl oxide.....	SF - DF	Aluminium sulphate.....	S - EP - P
Ethyl oxide.....	See ethyl ether	Ammonium.....	S - EP - P
* Ethylene oxide.....	EP - BU - SL	» Barium .....	S - EP - P
Mesityl oxide .....	EP - BU	» Copper .....	EP
Propyl oxide .....	→	» Ferric .....	S - EP - P
Propylene oxide .....	→	» Magnesium .....	S - EP - P
Oxygen (cold gas).....	EP - BU - DF - SL	» Nickel.....	S - EP - P
Oxygen (hot gas).....	SL - DF	» Potassium.....	S - EP - P
Oxygen (liquid).....	SL - DF - SF	» Sodium .....	S - EP - P
Ozone .....	Contact our services and indicate the concentration.	» Zinc.....	S - EP - P
		» Calcium.....	S - EP - P
		Carbon sulfide.....	See carbon disulfide
<b>P</b>		<b>T</b>	
Paradichlorobenzene.....	DF - SF	Tannin .....	S - EP
Paraffin .....	P - N - DF	Teepol .....	EP - S - P
Paranitrochlorobenzene.....	→	Terpene .....	DF
* Pentane .....	P - DF	Terpineol .....	DF
Sodium perborate .....	EP - BU	Terpinolene.....	DF
Perchloroethylene.....	See tetrachloroethylene	Tetrabromoethane .....	DF - SF
Perchlorobenzene.....	DF	Tetrabromomethane .....	DF - SF
* Nitrogen peroxide.....	BU - EP	Acetylene tetrabromide .....	DF - SF - EP
Benzoyl peroxide.....	→	Carbon tetrabromide.....	DF - SF
Hydrogen peroxide .....	See oxygenated water	Tetrachloroethane.....	DF - SF
Sodium peroxide.....	EP - BU - DF	Tetrachloroethylene .....	DF - SF
Ammonium persulfate.....	EP - BU	Tetrachloromethane .....	DF - SF
Petrol .....	P - DF - SF	Acetylene tetrachloride.....	DF - SF
Phenetol (Phenyl ethyl ether)...	→	Carbon tetrachloride .....	DF - SF
Phenol .....	DF - EP	Titanium tetrachloride.....	DF - SF
Phenylhydrazine.....	S - DF	Tetrahydrofuran .....	EP - BU
Phorone.....	EP - BU	Tetrahydronaphtalene .....	DF - SF
Phosgene.....	→	Tetrahydrothiophene.....	→
Aluminium phosphate .....	S - EP - P	Tetralin .....	DF - SF - P
» Ammonium.....	S - EP - P	Thiophene .....	→
» Sodium .....	S - EP - P	Sodium thiosulfate .....	EP - S - P
» Tributyl .....	EP - BU	Thymol .....	EP
» Tricresyl .....	EP - BU	Toluene .....	DF - SF
» Trioctyl.....	EP - DF	Toluol .....	DF - SF
Butyl phthalate (or dibutyl phthalate) .....	DF - SL - EP	Triacetin .....	EP - P - N
» Octyl.....	P - EP	Glycerin triacetate .....	EP - P - N
(or dioctyl) .....	P - EP	Tributylphosphate.....	See tributyl phosphate
» Methyl.....	EP - BU	Trichloroethane .....	DF - SF
(or dimethyl) .....	EP - BU	Trichloroethylene.....	DF - SF
Pinene .....	DF - P	Trichlorofluoromethane .....	DF - SF
Piperidine.....	→	Arsenic trichloride .....	P - N
Teraethyl lead.....	P - DF - SF	Tricresylphosphate.....	See tricresyl phosphate
Polyglycols .....	EP - S	Triethanolamine .....	P - EP - N - BU
Potash .....	Sett potassium hydroxide	Triethylamine.....	N
Propane .....	P - DF - DC	Chlorine trifluoride.....	DF - SF
Propene .....	DF - P - DC	Trinitrotoluene .....	DF - N - SF
Propylene.....	See propene	Trioctylphosphate .....	See trioctyl phosphate
Propylene glycol.....	S - EP - BU		
Pydraul F 9.....	DF - EP - SL	<b>V</b>	
» 150.....	DF - EP - SL	Steam .....	BU - EP - DT
» A 200.....	DF - EP - SL	Vaseline .....	PB - DF - SF
Pyralènes (PCBs).....	DF - SL - PA	Wine (food grade) .....	S - EP - N - P
Pyridine .....	BU - EP	Vinegar (food grade).....	S - EP - N - P
Pyrrrole .....	SL - SF		
		<b>W</b>	
<b>S</b>		Whisky (food grade) .....	S - EP - N - PB
Lard (food grade).....	P - N - DF	White spirit.....	P - DC - DF - SF
Methyl salicylate .....	EP - BU		
Benzyl sebacate (or dibenzyl sebacate).....	DF - EP	<b>X</b>	
Butyl sebacate (or dibutyl sebacate).....	DF - EP	Xenon .....	All elastomers, but for impermeability: BU - P
Ethyl sebacate (or diethyl sebacate).....	DF - EP - SL	Xylene .....	DF - SF
Octyl sebacate (or dioctyl sebacate).....	DF - EP	* Xylidine .....	P

# 4 - TYPES OF O-RING INSTALLATION

## 4.1 - VOLUME OF THE GROOVE

As rubber is deformable but also incompressible, the groove volume must always be greater than the installed O-Ring volume (groove at minimum tolerances, O-ring at maximum tolerances, plus possible swelling of the rubber compound when in contact with a fluid).

## 4.2 - DEFLECTION OF THE SEAL

This can occur in one of two ways:

### Radial type

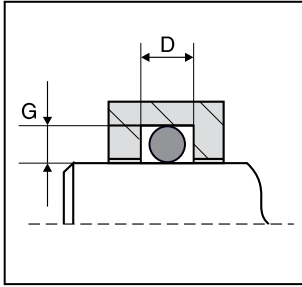


Figure 5  
piston / bore assembly

### Axial type

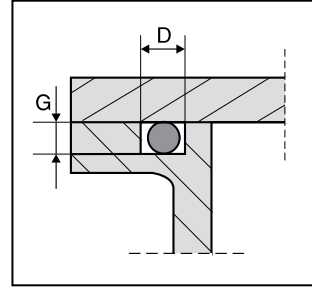


Figure 6  
cover assembly

The deflection is expressed in %

$$\% \text{ deflection} = \frac{\text{cross-section } \emptyset - \text{groove depth } G}{\text{cross-section } \emptyset} \times 100$$

Deflection varies according to the type of assembly and the application.

- It should ensure contact with the seal in the absence of pressure.
- Contact must be maintained in all dimension tolerance configurations of both the assembly and seal.

## 4.3 - GROOVE WIDTH D AND GROOVE DEPTH G

In order to maintain sufficient volume in the groove, the required width of the groove will be larger when the initial level of deflection is higher.

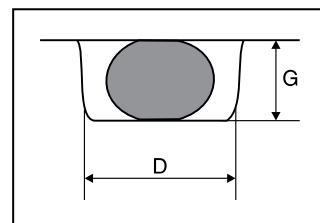


Figure 7

## 4.4 - INSIDE DIAMETER OF THE SEAL

In order to avoid pinching the O-Ring in assemblies where the groove is located on a piston, it is recommended to allow for the stretching of the O-Ring. In practice, a 3% stretch is sufficient, but it is possible to go as high as 10%.

The stretch causes a reduction in the diameter of the cross-section (for X% of stretch, the reduction of the cross-section is approximately  $\frac{X\%}{2}$ ).

If the grooves are machined in the bore, the seals should be fitted with a slight compression on their outside diameter in order to facilitate the installation of the piston assembly into the bore. For this type of assembly, the dimension requirements are usually more stringent.

## 4.5 - CROSS-SECTION DIAMETER

Except in cases of possible over-fill in the groove, use similar cross-section diameters as for "R" series O-rings.

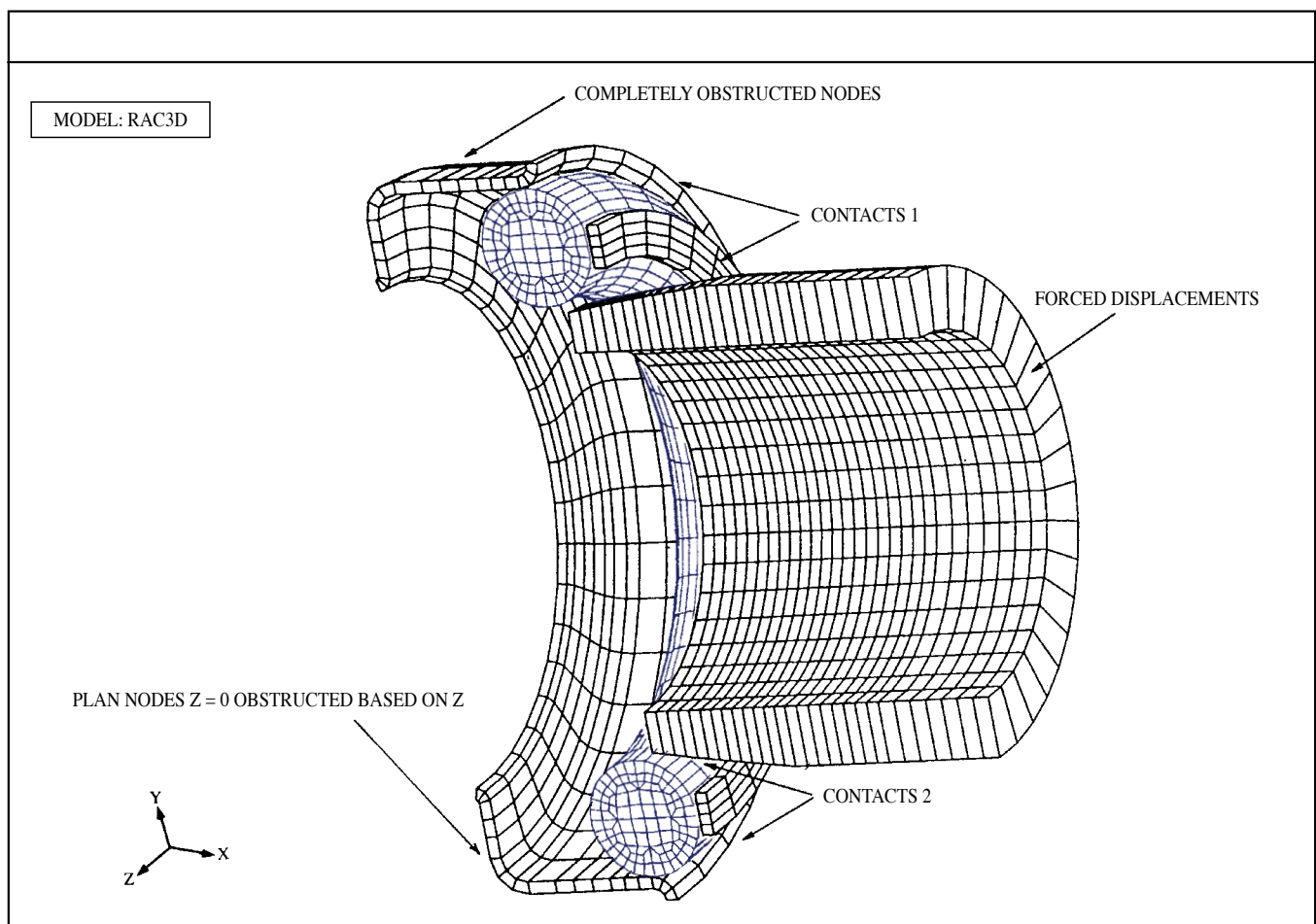
When the diameter of the cross-section increases for a same inside diameter.

NOTE: The formulas used to calculate the dimensions of the groove are presented in section 5.

**Important: Whenever possible, choose an "R" dimension due to the optimized inside  $\emptyset$  ratios of these seals.**

inside  $\emptyset$  of these seals  
 $\emptyset$  cross-section

	increases	decreases
Longevity (resistance to wear)	x	
The seal's resistance to twisting	x	
The influence of tolerances on the deflection level		x



3D simulation of an assembly consisting of a tube in a connector, in order to carry out finite element calculations.

# 5 - INSTRUCTIONS FOR THE DIFFERENT TYPES OF INSTALLATION

## 5.1 - STATIC APPLICATIONS

### 5.1.1 - GROOVE DIMENSIONS AND SHAPE

#### Rectangular grooves

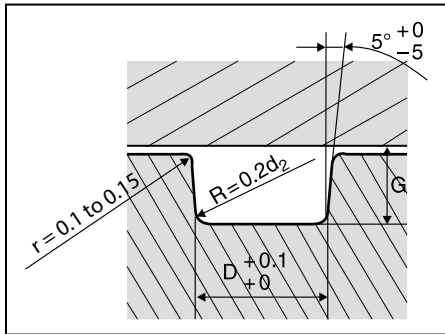


Figure 8

Dimension R is specified in relation to  $d_2$  (cross-section  $\emptyset$  of the O-Ring).

The D and G dimensions are indicated on pages 25 and 26 of this catalogue.

The groove may either have perpendicular walls or include an outward angle of up to  $5^\circ$ , which is then added to the dimensions specified for the width of the groove.

#### Dovetail grooves

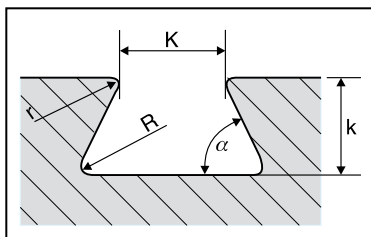


Figure 9

Cross-section diameter of the O-ring in mm	K - 0.05 in mm	k - 0.05 in mm	R in mm	r in mm	$\alpha$ in degree
1.78	1.27	1.42	0.2	0.1	$60^\circ$
2.62	2.03	2.16	0.3	0.15	$60^\circ$
3.53	2.82	2.92	0.3	0.15	$60^\circ$
5.33	4.9	4	0.5	0.25	$60^\circ$
6.99	6.4	5.2	0.7	0.3	$60^\circ$
8.00	7.3	6	0.8	0.4	$60^\circ$

To be used when the "O-RING" seal must be retained in its groove in order to keep it from falling out during assembly or disassembly.

#### Triangular grooves

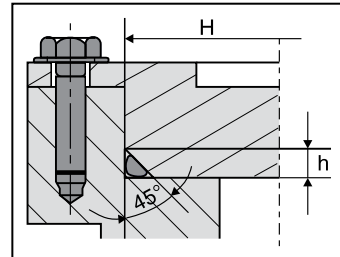


Figure 10

The outside diameter of the O-Ring will be slightly greater than the outside diameter of the chamfered section, dimension H, on which it will seat.  $h = \text{cross-section } \emptyset \text{ of the O-Ring } d_2 \times 1.35 \text{ to } 1.40$ .

#### Cover type assembly

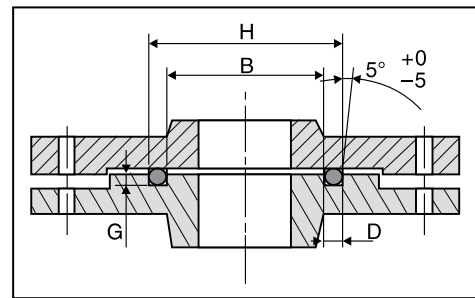


Figure 11

If pressure is exerted:

- **from the inside towards the outside:** the O-Ring seal should have an outside diameter which is slightly greater than dimension H, against which it will seat.

- **from the outside towards the inside:** the O-Ring should be fitted slightly stretched, seating itself against dimension B.

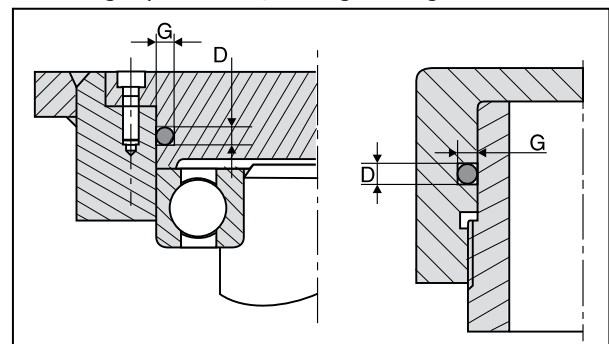


Figure 12

In all cases illustrated above, the edges should be radiused or chamfered.

In order to determine dimensions D and G, please consult the dimensions section of the catalogue. In the case of small inside diameters, a two-part groove is sometimes required to fit the O-Ring inside the bore. O-Rings of this type are identified by the symbol  $\blacktriangle$  in the dimensions catalogue.

## 5.1.2 - CLEARANCE AND EXTRUSION

In the case of Figure 13, the chances for extrusion are nil since there is no pressure. In cases of elevated pressure, one should pay special attention to the flatness of the assembled components and to the overall rigidity of the assembly.

Moreover, in assemblies set out in figure 13, clearance must be held in accordance with the operational pressures and the hardness of the rubber compound used.

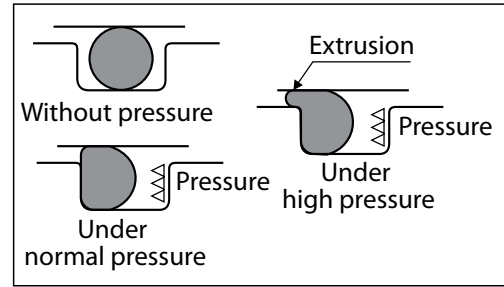


Figure 13

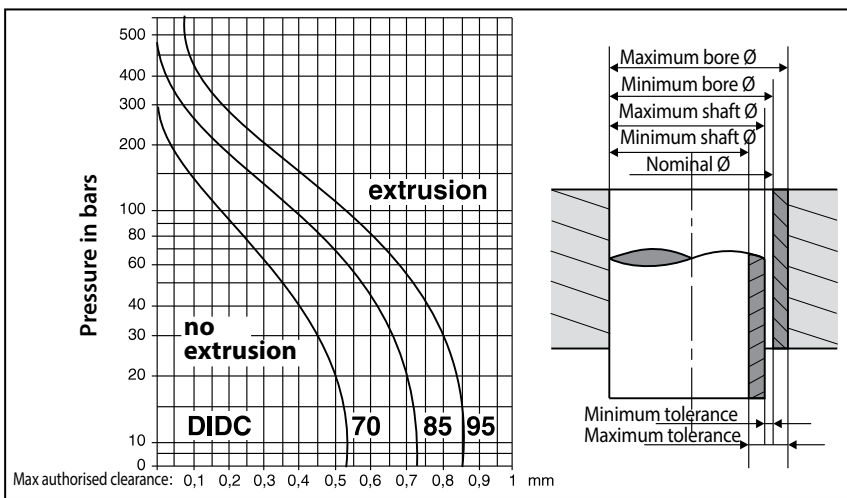


Figure 14

O-ring extrusion diagram according to the hardness of the rubber, tolerances and pressure.

Pressures under 80 bars:  
ISO H7 f7 tolerances can be used.

Pressures over 80 bars:  
We recommend ISO H7 g6 tolerances.

However, for large diameters (110/120mm and upwards), do not exceed a diametral clearance of .07/.08 mm.

If there is risk of extrusion, a harder rubber compound should be used and diametral clearance reduced or an anti-extrusion washer fitted. (See Section 5.2.3).

An increase in the hardness of rubber compounds increases the efforts required for assembly.

It should be noted that pressure fluctuations, a temperature increase and/or poor chemical resistance of the seal to a fluid (section 3.4) could cause the O-Ring to extrude.

## 5.1.3 - SURFACE FINISH

For assemblies which are fully static, where all the surfaces in contact with the O-Ring remain fixed, a surface finish between 0.8 and 1.6 micrometres shall be sufficient.

In cases where the O-Ring is subject to internal micro-friction (or from the oring groove) during changes in shape caused by:

- pressure variations in the fluid to be sealed,
- temperature variations,

We recommend a surface finish of 0.4 micrometres Ra.

If a very high level of sealing is sought with gasses, the quality of the surface finish should be particularly high (0.2 to 0.4 micrometres Ra). The same is true to obtain a high vacuum.

## 5.2 - DYNAMIC APPLICATIONS WITH RECIPROCATING MOVEMENT

### 5.2.1 - GROOVE DIMENSIONS AND SHAPE

The shape of the groove is, usually rectangular and the indications given in Figure 8 apply.

O-Rings can indiscriminately be fitted on the piston or inside the bore.

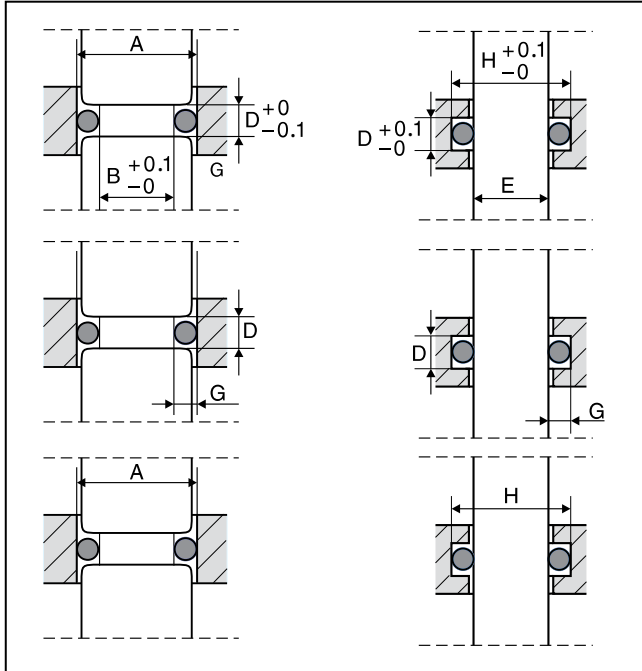


Figure 15

Fitted onto a piston	Fitted inside a cylinder
$A = \varnothing$ of the cylinder	$H = \varnothing$ at the bottom of the groove in the cylinder
$B = \varnothing$ at the bottom of the groove	$E = \varnothing$ of the piston rod
$G = \frac{A - B}{2}$	$G = \frac{H - E}{2}$
$D =$ width of the groove in both cases	

To determine the D and G dimensions, please refer to the seal dimension page starting at page 31.

Groove dimensions are specified for every seal listed in the seal dimension pages starting on page 31.

Deviations may be considered for each application to favour one or several operational criteria (for example: reduced effort required for assembly, low friction, etc.).

### 5.2.2 - CLEARANCE AND EXTRUSION

#### IMPORTANT

Under no circumstances should an O-Ring used for sealing purposes also be used as a centring device in a dynamic assembly. It is therefore mandatory that any dynamic component be centred by means of bearing surfaces.

The recommendations given in the section covering static sealing uses remain applicable.

It should be noted that rapid cycling and long strokes are conducive to seal extrusion.

### 5.2.3 - ANTI-EXTRUSION WASHER ("BACK-UP RING")

Back-up rings are made of PTFE (teflon), a substance which possesses excellent chemical resistance as well as a very low friction coefficient. They increase the useful life of seals operating in high pressure environments.

#### a. Description of back-up rings

Anti-extrusion washers ("back-up rings") are either closed-loop- or split rings with a rectangular cross section. They are both easy to install and remove.

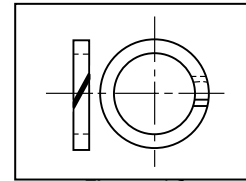


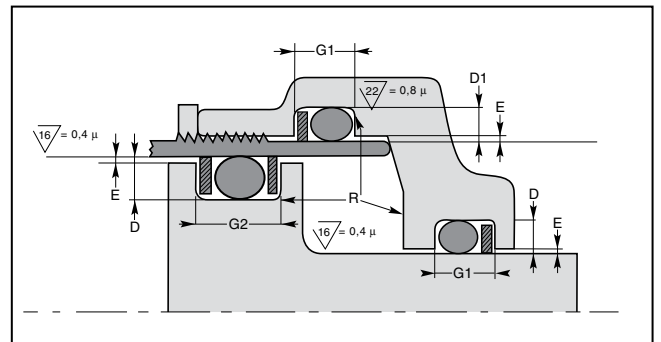
Figure 16

#### b. Installation of back-up rings

The following table specifies the width of the groove required for the installation of either one or two back-up rings (see diagram).

cross-section $\varnothing$	Width of the	$G2 + \frac{0.25}{-0.2}$	R	E max.	D or D1
1.78 - 1.9	3.9	5.26	0.4	0.13	1.55
2.62 - 2.7	4.8	6.22	0.5	0.13	2.3
3.53 - 3.6	6.10	7.72	0.7	0.15	3.2
5.33 - 6.35	8.6	10.77	1	0.15	4.75
6.99 - 7	12.20	14.71	1.4	0.18	6.1

#### GROOVE DIMENSIONS



### 5.2.4 - SURFACE FINISH

In order to ensure the longevity of the O-ring and to maintain its sealing properties. It is recommended to use a smooth lead in with either a polished or burnished finish to remove sharp edges or burrs.

For mating surfaces, including groove walls and bottom, we recommend a mean roughness between 0.2 to 0.4 micrometres Ra.

## 5.3 - LOW SPEED ROTARY APPLICATIONS

Due to thermal effects induced by the rotation speed, the use of O-Rings is generally only recommended for low speed or oscillating movements (e.g. valve operation).

It is preferable to install seals within the bore.

The rectangular cross-section groove should be machined in accordance with the following guidelines:

- Select an O-Ring with an inside diameter ( $d_1$ ) 5% larger than the maximum diameter of the shaft (E).
- The O-Ring must be subject to a 5% radial compression. The depth of the groove (G) must therefore be approximately 5% smaller than the O-Ring's cross-section diameter  $d_2$ .

The width of the groove (D) should be approximately 5% greater than the O-Ring's cross-section diameter  $d_2$ .

### Tolerances and clearances

Taking into account the low level of deflection to which the O-Ring is subject, it is recommended to limit the tolerance for the diameter of the bottom of the groove to  $H \pm 0.05$  mm

The applicable guidelines for radial clearances are the same as for dynamic applications, i.e. ISO H7 g6.

The required surface finishes are those recommended for dynamic applications, as set out above.

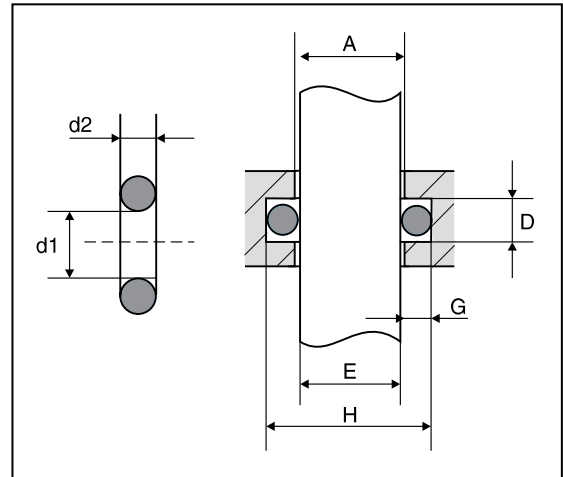


Figure 18

## 5.4 - FLOATING INSTALLATIONS

### Groove dimensions and shape

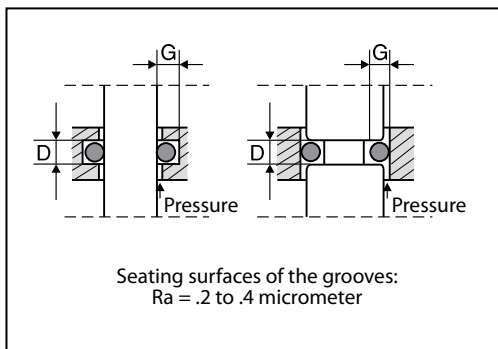


Figure 19

For applications involving low air pressures (10 bars maximum), a floating O-Ring installation may be used since it has the advantage of presenting a low friction coefficient, in which case:

- The grooves are machined so that the cross-section of the O-Ring will not be compressed when the assembly is at rest, without pressure.

The inside or outside diameter of the O-Ring permanently rests on the floating section.

The chart below specifies the "D" and "G" dimensions for the most commonly used cross-section diameters " $d_2$ ". For intermediate " $d_2$ " cross-section diameters, use as a guide)

$d_2$ (mm)	1.90	2.70	3.60	5.33	6.99
D (mm)	2.00	2.80	3.75	5.50	7.25
G (mm)	2.20	3.00	4.00	5.80	7.50

### Selection of O-Rings for floating assemblies

#### Installation on the piston:

Outside  $\varnothing$  of the O-Ring = bore  $\varnothing$  + 1% to 2% approximately

#### Installation inside the bore:

Inside  $\varnothing$  of the O-Ring = piston  $\varnothing$  - 1% to 2% approximately

### Tolerances - Radial clearance - Surface finishes:

Use the guidelines specified for reciprocating movement installations.



# 6 - RECOMMENDATIONS FOR ASSEMBLY

## 6.1 - CHAMFERS

Lead-in chamfers are essential to avoid damaging the O-Rings during installation.

**Examples:**

- A - Pinching of the seal due to the absence of chamfers
- B and C - Recommended chamfers
- Recommended radius

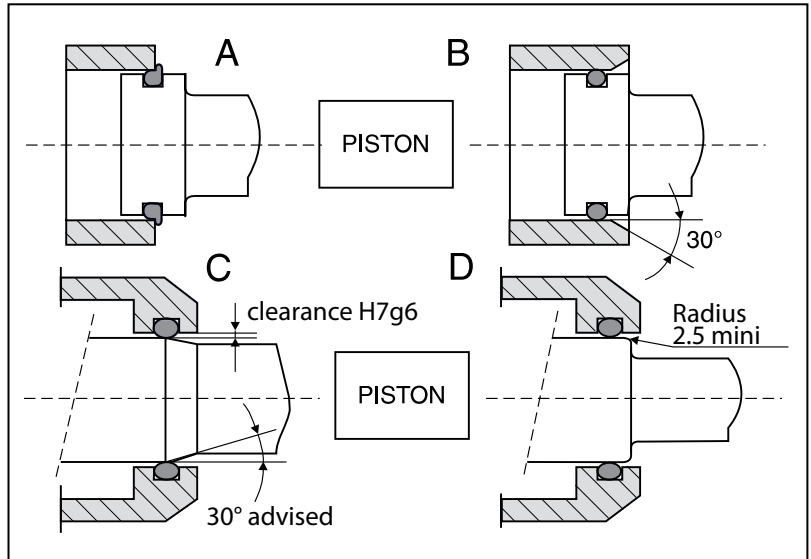


Figure 20

**Sizing:**

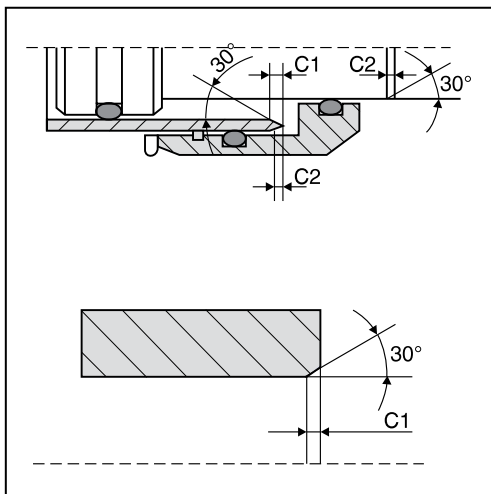


Figure 21

Diameter cross-section (mm)	C1 (in cylinder)	C2 (on piston)
cross-section ≤ 3.60	1.50 mm	2.50 mm
3.60 < cross-section ≤ 5.33	2.50 mm	4.00 mm
5.33 < cross-section	3.00 mm	4.00 mm

## 6.2 - O-RING INSTALLATION RECOMMENDATIONS

**• Before installation**

Make sure that all components are clean. The presence of foreign particles could compromise the effectiveness of the seal and cause damage.

Hutchinson Le Joint Francais is able to provide different levels of cleanliness depending on your needs, from a standard level to the use of a class 10.000 cleanroom.

In each case, special packaging guarantees the level of cleanliness during transport.

## ● Installation

Particular care should be taken to avoid working in dusty environments.

Use blunt tools, without sharp edges.

Install the O-Ring into its groove by sliding it in and:

- avoid all rough areas, threads or sharp ridges (use conical or cylindrical installation sleeves, as shown in the accompanying illustration),
- avoid deforming the O-Ring through rolling, oscillation or twisting,
- avoid subjecting the O-Ring to excessive tension.

Make sure that the O-Ring is positioned properly, making particularly sure that there is no twisting of the O-ring cross-section.

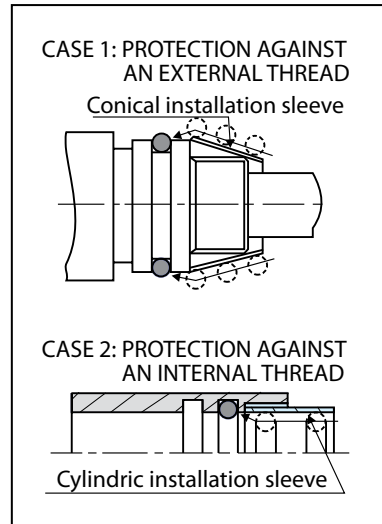


Figure 22

## 6.3 - AUTOMATED INSTALLATION

O-Rings can be supplied in special packaging which prevents distortion during handling and storage, in order to improve the installation of O-Rings by automatic assembly equipment.

## 6.4 - O-RING LUBRICATION AND SURFACE TREATMENTS

Hutchinson Le Joint Francais has developed many surface treatments that facilitate installation, reduce friction and abrasion for dynamic applications.

The use of unsuitable oils or greases may lead to a loss of sealing properties.

Several solutions are available whether you wish to improve automatic seal assembly and/or reduce fitting efforts,

A few of the available treatments are listed below:

- Powders (talcum, molykote)
- Films (Lubrifiilm)
- Varnishes (Lubricoat)
- Oils
- Rubber compound with improved friction coefficient

### Most often used treatments:

**Lubrifiilm SG:** external treatment reducing assembly efforts in static applications.

**Lubrifiilm FP:** external treatment for O-rings, four-lobed seals and other sections. It leaves an anti-adhesive film on the surface of the seal which enables easy assembly by reducing significantly the assembly effort.

**Lubricoat AN:** dry varnish for high performance and reduced assembly efforts (static and semi-dynamic applications).

Many other treatment possibilities are also offered (heat-resistant, food grade, etc.).

# 7 - STORAGE AND PRESERVATION OF O-RINGS

As is the case for all rubber components, the following procedures should be followed to achieve optimum storage conditions:

## LIGHT

Avoid direct exposure to sunlight or strong artificial light.

## TEMPERATURE

Maintain the storage room at a temperature between 5 and 30°C. Avoid storage in the proximity of a heat source (heater, lightbulb, etc.)

## ENVIRONMENTAL CONDITIONS

We recommend a level of relative humidity between 45% to 70%.

The air should be free of aggressive vapours (solvents, acids, etc.). Ionizing radiation and ozone are particularly detrimental, thus avoid the proximity of any device which is likely to produce ozone (mercury vapour lights, high voltage equipment, devices generating sparks, etc.).

## DEFORMATION

Rubber O-Rings should be stored with as little deformation as possible.

Serious deformations occurring during storage could become permanent; any stress on the seal will also favour the impact of ozone.

Avoid stacking and folding the packaging.

## NOTE

LJF developed special packaging which prevents the distortion of seals needed for automatic installations. Please contact our technical service.

## STANDARDISATION

We inform you of the existence of the NFT 46-022 "Information booklet" dated from July 1970, issued by AFNOR (French standardisation association) entitled "Rubbers and Analogous Elastomers: Storage Conditions of Vulcanised Elastomer-Based Products", as well as the standard NFT 47-507 and the international standard ISO 2230-2002 which specifically pertain to the storage and packaging of O-rings.



*Over 7,000 references are available in stock.*

# 8 - QUALITY

## 8.1- GENERAL INFORMATION

The production of O-Rings involves a number of processes including moulding, finishing, post curing, verification and packaging.

Each phase is carried out with the same philosophy aimed at reducing risk, and promoting consistency.

## 8.2 - CONTROL CHARACTERISTICS

There are 3 main factors which should be evaluated to determine the conformity of an O-Ring:

- the compound characteristics,
- the dimensions characteristics
- the visual quality.

- The compounds are tested in accordance with the standards in force.

- Our tolerances comply with standard ISO 3601-1 class B for standard seals.

These standard tolerances are defined by the curve in the table opposite.

The nominal dimensions of the O-Rings listed in the dimensions catalogue are applicable to PB 701 and PC 851 compounds.

Other elastomer families, having different shrinkage characteristics when produced using the same tools as above, may have slightly lower mean dimensions.

Given the elastic properties mentioned previously, these differences will generally have no impact on the function of the O-Ring.

If necessary, our technical service is at your disposal to develop and build special tools in order to produce O-Rings with highly specific characteristics.

The final Production verification make it possible to validate the product's conformity to customer requirements, as well as register the manufacturing batches which ensure product traceability.

### Tolerances for the inside diameter (d<sub>1</sub>)

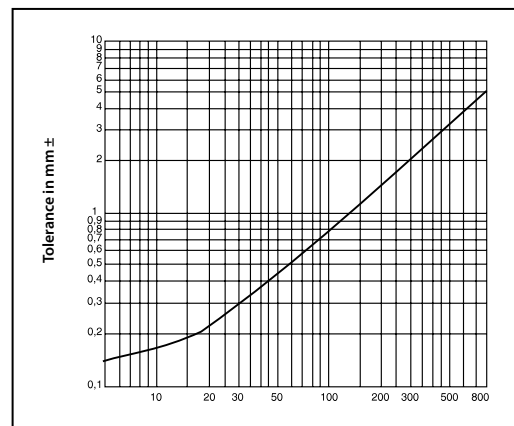
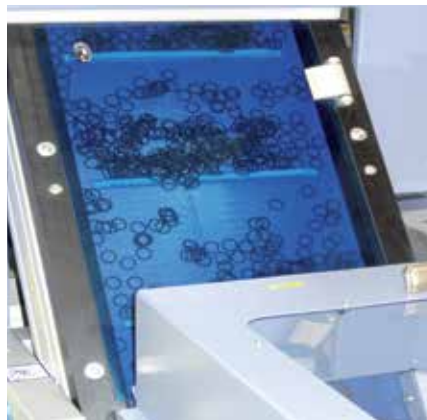


Figure 23

### Tolerances for the cross-section diameter (d<sub>2</sub>)

above	up to	tolerances
0 mm	2.64 mm	± 0.08 mm
2.64 mm	3.54 mm	± 0.09 mm
3.54 mm	5.29 mm	± 0.10 mm
5.29 mm	6.98 mm	± 0.13 mm
6.98 mm	8.39 mm	± 0.15 mm
8.39 mm	10.25 mm	± 0.20 mm



Control of O-rings with dedicated LJF tools.

## 8.3 - SURFACE FINISH

Table – Maximum acceptable limits for surface imperfections of O-rings (Norms NFT 47-502, DIN 3771 and ISO 3601-3).

Category of surface imperfection	Schematic illustration of surface imperfection	Dimensions limits	Maximum defect limits class N O-rings cross-section diameter d2				
			> 0,8 <sup>b</sup> ≤ 2,25	> 2,25 ≤ 3,15	> 3,15 ≤ 4,50	> 4,50 ≤ 6,30	> 6,30 ≤ 8,40 <sup>b</sup>
<b>Offset</b> (Off register and mismatch)		<i>e</i>	0.08	0.10	0.13	0.15	0.15
<b>Combined flash, offset and painting line projection</b>		<i>x</i>	0.10	0.12	0.14	0.16	0.18
		<i>y</i>	0.10	0.12	0.14	0.16	0.18
		<i>a</i>	If the flash can be distinguished, it must not exceed 0.07mm.				
<b>Backrind</b>		<i>g</i>	0.18	0.27	0.36	0.53	0.70
		<i>u</i>	0.08	0.08	0.10	0.10	0.13
<b>Excessive trimming</b> (Radial machining marks are not permissible)		<i>n</i>	Departure from a circular cross-section due to trimming is allowed provided that the resultant surface is smoothly blended and is within these tolerance limits for d <sub>2</sub>				
<b>Flow marks</b> (Radial orientation of flow marks is not permissible)		<i>v</i>	1.5	1.5	6,5	6,5	6,5
		<i>k</i>	0.08	0.08	0.08	0.08	0.08
<b>Non-fills and indentations</b> (including parting line indentations)		<i>w</i>	0.6	0.8	1	1.3	1.7
		<i>t</i>	0.08	0.08	0.10	0.10	0.10

<sup>a</sup> or 0.05 times less than the O-ring diameter (d1) by using the highest value.  
<sup>b</sup> The defect limits for cross-sections <0.8 mm or >8.40mm must be agreed upon between the manufacturer and the customer.  
<sup>c</sup> Rounded angles

### NOTE

These standards define maximum defect limits which do not impact usual industrial applications.

Our standard O-rings comply with all of these provisions. If necessary (specifications, special application, etc.), we are able to cater to more stringent requirements. Please contact us.

# 9 - LIST OF DIMENSIONS

## 9.1 - RECOMMENDATIONS FOR ASSEMBLY

### INSTALLATION OF THE O-RING IN A BORE

Use pages 27 to 42 where the seals are classified by inside diameter in increasing order. You will find the LJF product codes for the standard rubbers in this list.

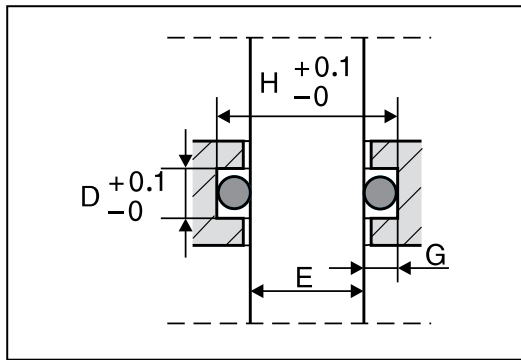


Figure 24

### INSTALLATION OF THE O-RING ON A PISTON

Use pages 43 to 50 where the seals are classified by assembly-bore dimensions in increasing order. Refer to pages 27 to 42 to find the corresponding LJF code.

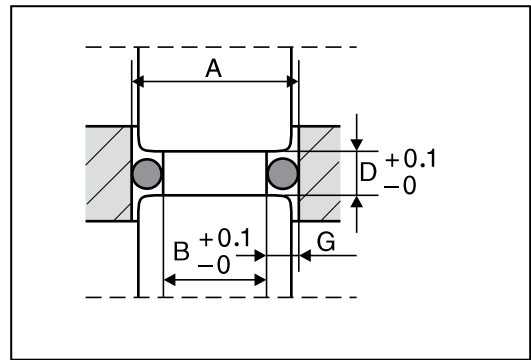


Figure 25

### DETERMINATION OF THE GROOVE IN THE BORE OR PISTON

In this table, we propose dimensions that are suitable for most applications using the most widespread cross-section diameters.

cross-section $\varnothing d_2$	static		dynamic	
	G	D + 0.10 - 0	G	D + 0.10 - 0
1.00	0.78	1.4	0.80	1.3
1.25	0.98	1.7	1.00	1.6
1.50	1.18	2.1	1.20	2.0
1.60	1.26	2.2	1.29	2.1
1.78	1.41	2.4	1.45	2.3
1.90	1.51	2.6	1.56	2.5
2.00	1.59	2.7	1.65	2.6
2.20	1.75	3.0	1.84	2.8
2.40	1.91	3.3	2.01	3.1
2.50	2.00	3.4	2.11	3.2
2.62	2.10	3.6	2.21	3.3
2.70	2.16	3.7	2.28	3.4
3.00	2.42	4.1	2.57	3.8
3.15	2.54	4.3	2.68	4.0
3.53	2.84	4.8	3.02	4.5
3.60	2.92	4.9	3.08	4.6
4.00	3.26	5.4	3.46	5.0
4.50	3.67	6.1	3.94	5.6
5.00	4.10	6.8	4.37	6.2
5.33	4.35	7.1	4.67	6.6
5.70	4.70	7.7	4.99	7.1
6.00	4.98	8.1	5.28	7.5
6.99	5.84	9.5	6.15	8.7
8.00	6.85	10.8	7.05	10.0

#### INSTALLATION INSIDE THE BORE

Calculation of dimension H  
 $H = E + 2G$

#### INSTALLATION ON A PISTON

Calculation of dimension B  
 $B = A - 2G$

## SHAPE OF THE GROOVE

Dimensions D, G and are specified in relation to  $d_2$  (cross-section  $\emptyset$  of the O-Ring).

The groove may either have perpendicular walls or include an outward angle of up to  $5^\circ$ , which is then added to the dimensions specified for the width of the groove.

### Notes on the recommended groove dimensions

Dynamic O-rings are defined from rubbers having very low variations in volume in the presence of the fluid to be sealed.

In the case of static sealing, the O-ring can tolerate a slightly higher deflection (smaller G, greater D) and the rubber may swell more.

Additional information is set out in the technical part at the beginning of the catalogue.

For more information concerning the definition of grooves, you may refer to standard 48-550 and to the information booklets 48-551, 48-552 and 48-565, issued by AFNOR.

## R-SEAL FACE TYPE ASSEMBLY

The dimensions D and G are indicated according to the cross-section diameter  $d_2$ .

If pressure is exerted:

- **from the inside towards the outside:** the O-Ring seal should have an outside diameter of 1% to 2% greater than dimension H, against which it will seat;
- **from the outside towards the inside:** the O-Ring should be fitted slightly stretched, of 1% to 2%, and seat itself against dimension B.

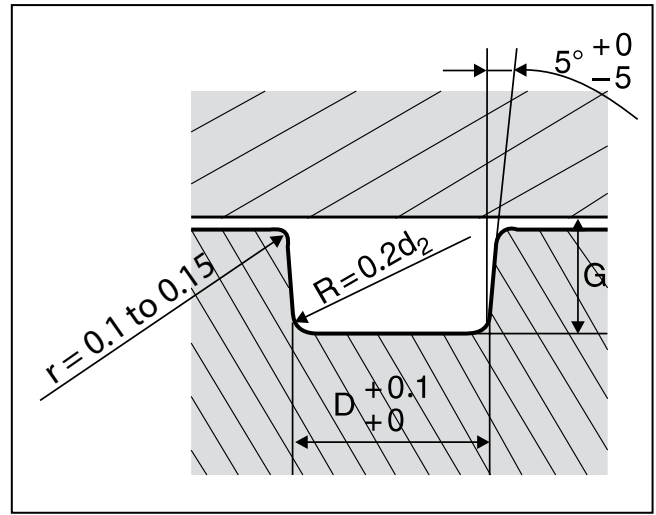


Figure 26

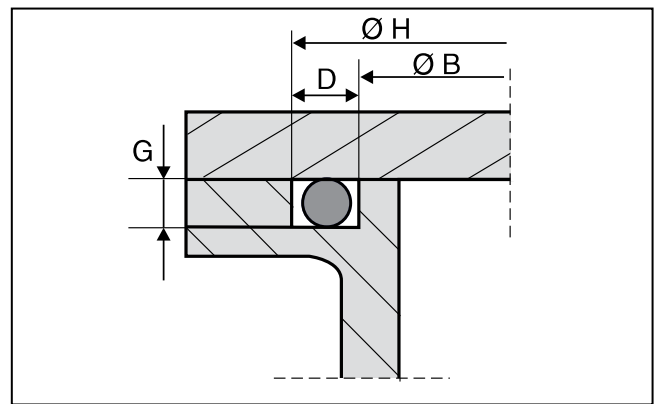


Figure 27

$\emptyset$ cross-section $d_2$	G + 0.10 / - 0	D + 0.10 / - 0	$\emptyset$ cross-section $d_2$	G + 0.10 / - 0	D + 0.10 / - 0
1.78	1.25	2.60	3.53	2.70	5.00
1.90	1.35	2.80	3.60	2.75	5.10
2.00	1.45	2.90	4.00	3.10	5.60
2.20	1.60	3.20	4.50	3.50	6.30
2.40	1.75	3.40	5.00	3.90	6.70
2.50	1.85	3.60	5.33	4.20	7.40
2.62	1.95	3.80	5.70	4.50	7.90
2.70	2.00	3.90	6.00	4.80	8.30
3.00	2.15	4.30	6.99	5.70	9.70
3.15	2.35	4.50	8.00	6.55	11.00

## SPECIAL APPLICATIONS

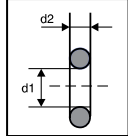
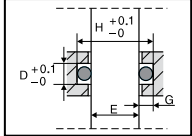
Refer to the technical section at the beginning of the catalogue.

### IMPORTANT

Although the dimensions set out herein are suitable for most applications, the combined effects of temperature, pressure and the type of fluid make it necessary to validate the chosen seal through tests (compound and size of the O-ring).

O-ring dimensions tolerances: refer to section 8.2 of this catalogue.

# O-RINGS INSTALLED IN BORES - PRODUCT CODES - NORMS

SIZES int. Ø d1 x cross-section Ø d2	CODES				<ul style="list-style-type: none"> <li>• R = LJF registered trademark</li> <li>• BS = 1806 or 4518</li> <li>• A AS 568 A</li> <li>• ISO 3601 (DIN)</li> <li>• AN AN 6227</li> </ul>	 		E min.	E max.	Dynam. ass.	Two-part groove ass.
	PC 851	PB 701	EP 851	DF 801							
0.74 x 1.00	100100	100101	100103	100104	A 001	0.73	0.84	★	▲		
1.07 x 1.27	101203	101204	101206	101207	A 002	1.18	1.29	★	▲		
1.15 x 1.00	101100	101101	101103	101104	<b>R 000</b>	1.20	1.30	★	▲		
1.25 x 1.25	101213	101214	101216	101217		1.34	1.45	★	▲		
1.40 x 1.25	101218	101219	101221	101222		1.47	1.59	★	▲		
1.42 x 1.52	101300	101301	101303	101304	A 003	1.51	1.64	★	▲		
1.60 x 1.25	101223	101224	101226	101227		1.65	1.77	★	▲		
1.60 x 1.60	101400	101401	101403	101404		1.68	1.82	★	▲		
1.78 x 1.78	101405	101406	101408	101409	A 004 / BS 004 / ISO	1.87	2.03	★	▲		
1.80 x 1.00	101105	101106	101108	101109		1.78	1.90	★	▲		
1.80 x 1.25	101228	101229	101231	101232		1.83	1.96	★	▲		
1.80 x 1.50	101305	101306	101308	101309		1.87	2.02	★	▲		
1.90 x 2.55	101710	101701	101711	101702		1.95	2.16	★	▲		
2.00 x 1.25	102200	102201	101233	101234		2.01	2.14	★	▲		
2.00 x 1.60	102400	102401	101415	101416		2.04	2.19	★	▲		
2.06 x 2.62	102746	102747	102701	102748	A 103	2.24	2.46	★	▲		
2.20 x 1.00	102146	102145	102147	102144		2.22	2.35	★	▲		
2.20 x 1.60	102403	102404	102406	102407	<b>R 00</b>	2.32	2.48	★	▲		
2.40 x 1.90	102413	102414	102416	102417	<b>R 0</b>	2.56	2.75	★	▲		
2.50 x 1.25	102210	102211	102212	102213		2.55	2.70	★	▲		
2.50 x 1.60	102418	102419	102421	102422		2.60	2.77	★	▲		
2.57 x 1.78	102423	102424	102426	102427	A 005 / BS 005 / ISO	2.69	2.88	★	▲		
2.60 x 1.00	102100	102101	102103	102104		2.59	2.72	★	▲		
2.60 x 1.90	102428	102429	102431	102432	<b>R 1</b>	2.75	2.94	★	▲		
2.75 x 1.60	102433	102434	102436	102437	<b>R 1 BIS</b>	2.82	3.00	★	▲		
2.84 x 2.62	102749	102750	102751	102752	A 104	2.95	3.19	★	▲		
2.90 x 1.20	102217	102218	102219	102220		2.90	3.06	★	▲		
2.90 x 1.78	102443	102444	102446	102447	AN 1 / A 006 / BS 006 / ISO	3.00	3.19	★	▲		
3.00 x 1.00	103109	103127	103128	103126		2.95	3.10	★	▲		
3.10 x 1.60	103403	103404	103406	103407	BS 0031-16	3.14	3.33	★	▲		
3.30 x 2.40	103600	103601	103603	103604		3.39	3.63	★	▲		
3.35 x 1.60	103413	103414	103416	103417		3.37	3.57	★	▲		
3.40 x 1.90	103500	103501	103503	103504	<b>R 2</b>	3.47	3.69	★	▲		
3.50 x 1.50	103314	103313	103129	103317		3.52	3.71	★	▲		
3.55 x 1.60	103418	103419	103421	103422		3.55	3.75	★	▲		
3.60 x 2.40	103605	103606	103608	103609	BS 0036-24	3.66	3.91	★	▲		
3.68 x 1.78	103423	103424	103426	103427	AN 2 / A 007 / BS 007 / ISO	3.70	3.92	★	▲		
3.75 x 1.60	103428	103429	103431	103432		3.73	3.94	★	▲		
3.80 x 1.30	103318	103319	103320	103321		3.74	3.94	★	▲		
4.00 x 1.00	104100	104102	103103	103112		3.86	4.04	★	▲		
4.00 x 1.50	104300	104301	103300	103301		3.97	4.18	★	▲		
4.00 x 1.80	104859	104860	104861	104862	ISO	4.00	4.23	★	▲		
4.00 x 2.00	104500	104501	103505	103506		3.96	4.20	★	▲		
4.10 x 1.60	104400	104401	104403	104404	BS 0041-16	4.05	4.27	★	▲		
4.20 x 1.90	104503	104504	104506	104507	<b>R 3</b>	4.20	4.44	★	▲		
4.25 x 2.00	104508	104509	104511	104512		4.19	4.44	★	▲		
4.30 x 2.40	104600	104601	104603	104604		4.30	4.57	★	▲		
4.42 x 2.62	104129	104130	104132	104131	BS 1802	4.39	4.68	★	▲		
4.47 x 1.78	104405	104406	104408	104409	AN 3 / A 008 / BS 008 / ISO	4.42	4.66	★	▲		
4.50 x 1.00	104113	104112	104114	104115		4.32	4.51	★	▲		
4.50 x 1.50	104340	104310	104341	104342		4.43	4.65	★	▲		
4.50 x 2.00	104513	104514	104516	104517		4.42	4.67	★	▲		
4.65 x 2.62	104703	104705	104701	104746		4.60	4.90	★	▲		
4.70 x 1.42	104303	104304	104306	104307	A 901	4.59	4.82	★	▲		
4.75 x 2.00	104518	104519	104521	104522		4.64	4.91	★	▲		
4.90 x 1.90	104523	104524	104526	104527	<b>R 4</b>	4.84	5.10	★	▲		
5.00 x 1.00	105135	105123	105140	105138		4.77	4.98	★	▲		
5.00 x 1.50	105300	105301	104308	104309		4.88	5.12	★	▲		
5.00 x 1.80	105739	105740	105741	105742	ISO	4.91	5.17	★	▲		
5.00 x 2.00	105500	105501	104528	104529		4.87	5.14	★	▲		
5.00 x 2.50	105136	105137	105141	105139		4.90	5.20	★	▲		
5.00 x 3.00	105800	105804	104812	104803		4.97	5.30	★	▲		
5.10 x 1.60	105409	105400	105450	105451	BS 0051-16	5.13	5.42	★	▲		
5.28 x 1.78	105401	105402	105404	105405	AN 4 / A 009 / BS 009 / ISO	5.34	5.65	★	▲		
5.30 x 2.00	105515	105516	105518	105519		5.33	5.65	★	▲		

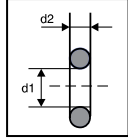
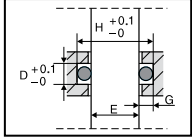
All the coded products are managed in stock.

★ Recommended for dynamic applications as well as static.

▲ Installation in two-part groove recommended. Refer to page 29 to determine groove dimensions.



# O-RINGS INSTALLED IN BORES - PRODUCT CODES - NORMS

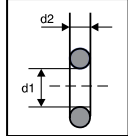
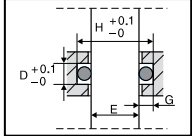
SIZES int. Ø d1 x cross-section Ø d2	CODES				<ul style="list-style-type: none"> <li>• R = LJF registered trademark</li> <li>• BS = 1806 or 4518</li> <li>• A AS 568 A</li> <li>• ISO 3601 (DIN)</li> <li>• AN AN 6227</li> </ul>	 		E min.	E max.	Dynam. ass.	Two-part groove ass.
	PC 851	PB 701	EP 851	DF 801							
5.30 x 2.40	105600	105601	105603	105604			5.41	5.76	★	▲	
5.50 x 1.00	105120	105145	105146	105144			5.38	5.64			
5.50 x 1.50	105323	105324	105325	105326			5.51	5.80	★		
5.50 x 2.00							5.52	5.85	★		
5.60 x 1.80	105429	105430	105431	105432	ISO		5.64	5.96	★		
5.60 x 2.40	105605	105606	105608	105609	BS 0056-24		5.69	6.05	★	▲	
5.70 x 1.20	105201	105208	105209	105210			5.61	5.90			
5.70 x 1.90	105508	105509	105511	105512	<b>R 5</b>		5.76	6.09	★		
6.00 x 1.00	106100	106101	105100	105101			5.84	6.12			
6.00 x 1.50	106300	106301	105303	105304			5.97	6.29	★		
6.00 x 2.00	106500	106501	105513	105514			5.98	6.33	★		
6.00 x 2.20	106600	106601	105610	105611	<b>R 6 BIS</b>		6.02	6.38	★		
6.00 x 3.00	106800	106801	106805	106806			6.12	6.54	★	▲	
6.07 x 1.63	106400	106401	106403	106404	A 902 / BS 0061-16		6.04	6.36	★		
6.07 x 1.78	106405	106406	106408	106409	AN 5 / A 010 / B 010 / ISO		6.07	6.41	★		
6.30 x 2.00	106503	106504	106506	106507			6.26	6.62	★		
6.30 x 2.40	106603	106604	106606	106607			6.34	6.73	★		
6.35 x 1.78	106412	106413	106415	106416	<b>R 5 BIS / ISO</b>		6.33	6.68	★		
6.40 x 1.90	106508	106509	106511	106512	<b>R 5 A</b>		6.41	6.77	★		
6.60 x 2.40	106608	106609	106611	106612	BS 0066-24		6.62	7.02	★		
6.70 x 2.00	106513	106514	106516	106517			6.63	7.01	★		
6.75 x 1.78	106417	106418	106420	106421	ISO		6.70	7.07	★		
7.00 x 1.50	107127	107131	107136	107133			6.90	7.25	★		
7.00 x 3.00	106131	106132	106134	106133			7.05	7.51	★	▲	
7.10 x 1.60	107400	107401	107403	107404	BS 0071-16		6.99	7.35	★		
7.10 x 1.80	107424	107425	107426	107427	ISO		7.04	7.41	★		
7.10 x 2.00	107500	107501	107503	107504			7.00	7.39	★		
7.20 x 1.90	107505	107506	107508	107509	<b>R 6</b>		7.15	7.54	★		
7.30 x 2.40	107600	107601	107603	107604			7.27	7.69	★		
7.30 x 2.70	107801	107800	107809	107810			7.28	7.72	★		
7.50 x 1.80	107428	107429	107430	107431	ISO		7.41	7.80	★		
7.50 x 2.00	107510	107511	107513	107514			7.38	7.78	★		
7.59 x 2.62	107757	107706	107758	107759	A 109		7.53	7.98	★		
7.60 x 2.40	107605	107606	107608	107609	BS 0076-24		7.55	7.98	★		
7.65 x 1.63	107405	107406	107408	107409	A 903		7.51	7.89	★		
7.65 x 1.78	107410	107411	107413	107414	AN 6 / A 011 / BS 011		7.54	7.93	★		
7.65 x 2.54	107700	107701	107703	107704			7.57	8.02	★		
7.80 x 3.60	107913	107914	107915	107916			7.83	8.36	★	▲	
8.00 x 1.00	108154	108155	108156	108134			7.70	8.05			
8.00 x 1.50	107128	107130	107137	107134			7.83	8.22	★		
8.00 x 1.80	108465	108311	108312	108313	ISO		7.87	8.28	★		
8.00 x 1.90	108500	108501	107515	107516	<b>R 6 A</b>		7.90	8.31	★		
8.00 x 2.00	108503	108504	107517	107518			7.84	8.26	★		
8.00 x 2.40	108600	108601	107610	107645			7.92	8.37	★		
8.00 x 3.00	107129	107132	107138	107135			7.98	8.47	★		
8.00 x 5.00	108900	108901	107900	107901			8.04	8.67	★	▲	
8.10 x 1.60	108400	108401	108403	108404	BS 0081-11		8.20	8.48	★		
8.30 x 2.40	108602	108603	108605	108606			8.53	8.85	★		
8.50 x 1.90	108751	108709	108752	108753			8.67	8.98	★		
8.60 x 2.40	108607	108608	108610	108611	BS 0086-24		8.81	9.15	★		
8.73 x 1.78	108405	108406	108408	108409			8.85	9.16	★		
8.90 x 1.90	108511	108512	108514	108515	<b>R 7</b>		9.05	9.37	★		
8.90 x 2.70	108800	108801	108803	108804	<b>R 8</b>		9.12	9.48	★		
9.00 x 1.00							8.91	9.18			
9.00 x 1.50	109300	109301	108300	108301			9.06	9.36	★		
9.00 x 2.00	109500	109501	108516	108517			9.10	9.42	★		
9.00 x 2.20	109600	109601	108612	108613	<b>R 7 BIS</b>		9.15	9.48	★		
9.00 x 2.50	109135	109121	109128	109124			9.17	9.52	★		
9.10 x 1.60	109400	109401	109403	109404	BS 0091-16		9.15	9.46	★		
9.12 x 3.53	109119	109122	109129	109125			9.45	9.86	★		
9.15 x 3.00	109800	109801	109803	109804			9.43	9.81	★		
9.19 x 2.62	109700	109701	109703	109704	AN 8 / A 110 / BS 110		9.38	9.74	★		
9.25 x 1.78	109405	109406	109408	109409	AN 7 / A 012 / BS 012		9.35	9.67	★		
9.30 x 2.40	109603	109604	109606	109607			9.48	9.83	★		
9.50 x 1.40	109303	109304	109306	109307			9.51	9.81			

All the coded parts are managed in stock.

★ Recommended for dynamic applications as well as static.

▲ Assembly in two-part groove recommended. Refer to page 29 to determine groove dimensions.

# O-RINGS INSTALLED IN BORES - PRODUCT CODES - NORMS

SIZES int. Ø d1 x cross-section Ø d2	CODES				<ul style="list-style-type: none"> <li>• R = LJF registered trademark</li> <li>• BS = 1806 or 4518</li> <li>• A AS 568 A</li> <li>• ISO 3601 (DIN)</li> <li>• AN AN 6227</li> </ul>	 		E min.	E max.	Dynam. ass.	Two-part groove ass.
	PC 851	PB 701	EP 851	DF 801							
9.50 x 1.60	109850	109415	109130	109126		9.54	9.85	★			
9.50 x 2.00	109503	109504	109506	109507		9.57	9.91	★			
9.52 x 1.78	109410	109411	109413	109414	<b>R 8 BIS / ISO</b>	9.61	9.93	★			
9.60 x 2.40	109608	109609	109611	109612	BS 0096-24	9.77	10.13	★			
9.90 x 1.90	109508	109509	109949	109950		10.01	10.35	★			
10.00 x 1.50	109120	109123	109131	109127		9.96	10.28	★			
10.00 x 1.30	110100	110101	109308	109309		9.95	10.27				
10.00 x 1.80	110819	110820	110821	110822	ISO	10.07	10.41	★			
10.00 x 2.00	110300	110301	109510	109511		10.05	10.40	★			
10.00 x 2.50	110500	110501	109705	109706		10.13	10.50	★			
10.00 x 3.50	110721	110722	110723	110724		10.29	10.71	★			
10.10 x 1.60	110200	110201	110252	110253	BS 0101-16	10.11	10.44	★			
10.30 x 2.40	110410	110400	110414	110415		10.44	10.81	★			
10.50 x 2.00	110303	110304	110306	110307		10.53	10.89	★			
10.50 x 2.70	110602	110603	110605	110606	<b>R 9</b>	10.65	11.05	★			
10.52 x 1.83	110202	110203	110205	110206	A 905 / ISO	10.58	10.93	★			
10.60 x 2.40	110401	110402	110404	110405	BS 0106-24	10.72	11.11	★			
10.77 x 2.62	110508	110509	110511	110512	AN 9 / A 111 / BS 111	10.89	11.29	★			
10.82 x 1.78	110207	110208	110210	110211	A 013 / BS 013	10.85	11.21	★			
11.00 x 1.50	111100	111101	110103	110104		10.97	11.32	★			
11.00 x 2.00	111300	111301	110308	110309		11.01	11.38	★			
11.00 x 2.50	111500	111501	110607	110608		11.08	11.48	★			
11.00 x 3.00						11.20	11.62	★			
11.00 x 5.00	111805	111806	111808	111807		11.36	11.88	★	▲		
11.10 x 1.60	111200	111201	110212	110213	BS 0111-16	11.06	11.42	★			
11.10 x 1.78	111203	111204	110214	110215	ISO	11.12	11.48	★			
11.20 x 2.50	111503	111504	111506	111507		11.27	11.68	★			
11.30 x 2.40	111400	111401	111403	111404		11.39	11.79	★			
11.50 x 1.50	111103	111104	111106	111107		11.45	11.81				
11.50 x 2.00	111321	111322	111323	111324		11.48	11.87	★			
11.50 x 3.00	111708	111709	111711	111710		11.67	12.11	★			
11.60 x 2.40	111405	111406	111408	111409	BS 0116-24	11.68	12.09	★			
11.80 x 2.50	111508	111509	111511	111512		11.84	12.26	★			
11.90 x 2.62	111513	111514	111516	111517		11.97	12.40	★			
12.00 x 1.00	112127	112128	112130	112129		11.77	12.12				
12.00 x 1.50	112110	112102	112111	112112		11.93	12.30				
12.00 x 2.00	112300	112301	111308	111309	A 906	11.96	12.36	★			
12.00 x 3.00	112661	112608	112662	111618		12.15	12.60	★			
12.10 x 1.60	112200	112201	111206	111207	BS 0121-16	12.02	12.40				
12.10 x 2.70	112600	112601	111600	111601	<b>R 10</b>	12.18	12.61	★			
12.29 x 3.53	112702	112703	112704	112705	A 206	12.48	12.96	★			
12.30 x 2.40	112400	112401	112412	112413		12.35	12.77	★			
12.37 x 2.62	112500	112501	112503	112504	AN 10 / A 112 / BS 112	12.42	12.86	★			
12.42 x 1.78	112203	112204	112206	112207	A 014 / BS 014	12.38	12.78	★			
12.50 x 1.50	112266	112214	112262	112261		12.40	12.79				
12.50 x 2.00	112303	112304	112306	112307		12.44	12.85	★			
12.50 x 2.50	112505	112506	112508	112509		12.51	12.95	★			
13.00 x 1.00	113111	113112	113114	113113		12.73	13.10				
13.00 x 2.00	113300	113301	112308	112309		12.92	13.34	★			
13.00 x 2.50	113500	113501	112510	112511		12.99	13.44	★			
13.00 x 3.00	113746	113747	112617	112616		13.11	13.58	★			
13.10 x 1.60	113200	113201	112208	112209	BS 0131-16	12.97	13.38				
13.10 x 1.80	113350	113351	113353	113352		13.03	13.45	★			
13.10 x 2.62	113503	113504	112512	112513		13.11	13.57	★			
13.20 x 2.50	113506	113507	113509	113510		13.18	13.64	★			
13.30 x 2.40	113400	113401	113403	113404		13.30	13.75	★			
13.46 x 2.08	113303	113304	113306	113307	A 907	13.37	13.81	★			
13.60 x 2.40	113405	113406	113408	113409	BS 0136-24	13.59	14.05	★			
13.60 x 2.70	113600	113601	113603	113604	<b>R 11</b>	13.61	14.08	★			
13.80 x 3.10	113700	113701	113703	113704		13.83	14.33	★			
13.87 x 3.53	113842	113843	113844	113845	A 207	13.99	14.51	★			
13.94 x 2.62	113511	113512	113514	113515	AN 11 / A 113 / BS 113	13.92	14.39	★			
14.00 x 1.60						13.83	14.26				
14.00 x 1.78	114200	114201	113203	113204	A 015 / BS 015 / ISO	13.89	14.33				
14.00 x 2.00	114300	114301	113308	113309		13.87	14.32	★			

All the coded parts are managed in stock.

★ Recommended for dynamic applications as well as static.

▲ Assembly in two-part groove recommended. Refer to page 29 to determine groove dimensions.

# O-RINGS INSTALLED IN BORES - PRODUCT CODES - NORMS

SIZES int. Ø d1 x cross-section Ø d2	CODES				<ul style="list-style-type: none"> <li>• R = LJJ registered trademark</li> <li>• BS = 1806 or 4518</li> <li>• A AS 568 A</li> <li>• ISO 3601 (DIN)</li> <li>• AN AN 6227</li> </ul>	 		E min.	E max.	Dynam. ass.
	PC 851	PB 701	EP 851	DF 801						
14.00 x 2.50	114500	114501	113516	113517			13.95	14.42	★	
14.00 x 3.00	114620	114619	114644	114645			14.06	14.56	★	
14.10 x 1.60	114203	114204	113205	113206	BS 0141-16		14.10	14.45		
14.30 x 2.40	114400	114401	114403	114404			14.45	14.83	★	
14.60 x 2.40	114405	114406	114408	114409	BS 0146-24		14.74	15.13	★	
15.00 x 1.00	115000	115001	114000	114001			14.81	15.15		
15.00 x 1.50	115100	115102	115108	115109			14.97	15.33		
15.00 x 1.80	115212	115213	114210	114211	ISO		15.03	15.41		
15.00 x 2.00	115300	115301	114303	114304			15.02	15.40	★	
15.00 x 2.50	115500	115501	114503	114504			15.10	15.50	★	
15.00 x 3.00	115612	115713	115724	115725			15.23	15.65	★	
15.08 x 2.62	115503	115504	114505	114506	ISO		15.21	15.61	★	
15.10 x 2.70	115600	115601	114600	114601	<b>R 12</b>		15.25	15.66	★	
15.12 x 3.53	115862	115863	115865	115864			15.40	15.85	★	
15.20 x 1.78	115201	115235	115223	115241			15.22	15.60		
15.20 x 4.00	115816	115866	115823	115803			15.43	15.89	★	
15.30 x 2.40	115400	115401	115403	115404			15.41	15.81	★	
15.47 x 3.53	115830	115831	115832	115833	A 208		15.74	16.19	★	
15.54 x 2.62	115506	115507	115509	115510	AN 12 / A 114 / BS 114		15.65	16.07	★	
15.60 x 1.78	115202	115203	115205	115206	A 016 / BS 016		15.61	15.99		
15.60 x 2.40	115405	115406	115408	115409	BS 0156-24		15.70	16.11	★	
15.88 x 2.62	115511	115512	115514	115515	ISO		15.98	16.40	★	
16.00 x 1.25	116003	116004	115004	115005			15.85	16.22		
16.00 x 1.90	116300	116301	115303	115304	<b>R 12 BIS</b>		16.03	16.43		
16.00 x 2.00	116303	116304	115305	115306			15.98	16.38		
16.00 x 2.50	116500	116501	115516	115517			16.07	16.49	★	
16.00 x 3.00	116710	116630	115618	115648			16.19	16.63	★	
16.00 x 3.50	116711	116701	116712	116713			16.25	16.71	★	
16.00 x 4.00	116800	116802	116810	116809			16.20	16.68	★	
16.10 x 1.60	116200	116201	115207	115208	BS 0161-16		16.03	16.42		
16.30 x 2.40	116400	116401	116403	116404			16.38	16.80	★	
16.36 x 2.21	116405	116406	116408	116409	A 908		16.38	16.80	★	
16.60 x 2.40	116410	116411	116413	116414	BS 0166-24		16.67	17.10	★	
16.90 x 2.70	116600	116601	116603	116604	<b>R 13</b>		16.98	17.43	★	
17.00 x 2.00	117300	117301	116306	116307			16.95	17.37		
17.00 x 2.50	117500	117501	116503	116504			17.03	17.47	★	
17.00 x 4.00	117812	117813	117815	117814			17.17	17.67	★	
17.04 x 3.53	117713	117714	117715	117716	A 209		17.26	17.74	★	
17.06 x 1.50	117234	117235	117243	117242			16.96	17.36		
17.10 x 1.60	117200	117201	116203	116204	BS 0171-16		17.00	17.40		
17.12 x 2.62	117503	117504	116505	116506	AN 13 / A 115 / BS 115 / ISO		17.18	17.62	★	
17.17 x 1.78	117203	117204	117206	117207	A 017 / BS 017 / ISO		17.12	17.54		
17.30 x 2.40	117400	117401	117403	117404			17.34	17.78	★	
17.50 x 1.50	117100	117101	117103	117104			17.38	17.79		
17.50 x 2.50	117506	117507	117509	117510			17.51	17.96	★	
17.60 x 2.40	117405	117406	117408	117409	BS 0176-24		17.63	18.08	★	
17.86 x 2.62	117511	117512	117514	117515			17.89	18.35	★	
17.93 x 2.46	117410	117411	117413	117414	A 909		17.97	18.42	★	
18.00 x 1.00							17.70	18.10		
18.00 x 2.00	118300	118301	117303	117304			17.91	18.35		
18.00 x 2.20	118400	118401	117415	117416			17.96	18.41		
18.00 x 2.50	118500	118501	117516	117517			18.00	18.46	★	
18.00 x 2.65	118520	118521	117524	117525	ISO		18.03	18.50	★	
18.00 x 2.80	118763	118764	118765	118865			18.07	18.54	★	
18.00 x 3.00	118767	118769	118773	118771			18.12	18.60	★	
18.00 x 3.15	118700	118701	117700	117701			18.09	18.58	★	
18.10 x 1.60	118200	118201	117208	117209	BS 0181-16		17.96	18.39		
18.20 x 3.00	118905	118661	118906	118907			18.31	18.80	★	
18.30 x 3.60	118800	118801	118803	118804	<b>R 15</b>		18.49	19.00	★	
18.40 x 2.70	118600	118601	118603	118604	<b>R 14</b>		18.43	18.91	★	
18.42 x 5.33					A 314		18.79	19.37	★	
18.50 x 1.60	118203	118331	118332	118333			18.35	18.78		
18.60 x 2.40					BS 0186-24		18.60	19.07	★	
18.64 x 3.53	118703	118704	118706	118707	AN 15 / A 210 / BS 210		18.80	19.31	★	
18.72 x 2.62	118505	118506	118508	118509	AN 14 / A 116 / BS 116		18.72	19.20	★	

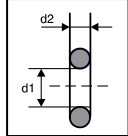
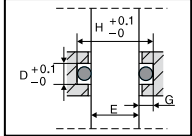
All the coded parts are managed in stock.  
 ★ Recommended for dynamic applications as well as static.  
 Refer to page 29 to determine groove dimensions.

# O-RINGS INSTALLED IN BORES - PRODUCT CODES - NORMS

SIZES int. Ø d1 x cross-section Ø d2	CODES				<ul style="list-style-type: none"> <li>• R = LJF registered trademark</li> <li>• BS = 1806 or 4518</li> <li>• A AS 568 A</li> <li>• ISO 3601 (DIN)</li> <li>• AN AN 6227</li> </ul>	 		E min.	E max.	Dynam. ass.
	PC 851	PB 701	EP 851	DF 801						
18.77 x 1.78	118204	118205	118207	118208	A 018 / BS 018	18.66	19.11			
18.80 x 3.00	118768	118770	118774	118772		18.89	19.39	★		
19.00 x 1.50	119100	119101	118100	118101		18.83	19.27			
19.00 x 1.80	119200	119201	118209	118210		18.89	19.35			
19.00 x 2.50	119500	119501	118503	118504		18.96	19.44	★		
19.00 x 3.15	119700	119701	118708	118709		19.06	19.57	★		
19.00 x 3.55	119706	119707	118717	118718	ISO	19.15	19.67	★		
19.18 x 2.46	119400	119401	118408	118409	A 910	19.17	19.65	★		
19.20 x 3.00	119600	119601	119603	119604		19.28	19.78	★		
19.50 x 1.50	119103	119104	119123	119124		19.31	19.76			
19.60 x 2.40	119403	119404	119406	119407	BS 0196-24	19.56	20.05	★		
19.80 x 3.60	119800	119801	119803	119804	<b>R 16</b>	19.94	20.48	★		
20.00 x 1.80	120206	120207	119210	119211		19.86	20.33			
20.00 x 2.00	120300	120301	119300	119301		19.84	20.32			
20.00 x 2.50	120500	120501	119503	119504		19.93	20.43	★		
20.00 x 2.65	120526	120527	120642	120636	ISO	19.96	20.47	★		
20.00 x 3.00	120600	120601	119610	119611		20.05	20.57	★		
20.00 x 3.15	120700	120701	119703	119704		20.02	20.55	★		
20.00 x 1.50	120251	120252	120254	120253		19.82	20.28			
20.22 x 3.53	120703	120704	120706	120707	AN 16 / A 211 / BS 211	20.32	20.87	★		
20.29 x 2.62	120510	120511	120513	120514	A 117 / B 117 / ISO	20.23	20.75	★		
20.35 x 1.78	120200	120201	120203	120204	A 019 / BS 019	20.19	20.67			
20.63 x 2.62	120515	120516	120518	120519		20.56	21.08	★		
21.00 x 3.00	121600	121601	121603	121604		21.02	21.56	★		
21.00 x 2.00	121415	121416	121418	121417		20.83	21.33			
21.08 x 1.50	121265	121264	121266	121263		20.84	21.32			
21.20 x 1.90	121300	121301	120303	120304		21.05	21.55			
21.20 x 2.50	121500	121501	121503	121504		21.08	21.61	★		
21.20 x 3.15	121700	121701	121703	121704		21.18	21.73	★		
21.30 x 3.60	121800	121801	121803	121804	<b>R 17</b>	21.38	21.95	★		
21.35 x 2.00						21.14	21.65			
21.50 x 3.00	121605	121606	121608	121609	BS 0215-30	21.50	22.05	★		
21.59 x 5.33	121905	121906	121902	121907	A 316	21.85	22.49	★		
21.60 x 2.40	121400	121401	121403	121404	BS 0216-24	21.49	22.02			
21.80 x 2.52	121627	121628	121630	121629		21.66	22.19	★		
21.82 x 3.53	121705	121706	121708	121709	AN 17 / A 212 / BS 212	21.87	22.45	★		
21.89 x 2.62	121505	121506	121508	121509	A 118 / BS 118	21.78	22.32	★		
21.92 x 2.95	121610	121611	121613	121614	A 911	21.89	22.45	★		
21.95 x 1.78	121200	121201	121203	121204	A 020 / BS 020	21.73	22.24			
22.00 x 1.50	122214	122210	122216	122215		21.73	22.23			
22.00 x 2.00	122300	122301	121303	121304		21.77	22.29			
22.10 x 1.60	122200	122201	121205	121206	BS 0221-16	21.82	22.33			
22.20 x 3.00	122600	122601	121615	121616		22.17	22.74	★		
22.22 x 2.62	122503	122504	122506	122507	ISO	22.10	22.65	★		
22.40 x 2.50	122508	122509	122511	122512		22.24	22.79			
22.40 x 3.15	122700	122701	122703	122704		22.34	22.91	★		
22.50 x 2.00	122303	122304	122309	122315		22.25	22.78			
22.50 x 3.00	122603	122604	122606	122607	BS 0225-30	22.46	23.03	★		
23.00 x 2.50	123510	123511	122513	122514		22.82	23.38			
23.00 x 3.60	123800	123801	122800	122801	<b>R 18</b>	23.02	23.63	★		
23.16 x 5.33	123909	123910	123911	123912	A 317	23.36	24.04	▶★		
23.20 x 2.00	123404	123403	123405	123402		22.93	23.47			
23.39 x 3.53	123700	123701	123703	123704	AN 18 / A 213 / BS 213	23.38	23.99	★		
23.47 x 2.62	123500	123501	123503	123504	A 119 / BS 119 / ISO	23.30	23.88			
23.47 x 2.95	123600	123601	123603	123604	A 912	23.39	23.97	★		
23.52 x 1.78	123200	123201	123203	123204	A 021 / BS 021	23.25	23.79			
23.60 x 2.50	123505	123506	123508	123509		23.40	23.97			
23.60 x 3.15	123705	123706	123708	123709		23.50	24.10	★		
24.00 x 4.00	123818	123828	123848	123830		23.90	24.54	★		
24.00 x 1.50	124102	124101	124104	124105		23.66	24.20			
24.00 x 2.00	124300	124301	123300	123301		23.70	24.26			
24.00 x 2.50	124504	124505	123513	123514		23.79	24.37			
24.20 x 3.00	124600	124601	123605	123606		24.10	24.71	★		
24.50 x 3.00	124603	124604	124606	124607	BS 0245-30	24.39	25.00	★		
24.60 x 2.40	124400	124401	124403	124404	BS 0246-24	24.39	24.98			

All the coded parts are managed in stock.  
 ★ Recommended for dynamic applications as well as static.  
 Refer to page 29 to determine groove dimensions.

# O-RINGS INSTALLED IN BORES - PRODUCT CODES - NORMS

SIZES int. Ø d1 x cross-section Ø d2	CODES				<ul style="list-style-type: none"> <li>• R = LJF registered trademark</li> <li>• BS = 1806 or 4518</li> <li>• A AS 568 A</li> <li>• ISO 3601 (DIN)</li> <li>• AN AN 6227</li> </ul>	 		E min.	E max.	Dynam. ass.
	PC 851	PB 701	EP 851	DF 801						
24.60 x 3.60	124800	124801	124803	124804	<b>R 19</b>	24.57	25.20	★		
24.76 x 3.00	123761	123767	123769	123768		24.64	25.26	★		
24.99 x 3.53	124700	124701	124703	124704	AN 19 / A 214 / BS 214	24.93	25.57	★		
25.00 x 2.00	125303	124420	124424	124422		24.67	25.25			
25.00 x 2.40	125400	125401	124405	124406	<b>R 19 BIS</b>	24.77	25.37			
25.00 x 2.50	125500	125501	124500	124501		24.75	25.35			
25.00 x 3.15	125700	125701	124705	124706		24.85	25.48	★		
25.00 x 4.00	124854	124867	124869	124868		24.89	25.55	★		
25.00 x 5.00	125921	125901	124903	124907		25.08	25.78	★		
25.04 x 2.95	125600	125601	124608	124609	A 913	25.21	25.67	★		
25.07 x 2.62	125503	125504	124502	124503	A 120 / BS 120	25.15	25.61			
25.12 x 1.78	125203	125204	124202	124203	A 022 / BS 022	25.08	25.51			
25.50 x 3.00	125603	125604	125606	125607	BS 0255-30	25.67	26.15	★		
25.80 x 3.53	125703	125704	125706	125707	ISO	26.04	26.53	★		
26.00 x 2.50	125506	125507	125509	125510		26.03	26.49			
26.00 x 2.00	124419	124421	124425	124423		25.95	26.40			
26.20 x 3.00	125608	125609	125611	125612		26.36	26.84	★		
26.20 x 3.60	125800	125801	125803	125804	<b>R 20</b>	26.45	26.95	★		
26.22 x 3.00	124755	124757	124761	124759		26.37	26.86	★		
26.34 x 5.33	125963	125964	125965	125415	A 319	26.80	27.36	★		
26.40 x 3.00	124756	124758	124762	124760		26.55	27.04	★		
26.50 x 2.50	125511	125512	125514	125515		26.51	26.99			
26.57 x 3.53	125713	125714	125716	125717	AN 20 / A 215 / BS 215 / ISO	26.79	27.29	★		
26.62 x 2.95	125618	125619	125416	125417	A 914	26.75	27.24	★		
26.64 x 2.62	125516	125517	125519	125520	A 121 / BS 121	26.68	27.16			
26.70 x 1.78	125206	125207	125209	125210	A 023 / BS 023	26.62	27.07			
27.00 x 2.00	126300	126301	125300	125301		26.91	27.37			
27.00 x 2.50	126500	126501	125521	125522		27.00	27.48			
27.06 x 3.00	125766	125726	125767	125753		27.19	27.69	★		
27.10 x 1.60	126200	126201	125211	125212	BS 0271-16	26.95	27.41			
27.30 x 2.50	125668	125669	125671	125670		27.26	27.74			
27.30 x 2.70	126600	126601	126603	126604	<b>R 20 TER</b>	27.35	27.84			
27.50 x 3.00	126605	126606	126608	126609	BS 0275-30	27.62	28.13	★		
27.80 x 3.60	126800	126801	126803	126804	<b>R 21</b>	28.01	28.53	★		
28.00 x 2.00	126303	126304	126306	126307		27.88	28.36			
28.00 x 2.50	126503	126504	126506	126507		27.98	28.47			
28.00 x 3.00	126621	126627	126634	125765		28.11	28.62	★		
28.00 x 3.15	126700	126701	126703	126704		28.09	28.60	★		
28.00 x 5.00	126908	126909	126910	126911		28.35	28.92	★		
28.17 x 3.53	126705	126706	126708	126709	AN 21 / A 216 / BS 216 / ISO	28.35	28.88	★		
28.24 x 2.62	126508	126509	126511	126512	A 122 / BS 122 / ISO	28.24	28.74			
28.30 x 1.78	126203	126204	126206	126207	A 024 / BS 024	28.18	28.66			
29.10 x 1.60	127100	127101	126208	126209	BS 0291-16	28.90	29.39			
29.10 x 2.55	127200	127201	126513	126514	<b>R 20 BIS</b>	29.06	29.57			
29.20 x 3.00	127300	127301	126610	126611		29.28	29.81			
29.30 x 3.60	127500	127501	127503	127504	<b>R 22</b>	29.47	30.02	★		
29.50 x 3.00	127303	127304	127306	127307	BS 0295-30	29.57	30.11			
29.60 x 2.40	127203	127204	127206	127207	BS 0296-24	29.56	30.07			
29.74 x 2.95	127308	127309	127311	127312	A 916	29.79	30.33			
29.74 x 3.53	127400	127401	127403	127404	AN 22 / A 217 / BS 217 / ISO	29.88	30.43	★		
29.82 x 2.62	127208	127209	127211	127212	A 123 / BS 123	29.78	30.31			
29.87 x 1.78	127103	127104	127106	127107	A 025 / BS 025	29.71	30.21			
30.00 x 2.00	127108	127109	127111	127112		29.83	30.34			
30.00 x 2.50	127213	127214	127216	127217		29.93	30.45			
30.00 x 2.70	127313	127314	127316	127317		29.98	30.51			
30.00 x 3.00	127318	127319	127321	127322		30.06	30.60			
30.00 x 4.00	127505	127506	127508	127509		30.09	30.66	★		
30.80 x 3.60	127510	127511	127513	127514	<b>R 23</b>	30.93	31.50	★		
31.00 x 2.50	126410	126411	126413	126412		30.90	31.44			
31.12 x 5.33	128751	128752	128753	128754	A 322	31.46	32.09	★		
31.34 x 3.53	128400	128401	128403	128404	AN 23 / A 218 / BS 218 / ISO	31.44	32.02	★		
31.42 x 2.62	128200	128201	128203	128204	A 124 / BS 124	31.34	31.89			
31.47 x 1.78	128100	128101	128103	128104	A 026 / BS 026	31.27	31.80			
31.50 x 3.00	128300	128301	128303	128304	BS 0315-30	31.52	32.09			
31.50 x 3.15	128405	128406	128408	128409		31.50	32.07	★		

All the coded parts are managed in stock.  
 ★ Recommended for dynamic applications as well as static.  
 Refer to page 29 to determine groove dimensions.

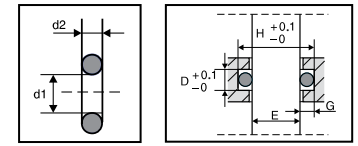
# O-RINGS INSTALLED IN BORES - PRODUCT CODES - NORMS

SIZES int. Ø d1 x cross-section Ø d2	CODES				<ul style="list-style-type: none"> <li>• R = LJF registered trademark</li> <li>• BS = 1806 or 4518</li> <li>• A AS 568 A</li> <li>• ISO 3601 (DIN)</li> <li>• AN AN 6227</li> </ul>	 		E min.	E max.	Dynam. ass.
	PC 851	PB 701	EP 851	DF 801						
31.60 x 2.40	128205	128206	128208	128209	BS 0316-24	31.51	32.05			
32.00 x 1.50	127166	127115	127156	127155		31.73	32.25			
32.00 x 2.00	128105	128106	128108	128109		31.78	32.32			
32.00 x 2.50	128265	128264	128246	128346		31.88	32.43			
32.10 x 1.60	128110	128111	128113	128114	BS 0321-16	31.83	32.36			
32.20 x 3.00	128305	128306	128308	128309		32.21	32.78			
32.50 x 1.90	128115	128116	128118	128119		32.31	32.86			
32.50 x 3.00	128310	128311	128313	128314	BS 0325-30	32.50	33.08			
32.50 x 3.60	128505	128506	128508	128509	<b>R 24</b>	32.59	33.18	★		
32.92 x 3.53	128410	128411	128413	128414	AN 24 / A 219 / BS 219 / ISO	32.98	33.58	★		
32.99 x 2.62	128210	128211	128213	128214	A 125 / BS 125 / ISO	32.87	33.45			
33.00 x 2.00						32.76	33.31			
33.00 x 3.00	128566	128567	128569	128568		32.99	33.57			
33.05 x 1.78	129100	129101	128120	128121	A 027 / BS 027	32.81	33.36			
33.50 x 3.15	129400	129401	129403	129404		33.45	34.05			
33.50 x 4.00	129500	129501	129503	129504		33.50	34.13	★		
34.00 x 2.00	128267	128268	128270	128269		33.73	34.30			
34.00 x 3.00	129300	129301	129303	129304		33.96	34.56			
34.00 x 5.00	128811	128812	128814	128813		34.20	34.86	★		
34.10 x 3.60	129505	129506	129508	129509	<b>R 25</b>	34.15	34.77	★		
34.20 x 3.00	129305	129306	129308	129309		34.16	34.76			
34.29 x 5.33	129614	129615	129616	129617	A 324	34.55	35.23	★		
34.50 x 3.00	129315	129316	129318	129319	BS 0345-30	34.45	35.06			
34.52 x 3.53	129405	129406	129408	129409	AN 25 / A 220 / BS 220 / ISO	34.54	35.16	★		
34.59 x 2.62	129200	129201	129203	129204	A 126 / BS 126 / ISO	34.43	35.03			
34.60 x 2.40	129205	129206	129208	129209	BS 0346 -24	34.43	35.02			
34.65 x 1.78	129103	129104	129106	129107	A 028 / BS 028	34.37	34.94			
35.00 x 2.00	130100	130101	129108	129109		34.71	35.29			
35.00 x 2.50	130229	130228	130230	130231		34.80	35.40			
35.00 x 3.00	130300	130301	129320	129321		34.94	35.55			
35.00 x 5.30	130600	130601	129600	129601		35.24	35.92	★		
35.10 x 1.60	130103	130104	129110	129111	BS 0351-16	34.75	35.33			
35.50 x 3.00	130303	130304	130306	130307	BS 0355-30	35.42	36.05			
35.50 x 3.15	130400	130401	130403	130404		35.40	36.03			
35.50 x 4.00	130500	130501	130503	130504		35.45	36.11	★		
35.60 x 3.60	130505	130506	130508	130509	<b>R 26 / ISO</b>	35.61	36.25	★		
36.00 x 2.00	129242	129248	129250	129249		35.64	36.24			
36.09 x 3.53	130405	130406	130408	130409	AN 26 / A 217 / BS 217	36.07	36.72	★		
36.17 x 2.62	130200	130201	130203	130204	A 127 / BS 127	35.97	36.59			
36.30 x 2.00	129264	129262	129267	129256		35.97	36.58			
36.50 x 2.65	130206	130207	130208	130209	ISO	36.30	36.93			
36.50 x 3.00	130313	130314	130316	130317	BS 0365-30	36.40	37.04			
37.10 x 1.60	131100	131101	130106	130107	BS 0371-16	36.70	37.31			
37.30 x 3.60	131500	131501	130510	130511	<b>R 27</b>	37.27	37.94	★		
37.40 x 1.80	131103	131104	131106	131107		37.06	37.67			
37.46 x 3.00	131300	131301	131303	131304	A 920 / BS 0375-30	37.33	37.99			
37.47 x 5.33	131600	131601	131603	131604	<b>R 28 / A 325 / BS 325</b>	37.65	38.37	★		
37.50 x 3.15	131400	131401	131403	131404		37.35	38.01			
37.50 x 4.00	131503	131504	131506	131507		37.40	38.09	★		
37.60 x 1.20	131004	131005	131006	131007		37.08	37.68			
37.60 x 2.40	131200	131201	131203	131204	BS 0376-24	37.36	37.99	★		
37.69 x 3.53	131405	131406	131408	131409	AN 27 / A 222 / BS 222	37.63	38.30	★		
37.70 x 2.00	130250	130252	130256	130254		37.34	37.96			
37.77 x 2.62	131205	131206	131208	131209	A 128 / BS 128 / ISO	37.53	38.18	★		
37.82 x 1.78	131108	131109	131111	131112	A 029	37.46	38.08			
38.10 x 3.00	130567	130568	130570	130569		37.96	38.62			
38.30 x 4.00	130716	130718	130722	130720		38.18	38.88	★		
38.70 x 2.00	130251	130253	130257	130255		38.31	38.95			
38.70 x 3.55	131731	131732	131463	131733	ISO	38.62	39.31	★		
38.80 x 4.00	130717	130719	130723	130721		38.67	39.37	★		
39.00 x 3.00	132300	132301	131310	131311		38.84	39.51			
39.34 x 2.62	132200	132201	131210	131211	A 129 / BS 129	39.06	39.73			
39.50 x 3.00	132306	132307	132309	132310	BS 0395-30	39.32	40.01			
39.60 x 2.40	132203	132204	132206	132207	BS 0396-24	39.31	39.97			
39.69 x 3.53	132400	132401	132403	132404	ISO	39.58	40.28	★		

All the coded parts are managed in stock.  
 ★ Recommended for dynamic applications as well as static.  
 Refer to page 29 to determine groove dimensions.

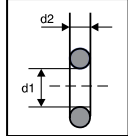
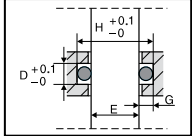
# O-RINGS INSTALLED IN BORES - PRODUCT CODES - NORMS

SIZES int. Ø d1 x cross-section Ø d2	CODES				<ul style="list-style-type: none"> <li>• R = LJF registered trademark</li> <li>• BS = 1806 or 4518</li> <li>• A AS 568 A</li> <li>• ISO 3601 (DIN)</li> <li>• AN AN 6227</li> </ul>	E min.	E max.	Dynam. ass.
	PC 851	PB 701	EP 851	DF 801				
39.80 x 2.00	131267	131269	131275	131271		39.39	40.04	
40.00 x 1.50	132006	132007	132008	132009		39.53	40.17	
40.00 x 2.50	132208	132209	132211	132212		39.68	40.35	
40.00 x 3.00	132316	132315	132319	131340		39.81	40.50	
40.00 x 3.15	132405	132406	132408	132409		39.79	40.48	
40.00 x 4.00	132500	132501	132503	132504		39.84	40.56	★
40.20 x 2.00	131268	131270	131276	131274		40.00	40.44	
40.64 x 5.33	132600	132601	132603	132604	R 29 / A 326 / BS 326 / ISO	41.00	41.51	★
40.87 x 3.53	132410	132411	132413	132414	A 223 / BS 223 / ISO	40.97	41.45	★
40.95 x 2.62	132213	132214	132216	132217	A 130 / BS 130 / ISO	40.86	41.33	
41.00 x 1.78	133100	133101	132100	132101	A 030	40.79	41.23	
41.10 x 2.00	132262	132263	132268	132267		40.88	41.33	
41.40 x 5.30	133600	133601	132605	132606	R 29 BIS / ISO	41.74	42.26	★
41.50 x 3.00	133300	133301	133303	133304	BS 0415-30	41.51	41.99	
41.60 x 2.40	133200	133201	133203	133204	BS 0416-24	41.49	41.95	
42.00 x 2.00	133107	133111	133121	133122		41.76	42.22	
42.00 x 4.00	132731	132741	132749	132743		42.04	42.54	★
42.20 x 3.00	133305	133306	133308	133309		42.20	42.68	
42.50 x 3.00	133310	133311	133313	133314	BS 0425-30	42.49	42.98	
42.50 x 3.15	133400	133401	133403	133404		42.47	42.96	
42.50 x 4.00	133500	133501	133503	133504		42.53	43.04	★
42.50 x 5.30	133613	133610	133612	133611	ISO	42.82	43.35	★
42.52 x 2.62	133205	133206	133208	133209	A 131 / BS 131	42.40	42.88	
42.86 x 3.53	133405	133406	133408	133409		42.92	43.42	★
43.00 x 3.00	134300	134301	133315	133316		42.98	43.47	
43.40 x 3.60	134500	134501	133505	133506	R 29 TER	43.47	43.97	★
43.69 x 3.00	134303	134304	134306	134307	A 924	43.66	44.15	
43.70 x 3.55	134413	134414	134415	134416	ISO	43.75	44.26	★
43.82 x 5.33	134600	134601	134603	134604	R 30 / A 327 / BS 327 / ISO	44.12	44.66	★
44.00 x 2.00	133245	133246	133248	133247		43.72	44.20	
44.05 x 3.53	134400	134401	134403	134404	A 224 / BS 224	44.09	44.60	★
44.12 x 2.62	134200	134201	134203	134204	A 132 / BS 132	43.97	44.46	
44.17 x 1.78	134100	134101	134103	134104	A 031	43.89	44.37	
44.20 x 3.00	134308	134309	134311	134312	BS 0445-30	44.16	44.66	
44.20 x 5.70	134700	134701	134703	134704	BS 0443-57	44.57	45.13	★
44.45 x 1.56	134000	134001	134003	134004		44.09	44.57	
44.60 x 2.40	134205	134206	134208	134209		44.43	44.92	
44.64 x 3.00	133520	133521	133524	133523		44.59	45.09	
44.64 x 3.52	133617	133618	133620	133619		44.66	45.18	★
45.00 x 2.00	134241	135130	134244	134243		44.70	45.19	
45.00 x 2.50	135240	135227	135241	135242		44.80	45.30	
45.00 x 3.15	135400	135401	134405	134406		44.92	45.43	
45.00 x 4.00	135500	135501	134503	134504		44.98	45.51	★
45.30 x 5.70	135700	135701	134710	134711	BS 0453-57	45.65	46.22	★
45.54 x 3.60	135508	135509	135510	135504		45.57	46.09	★
45.69 x 2.62	135200	135201	135203	135204	A 133 / BS 133	45.51	46.02	
46.00 x 2.00	135100	135101	135103	135104		45.68	46.18	
46.00 x 3.00	135300	135301	135303	135304		45.92	46.44	
46.50 x 2.50	135205	135206	135208	135209		46.27	46.79	
46.99 x 5.33	135600	135601	135603	135604	R 31 / A 328 / BS 328 / ISO	47.22	47.80	★
47.00 x 2.00	136100	136101	135105	135106		46.66	47.17	
47.00 x 4.00	136519	136514	136520	136521		46.94	47.49	★
47.20 x 3.00	135511	135512	135514	135513		47.10	47.63	
47.22 x 3.53	136400	136401	135403	135404	A 225 / BS 225	47.19	47.74	★
47.29 x 2.62	136200	136201	135210	135211	A 134 / BS 134	47.08	47.60	
47.34 x 1.78	136103	136104	135107	135108	A 032	47.00	47.51	
47.50 x 3.15	136403	136404	136406	136407		47.37	47.91	
47.60 x 2.40	136203	136204	136206	136207	BS 0476-24	47.37	47.89	
47.63 x 3.53	136408	136409	136411	136412	ISO	47.60	48.14	
48.00 x 2.00	136106	136107	136109	136110		47.64	48.16	
48.00 x 3.00	136300	136301	136303	136304		47.88	48.42	
48.70 x 5.30	136603	136600	136604	136605	ISO	48.89	49.49	★
48.90 x 2.62	136208	136209	136211	136212	A 135 / BS 135	48.66	49.20	
49.20 x 5.70	137700	137701	136700	136701	BS 0493-57	49.47	50.08	★
49.21 x 3.53	137400	137401	136413	136414	ISO	49.14	49.71	



All the coded parts are managed in stock.  
 ★ Recommended for dynamic applications as well as static.  
 Refer to page 29 to determine groove dimensions.

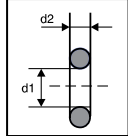
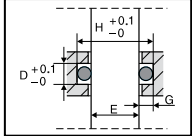
# O-RINGS INSTALLED IN BORES - PRODUCT CODES - NORMS

SIZES int. Ø d1 x cross-section Ø d2	CODES				<ul style="list-style-type: none"> <li>• R = LJF registered trademark</li> <li>• BS = 1806 or 4518</li> <li>• A AS 568 A</li> <li>• ISO 3601 (DIN)</li> <li>• AN AN 6227</li> </ul>	 		E min.	E max.	Dynam. ass.
	PC 851	PB 701	EP 851	DF 801						
49.50 x 2.00	136252	136253	136255	136254		49.11	49.65			
49.50 x 3.00	137300	137301	137303	137304	BS 0495-30	49.35	49.91			
49.60 x 2.00						49.21	49.74			
49.60 x 2.40	137200	137201	137203	137204	BS 0496-24	49.33	49.87			
50.00 x 3.15	137403	137404	137406	137407		49.82	50.38			
50.00 x 4.00	137500	137501	137503	137504		49.88	50.46	★		
50.00 x 5.00	137600	137601	137603	137604		50.10	50.70	★		
50.17 x 5.33	137605	137606	137608	137609	<b>R 32</b> / A 329 / BS 329 / ISO	50.34	50.95	★		
50.40 x 3.53	137408	137409	137411	137412	A 226 / BS 226 / ISO	50.31	50.88			
50.47 x 2.62	137205	137206	137208	137209	A 136 / BS 136	50.19	50.75			
50.52 x 1.78	137100	137101	137103	137104	A 033	50.11	50.66			
50.80 x 3.53	137413	137414	137416	137417		50.70	51.28			
51.00 x 2.50	138200	138201	137210	137211		50.68	51.24			
51.50 x 3.55	138422	138423	138424	138425	ISO	51.39	51.98			
51.60 x 2.40	138203	138204	138206	138207	BS 0516-24	51.29	51.85			
52.00 x 2.00	138100	138101	138103	138104		51.56	52.12			
52.00 x 3.00	138305	138306	138308	138309		51.80	52.38			
52.07 x 2.62	138208	138209	138211	138212	A 137 / BS 137	51.76	52.34			
52.30 x 5.70	138700	138701	138703	138704	BS 0523-57	52.51	53.15	★		
53.00 x 3.00	138515	138518	138517	138516		52.78	53.37			
53.00 x 4.00	139500	139501	138500	138501		52.82	53.43	★		
53.10 x 3.00	139300	139301	138310	138311		52.88	53.47			
53.34 x 5.33	139603	139604	138602	138603	<b>R 33</b> / A 330 / BS 330 / ISO	53.45	54.09	★		
53.57 x 3.53	139400	139401	139403	139404	A 227 / BS 227 / ISO	53.42	54.02			
53.64 x 2.62	139200	139201	139203	139204	A 138 / BS 138	53.30	53.89			
53.69 x 1.78	139100	139101	139103	139104	A 034	53.22	53.79			
53.90 x 4.00	138712	138713	138715	138714		53.70	54.32	★		
53.98 x 3.53	139405	139406	139408	139409	ISO	53.82	54.43			
54.00 x 2.00	139105	139106	139108	139109		53.52	54.10			
54.00 x 3.00	139303	139304	139306	139307		53.76	54.36			
54.20 x 5.70	139700	139701	139703	139704	BS 0543-57	54.37	55.03	★		
54.40 x 5.30	139606	139607	139609	139610	<b>R 33 BIS</b> / ISO	54.48	55.13	★		
54.50 x 3.00	139308	139309	139311	139312	BS 0545-30	54.25	54.86			
54.60 x 2.40	139205	139206	139208	139209	BS 0546-24	54.23	54.82			
55.00 x 2.00	140100	140101	139110	139111		54.50	55.09			
55.00 x 2.50	139452	139453	139461	139459		54.60	55.20			
55.00 x 3.50	140400	140401	139410	139411		54.81	55.43			
55.25 x 2.62	140200	140201	139210	139211	A 139 / BS 139	54.88	55.48			
55.30 x 5.70	140700	140701	139710	139711	BS 0553-57	55.45	56.12	★		
55.50 x 3.00	140300	140301	139313	139314	BS 0555-30	55.23	55.85			
55.56 x 3.53	140403	140404	140406	140407	ISO	55.37	55.99			
56.00 x 4.00	140500	140501	140503	140504		55.76	56.40	★		
56.00 x 5.00	140600	140601	140603	140604		55.98	56.64	★		
56.52 x 5.33	140605	140606	140608	140609	<b>R 34</b> / A 331 / BS 331 / ISO	56.56	57.23	★		
56.75 x 3.53	140408	140409	140411	140412	A 228 / BS 228	56.53	57.17			
56.82 x 2.62	140203	140204	140206	140207	A 140 / BS 140	56.42	57.04			
56.87 x 1.78	140103	140104	140106	140107	A 035	56.34	56.94			
57.00 x 2.80	141300	141301	140303	140304		56.64	57.27			
57.00 x 3.10	141400	141401	140413	140414		56.67	57.30			
57.50 x 2.00	141100	141101	140108	140109		56.95	57.57			
57.60 x 2.40	141200	141201	141203	141204	BS 0576-24	57.17	57.79			
58.00 x 3.00	141303	141304	141306	141307	BS 0575-30	57.68	58.32			
58.00 x 3.55	141421	141423	141424	141425	ISO	57.76	58.41			
58.40 x 4.00	140744	140743	140745	140742		58.11	58.78	★		
58.42 x 2.62	141205	141206	141208	141209	A 141 / BS 141	57.99	58.62			
58.58 x 7.00	140801	140802	140804	140803		58.81	59.53	★		
58.74 x 3.53	141406	141407	141409	141410		58.48	59.14			
59.20 x 2.50	142200	142201	141210	141211		58.72	59.36			
59.20 x 5.70	142700	142701	141700	141701	BS 0593-57	59.27	59.98	★		
59.36 x 3.00	142300	142301	141308	141309	BS 0596-30	59.01	59.67			
59.69 x 5.33	142600	142601	142603	142604	<b>R 35</b> / A 332 / BS 332 / ISO	59.67	60.37	★		
59.92 x 3.53	142400	142401	142403	142404	A 229 / BS 229 / ISO	59.64	60.31			
59.99 x 2.62	142208	142209	142211	142212	A 142 / BS 142	59.52	60.18			
60.00 x 4.00	142500	142501	142503	142504		59.68	60.36	★		
60.00 x 5.00	142605	142606	142608	142609		59.90	60.60	★		

All the coded parts are managed in stock.  
 ★ Recommended for dynamic applications as well as static.  
 Refer to page 29 to determine groove dimensions.



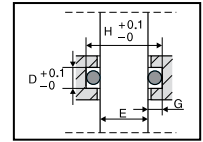
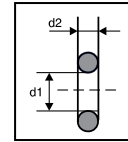
# O-RINGS INSTALLED IN BORES - PRODUCT CODES - NORMS

SIZES int. Ø d1 x cross-section Ø d2	CODES				<ul style="list-style-type: none"> <li>• R = LJF registered trademark</li> <li>• BS = 1806 or 4518</li> <li>• A AS 568 A</li> <li>• ISO 3601 (DIN)</li> <li>• AN AN 6227</li> </ul>	 		E min.	E max.	Dynam. ass.
	PC 851	PB 701	EP 851	DF 801						
60.04 x 1.78	142100	142101	142103	142104	A 036	59.44	60.08			
60.40 x 3.00	141510	141511	141513	141512		60.03	60.70			
60.50 x 2.00	142112	142110	142113	142114		59.89	60.54			
61.60 x 2.40	143200	143201	142213	142214	BS 0616-24	61.09	61.75			
61.60 x 2.62	143203	143204	142215	142216	A 143 / BS 143	61.10	61.77			
61.91 x 3.53	143400	143401	143403	143404		61.59	62.28			
62.00 x 3.00	143300	143301	143303	143304	BS 0625-30	61.60	62.28			
62.00 x 3.50	143405	143406	143408	143409	ISO	61.67	62.36			
62.87 x 5.33	143600	143601	143603	143604	<b>R 36</b> / A 333 / BS 333 / ISO	62.79	63.52	★		
63.00 x 2.00	144100	144101	143100	143101		62.34	63.01			
63.00 x 4.00	144500	144501	143500	143501		62.62	63.33	★		
63.10 x 3.53	144400	144401	143410	143411	A 230 / BS 230 / ISO	62.76	63.46			
63.17 x 2.62	144200	144201	143206	143207	A 144 / BS 144	62.64	63.32			
63.22 x 1.78	144103	144104	143102	143103	A 037	62.56	63.23			
64.50 x 3.00	144300	144301	144303	144304	BS 0645-030	64.05	64.76			
64.60 x 2.40	144203	144204	144206	144207	BS 0646-24	64.03	64.72			
64.77 x 2.62	144208	144209	144211	144212	A 145 / BS 145	64.21	64.91			
65.00 x 2.00	144264	144265	144250	144266		64.30	64.99			
65.00 x 3.00	145300	145301	144305	144306		64.54	65.25			
65.09 x 3.53	145400	145401	144403	144404		64.71	65.43			
66.04 x 5.33	145600	145601	145603	145604	<b>R 37</b> / A 334 / BS 334	65.89	66.66	★		
66.27 x 3.53	145403	145404	145406	145407	A 231 / BS 231	65.86	66.60			
66.34 x 2.62	145200	145201	145203	145204	A 146 / BS 146	65.75	66.46			
66.39 x 1.78	145100	145101	145103	145104	A 038	65.67	66.37			
67.00 x 2.50	146200	146201	145205	145206		66.36	67.08			
67.60 x 2.40	146203	146204	145207	145208	BS 0676-24	66.97	67.69			
67.93 x 5.00	145801	145802	145804	145803		67.67	68.45	★		
67.95 x 2.62	146206	146207	146209	146210	A 147 / BS 147	67.32	68.06			
68.00 x 2.00	146109	146102	146110	146106		67.24	67.96			
68.00 x 3.00	146300	146301	146303	146304		67.48	68.22			
68.00 x 4.00	145731	145732	145734	145733		67.52	68.28	★		
68.26 x 3.53	146400	146401	146403	146404		67.81	68.57			
69.20 x 5.70	147700	147701	146700	146701	BS 0693-57	69.07	69.88	★		
69.22 x 5.33	147600	147601	146603	146604	<b>R 38</b> / A 335 / BS 335 / ISO	69.01	69.81	★		
69.45 x 3.53	147400	147401	146405	146406	A 232 / BS 232	68.98	69.74			
69.52 x 2.62	147200	147201	146211	146212	A 148 / BS 148	68.86	69.61			
69.57 x 1.78	147100	147101	146100	146101	A 039	68.78	69.52			
69.60 x 2.00						68.81	69.54			
69.85 x 3.53	147403	147404	147406	147407		69.37	70.14			
70.00 x 2.00	147108	146242	146244	146243		69.20	69.94			
70.00 x 2.50	147206	147207	147209	147210		69.30	70.05			
70.00 x 3.00	146506	146507	146509	146508		69.44	70.20			
70.00 x 5.00	146804	146805	146807	146806		69.70	70.50	★		
71.00 x 3.55	148408	148409	147412	147413	ISO	70.50	71.28			
71.00 x 5.00	148600	148601	147603	147604		70.68	71.49	★		
71.12 x 2.62	148200	148201	147211	147212	A 149 / BS 149	70.43	71.19			
71.50 x 2.00						70.67	71.43			
71.50 x 2.50	148208	148209	147213	147214		70.77	71.54			
72.00 x 3.00	148300	148301	148303	148304		71.40	72.18			
72.39 x 5.33	148603	148604	148606	148607	<b>R 39</b> / A 336 / BS 336 / ISO	72.11	72.95	★		
72.62 x 3.53	148400	148401	148403	148404	A 233 / BS 233	72.09	72.88			
72.69 x 2.62	148203	148204	148206	148207	A 150	71.97	72.75			
72.74 x 1.78	148100	148101	148103	148104	A 040	71.89	72.65			
73.00 x 4.00	149507	149508	149509	149510		72.42	73.23	★		
73.03 x 3.53	149400	149401	148405	148406		72.49	73.29			
74.00 x 2.00	148230	148231	148233	148232		73.12	73.90			
74.00 x 3.00	149300	149301	149303	149304	BS 0745-30	73.36	74.16			
74.20 x 5.70	149700	149701	149703	149704		73.97	74.83	★		
74.30 x 5.70	149705	149706	149708	149709	BS 0743-57	74.07	74.93	★		
74.61 x 3.53	149403	149404	149406	149407	ISO	74.04	74.85			
74.85 x 3.00	148505	148506	148508	148507		74.19	75.00			
75.00 x 2.00	150100	150101	149100	149101		74.10	74.89			
75.00 x 4.00	150500	150501	149500	149501		74.38	75.21	★		
75.00 x 5.00	150600	150601	149605	149606		74.60	75.45	★		
75.54 x 3.53	149639	149640	149642	149641		74.95	75.77			

All the coded parts are managed in stock.  
 ★ Recommended for dynamic applications as well as static.  
 Refer to page 29 to determine groove dimensions.

# O-RINGS INSTALLED IN BORES - PRODUCT CODES - NORMS

SIZES int. Ø d1 x cross-section Ø d2	CODES				<ul style="list-style-type: none"> <li>• R = LJF registered trademark</li> <li>• BS = 1806 or 4518</li> <li>• A AS 568 A</li> <li>• ISO 3601 (DIN)</li> <li>• AN AN 6227</li> </ul>	E min.	E max.	Dynam. ass.
	PC 851	PB 701	EP 851	DF 801				
75.57 x 5.33	150603	150604	149607	149608	R 40 / A 337 / BS 337 / ISO	75.23	76.09	★
75.79 x 3.53	150400	150401	150403	150404	A 234 / BS 234	75.19	76.02	
75.87 x 2.62	150200	150201	150203	150204	A 151	75.09	75.90	
75.92 x 1.78	150103	150104	150106	150107	A 041	75.01	75.80	
76.93 x 2.62	149428	149427	149429	149426		76.13	76.95	
78.00 x 3.00	150300	150301	150303	150304		77.28	78.12	
78.30 x 2.00	149213	149212	149214	149211		77.33	78.16	
78.74 x 5.33	150606	150607	150609	150610	R 41 / A 338 / BS 338 / ISO	78.34	79.23	★
78.97 x 3.53	150405	150406	150408	150409	A 235 / BS 235	78.31	79.17	
79.20 x 5.70	150700	150701	150703	150709	BS 0792-57	78.87	79.78	★
79.50 x 3.00	150305	150306	150308	150309	BS 0795-30	78.75	79.61	
79.77 x 5.33	150611	150612	150614	150615		79.35	80.25	★
80.00 x 2.00	150228	150230	150234	150232		79.00	79.84	
80.00 x 2.65	151210	151211	150211	150212		79.14	80.00	
80.00 x 4.00	151500	151501	150503	150504		79.28	80.16	★
80.00 x 5.00	151600	151601	150616	150617		79.50	80.40	★
80.50 x 2.20	151200	151201	150205	150206		79.55	80.40	
81.00 x 3.00	151300	151301	151303	151304		80.22	81.09	
81.92 x 5.33	151603	151604	151606	151607	R 42 / A 339 / BS 339 / ISO	81.45	82.38	★
82.00 x 2.00	151100	151101	151103	151104		80.96	81.82	
82.15 x 3.53	151400	151401	151403	151404	A 236 / BS 236	81.42	82.32	
82.22 x 2.62	151203	151204	151206	151207	A 152	81.31	82.18	
82.27 x 1.78	151105	151106	151108	151109	A 042	81.23	82.09	
84.00 x 3.00	151305	151306	151308	151309		83.16	84.06	
84.02 x 2.00	150229	150231	150235	150233		82.94	83.82	
84.11 x 5.72	150837	150838	150840	150839		83.69	84.64	★
84.50 x 3.00	151310	151311	151313	151314	BS 0845-30	83.65	84.56	
84.53 x 2.62	150466	151226	150460	150459		83.57	84.47	
85.00 x 2.00	152100	152101	151110	151111		83.90	84.79	
85.00 x 5.00	152600	152601	151608	151609		84.40	85.35	★
85.00 x 6.30	152800	152801	151803	151804		84.56	85.54	★
85.09 x 5.33	152603	152604	151610	151611	R 43 / A 340 / BS 340 / ISO	84.56	85.52	★
85.30 x 4.00	151749	151750	151752	151751		84.47	85.41	★
85.32 x 3.53	152400	152401	151405	151406	A 237 / BS 237	84.53	85.46	
86.15 x 1.25	151909	151908	151910	151907		84.88	85.76	
87.20 x 2.50	152200	152201	152203	152204		86.16	87.08	
87.90 x 3.00	151511	151512	151514	151513		86.98	87.92	
88.27 x 5.33	152606	152607	152609	152610	R 44 / A 341 / BS 341 / ISO	87.68	88.67	★
88.50 x 3.53	152403	152404	152406	152407	A 238 / BS 238	87.65	88.60	
88.57 x 2.62	152205	152206	152208	152209	A 153	87.53	88.47	
88.62 x 1.78	152103	152104	152106	152107	A 043	87.45	88.37	
89.00 x 4.00	152500	152501	152503	152504		88.10	89.07	★
89.50 x 3.00	152300	152301	152303	152304	BS 0895-30	88.55	89.51	
89.69 x 5.33	152611	152612	152614	152615	ISO	89.07	90.07	★
90.00 x 5.00	153600	153601	152616	152617		89.30	90.30	★
90.00 x 6.30	153800	153801	152803	152804		89.46	90.49	★
91.00 x 3.00	153300	153301	153303	153304		90.02	90.99	
91.38 x 4.04	152766	152767	152769	152768		90.44	91.44	★
91.42 x 3.00	152527	152528	152530	152529		90.43	91.41	
91.44 x 5.33	153603	153604	153606	153607	R 45 / A 342 / BS 342 / ISO	90.78	91.80	★
91.67 x 3.53	153400	153401	153403	153404	A 239 / BS 239	90.75	91.74	
93.66 x 2.50	152459	152460	152462	152461		92.49	93.47	
94.10 x 5.70	153700	153701	153703	153704		93.47	94.53	★
94.50 x 3.00	153305	153306	153308	153309	BS 0945-30	93.45	94.46	
94.62 x 5.33	153608	153609	153611	153612	R 46 / A 343 / BS 343 / ISO	93.90	94.95	★
94.85 x 2.00	152241	152240	152242	152239		93.55	94.54	
94.85 x 3.53	153405	153406	153408	153409	A 240 / BS 240 / ISO	93.87	94.89	
94.92 x 2.62	153200	153201	153203	153204	A 154	93.76	94.76	
94.97 x 1.78	153100	153101	153103	153104	A 044	93.68	94.66	
95.00 x 5.00	154600	154601	153613	153614		94.20	95.25	★
95.10 x 2.40	154200	154201	153205	153206		93.92	94.92	
95.37 x 2.00	153231	153232	153234	153233		94.06	95.06	
96.00 x 4.00	153766	153764	153767	153765		94.96	96.00	★
96.30 x 3.60	154500	154501	154503	154504		95.31	96.35	
97.79 x 5.33	154603	154604	154606	154607	R 47 / A 344 / BS 344 / ISO	97.01	98.09	★



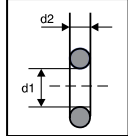
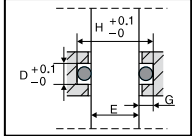
All the coded parts are managed in stock.  
 ★ Recommended for dynamic applications as well as static.  
 Refer to page 29 to determine groove dimensions.

# O-RINGS INSTALLED IN BORES - PRODUCT CODES - NORMS

SIZES int. Ø d1 x cross-section Ø d2	CODES				<ul style="list-style-type: none"> <li>• R = LJF registered trademark</li> <li>• BS = 1806 or 4518</li> <li>• A AS 568 A</li> <li>• ISO 3601 (DIN)</li> <li>• AN AN 6227</li> </ul>	 		E min.	E max.	Dynam. ass.
	PC 851	PB 701	EP 851	DF 801						
98.00 x 2.20	154203	154204	154206	154207			96.70	97.72		
98.02 x 3.53	154400	154401	154403	154404	A 241 / BS 241		96.98	98.03		
99.30 x 5.70	154700	154701	154703	154704			98.57	99.68	★	
99.50 x 3.00	154300	154301	154303	154304	BS 0995-30		98.35	99.41		
100.00 x 2.00	155100	155101	154100	154101			98.60	99.64		
100.00 x 5.00	155500	155501	154608	154609			99.10	100.20	★	
100.97 x 5.33	155506	155507	154612	154613	R 48 / A 345 / BS 345 / ISO		100.68	102.36	★	
101.00 x 3.00	155300	155301	154305	154306			100.36	101.96		
101.20 x 3.53	155303	155304	155306	155307	A 242 / BS 242 / ISO		100.64	102.26		
101.27 x 2.62	155200	155201	155203	155204	A 155		100.51	102.11		
101.32 x 1.78	155103	155104	155106	155107	A 045		100.42	102.00		
102.00 x 3.00	154224	155355	154229	154227			101.34	102.96		
103.30 x 3.00	154225	154226	154230	154228			102.62	104.26		
104.00 x 4.00	155435	155419	155436	155437			103.36	105.04		
104.14 x 5.33	155509	155510	155512	155513	R 49 / A 346 / BS 346 / ISO		103.80	105.53	★	
104.37 x 3.53	155308	155309	155311	155312	A 243 / BS 243		103.76	105.43		
104.50 x 3.00	155313	155314	155316	155317	BS 1045-30		103.80	105.46		
104.64 x 5.05	154518	154519	154521	154520			104.23	105.95	★	
106.00 x 2.00	155126	155127	155129	155128			105.02	106.67		
106.00 x 2.50	156200	156201	155205	155206			105.14	106.80		
107.32 x 5.33	156503	156504	156506	156507	R 50 / A 347 / BS 347 / ISO		106.94	108.71	★	
107.55 x 3.53	156300	156301	156303	156304	A 244 / BS 244		106.89	108.61		
107.62 x 2.62	156203	156204	156206	156207	A 156		106.77	108.46		
107.67 x 1.78	156100	156101	156103	156104	A 046		106.68	108.35		
109.30 x 5.70	156600	156601	156603	156604	BS 1093-57		108.97	110.78	★	
109.50 x 3.00	156305	156306	156308	156309	BS 1095-30		108.73	110.46		
110.00 x 2.00	156112	157111	156114	156113			108.97	110.68		
110.49 x 5.33	157500	157501	156513	156514	R 51 / A 348 / BS 348		110.06	111.88	★	
110.72 x 3.53	157300	157301	156310	156311	A 245 / BS 245		110.01	111.78		
112.00 x 3.00	157303	157304	157306	157307			111.19	112.96		
113.67 x 5.33	157508	157509	157511	157512	R 52 / A 349 / BS 349		113.19	115.06	★	
113.67 x 6.99	157705	157706	157708	157709	R 53 / A 425 / BS 425		113.43	115.35	★	
113.90 x 3.53	157308	157309	157311	157312	A 246 / BS 246 / ISO		113.14	114.96		
113.97 x 2.62	157200	157201	157203	157204	A 157		113.02	114.81		
114.02 x 1.78	157100	157101	157103	157104	A 047		112.93	114.70		
114.30 x 5.70	157600	157601	157603	157604	BS 1143-57		113.90	115.78	★	
115.00 x 3.00	158300	158301	157318	157319	BS 1145-30		114.15	115.96		
116.00 x 4.00	158400	158401	157400	157401			115.18	117.04		
116.84 x 6.99	158700	158701	158703	158704	R 54 / A 426 / BS 426		116.56	118.52	★	
117.07 x 3.53	158303	158304	158306	158307	A 247		116.27	118.13		
117.50 x 5.33	158505	158506	158508	158509			116.96	118.89	★	
118.00 x 5.30	158521	158522	158523	158524	ISO		117.45	119.38	★	
118.50 x 3.00	158308	158309	158311	158312			117.59	119.46		
119.00 x 4.00	158403	158404	158406	158407			118.14	120.04		
119.30 x 5.70	158600	158601	158603	158604	BS 1193-57		118.82	120.78	★	
119.50 x 3.00	158313	158314	158316	158317	BS 1195-30		118.58	120.46		
120.02 x 6.99	159700	159701	158710	158711	R 55 / A 427 / BS 427		119.69	121.70	★	
120.25 x 3.53	159300	159301	158318	158319	A 248 / BS 248		119.40	121.31		
120.32 x 2.62	159200	159201	158200	158201	A 158		119.28	121.16		
120.37 x 1.78	159100	159101	158100	158101	A 048		119.19	121.05		
123.00 x 3.00	159303	159304	159306	159307			122.03	123.96		
123.19 x 6.99	159703	159704	159706	159707	R 56 / A 428 / BS 428		122.81	124.87	★	
123.42 x 3.53	159308	159309	159311	159312	A 249 / BS 249		122.52	124.48		
123.80 x 5.33	159511	159512	159514	159515	A 352 / ISO		123.17	125.19	★	
124.50 x 3.00	159313	159314	159316	159317	BS 1245-30		123.50	125.46		
125.00 x 2.00	160100	160101	159103	159104			123.75	125.68		
125.00 x 5.00	160500	160501	159516	159517			124.28	126.30	★	
126.00 x 3.00	160300	160301	159318	159319			124.98	126.96		
126.37 x 5.33	160503	160504	160506	160507	A 353		125.70	127.76	★	
126.37 x 6.99	160700	160701	160703	160704	R 57 / A 429 / BS 429		125.94	128.05	★	
126.60 x 3.53	160303	160304	160306	160307	A 250 / BS 250 / ISO		125.65	127.66		
126.67 x 2.62	160200	160201	160203	160204	A 159		125.53	127.51		
126.72 x 1.78	160103	160104	160106	160107	A 049		125.44	127.40		
128.00 x 3.00	159207	159208	159210	159209			126.95	128.96		
129.30 x 5.70	160600	160601	160603	160604	BS 1293-57		128.67	130.78	★	

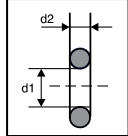
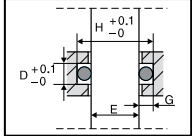
All the coded parts are managed in stock.  
 ★ Recommended for dynamic applications as well as static.  
 Refer to page 29 to determine groove dimensions.

# O-RINGS INSTALLED IN BORES - PRODUCT CODES - NORMS

SIZES int. Ø d1 x cross-section Ø d2	CODES				<ul style="list-style-type: none"> <li>• R = LJF registered trademark</li> <li>• BS = 1806 or 4518</li> <li>• A AS 568 A</li> <li>• ISO 3601 (DIN)</li> <li>• AN AN 6227</li> </ul>	 		Dynam. ass.
	PC 851	PB 701	EP 851	DF 801		E min.	E max.	
129.50 x 3.00	160308	160309	160311	160312	BS 1295-30	128.43	130.46	
129.54 x 5.33	160508	160509	160511	160512	A 354	128.82	130.93	★
129.54 x 6.99	160705	160706	160708	160709	R 58 / A 430 / BS 430	129.06	131.22	★
129.77 x 3.53	160313	160314	160316	160317	A 251 / BS 251	128.78	130.83	
132.00 x 3.00	160218	160219	160221	160220		130.89	132.96	
132.72 x 5.33	161505	161506	161508	161509	A 355	131.96	134.11	★
132.72 x 6.99	161700	161701	161703	161704	R 59 / A 431 / BS 431	132.20	134.40	★
132.94 x 3.53	161300	161301	161303	161304	A 252 / BS 252 / ISO	131.90	134.00	
133.02 x 2.62	161203	161204	161206	161207	A 160	131.78	133.86	
133.07 x 1.78	161100	161101	161103	161104	A 050	131.70	133.75	
134.30 x 5.70	161600	161601	161603	161604	BS 1343-57	133.60	135.78	★
134.50 x 3.00	161305	161306	161308	161309	BS 1345-30	133.35	135.46	
135.00 x 4.00	162400	162401	161400	161401		133.90	136.04	
135.89 x 6.99	162700	162701	161710	161711	R 60 / A 432 / BS 432	135.32	137.57	★
136.12 x 3.53	162300	162301	161310	161311	A 253 / BS 253 / ISO	135.03	137.18	
136.50 x 5.33	162503	162504	162506	162507		135.68	137.89	★
137.00 x 3.00	162303	162304	162306	162307		135.82	137.96	
138.70 x 1.80	162106	162102	162107	162103		137.25	139.38	
139.00 x 4.00	162403	162404	162406	162407		137.84	140.04	
139.07 x 6.99	162703	162704	162706	162707	R 61 / A 433 / BS 433	138.45	140.75	★
139.30 x 3.53	162308	162309	162311	162312	A 254 / BS 254 / ISO	138.16	140.36	
139.37 x 2.62	162200	162201	162203	162204	A 161	138.04	140.21	
139.50 x 3.00	161228	161227	161229	161226	BS 1395-30	138.28	140.46	
139.70 x 5.33	162513	162514	162516	162517	A 357 / ISO	138.83	141.09	★
139.96 x 3.00	161222	161223	161225	161224		138.73	140.92	
140.00 x 5.00	163500	163501	162518	162519		139.05	141.30	★
141.00 x 3.00	162209	162210	162212	162211		139.76	141.96	
142.24 x 5.33	163508	163509	163506	163507	A 358	141.33	143.63	★
142.24 x 6.99	163700	163701	163703	163704	R 62 / A 434 / BS 434	141.57	143.92	★
142.47 x 3.53	163300	163301	163303	163304	A 255 / BS 255	141.29	143.53	
144.00 x 3.70	163400	163401	163403	163404		142.84	145.11	
144.30 x 5.70	163600	163601	163603	163604	BS 1443-57	143.45	145.78	★
144.50 x 3.00	163305	163306	163308	163309	BS 1445-30	143.20	145.46	
145.00 x 4.00	164400	164401	163405	163406		143.75	146.04	
145.42 x 6.99	164700	164701	163705	163706	R 63 / A 435 / BS 435	144.71	147.10	★
145.64 x 3.53	164300	164301	163310	163311	A 256 / BS 256 / ISO	144.41	146.70	
145.72 x 2.62	164200	164201	163200	163201	A 162	144.29	146.56	
146.10 x 5.33	164503	164504	163515	163516		145.13	147.49	★
148.00 x 3.00	163210	163211	163213	163212		146.65	148.96	
148.59 x 5.33	164506	164507	164509	164510	A 360	147.59	149.98	★
148.59 x 6.99	164703	164704	164706	164707	R 64 / A 436 / BS 436	147.83	150.27	★
148.82 x 3.53	164303	164304	164306	164307	A 257 / BS 257 / ISO	147.54	149.88	
149.20 x 5.33	164511	164512	164514	164515		148.19	150.59	★
149.30 x 5.70	163609	163610	163612	163611		148.39	150.80	★
150.00 x 2.00	164102	164103	164105	164104		148.37	150.68	
150.00 x 3.40	165300	165301	164313	164314		148.67	151.02	
150.00 x 5.00	165500	165501	164516	164517		148.90	151.30	★
151.00 x 3.00	165303	165304	164315	164316		149.61	151.96	
151.77 x 6.99	165700	165701	165703	165704	R 65 / A 437 / BS 437	150.96	153.45	★
152.00 x 3.53	165306	165307	165309	165310	A 258 / BS 258	150.67	153.06	
152.07 x 2.62	165200	165201	165203	165204	A 163	150.55	152.91	
154.30 x 5.70	165600	165601	165603	165604	BS 1543-57	153.30	155.78	★
154.50 x 3.00	165311	165312	165314	165315	BS 1545-30	153.05	155.46	
155.00 x 3.50	166300	166301	165316	165317	ISO	153.62	156.05	
156.00 x 2.00	165102	165103	165105	165104		154.28	156.68	
158.12 x 5.33	166500	166501	166503	166504	A 362	156.97	159.51	★
158.12 x 6.99	166703	166704	166706	166707	R 66 / A 438 / BS 438	157.22	159.80	★
158.34 x 3.53	166303	166304	166306	166307	A 259 / BS 259 / ISO	156.92	159.40	
158.42 x 2.62	166200	166201	166203	166204	A 164	156.80	159.26	
159.30 x 5.70	166600	166601	166603	166604	BS 1593-57	158.22	160.78	★
159.50 x 3.00	166308	166309	166311	166312	BS 1595-30	157.98	160.46	
160.00 x 2.00	167103	167100	167104	167105		158.22	160.68	
160.00 x 2.50	167200	167201	166205	166206		158.33	160.80	
160.00 x 5.00	167500	167501	166505	166506		158.75	161.30	★
162.50 x 3.50	167300	167301	167303	167304		161.01	163.55	

All the coded parts are managed in stock.  
 ★ Recommended for dynamic applications as well as static.  
 Refer to page 29 to determine groove dimensions.

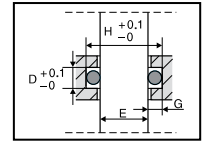
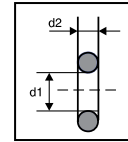
# O-RINGS INSTALLED IN BORES - PRODUCT CODES - NORMS

SIZES int. Ø d1 x cross-section Ø d2	CODES				<ul style="list-style-type: none"> <li>• R = LJJ registered trademark</li> <li>• BS = 1806 or 4518</li> <li>• A AS 568 A</li> <li>• ISO 3601 (DIN)</li> <li>• AN AN 6227</li> </ul>	 		E min.	E max.	Dynam. ass.
	PC 851	PB 701	EP 851	DF 801						
164.10 x 8.40	167803	167804	167806	167807	BS 1614-84	163.40	166.12	★		
164.30 x 5.70	167600	167601	167603	167604		163.15	165.78	★		
164.47 x 5.33	168504	168505	167514	167515	A 363	163.23	165.86	★		
164.47 x 6.99	167705	167706	167708	167709	R 67 / A 439 / BS 439	163.47	166.15	★		
164.50 x 3.00	167305	167306	167308	167309	BS 1645-30	162.90	165.46			
164.70 x 3.53	167310	167311	167313	167314	A 260 / BS 260 / ISO	163.18	165.76			
164.77 x 2.62	167203	167204	167219	167207	A 165	163.06	165.61			
165.00 x 4.00	167408	167409	167411	167410		163.45	166.04			
166.70 x 6.99	168700	168701	168703	168704		165.67	168.38	★		
167.00 x 2.80	168300	168301	168303	168304		165.31	167.90			
169.30 x 5.70	168600	168601	168603	168604	BS 1693-57	168.07	170.78	★		
169.50 x 3.00	168305	168306	168308	168309	BS 1695-30	167.83	170.46			
170.00 x 5.00	169500	169501	168500	168501		168.60	171.30	★		
170.82 x 5.33	169503	169504	168502	168503	A 364	169.48	172.21	★		
170.82 x 6.99	169700	169701	168710	168711	R 68 / A 440 / BS 440	169.73	172.50	★		
171.05 x 3.53	169300	169301	168310	168311	A 261 / BS 261 / ISO	169.44	172.11			
172.00 x 3.00	169303	169304	169306	169307		170.29	172.96			
174.46 x 3.00	168203	168204	168206	168205		172.71	175.42			
174.50 x 3.00	169308	169309	169311	169312	BS 1745-30	172.75	175.46			
174.60 x 6.99	169703	169704	169706	169707		173.45	176.28	★		
175.00 x 4.00	170400	170401	169400	169401		173.30	176.04			
176.00 x 3.00	170300	170301	169313	169314		174.23	176.96			
177.17 x 5.33	170500	170501	170503	170504	A 365 / ISO	175.74	178.56	★		
177.17 x 6.99	170700	170701	170703	170704	R 69 / A 441 / BS 441	175.98	178.85	★		
177.40 x 3.53	170303	170304	170306	170307	A 262 / BS 262 / ISO	175.69	178.46			
179.30 x 5.70	170600	170601	170603	170604	BS 1793-57	177.92	180.78	★		
179.50 x 3.00	170308	170309	170311	170312	BS 1795-30	177.68	180.46			
180.00 x 2.50	171200	171201	170205	170206		178.03	180.80			
180.00 x 5.00	171500	171501	170505	170506		178.45	181.30	★		
183.52 x 6.99	171703	171704	171706	171707	R 70 / A 442 / BS 442	182.24	185.20	★		
183.74 x 3.53	171300	171301	171303	171304	A 263 / BS 263 / ISO	181.94	184.80			
183.82 x 2.62	171203	171204	171206	171215	A 168	181.82	184.66			
184.00 x 4.00	171412	171413	171414	171415		182.16	185.04			
184.30 x 5.70	171600	171601	171603	171604	BS 1843-57	182.85	185.78	★		
184.50 x 3.00	171305	171306	171308	171309	BS 1845-30	182.60	185.46			
187.33 x 6.99	171750	171755	171767	171757		185.99	189.01	★		
188.00 x 3.00	172321	172322	172323	172324		186.05	188.96			
189.30 x 5.70	172600	172601	172603	172604	BS 1893-57	187.77	190.78	★		
189.87 x 6.99	172705	172706	172708	172709	R 71 / A 443 / BS 443	188.49	191.55	★		
190.00 x 2.70	173300	173301	172305	172306		187.93	190.86			
190.00 x 4.00	173400	173401	172400	172401		188.07	191.04			
190.00 x 5.30	173507	173508	173531	173532	ISO	188.37	191.38	★		
190.10 x 3.53	173303	173304	172307	172308	A 264 / BS 264 / ISO	188.20	191.16			
194.50 x 3.00	173306	173307	173309	173310	BS 1945-30	192.45	195.46			
196.22 x 5.33	174500	174501	173500	173501	A 368 / ISO	194.50	197.61	★		
196.22 x 6.99	174700	174701	173708	173709	R 72 / A 441 / BS 441	194.74	197.90	★		
196.45 x 3.53	174300	174301	173311	173312	A 265 / BS 265	194.46	197.51			
198.80 x 3.80	174400	174401	174403	174404		196.84	199.94			
199.30 x 5.70	174600	174601	174603	174604	BS 1993-57	197.62	200.78	★		
200.78 x 6.96	174612	174613	174615	174614		199.23	202.45	★		
201.75 x 4.00	174331	174332	174334	174333		199.65	202.80			
202.57 x 5.33	175400	175401	175436	175404	A 369	200.76	203.96	★		
202.57 x 6.99	175606	175607	175609	175610	R 73 / A 445 / BS 445	201.00	204.25	★		
202.80 x 3.53	175200	175201	175203	175204	A 266 / BS 266 / ISO	200.71	203.86			
204.10 x 8.40	175700	174734	174735	174733	BS 2041-84	202.80	206.12	★		
209.14 x 3.53	175210	175211	175213	175214	A 267 / BS 267	206.96	210.20			
209.30 x 5.70	175500	175501	175503	175504	BS 2093-57	207.47	210.78	★		
209.50 x 3.00	175215	175216	175218	175219	BS 2095-30	207.23	210.46			
210.00 x 4.00	176300	176301	175300	175301		207.77	211.04			
212.00 x 6.30	176600	176601	175616	175617		210.14	213.51	★		
214.00 x 3.00	176200	176201	176203	176204		211.66	214.96			
215.27 x 5.33	176400	176401	176403	176404	A 371 / ISO	213.27	216.66	★		
215.27 x 6.99	176603	176604	176606	176607	R 74 / A 446 / BS 446 / ISO	213.51	216.95	★		
215.49 x 3.53	176205	176206	176208	176209	A 268 / BS 268	213.21	216.55			
221.60 x 6.99	177600	177601	176608	176609	BS 446 A	219.74	223.28	★		

All the coded parts are managed in stock.  
 ★ Recommended for dynamic applications as well as static.  
 Refer to page 29 to determine groove dimensions.

# O-RINGS INSTALLED IN BORES - PRODUCT CODES - NORMS

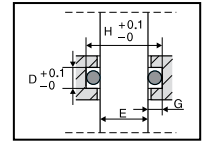
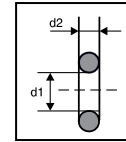
SIZES int. Ø d1 x cross-section Ø d2	CODES				<ul style="list-style-type: none"> <li>• R = LJF registered trademark</li> <li>• BS = 1806 or 4518</li> <li>• A AS 568 A</li> <li>• ISO 3601 (DIN)</li> <li>• AN AN 6227</li> </ul>	E min.	E max.	Dynam. ass.
	PC 851	PB 701	EP 851	DF 801				
221.62 x 5.33	177400	177401	176405	176406	A 372	219.52	223.01	★
221.84 x 3.53	177200	177201	176215	176216	A 269	219.47	222.90	
224.50 x 3.00	177203	177204	177206	177207		222.00	225.46	
226.32 x 4.00	176321	176322	176324	176323		223.85	227.37	
227.97 x 5.33	177403	177404	177406	177407	A 373	225.78	229.36	★
227.97 x 6.99	177608	177609	177611	177612	<b>R 75</b> / A 447 / BS 447 / ISO	226.02	229.65	★
228.19 x 3.53	177208	177209	177211	177212	A 270 / BS 270	225.72	229.25	
229.30 x 5.70	177500	177501	177503	177504	BS 2293-57	227.17	230.78	★
233.00 x 3.00	178200	178201	178203	178204		230.38	233.96	
234.30 x 6.99	178600	178601	178603	178604	BS 447 A	232.25	235.98	★
234.54 x 3.53	178205	178206	178208	178209	A 271 / BS 271	231.98	235.60	
234.62 x 2.62	178100	178101	178103	178104	A 176	231.86	235.46	
235.00 x 3.00	178210	178211	178213	178214		232.35	235.96	
236.00 x 6.30	178605	178606	178608	178609		233.78	237.51	★
240.67 x 5.33	179428	179429	179430	179431	A 375	238.29	242.06	★
240.67 x 6.99	179600	179601	178610	178611	<b>R 76</b> / A 448 / BS 448	238.53	242.35	★
240.90 x 3.53	179200	179201	178220	178221	A 272 / BS 272	238.24	241.96	
245.00 x 3.00	179203	179204	179206	179207		242.20	245.96	
247.02 x 6.99	179603	179604	179606	179607	BS 448 A	244.78	248.70	★
247.24 x 3.53	179208	179209	179211	179212	A 273 / BS 273	244.48	248.30	
249.30 x 5.70	179500	179501	179503	179504	BS 2493-057	246.87	250.78	★
250.00 x 5.00	180407	180406	180414	180415		247.40	251.30	★
253.37 x 6.99	180603	180604	180606	180607	<b>R 77</b> / A 449 / BS 449	251.04	255.05	★
253.59 x 3.53	180200	180201	180203	180204	A 274 / BS 274	250.74	254.65	
259.30 x 5.70	180500	180501	180503	180504	BS 2593-30	256.72	260.78	★
259.72 x 6.99	180608	180609	180611	180612	BS 449 A	257.29	261.40	★
260.00 x 3.00	181200	181201	180205	180206		256.97	260.96	
266.07 x 5.33	181416	181417	181418	181419	A 378 / ISO	263.30	267.46	★
266.07 x 6.99	181605	181606	181608	181609	<b>R 78</b> / A 450 / BS 450 / ISO	263.55	267.75	★
266.29 x 3.53	181203	181204	181206	181207	A 275	263.25	267.35	
269.30 x 5.70	181500	181501	181503	181504	BS 2693-57	266.57	270.78	★
271.00 x 3.00	182200	182201	181208	181209		267.81	271.96	
272.42 x 6.99	182600	182601	181610	181611	BS 450 A / ISO	269.80	274.10	★
275.00 x 4.00	182300	182301	182303	182304		271.80	276.04	
278.77 x 5.33	182400	182401	182403	182404	A 379 B	275.81	280.16	★
278.77 x 6.99	182603	182604	182606	182607	<b>R 79</b> / A 451 / BS 451	276.06	280.45	★
278.99 x 3.53	182203	182204	182206	182207	A 276	275.76	280.05	★
279.30 x 5.70	182500	182501	182503	182504	BS 2796-57	276.42	280.78	
280.00 x 3.00	183200	183201	182208	182209		276.67	280.96	
285.12 x 6.99	183603	183604	183606	183607	BS 451 A / ISO	282.31	286.80	★
286.45 x 4.00	182319	182322	182321	182320		283.07	287.49	
288.00 x 4.00	183300	183301	183303	183304		284.60	289.04	
290.00 x 3.00	184200	184201	183203	183204		286.52	290.96	
291.47 x 5.33	184400	184401	183400	183401	A 380 / ISO	288.32	292.86	★
291.47 x 6.99	184600	184601	183608	183609	<b>R 80</b> / A 452 / BS 452 / ISO	288.57	293.15	★
291.69 x 3.53	184203	184204	183205	183206	A 277	288.27	292.75	
297.82 x 6.99	184603	184604	184606	184607	BS 452 / ISO	294.82	299.50	★
298.00 x 2.50	184100	184101	184103	184104		294.26	298.80	
304.17 x 6.99	185603	185604	185606	185607	<b>R 81</b> / A 453 / BS 453	301.08	305.85	★
304.39 x 3.53	185200	185201	185203	185204	A 278	300.78	305.45	
307.00 x 5.00	185405	185406	185408	185409		303.55	308.30	
310.00 x 3.00	185205	185206	185208	185209		306.22	310.96	
315.00 x 7.00	185634	185635	185636	185637	ISO	311.75	316.68	★
315.00 x 10.00	185803	185804	185806	185807		312.38	317.40	★
316.87 x 6.99	185613	185614	185616	185617	<b>R 82</b> / A 454 / BS 454 / ISO	313.58	318.55	★
317.50 x 3.20	185210	185211	185213	185214		313.60	318.46	
319.30 x 5.70	185500	185501	185503	185504	BS 3193-57	315.82	320.78	★
325.00 x 3.00	186200	186201	185215	185216		321.00	325.96	
329.57 x 5.33	186400	186401	186403	186404	A 382 / A 455 / BS 455	325.85	330.96	★
329.57 x 6.99	186600	186601	186603	186604	<b>R 83</b> / A 456 / BS 456	326.09	331.25	★
329.79 x 3.53	186203	186204	186206	186207	A 279	325.80	330.85	
330.00 x 3.70	186300	186301	186303	186304		326.05	331.11	
335.00 x 3.00	186208	186209	186211	186212		330.85	335.96	
339.30 x 5.70	186505	186506	186508	186509	BS 3393-57	335.52	340.78	★



All the coded parts are managed in stock.  
 ★ Recommended for dynamic applications as well as static.  
 Refer to page 29 to determine groove dimensions.

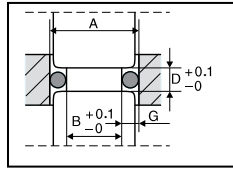
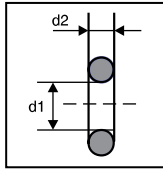
# O-RINGS INSTALLED IN BORES - PRODUCT CODES - NORMS

SIZES int. Ø d1 x cross-section Ø d2	CODES				<ul style="list-style-type: none"> <li>• R = LJF registered trademark</li> <li>• BS = 1806 or 4518</li> <li>• A AS 568 A</li> <li>• ISO 3601 (DIN)</li> <li>• AN AN 6227</li> </ul>	E min.	E max.	Dynam. ass.
	PC 851	PB 701	EP 851	DF 801				
342.27 x 6.99	186605	186606	186608	186609	R 84 / A 456 / BS 456	338.60	343.95	★
345.00 x 3.00	186213	186214	186216	186217		340.70	345.96	
354.97 x 6.99	187600	187601	187603	187604	R 85 / A 457 / BS 457 / ISO	351.11	356.65	★
355.00 x 3.00	187200	187201	187203	187204		350.55	355.96	
355.00 x 5.30	187408	187409	187410	187411	A 383 / ISO	350.89	356.38	★
355.19 x 3.53	187205	187206	187208	187209	A 280	350.82	356.25	
359.30 x 5.70	187500	187501	187503	187504	BS 3593-57	355.22	360.78	★
365.00 x 3.00	187210	187211	187213	187214		360.40	365.96	
367.67 x 6.99	187605	187606	187608	187609	R 86 / A 458 / BS 458	363.62	369.35	★
372.00 x 6.00	187505	187506	187508	187509		367.68	373.44	
380.37 x 5.33	188400	188401	188403	188404	A 384	375.89	381.76	
380.37 x 6.99	188600	188601	188603	188604	R 87 / A 459 / BS 459	376.13	382.05	★
380.59 x 3.53	188200	188201	188203	188204	A 281	375.83	381.65	
385.00 x 3.00	188205	188206	188208	188209		380.10	385.96	
393.07 x 6.99	188605	188606	188608	188609	R 88 / A 460 / BS 460	388.64	394.75	★
399.30 x 5.70	188505	188506	188508	188509	BS 3993-57	394.62	400.78	★
405.26 x 3.53	189200	189201	189203	189204	A 282	400.13	406.32	
405.26 x 5.33	189400	189401	189403	189404	A 385	400.41	406.65	
406.40 x 3.20	189205	189206	189208	189209		401.17	407.36	
412.00 x 8.00	189703	189704	189706	189707		407.50	413.92	★
412.48 x 6.94	188632	188667	188669	188668		407.75	414.15	★
425.00 x 8.00	190700	190701	189708	189709		420.31	426.92	★
430.66 x 3.53	190200	190201	190203	190204	A 283	425.15	431.72	
430.66 x 6.99	190600	190601	190603	190604	A 463	425.67	432.34	★
431.50 x 6.00	190500	190501	190503	190504		426.29	432.94	★
439.00 x 6.00	190505	190506	190508	190509		433.68	440.44	★
440.00 x 10.00	190803	190804	190806	190807		435.50	442.40	★
444.00 x 8.00	190703	190704	190706	190707		439.02	445.92	★
447.00 x 7.00	189662	189663	189665	189666		441.77	448.68	★
459.00 x 8.00	191703	191704	191706	191707		453.80	460.92	★
459.30 x 5.70	191500	191501	191503	191504	BS 4593-57	453.72	460.78	
465.00 x 5.30	191405	191406	191408	191409		459.24	466.38	★
468.00 x 6.00	191505	191506	191508	191509		462.24	469.44	★
486.00 x 6.00	192503	192504	192506	192507		479.97	487.44	★
487.00 x 7.00	192614	192615	192616	192617	ISO	481.17	488.68	★
493.72 x 7.00	191658	191659	191661	191660		487.80	495.41	★
495.00 x 3.00	192200	192201	192203	192204		488.45	495.96	
500.00 x 6.00	193500	193501	192513	192514		493.76	501.44	
500.00 x 8.00	193700	193701	192703	192704		494.18	501.92	★
505.00 x 6.00	193503	193504	192515	192516		498.69	506.44	
506.81 x 5.33	193400	193401	193403	193404	A 389	500.43	508.20	
522.00 x 6.00	193506	193507	193509	193510		515.43	523.44	
530.00 x 10.00	193803	193804	193806	193807		524.15	532.40	★
531.00 x 6.00	193511	193512	193514	193515		524.30	532.44	
532.21 x 5.33	193405	193406	193408	193409	A 390	525.45	533.60	
532.26 x 6.99	193605	193606	193608	193609	A 470	525.74	533.94	★
554.00 x 8.00	193703	193704	193706	193707		547.37	555.92	★
557.66 x 6.99	193646	193647	193648	193649	A 471 / ISO	550.76	559.34	★
582.68 x 5.33	193415	193416	193418	193419	A 392	575.17	584.07	
582.68 x 6.99	193650	193651	193652	193653	A 472 / ISO	575.41	584.36	★
608.08 x 6.99	194600	194601	194603	194604	A 473	600.43	609.76	★
610.00 x 10.00	194803	194804	194806	194807		602.95	612.40	★
710.00 x 10.00	195800	195801	195803	195804		701.45	712.40	★
738.00 x 10.25	195805	195806	195808	195809		729.08	740.46	★
800.00 x 10.00	196800	196801	195815	195816		790.10	802.40	★



All the coded parts are managed in stock.  
 ★ Recommended for dynamic applications as well as static.  
 Refer to page 29 to determine groove dimensions.

# FITTING TO PISTON

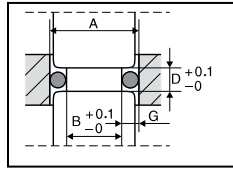
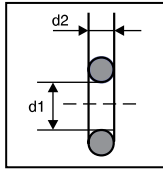


A min.	A max.	O-ring	
		int. $\varnothing$ d1	$\varnothing$ cross-section d2
2.34	2.41	0.74	1.00
2.75	2.85	1.15	1.00
3.10	3.20	1.07	1.27
3.25	3.36	1.25	1.25
3.40	3.53	1.40	1.25
3.40	3.56	1.80	1.00
3.60	3.74	1.60	1.25
3.80	3.96	1.80	1.25
3.80	4.00	2.20	1.00
3.88	4.01	1.42	1.52
4.00	4.18	2.00	1.25
4.19	4.34	1.60	1.60
4.20	4.36	1.80	1.50
4.20	4.43	2.60	1.00
4.50	4.73	2.50	1.25
4.59	4.77	2.00	1.60
4.60	4.87	3.00	1.00
4.66	4.82	1.78	1.78
4.79	4.99	2.20	1.60
4.82	5.08	2.90	1.20
5.09	5.32	2.50	1.60
5.34	5.59	2.75	1.60
5.45	5.68	2.57	1.78
5.48	5.69	2.40	1.90
5.60	5.92	4.00	1.00
5.68	5.91	2.60	1.90
5.69	5.97	3.10	1.60
5.78	6.04	2.90	1.78
5.88	6.22	3.80	1.30
5.90	6.22	3.50	1.50
5.94	6.24	3.35	1.60
6.10	6.46	4.50	1.00
6.14	6.46	3.55	1.60
6.18	6.36	1.90	2.55
6.34	6.68	3.75	1.60
6.40	6.72	4.00	1.50
6.46	6.65	2.06	2.62
6.48	6.78	3.40	1.90
6.56	6.89	3.68	1.78
6.60	7.00	5.00	1.00
6.69	7.02	4.10	1.60
6.90	7.26	4.50	1.50
6.92	7.24	4.00	1.80
6.97	7.35	4.70	1.42
7.10	7.54	5.50	1.00
7.24	7.50	2.84	2.62
7.28	7.61	4.20	1.90
7.28	7.58	3.30	2.40
7.32	7.64	4.00	2.00
7.35	7.71	4.47	1.78
7.40	7.80	5.00	1.50
7.57	7.91	4.25	2.00
7.58	7.91	3.60	2.40
7.60	8.08	6.00	1.00
7.62	8.08	5.70	1.20
7.69	8.10	5.10	1.60
7.82	8.18	4.50	2.00
7.90	8.34	5.50	1.50
7.92	8.32	5.00	1.80
7.98	8.37	4.90	1.90
8.07	8.45	4.75	2.00
8.16	8.59	5.28	1.78
8.28	8.63	4.30	2.40
8.32	8.72	5.00	2.00
8.40	8.88	6.00	1.50
8.52	8.96	5.60	1.80
8.62	9.04	5.30	2.00
8.71	9.20	6.07	1.63
8.78	9.23	5.70	1.90
8.82	9.26	5.50	2.00

A min.	A max.	O-ring	
		int. $\varnothing$ d1	$\varnothing$ cross-section d2
8.82	9.18	4.42	2.62
8.95	9.44	6.07	1.78
9.05	9.42	4.65	2.62
9.20	9.60	5.00	2.50
9.23	9.74	6.35	1.78
9.28	9.71	5.30	2.40
9.32	9.80	6.00	2.00
9.40	9.96	7.00	1.50
9.48	9.99	6.40	1.90
9.58	10.03	5.60	2.40
9.60	10.24	8.00	1.00
9.62	10.12	6.30	2.00
9.63	10.17	6.75	1.78
9.65	10.13	6.00	2.20
9.69	10.26	7.10	1.60
10.02	10.58	7.10	1.80
10.02	10.56	6.70	2.00
10.04	10.44	5.00	3.00
10.28	10.85	7.20	1.90
10.28	10.79	6.30	2.40
10.29	10.90	7.65	1.63
10.40	11.04	8.00	1.50
10.42	11.02	7.50	1.80
10.42	10.99	7.10	2.00
10.53	11.15	7.65	1.78
10.58	11.11	6.60	2.40
10.60	11.32	9.00	1.00
10.69	11.34	8.10	1.60
10.82	11.42	7.50	2.00
10.92	11.56	8.00	1.80
11.04	11.52	6.00	3.00
11.08	11.72	8.00	1.90
11.28	11.87	7.30	2.40
11.32	11.96	8.00	2.00
11.40	12.12	9.00	1.50
11.58	12.26	8.50	1.90
11.58	12.19	7.60	2.40
11.61	12.31	8.73	1.78
11.69	12.42	9.10	1.60
11.74	12.50	9.50	1.40
11.84	12.42	7.30	2.70
11.92	12.53	7.65	2.54
11.98	12.69	8.90	1.90
11.98	12.62	8.00	2.40
11.99	12.60	7.59	2.62
12.04	12.60	7.00	3.00
12.08	12.88	10.00	1.30
12.09	12.85	9.50	1.60
12.13	12.87	9.25	1.78
12.28	12.95	8.30	2.40
12.32	13.04	9.00	2.00
12.34	13.14	10.00	1.50
12.40	13.17	9.52	1.78
12.58	13.27	8.60	2.40
12.65	13.37	9.00	2.20
12.69	13.50	10.10	1.60
12.82	13.58	9.50	2.00
12.92	13.72	10.00	1.80
12.98	13.77	9.90	1.90
13.04	13.68	8.00	3.00
13.20	13.92	9.00	2.50
13.28	14.03	9.30	2.40
13.32	14.12	10.00	2.00
13.40	14.28	11.00	1.50
13.44	14.15	8.90	2.70
13.48	14.33	10.52	1.83
13.58	14.35	9.60	2.40
13.59	14.33	9.19	2.62
13.60	14.56	12.00	1.00
13.69	14.58	11.10	1.60



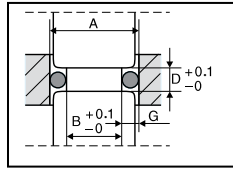
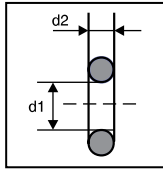
# FITTING TO PISTON



A min.	A max.	O-ring	
		int. $\varnothing$ d1	$\varnothing$ cross-section d2
13.70	14.57	10.82	1.78
13.82	14.66	10.50	2.00
13.90	14.82	11.50	1.50
13.92	14.54	7.80	3.60
13.98	14.87	11.10	1.78
14.19	14.92	9.15	3.00
14.20	15.00	10.00	2.50
14.28	15.11	10.30	2.40
14.32	15.20	11.00	2.00
14.40	15.36	12.00	1.50
14.58	15.43	10.60	2.40
14.60	15.64	13.00	1.00
14.69	15.66	12.10	1.60
14.82	15.74	11.50	2.00
14.90	15.90	12.50	1.50
15.04	15.88	10.50	2.70
15.12	15.85	9.12	3.53
15.17	16.03	10.77	2.62
15.20	16.08	11.00	2.50
15.28	16.19	11.30	2.40
15.30	16.30	12.42	1.78
15.32	16.28	12.00	2.00
15.40	16.30	11.20	2.50
15.58	16.51	11.60	2.40
15.69	16.74	13.10	1.60
15.82	16.82	12.50	2.00
15.95	16.75	10.00	3.50
16.00	16.94	11.80	2.50
16.02	17.06	13.10	1.80
16.04	16.92	11.00	3.00
16.28	17.27	12.30	2.40
16.30	17.25	11.90	2.62
16.32	17.36	13.00	2.00
16.54	17.46	11.50	3.00
16.59	17.71	14.00	1.60
16.60	17.65	15.00	1.00
16.64	17.60	12.10	2.70
16.69	17.68	14.10	1.60
16.70	17.34	8.00	5.00
16.70	17.70	12.50	2.50
16.77	17.76	12.37	2.62
16.88	18.00	14.00	1.78
16.91	17.99	13.46	2.08
17.04	18.00	12.00	3.00
17.20	18.24	13.00	2.50
17.28	18.35	13.30	2.40
17.32	18.44	14.00	2.00
17.40	18.45	15.00	1.50
17.40	18.46	13.20	2.50
17.50	18.55	13.10	2.62
17.58	18.67	13.60	2.40
17.92	18.97	15.00	1.80
18.00	19.12	16.00	1.25
18.04	19.08	13.00	3.00
18.08	19.15	15.20	1.78
18.14	19.22	13.60	2.70
18.20	19.32	14.00	2.50
18.28	19.29	14.30	2.40
18.29	19.27	12.29	3.53
18.32	19.37	15.00	2.00
18.34	19.46	13.94	2.62
18.48	19.58	15.60	1.78
18.58	19.61	14.60	2.40
18.69	19.82	16.10	1.60
19.04	20.16	14.00	3.00
19.07	20.17	13.80	3.10
19.08	20.20	16.00	1.90
19.20	20.25	15.00	2.50
19.28	20.36	15.30	2.40
19.32	20.44	16.00	2.00

A min.	A max.	O-ring	
		int. $\varnothing$ d1	$\varnothing$ cross-section d2
19.46	20.65	17.06	1.50
19.48	20.54	15.08	2.62
19.58	20.68	15.60	2.40
19.60	20.86	18.00	1.00
19.64	20.69	15.10	2.70
19.69	20.89	17.10	1.60
19.70	20.58	11.00	5.00
19.87	20.98	13.87	3.53
19.90	21.13	17.50	1.50
19.94	21.03	15.54	2.62
20.03	21.17	16.36	2.21
20.04	21.09	15.00	3.00
20.05	21.26	17.17	1.78
20.20	21.32	16.00	2.50
20.28	21.39	15.88	2.62
20.28	21.43	16.30	2.40
20.32	21.51	17.00	2.00
20.58	21.75	16.60	2.40
20.69	21.96	18.10	1.60
21.04	22.16	16.00	3.00
21.09	22.39	18.50	1.60
21.12	22.18	15.12	3.53
21.20	22.39	17.00	2.50
21.28	22.50	17.30	2.40
21.32	22.58	18.00	2.00
21.40	22.73	19.00	1.50
21.44	22.62	16.90	2.70
21.47	22.55	15.47	3.53
21.52	22.72	17.12	2.62
21.58	22.82	17.60	2.40
21.65	22.91	18.00	2.20
21.65	22.97	18.77	1.78
21.70	22.93	17.50	2.50
21.90	23.27	19.50	1.50
21.92	23.25	19.00	1.80
21.95	23.07	16.00	3.50
22.01	23.27	17.93	2.46
22.16	23.22	15.20	4.00
22.20	23.46	18.00	2.50
22.26	23.51	17.86	2.62
22.43	23.83	20.00	1.50
22.45	23.71	18.00	2.65
22.58	23.89	18.60	2.40
22.70	23.96	18.00	2.80
22.92	24.32	20.00	1.80
22.94	24.22	18.40	2.70
22.96	24.08	16.00	4.00
23.04	24.30	18.00	3.00
23.04	24.23	17.04	3.53
23.12	24.43	18.72	2.62
23.20	24.53	19.00	2.50
23.23	24.66	20.35	1.78
23.24	24.51	18.20	3.00
23.26	24.61	19.18	2.46
23.32	24.72	20.00	2.00
23.36	24.62	18.00	3.15
23.48	24.96	21.08	1.50
23.58	24.96	19.60	2.40
23.84	25.16	18.80	3.00
23.96	25.15	17.00	4.00
24.20	25.60	20.00	2.50
24.24	25.58	19.20	3.00
24.28	25.76	21.20	1.90
24.35	25.82	21.00	2.00
24.36	25.69	19.00	3.15
24.40	25.94	22.00	1.50
24.42	25.70	18.30	3.60
24.45	25.85	20.00	2.65
24.64	25.95	18.64	3.53
24.67	26.16	21.35	2.00

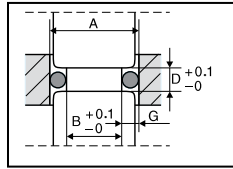
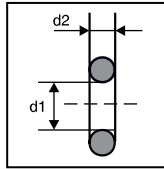
# FITTING TO PISTON



A min.	A max.	O-ring	
		int. $\varnothing$ d1	$\varnothing$ cross-section d2
24.69	26.11	20.29	2.62
24.69	26.24	22.10	1.60
24.83	26.37	21.95	1.78
25.03	26.48	20.63	2.62
25.04	26.37	19.00	3.55
25.04	26.44	20.00	3.00
25.32	26.86	22.00	2.00
25.36	26.76	20.00	3.15
25.40	26.88	21.20	2.50
25.58	27.10	21.60	2.40
25.82	27.40	22.50	2.00
25.92	27.31	19.80	3.60
26.02	27.55	21.80	2.52
26.04	27.51	21.00	3.00
26.22	27.64	20.22	3.53
26.29	27.82	21.89	2.62
26.40	28.08	24.00	1.50
26.40	28.05	23.52	1.78
26.52	28.14	23.20	2.00
26.54	28.05	21.50	3.00
26.56	28.04	21.20	3.15
26.60	28.17	22.40	2.50
26.62	28.18	22.22	2.62
26.88	28.41	21.92	2.95
27.20	28.81	23.00	2.50
27.24	28.79	22.20	3.00
27.32	29.00	24.00	2.00
27.42	28.91	21.30	3.60
27.54	29.12	22.50	3.00
27.69	28.98	18.42	5.33
27.76	29.32	22.40	3.15
27.80	29.45	23.60	2.50
27.82	29.35	21.82	3.53
27.87	29.51	23.47	2.62
28.00	29.51	25.12	1.78
28.20	29.88	24.00	2.50
28.32	30.07	25.00	2.00
28.43	30.07	23.47	2.95
28.58	30.31	24.60	2.40
28.96	30.61	23.60	3.15
28.98	30.73	25.00	2.40
29.12	30.73	23.00	3.60
29.20	30.95	25.00	2.50
29.24	30.93	24.20	3.00
29.34	30.90	26.00	2.00
29.39	31.03	23.39	3.53
29.47	30.98	25.07	2.62
29.54	31.26	24.50	3.00
29.58	31.19	26.70	1.78
29.69	31.32	27.10	1.60
29.80	31.53	24.76	3.00
30.00	31.50	25.04	2.95
30.20	31.76	26.00	2.50
30.32	31.94	27.00	2.00
30.36	32.11	25.00	3.15
30.54	32.07	25.50	3.00
30.70	32.29	26.50	2.50
30.72	32.44	24.60	3.60
30.86	32.38	21.59	5.33
30.94	32.62	24.00	4.00
30.99	32.74	24.99	3.53
31.04	32.64	26.64	2.62
31.18	32.88	28.30	1.78
31.20	32.82	27.00	2.50
31.24	32.81	26.20	3.00
31.26	32.83	26.22	3.00
31.32	33.00	28.00	2.00
31.44	33.02	26.40	3.00
31.49	33.13	27.30	2.52
31.58	33.17	26.62	2.95

A min.	A max.	O-ring	
		int. $\varnothing$ d1	$\varnothing$ cross-section d2
31.69	33.44	29.10	1.60
31.80	33.35	25.80	3.53
31.84	33.47	27.30	2.70
31.96	33.71	25.00	4.00
32.10	33.72	27.06	3.00
32.20	33.88	28.00	2.50
32.32	33.89	26.20	3.60
32.43	34.06	23.16	5.33
32.54	34.19	27.50	3.00
32.57	34.17	26.57	3.53
32.64	34.34	28.24	2.62
32.75	34.55	29.87	1.78
33.04	34.72	28.00	3.00
33.32	35.12	30.00	2.00
33.36	35.04	28.00	3.15
33.38	35.13	29.10	2.55
33.58	35.36	29.60	2.40
33.70	35.45	25.00	5.00
33.92	35.59	27.80	3.60
34.17	35.86	28.17	3.53
34.20	36.00	30.00	2.50
34.22	36.01	29.82	2.62
34.24	35.99	29.20	3.00
34.35	36.24	31.47	1.78
34.40	36.32	32.00	1.50
34.54	36.34	30.00	2.70
34.54	36.31	29.50	3.00
34.69	36.62	32.10	1.60
34.70	36.48	29.74	2.95
35.04	36.84	30.00	3.00
35.20	37.06	31.00	2.50
35.32	37.24	32.00	2.00
35.42	37.18	29.30	3.60
35.58	37.53	32.50	1.90
35.58	37.48	31.60	2.40
35.61	37.19	26.34	5.33
35.74	37.53	29.74	3.53
35.82	37.71	31.42	2.62
35.93	37.92	33.05	1.78
36.20	38.12	32.00	2.50
36.32	38.30	33.00	2.00
36.54	38.43	31.50	3.00
36.70	38.38	28.00	5.00
36.86	38.75	31.50	3.15
36.92	38.77	30.80	3.60
36.96	38.76	30.00	4.00
37.24	39.17	32.20	3.00
37.32	39.36	34.00	2.00
37.34	39.22	31.34	3.53
37.39	39.37	32.99	2.62
37.53	39.61	34.65	1.78
37.54	39.49	32.50	3.00
37.69	39.80	35.10	1.60
38.04	40.02	33.00	3.00
38.32	40.42	35.00	2.00
38.58	40.66	34.60	2.40
38.62	40.57	32.50	3.60
38.86	40.87	33.50	3.15
38.92	40.90	32.92	3.53
38.99	41.07	34.59	2.62
39.04	41.08	34.00	3.00
39.20	41.30	35.00	2.50
39.24	41.29	34.20	3.00
39.28	41.44	36.00	2.00
39.52	41.78	37.60	1.20
39.54	41.61	34.50	3.00
39.62	41.80	36.30	2.00
39.69	41.92	37.10	1.60
40.04	42.14	35.00	3.00
40.22	42.27	34.10	3.60

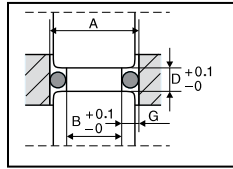
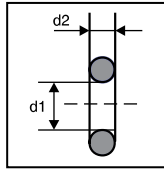
# FITTING TO PISTON



A min.	A max.	O-ring	
		int. $\varnothing$ d1	$\varnothing$ cross-section d2
40.32	42.56	37.40	1.80
40.39	42.26	31.12	5.33
40.46	42.47	33.50	4.00
40.52	42.59	34.52	3.53
40.54	42.67	35.50	3.00
40.57	42.74	36.17	2.62
40.70	42.97	37.82	1.78
40.86	42.99	35.50	3.15
40.95	43.14	36.50	2.65
41.02	43.28	37.70	2.00
41.54	43.73	36.50	3.00
41.58	43.84	37.60	2.40
41.72	43.86	35.60	3.60
42.02	44.34	38.70	2.00
42.09	44.26	36.09	3.53
42.17	44.44	37.77	2.62
42.40	44.80	40.00	1.50
42.46	44.59	35.50	4.00
42.50	44.75	37.46	3.00
42.70	44.74	34.00	5.00
42.86	45.11	37.50	3.15
43.12	45.51	39.80	2.00
43.14	45.43	38.10	3.00
43.42	45.66	37.30	3.60
43.52	45.53	40.20	2.00
43.56	45.62	34.29	5.33
43.58	45.96	39.60	2.40
43.69	45.95	37.69	3.53
43.74	46.10	39.34	2.62
43.88	45.93	41.00	1.78
44.04	46.38	39.00	3.00
44.20	46.60	40.00	2.50
44.22	46.32	35.00	5.30
44.42	46.48	41.10	2.00
44.46	46.71	37.50	4.00
44.54	46.91	39.50	3.00
44.74	47.06	38.70	3.55
45.04	47.44	40.00	3.00
45.32	47.62	38.30	4.00
45.32	47.42	42.00	2.00
45.35	47.40	40.95	2.62
45.36	47.76	40.00	3.15
45.58	47.66	41.60	2.40
45.69	48.07	39.69	3.53
45.76	48.09	38.80	4.00
46.54	48.62	41.50	3.00
46.74	48.99	37.47	5.33
46.87	48.91	40.87	3.53
46.92	49.05	42.52	2.62
46.96	49.36	40.00	4.00
46.98	49.20	44.45	1.56
47.05	49.26	44.17	1.78
47.24	49.35	42.20	3.00
47.32	49.52	44.00	2.00
47.54	49.67	42.50	3.00
47.86	49.98	42.50	3.15
48.04	50.19	43.00	3.00
48.32	50.57	45.00	2.00
48.52	50.73	44.12	2.62
48.58	50.81	44.60	2.40
48.73	50.91	43.69	3.00
48.86	51.00	42.86	3.53
48.96	51.06	42.00	4.00
49.20	51.45	45.00	2.50
49.24	51.45	44.20	3.00
49.32	51.62	46.00	2.00
49.46	51.59	42.50	4.00
49.52	51.69	43.40	3.60
49.68	51.91	44.64	3.00
49.74	51.92	43.70	3.55

A min.	A max.	O-ring	
		int. $\varnothing$ d1	$\varnothing$ cross-section d2
49.91	51.95	40.64	5.33
50.05	52.25	44.05	3.53
50.09	52.38	45.69	2.62
50.22	52.59	47.34	1.78
50.32	52.67	47.00	2.00
50.36	52.61	45.00	3.15
50.62	52.69	41.40	5.30
50.62	52.86	44.64	3.52
50.70	53.03	46.50	2.50
51.04	53.34	46.00	3.00
51.32	53.72	48.00	2.00
51.58	53.96	47.60	2.40
51.66	53.94	45.54	3.60
51.69	54.06	47.29	2.62
51.72	53.85	42.50	5.30
51.96	54.21	45.00	4.00
52.24	54.60	47.20	3.00
52.82	55.30	49.50	2.00
52.86	55.23	47.50	3.15
52.92	55.40	49.60	2.00
53.04	55.44	48.00	3.00
53.09	55.29	43.82	5.33
53.22	55.58	47.22	3.53
53.30	55.75	48.90	2.62
53.40	55.93	50.52	1.78
53.58	56.06	49.60	2.40
53.63	56.01	47.63	3.53
53.96	56.31	47.00	4.00
54.12	56.33	44.20	5.70
54.54	57.02	49.50	3.00
54.87	57.40	50.47	2.62
55.20	57.75	51.00	2.50
55.21	57.67	49.21	3.53
55.22	57.48	45.30	5.70
55.32	57.92	52.00	2.00
55.36	57.86	50.00	3.15
55.58	58.16	51.60	2.40
56.26	58.61	46.99	5.33
56.40	58.92	50.40	3.53
56.47	59.08	52.07	2.62
56.57	59.26	53.69	1.78
56.80	59.34	50.80	3.53
56.96	59.46	50.00	4.00
57.04	59.64	52.00	3.00
57.32	60.02	54.00	2.00
57.54	60.11	51.50	3.55
57.92	60.36	48.70	5.30
58.04	60.69	53.00	3.00
58.04	60.72	53.64	2.62
58.14	60.80	53.10	3.00
58.32	61.07	55.00	2.00
58.58	61.31	54.60	2.40
58.70	61.20	50.00	5.00
59.04	61.74	54.00	3.00
59.12	61.58	49.20	5.70
59.20	61.95	55.00	2.50
59.44	61.95	50.17	5.33
59.54	62.27	54.50	3.00
59.57	62.25	53.57	3.53
59.65	62.41	55.25	2.62
59.75	62.60	56.87	1.78
59.96	62.61	53.00	4.00
59.98	62.68	53.98	3.53
60.54	63.32	55.50	3.00
60.82	63.70	57.50	2.00
60.86	63.56	53.90	4.00
60.95	63.70	55.00	3.50
61.22	64.06	56.82	2.62
61.56	64.34	55.56	3.53
61.58	64.46	57.60	2.40

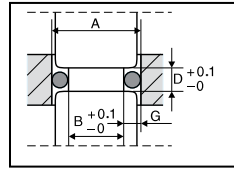
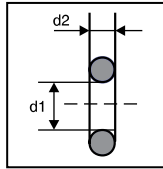
# FITTING TO PISTON



A min.	A max.	O-ring	
		int. $\varnothing$ d1	$\varnothing$ cross-section d2
61.70	64.55	57.00	2.80
62.22	64.83	52.30	5.70
62.27	65.12	57.00	3.10
62.61	65.28	53.34	5.33
62.75	65.59	56.75	3.53
62.82	65.74	58.42	2.62
62.92	65.93	60.04	1.78
62.96	65.76	56.00	4.00
63.04	65.94	58.00	3.00
63.40	66.36	59.20	2.50
63.62	66.34	54.40	5.30
63.82	66.85	60.50	2.00
64.04	66.94	58.00	3.55
64.12	66.83	54.20	5.70
64.39	67.39	59.99	2.62
64.40	67.37	59.36	3.00
64.70	67.50	56.00	5.00
64.74	67.68	58.74	3.53
65.22	67.98	55.30	5.70
65.36	68.28	58.40	4.00
65.44	68.46	60.40	3.00
65.58	68.66	61.60	2.40
65.79	68.62	56.52	5.33
65.92	68.92	59.92	3.53
66.00	69.08	61.60	2.62
66.10	69.26	63.22	1.78
66.32	69.47	63.00	2.00
66.96	69.96	60.00	4.00
67.04	70.14	62.00	3.00
67.57	70.73	63.17	2.62
67.91	71.01	61.91	3.53
67.95	71.05	62.00	3.50
68.32	71.57	65.00	2.00
68.58	71.81	64.60	2.40
68.70	71.70	60.00	5.00
68.96	71.95	59.69	5.33
69.10	72.26	63.10	3.53
69.12	72.08	59.20	5.70
69.17	72.41	64.77	2.62
69.27	72.59	66.39	1.78
69.54	72.77	64.50	3.00
69.96	73.11	63.00	4.00
70.04	73.29	65.00	3.00
70.74	74.06	66.34	2.62
70.90	73.83	58.58	7.00
71.09	74.35	65.09	3.53
71.20	74.55	67.00	2.50
71.32	74.72	68.00	2.00
71.58	74.96	67.60	2.40
72.14	75.29	62.87	5.33
72.27	75.58	66.27	3.53
72.35	75.75	67.95	2.62
72.45	75.93	69.57	1.78
72.92	76.40	69.60	2.00
73.04	76.44	68.00	3.00
73.32	76.82	70.00	2.00
73.92	77.40	69.52	2.62
74.20	77.70	70.00	2.50
74.26	77.67	68.26	3.53
74.82	78.40	71.50	2.00
74.96	78.36	68.00	4.00
75.04	78.54	70.00	3.00
75.31	78.62	66.04	5.33
75.45	78.92	69.45	3.53
75.52	79.08	71.12	2.62
75.62	79.26	72.74	1.78
75.70	79.28	71.50	2.50
75.85	79.34	69.85	3.53
76.63	80.03	67.93	5.00
77.04	80.59	71.00	3.55

A min.	A max.	O-ring	
		int. $\varnothing$ d1	$\varnothing$ cross-section d2
77.04	80.64	72.00	3.00
77.09	80.73	72.69	2.62
77.32	81.02	74.00	2.00
78.32	82.07	75.00	2.00
78.49	81.96	69.22	5.33
78.62	82.25	72.62	3.53
78.70	82.20	70.00	5.00
78.80	82.60	75.92	1.78
79.03	82.68	73.03	3.53
79.04	82.74	74.00	3.00
79.12	82.58	69.20	5.70
79.70	83.25	71.00	5.00
79.89	83.63	74.85	3.00
79.96	83.61	73.00	4.00
80.27	84.07	75.87	2.62
80.61	84.34	74.61	3.53
81.33	85.18	76.93	2.62
81.54	85.32	75.54	3.53
81.62	85.54	78.30	2.00
81.66	85.28	72.39	5.33
81.79	85.58	75.79	3.53
81.96	85.71	75.00	4.00
83.04	86.94	78.00	3.00
83.32	87.32	80.00	2.00
83.70	87.45	75.00	5.00
84.12	87.83	74.20	5.70
84.15	88.18	80.50	2.20
84.22	87.93	74.30	5.70
84.45	88.45	80.00	2.65
84.54	88.52	79.50	3.00
84.84	88.62	75.57	5.33
84.97	88.92	78.97	3.53
85.15	89.27	82.27	1.78
85.32	89.42	82.00	2.00
86.04	90.09	81.00	3.00
86.62	90.73	82.22	2.62
86.96	90.96	80.00	4.00
87.34	91.54	84.02	2.00
88.01	91.95	78.74	5.33
88.15	92.46	86.15	1.25
88.15	92.26	82.15	3.53
88.32	92.57	85.00	2.00
88.70	92.70	80.00	5.00
88.93	93.16	84.53	2.62
89.04	93.24	84.00	3.00
89.04	93.03	79.77	5.33
89.12	93.08	79.20	5.70
89.54	93.77	84.50	3.00
91.19	95.29	81.92	5.33
91.32	95.59	85.32	3.53
91.40	95.76	87.20	2.50
91.50	95.93	88.62	1.78
92.26	96.53	85.30	4.00
92.94	97.34	87.90	3.00
92.97	97.40	88.57	2.62
93.70	97.95	85.00	5.00
94.06	98.27	84.11	5.72
94.36	98.62	85.09	5.33
94.50	98.93	88.50	3.53
94.54	99.02	89.50	3.00
95.96	100.41	89.00	4.00
96.04	100.59	91.00	3.00
96.09	100.34	85.00	6.30
96.46	101.03	91.42	3.00
97.54	101.96	88.27	5.33
97.67	102.25	91.67	3.53
97.85	102.60	94.97	1.78
97.86	102.54	93.66	2.50
98.17	102.91	94.85	2.00
98.41	102.98	91.38	4.04

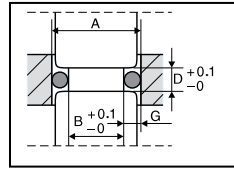
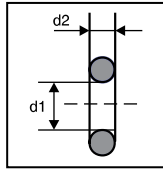
# FITTING TO PISTON



A min.	A max.	O-ring	
		int. Ø d1	Ø cross-section d2
98.69	103.46	95.37	2.00
98.70	103.20	90.00	5.00
98.96	103.45	89.69	5.33
99.08	103.84	95.10	2.40
99.32	104.07	94.92	2.62
99.54	104.27	94.50	3.00
100.71	105.29	91.44	5.33
100.85	105.59	94.85	3.53
101.09	105.59	90.00	6.30
101.65	106.55	98.00	2.20
102.42	107.24	96.30	3.60
102.96	107.76	96.00	4.00
103.32	108.32	100.00	2.00
103.70	108.45	95.00	5.00
103.89	108.63	94.62	5.33
104.02	108.72	94.10	5.70
104.02	108.92	98.02	3.53
104.20	108.26	101.32	1.78
104.54	109.52	99.50	3.00
105.67	109.72	101.27	2.62
106.04	110.08	101.00	3.00
107.04	111.12	102.00	3.00
107.06	111.95	97.79	5.33
107.20	111.25	101.20	3.53
108.34	112.47	103.30	3.00
108.70	113.70	100.00	5.00
109.22	114.18	99.30	5.70
109.31	113.55	106.00	2.00
109.54	113.72	104.50	3.00
110.20	114.44	106.00	2.50
110.24	114.28	100.97	5.33
110.37	114.55	104.37	3.53
110.55	114.86	107.67	1.78
110.96	115.12	104.00	4.00
112.02	116.33	107.62	2.62
113.32	117.72	110.00	2.00
113.41	117.58	104.14	5.33
113.43	117.61	104.64	5.05
113.55	117.85	107.55	3.53
114.54	118.92	109.50	3.00
116.59	120.89	107.32	5.33
116.72	121.15	110.72	3.53
116.90	121.46	114.02	1.78
117.04	121.52	112.00	3.00
118.37	122.93	113.97	2.62
119.22	123.59	109.30	5.70
119.76	124.18	110.49	5.33
119.90	124.46	113.90	3.53
120.04	124.64	115.00	3.00
122.94	127.49	113.67	5.33
122.96	127.60	116.00	4.00
123.07	127.75	117.07	3.53
123.25	128.07	120.37	1.78
123.54	128.28	118.50	3.00
124.22	128.79	114.30	5.70
124.54	129.32	119.50	3.00
124.72	129.53	120.32	2.62
125.96	130.72	119.00	4.00
125.97	130.52	113.67	6.99
126.25	131.06	120.25	3.53
126.77	131.47	117.50	5.33
127.22	131.94	118.00	5.30
128.04	132.96	123.00	3.00
128.32	133.32	125.00	2.00
129.14	133.82	116.84	6.99
129.22	133.99	119.30	5.70
129.42	134.36	123.42	3.53
129.54	134.52	124.50	3.00
129.60	134.67	126.72	1.78
131.04	136.08	126.00	3.00

A min.	A max.	O-ring	
		int. Ø d1	Ø cross-section d2
131.07	136.14	126.67	2.62
132.32	137.12	120.02	6.99
132.60	137.67	126.60	3.53
133.04	138.16	128.00	3.00
133.07	138.03	123.80	5.33
133.70	138.70	125.00	5.00
134.54	139.72	129.50	3.00
135.49	140.42	123.19	6.99
135.64	140.70	126.37	5.33
135.77	140.96	129.77	3.53
135.95	141.28	133.07	1.78
137.04	142.32	132.00	3.00
137.42	142.74	133.02	2.62
138.67	143.73	126.37	6.99
138.81	144.00	129.54	5.33
138.94	144.26	132.94	3.53
139.22	144.39	129.30	5.70
139.54	144.92	134.50	3.00
141.62	147.16	138.70	1.80
141.84	147.02	129.54	6.99
141.96	147.36	135.00	4.00
141.99	147.30	132.72	5.33
142.04	147.52	137.00	3.00
142.12	147.57	136.12	3.53
143.77	149.35	139.37	2.62
144.22	149.59	134.30	5.70
144.54	150.12	139.50	3.00
145.00	150.60	139.96	3.00
145.02	150.33	132.72	6.99
145.30	150.87	139.30	3.53
145.77	151.23	136.50	5.33
145.96	151.52	139.00	4.00
146.04	151.68	141.00	3.00
148.19	153.63	135.89	6.99
148.47	154.17	142.47	3.53
148.70	154.30	140.00	5.00
148.97	154.56	139.70	5.33
149.54	155.32	144.50	3.00
150.12	155.95	145.72	2.62
150.29	156.05	144.00	3.70
151.37	156.94	139.07	6.99
151.51	157.20	142.24	5.33
151.64	157.47	145.64	3.53
151.96	157.76	145.00	4.00
153.04	158.96	148.00	3.00
153.32	159.32	150.00	2.00
154.22	159.99	144.30	5.70
154.54	160.23	142.24	6.99
154.82	160.77	148.82	3.53
155.37	161.22	146.10	5.33
155.78	161.78	150.00	3.40
156.04	162.08	151.00	3.00
156.47	162.55	152.07	2.62
157.72	163.54	145.42	6.99
157.86	163.81	148.59	5.33
158.00	164.08	152.00	3.53
158.47	164.44	149.20	5.33
158.70	164.70	150.00	5.00
159.20	165.18	149.30	5.70
159.32	165.56	156.00	2.00
159.54	165.72	154.50	3.00
160.89	166.84	148.59	6.99
160.95	167.15	155.00	3.50
162.82	169.16	158.42	2.62
163.32	169.72	160.00	2.00
164.07	170.14	151.77	6.99
164.20	170.60	160.00	2.50
164.22	170.39	154.30	5.70
164.34	170.67	158.34	3.53
164.54	170.92	159.50	3.00

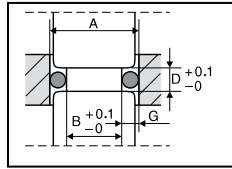
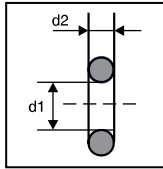
# FITTING TO PISTON



A min.	A max.	O-ring	
		int. $\varnothing$ d1	$\varnothing$ cross-section d2
167.39	173.72	158.12	5.33
168.45	174.95	162.50	3.50
168.70	175.10	160.00	5.00
169.17	175.76	164.77	2.62
169.22	175.59	159.30	5.70
169.54	176.12	164.50	3.00
170.42	176.75	158.12	6.99
170.70	177.29	164.70	3.53
171.70	178.38	167.00	2.80
171.96	178.56	165.00	4.00
173.74	180.32	164.47	5.33
174.22	180.79	164.30	5.70
174.54	181.32	169.50	3.00
176.77	183.35	164.47	6.99
177.04	183.92	172.00	3.00
177.05	183.89	171.05	3.53
178.70	185.50	170.00	5.00
178.88	185.45	164.10	8.40
179.00	185.67	166.70	6.99
179.22	185.99	169.30	5.70
179.50	186.48	174.46	3.00
179.54	186.52	174.50	3.00
180.09	186.93	170.82	5.33
181.04	188.08	176.00	3.00
181.96	188.96	175.00	4.00
183.12	189.96	170.82	6.99
183.40	190.50	177.40	3.53
184.20	191.40	180.00	2.50
184.54	191.72	179.50	3.00
186.44	193.53	177.17	5.33
186.90	193.89	174.60	6.99
188.22	195.57	183.82	2.62
188.70	195.90	180.00	5.00
189.22	196.39	179.30	5.70
189.47	196.56	177.17	6.99
189.54	196.92	184.50	3.00
189.74	197.09	183.74	3.53
190.96	198.32	184.00	4.00
193.04	200.56	188.00	3.00
194.22	201.59	184.30	5.70
194.54	202.14	190.00	2.70
195.82	203.16	183.52	6.99
196.10	203.71	190.10	3.53
196.96	204.56	190.00	4.00
199.22	206.79	189.30	5.70
199.22	206.82	190.00	5.30
199.54	207.32	194.50	3.00
199.63	207.13	187.33	6.99
202.17	209.77	189.87	6.99
202.45	210.31	196.45	3.53
205.26	213.21	198.80	3.80
205.49	213.34	196.22	5.33
208.52	216.37	196.22	6.99
208.78	214.83	201.75	4.00
208.80	214.89	202.80	3.53
209.22	217.19	199.30	5.70
211.84	217.92	202.57	5.33
213.03	219.05	200.78	6.96
214.54	220.83	209.50	3.00
214.87	220.95	202.57	6.99
215.14	221.42	209.14	3.53
216.96	223.26	210.00	4.00
218.88	225.01	204.10	8.40
219.04	225.46	214.00	3.00
219.22	225.50	209.30	5.70
221.49	227.96	215.49	3.53
223.09	229.45	212.00	6.30
224.54	231.00	215.27	5.33
227.57	234.03	215.27	6.99
227.84	234.50	221.84	3.53

A min.	A max.	O-ring	
		int. $\varnothing$ d1	$\varnothing$ cross-section d2
229.54	236.28	224.50	3.00
230.89	237.54	221.62	5.33
233.33	240.12	226.32	4.00
233.90	240.55	221.60	6.99
234.19	241.04	228.19	3.53
237.24	244.08	227.97	5.33
238.04	245.03	233.00	3.00
239.02	246.06	234.62	2.62
239.22	246.10	229.30	5.70
240.04	247.09	235.00	3.00
240.27	247.11	227.97	6.99
240.54	247.58	234.54	3.53
243.59	250.62	234.32	5.33
246.60	253.63	234.30	6.99
246.90	254.13	240.90	3.53
247.09	254.17	236.00	6.30
249.94	257.16	240.67	5.33
250.04	257.39	245.00	3.00
252.97	260.19	240.67	6.99
253.24	260.66	247.24	3.53
258.70	266.20	250.00	5.00
259.22	266.70	249.30	5.70
259.32	266.73	247.02	6.99
259.59	267.20	253.59	3.53
265.04	272.84	260.00	3.00
265.67	273.27	253.37	6.99
269.22	277.00	259.30	5.70
272.02	279.81	259.72	6.99
272.29	280.28	266.29	3.53
275.34	283.33	266.07	5.33
276.04	284.17	271.00	3.00
278.37	286.35	266.07	6.99
279.22	287.30	269.30	5.70
281.96	290.21	275.00	4.00
284.72	292.90	272.42	6.99
284.99	293.36	278.99	3.53
285.04	293.44	280.00	3.00
288.04	296.41	278.77	5.33
289.22	297.60	279.30	5.70
291.07	299.44	278.77	6.99
293.41	302.00	286.45	4.00
294.96	303.60	288.00	4.00
295.04	303.74	290.00	3.00
297.42	305.98	285.12	6.99
297.69	306.44	291.69	3.53
300.74	309.49	291.47	5.33
302.20	311.14	298.00	2.50
303.77	312.52	291.47	6.99
310.12	319.06	297.82	6.99
310.39	319.52	304.39	3.53
315.04	324.34	310.00	3.00
315.70	324.91	307.00	5.00
316.47	325.60	304.17	6.99
322.94	332.47	317.50	3.20
327.32	336.77	315.00	7.00
329.17	338.68	316.87	6.99
329.22	338.80	319.30	5.70
330.04	339.79	325.00	3.00
332.60	342.05	315.00	10.00
335.79	345.68	329.79	3.53
336.29	346.19	330.00	3.70
338.84	348.73	329.57	5.33
340.04	350.09	335.00	3.00
341.87	351.76	329.57	6.99
349.22	359.40	339.30	5.70
350.04	360.39	345.00	3.00
354.57	364.84	342.27	6.99
360.04	370.69	355.00	3.00
361.19	371.85	355.19	3.53
364.22	374.87	355.00	5.30

# FITTING TO PISTON



A min.	A max.	O-ring	
		int. $\varnothing$ d1	$\varnothing$ cross-section d2
367.27	377.92	354.97	6.99
369.22	380.00	359.30	5.70
370.04	380.99	365.00	3.00
379.97	391.00	367.67	6.99
382.56	393.72	372.00	6.00
386.59	398.01	380.59	3.53
389.64	401.06	380.37	5.33
390.04	401.59	385.00	3.00
392.67	404.08	380.37	6.99
405.37	417.16	393.07	6.99
409.22	421.20	399.30	5.70
411.26	419.37	405.26	3.53
411.84	419.97	406.40	3.20
414.53	422.64	405.26	5.33
424.69	432.94	412.48	6.94
426.08	434.32	412.00	8.00
436.66	445.27	430.66	3.53
439.08	447.58	425.00	8.00
442.06	450.69	431.50	6.00
442.96	451.58	430.66	6.99
449.56	458.34	439.00	6.00
457.60	466.40	440.00	10.00
458.08	466.96	444.00	8.00
459.32	468.26	447.00	7.00
469.22	478.40	459.30	5.70

A min.	A max.	O-ring	
		int. $\varnothing$ d1	$\varnothing$ cross-section d2
473.08	482.26	459.00	8.00
474.22	483.52	465.00	5.30
478.56	487.92	468.00	6.00
496.56	506.28	486.00	6.00
499.32	509.06	487.00	7.00
500.04	509.94	495.00	3.00
506.15	516.02	493.72	7.00
510.56	520.56	500.00	6.00
514.08	524.08	500.00	8.00
515.56	525.66	505.00	6.00
516.08	526.22	506.81	5.33
532.56	543.00	522.00	6.00
541.48	552.13	532.21	5.33
541.56	552.18	531.00	6.00
544.56	555.21	532.26	6.99
547.60	558.20	530.00	10.00
568.08	579.16	554.00	8.00
569.96	581.12	557.66	6.99
591.95	603.61	582.68	5.33
594.98	606.64	582.68	6.99
620.38	632.54	608.08	6.99
627.60	639.80	610.00	10.00
727.60	741.80	710.00	10.00
756.04	770.80	738.00	10.25
817.60	833.60	800.00	10.00



We make it *possible*

**In-house Manufacturing, Authentic Sealing**

**Four-lips seals**



**HUTCHINSON®**

**Precision Sealing**





# 1- GENERAL INFORMATION

Four-lips seals have 4-lobed sections, offering the same symmetrical advantages as our O-Rings:

- No mounting direction.

They provide an improved solution for the sealing of hydraulic, pneumatic and oleopneumatic equipment.

Four-lips seals are suitable for both dynamic, and static applications, and particularly for the following conditions:

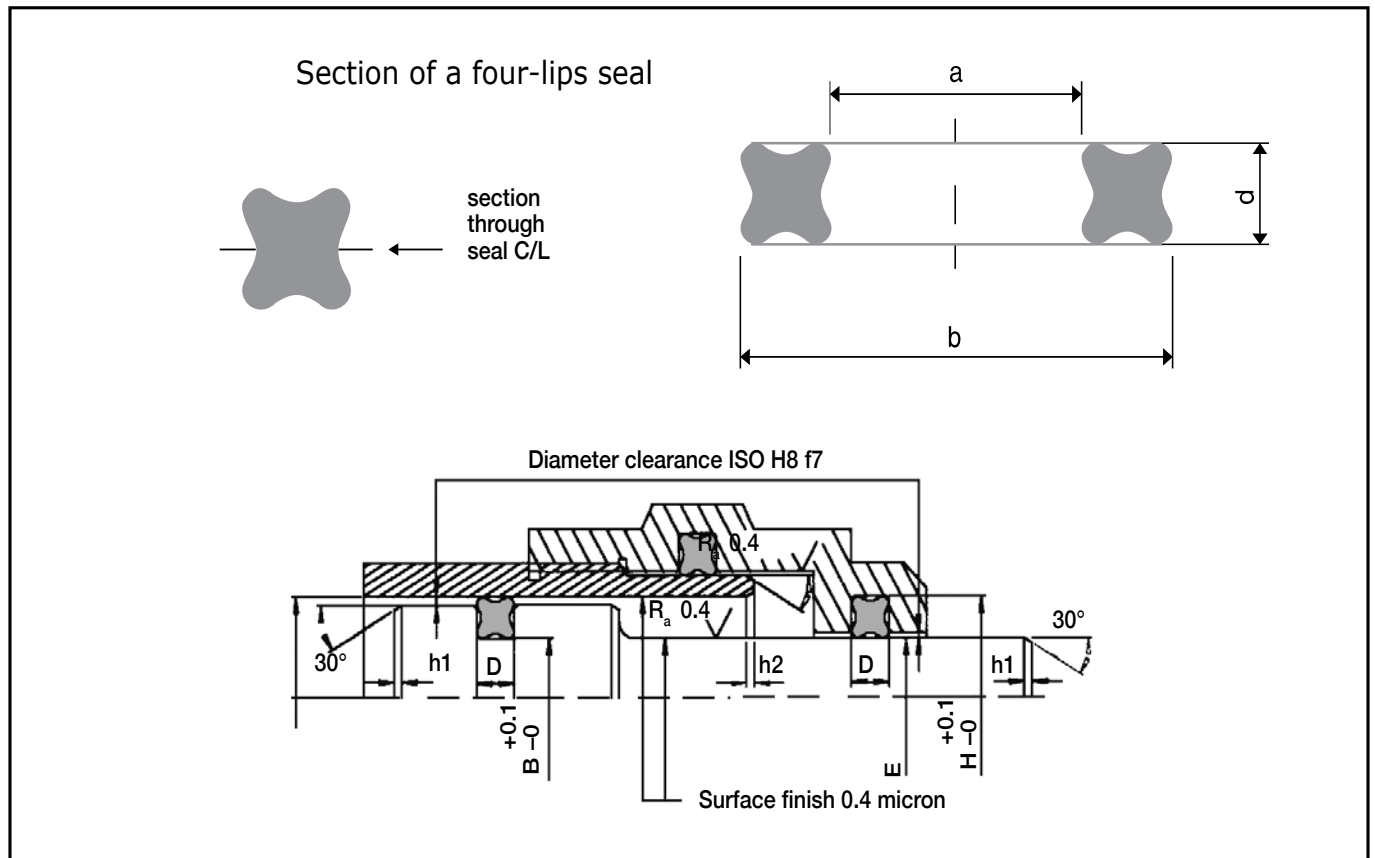
## Reciprocating applications:

Based on the method of assembly set out in this guide, satisfactory results were recorded up to a pressure of 150 bars.

## Rotary applications:

Acceptable results may be obtained at speeds up to 1 m/s. Above this limit, certain conditions of installation and lubrication must be observed.

For each application, however, prior tests must be carried out. To do so, our customers may rely on the assistance of our technical department.



## 2 - TECHNICAL ADVANTAGES

### 2.1 - REDUCED FRICTION

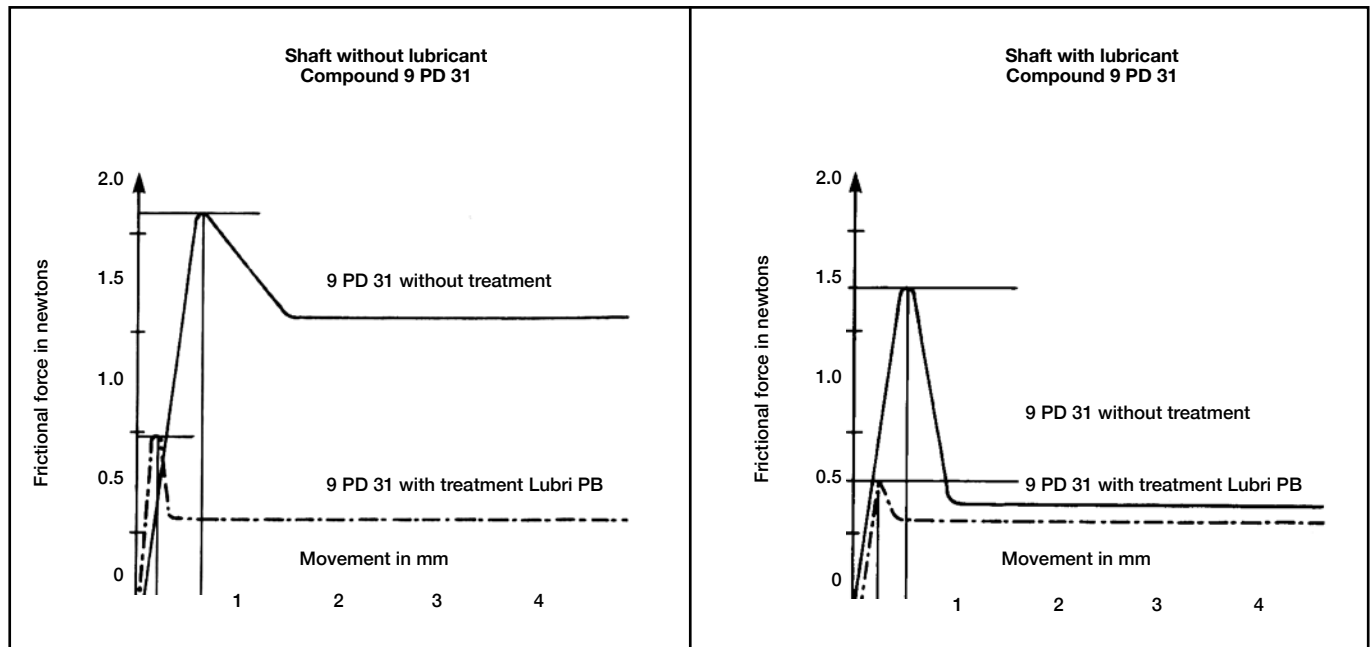
Four-lips seals provide reduced friction thanks to:

- The working principle based on the flexibility of the lobes and not on compression of the section.
- A reserve of lubricant retained between the lobes.
- Special characteristics of the synthetic rubbers which have been researched for maximum seal longevity.
- A special treatment LUBRI PB systematically applied to our compound 9PD31.

### 2.2 - REDUCED STARTING TORQUE

With many standard seals a significant starting force is required after prolonged periods of stoppage.

This force is reduced by approximately 75 % with four-lips seals, which act as a lip seal in this respect.



### 2.3 - REDUCED EQUIPMENT SIZE

Compared with standard lip seals and packing, four-lips seals avoid needing to increase equipment size which reduces its cost.

### 2.4 - REDUCED RESIDUAL FILM

The double contact provided by the lobes of four-lips seals and their flexibility keeps the shafts clean, even after prolonged use; this result is comparable to that obtained with lip seals, and far superior to that registered with O-Ring seals.

The residual film is scraped so that, in identical working conditions, the leak rate is reduced by 60%.

## 2.5 - RESISTANCE TO WEAR

Friction being proportional to pressure, the wear on a four-lips seal is negligible when there is movement without pressure.

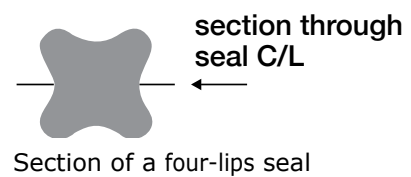
Contrary to other sealing devices which remain in permanent contact with moving parts, four-lips seals by virtue of their geometric shape, exercise insignificant friction when the pressure is removed, thereby ensuring highly reduced wear.

## 2.6 - ELIMINATION OF TWISTING

The almost square section of four-lips seals eliminates the possibility of twisting or kinking both during installation and in operation, provided our installation instructions are observed.

## 2.7 - POSITION OF THE LAND AREA

The mating surfaces of four-lips seals are free from flash, this being restricted to a non-functional zone.



# 3 - SELECTION OF FOUR-LIPS SEALS

## 3.1 - SURFACE TREATMENTS

We offer several surface treatments for different types of applications:

- Lubri PB
- Lubrifilm SG
- Lubrifilm SY
- Molycote
- Talcum
- Lubriccoat AN

Please contact our technical department.

## 3 - SELECTION OF FOUR-LIPS SEALS

### 3.2 - STANDARD COMPOUNDS FOR FOUR-LIPS SEALS

ELASTOMER	GENERAL CHARACTERISTICS OF THE RUBBER	REFERENCE & APPLICATION	Operational temperature			IRDH hardness NFT 46.003
			Min	continuous	Max	
NBR (nitrile)	Good resistance to <ul style="list-style-type: none"> <li>• mineral oils</li> <li>• residential cooking gas</li> <li>• water up to 80° C</li> <li>• fuels</li> <li>• aliphatic solvents</li> </ul> Bad resistance to <ul style="list-style-type: none"> <li>• atmospheric agents</li> <li>• acids</li> <li>• brake fluids</li> </ul> Good mechanical characteristics	7PB496 heat resistance	-30	110	130	70
		9PD31	-30	100	120	79
		9PC1708	-25	100	120	88
HNBR (hydrogenated nitrile)	Good resistance to: <ul style="list-style-type: none"> <li>• aggressive mineral oils</li> <li>• atmospheric agents</li> <li>• water, steam</li> <li>• diluted bases</li> </ul> Bad resistance to: <ul style="list-style-type: none"> <li>• fuels</li> <li>• brake fluids</li> </ul> Very good mechanical characteristics Abrasion resistance	7DT1593	-30	125	150	72
EPDM (ethylene propylene)	Very good resistance to: <ul style="list-style-type: none"> <li>• water, steam and water-based solutions in general</li> <li>• synthetic brake fluids</li> <li>• atmospheric agents</li> </ul> Bad resistance to: <ul style="list-style-type: none"> <li>• mineral oils and hydrocarbons</li> </ul> Good resistance to cold Relatively good mechanical characteristics	6EP1385	-55	125	175	62
		EP7010	-50	125	175	73
		EP851	-40	125	175	83
FPM (fluorocarbon)	Very good resistance to: <ul style="list-style-type: none"> <li>• heat</li> <li>• mineral oils</li> <li>• residential cooking gas</li> <li>• atmospheric agents</li> <li>• fuels</li> <li>• aliphatic and aromatic solvents</li> </ul> Good resistance <ul style="list-style-type: none"> <li>• chemical in general</li> <li>• to acids</li> </ul> Bad resistance to: <ul style="list-style-type: none"> <li>• bases</li> <li>• brake fluids</li> </ul> Limited resistance to cold temperature Rather good mechanical characteristics Good impermeability	DF701	-25	200	250	66
		DF801	-25	200	250	78

Preference should be given to our standard 9PD31 where stocks are usually available.

7DT1593 : This compound is not suitable for all mould sizes. Please check prior to ordering.

REFERENCE	Compression Set Conditions NFT 46.011	% CS	% Volume change Oil 1 / 100°C	% Volume change Oil 3 / 100°C	ASTMD 2000
7PB496	24 H 100°C	10	-3	+11	3CH 717 A25 B14 E016 E036
9PD31	24 H 100°C	15	-7	+8	6BG 814 A14 B14 E014 E034
9PC1708	24 H 100°C	15	-5	+12	6BG 910 A14 B14 E014 E034
7DT1593	72 H 150°C	25	+1	+22	3DH 710 A26 B16 E016 E036 Z1 Z2
6EP1385	24 H 150°C	18	Avoid any contact with petroleum products		3DA 610 A26 B36 EA14 F19
EP7010	24 H 150°C	12			3DA 710 A26 B36 EA14 F19
EP851	24 H 150°C	12			3DA 814 A26 B36 EA14 F19
DF701	24 H 200°C	20	0 (150°C)	+2 (150°C)	6HK 710 A1-10 B38 EF31 F15
DF801	24 H 200°C	18	0 (150°C)	+2 (150°C)	6HK 814 A1-160 B38 EF31 F15

All of these rubber compounds are black.

For another compound or specification, please ask our technical services.

## 4 - TEMPERATURE RANGE

The working temperatures are subject to numerous conditions:

- Environment,
- Working life,
- Assembly type.

The temperatures given are for indicative purposes only.

The low temperature indicates a condition where reasonable flexibility is retained and is the intermediary between:

- The brittle point as determined by the French standard AFNOR NF T 46-018.
- The TR 10 as determined by the standards AFNOR NF T 46-032 (French) and ISO 2921.

At low temperatures, slight shrinkage with a hardening of the rubber may cause leaks to occur. These characteristics can have significant effects on seals in gas applications where there is a low initial deflection. The low temperature limit may be modified by the action of the fluid.

**N.B.:** The hardening of rubber compounds is a reversible phenomenon. In other words, the rubber fully returns to its initial characteristics when the temperature increases again.

Compared to metals, rubber compounds have a high thermal expansion coefficient. The recommended groove dimensions will be adequate to support any expansion in the rubber at high temperatures (negligible variation of the volume).

**N.B.:** At high temperature the properties of a rubber compound will change (reduction in hardness, increase in compression set and therefore a change in the sealing capability).

If the maximum recommended temperatures are respected, the characteristics of the compound will remain stable. If maximum temperatures are exceeded, an irreversible change will inevitably take place, which will result in severe hardening of the rubber, loss of elasticity and an increase in compression set up to 100%.

The maximum temperatures given correspond to a service life of 100 hours for static applications in contact with air.

### REMARKS

Please note that operational conditions (temperature, pressure, friction, etc.), as well as combinations of several substances modify, sometimes to a great extent, the aggressiveness of the fluids in contact with the seals.

It is therefore recommended that tests be conducted before the sealing material is finally selected.

# 5 - DIMENSIONS AND GROOVE SIZES

Before selecting a four-lips seal, it is recommended to refer to the dimension charts and take into account the working conditions indicated.

These dimensions correspond to the usual working conditions. The elasticity of the rubbers makes it possible to cover all applications from the range offered. A good sealing/reduced friction compromise is set out in the charts appended hereto. Every use, depending on the corresponding application, may favour either the sealing or friction function by slightly changing the recommended groove dimensions.

For high volume applications, we recommend testing.

## EXAMPLE

Four-lips seal n° 44: fitted to a piston groove will function in a cylinder bore measuring between 99 and 100.4 mm.

The dimensions for the depth of groove machined in the piston must be calculated in relation to the dimensions of the cylinder bore, so that the width L remains constant between the base of the groove and the cylinder bore for a given section of seal.

In the example above, L = 5 mm, the depth of the groove is calculated between 89 and 90.4, according to the specific cylinder bore.

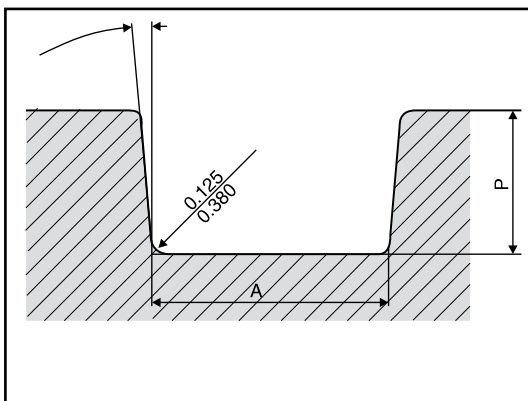
# 6 - TYPES OF ASSEMBLY

## 6.1 - STATIC APPLICATIONS

Four-lips seals, when used for static applications, must be fitted into a trapezoidal groove, whose depth and width is defined according to the section of the seal, as set out in the following table.

Grooves may either have parallel walls or an outward angle of up to 5° to be added to the width.

Section of the JF4 seal	GROOVE	
	Depth (P)	Width (A)
1.78	1.42	2.14
2.62	2.15	3.15
3.53	2.86	4.10
5.33	4.33	6.40
6.99	5.70	8.40



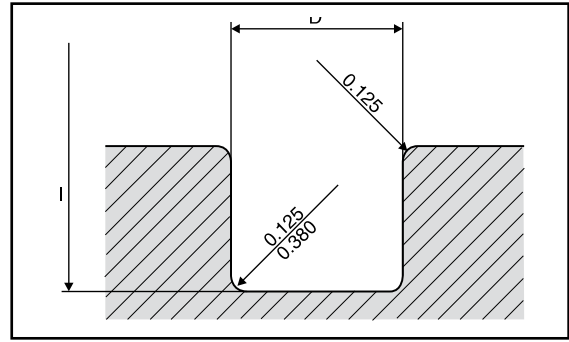


## 6.2 - DYNAMIC APPLICATIONS

Four-lips seals operating in dynamic application are fitted in perfectly smooth rectangular groove.

A slight radius (0.125 mm to 0.380 mm max.) is admitted for groove depth; it is advisable to lead-in angles on the friction side.

The alignment of moving parts must be ensured as perfectly as possible.

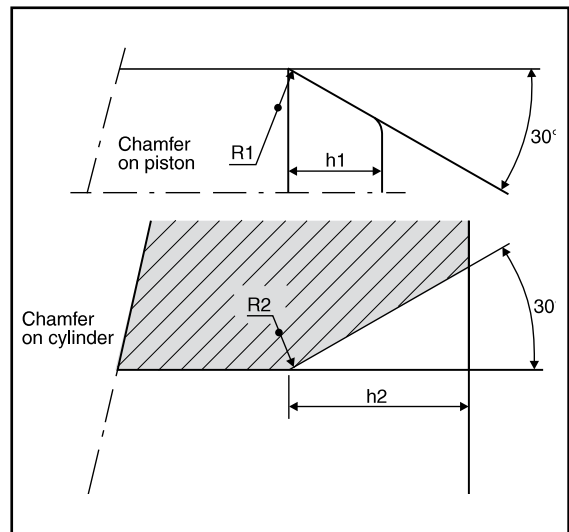


## 6.3 - LEAD CHAMFERS

In order to avoid damaging four-lips seals during installation, it is important to include 30° lead chamfers with a radius connection.

The height of these chamfers and the importance of the radius are relative to the section of the four-lips seal as shown in the following table:

Section JF4	Chamfer on piston		Chamfer on cylinder	
	h1	R1	h2	R2
1.78 2.62 3.53	1.50	3.00	2.50	5.00
5.33	2.50	5.00	3.00	6.00
6.99	3.00	6.00	4.00	8.00



## 6.4 - MACHINING TOLERANCES

### Pressures 10 bar and above

Use the tightest machining tolerances possible, ISO H8/f7 tolerances are recommended.

For large diameters do not exceed a diametral clearance of 0.12 mm.

### Pressures under 10 bars

Slightly broader tolerances are permissible.

## 6.5 - SURFACE CONDITION AND PROTECTION

a) The surface condition determines the wear and in consequence the seal's longevity. For the best results an Ra (arithmetical mean deviation from a mean roughness line) of 0.2 to 0.4 microns is recommended.

b) It is advised to filter all engine oils and avoid any abrasive deposits on all moving parts, as the latter affect the surfaces and lead to the rapid deterioration of the seals.

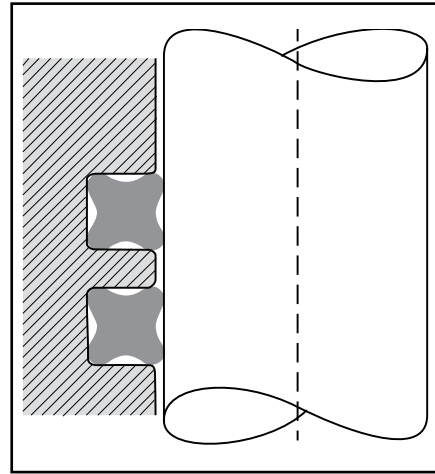
## 6.6 - RECIPROCATING APPLICATIONS

### For medium and high pressures (over 7 bars)

It is preferable for the same side of the seal to receive the pressure, and whenever possible, it is recommended to use two seals fitted in adjoining grooves.

### For low pressures (up to 7 bars)

Only reciprocating applications may use one seal.



## 6.7 - ROTARY APPLICATIONS

- Fit the seal to the fixed part.
- Peripheral compression should be as close to 5% as possible and radial compression approximately 3% of the section.
- The volume of the groove must be approximately 5% greater than that of the seal.

## 6.8 - EXTRUSION

This phenomena, as illustrated in the sketch, can occur under certain unfavourable conditions due to:

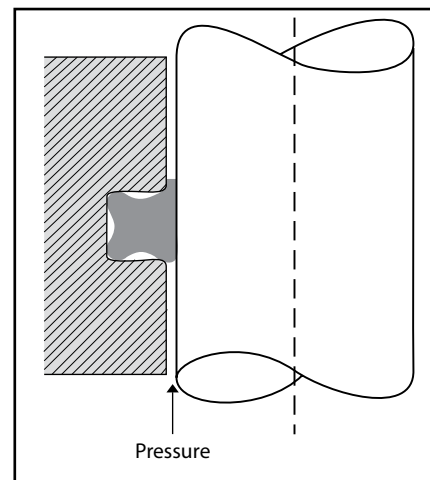
- Excessive tolerances;
- Operating pressures;
- The compression set of the rubber.

To limit the risk of extrusion:

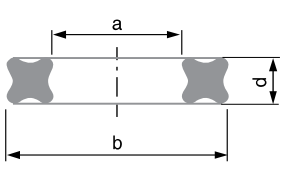
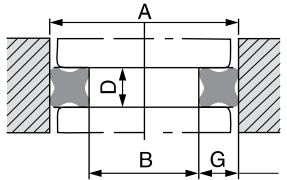
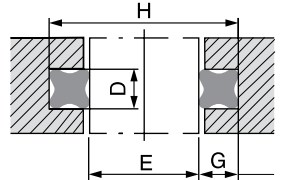
- The greater the pressure the tighter the permitted clearance.

Other causes of malfunction by extrusion:

- Abnormal mechanical conditions (play, poor surface finish, eccentricity, bad alignment);
- Poor quality fluids;
- Unsuitable rubber compound.



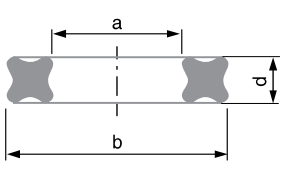
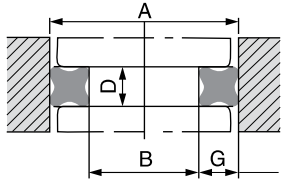
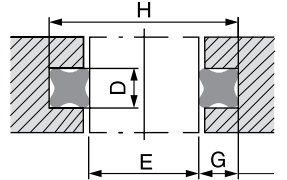
# 9 - DIMENSION TABLES

		SIZES			RECIPROCATING MOVEMENT FITTING						
REFERENCES for compound 9 PD 31	JF4										
		N°	a	b	d	Seals mounted on pistons		Groove		Seals mounted in cylinders	
						A min A max	B + 0,1 - 0	D + 0.1 - 0	G	E min E max	H + 0 - 0.1
200000	<b>1</b>	2.90	6.46	1.78	6.10 6.20	2.95 3.05	2	1.575	3.25	6.40 ▲	
200001	<b>2</b>	3.68	7.24	1.78	6.90 7	3.75 3.85	2	1.575	4.00 4.05	7.15 7.20 ▲	
200002	<b>3</b>	4.47	8.03	1.78	7.70 7.80	4.55 4.65	2	1.575	4.75 4.80	7.90 7.95 ▲	
200003	<b>3 A</b>	4.62	8.18	1.78	7.85 8.00	4.70 4.85	2	1.575	4.95 5.00	8.10 8.15 ▲	
200004	<b>4</b>	5.28	8.84	1.78	8.50 8.65	5.35 5.50	2	1.575	5.55 5.60	8.70 8.75	
200005	<b>4 A</b>	5.70	9.26	1.78	8.95 9.10	5.80 5.95	2	1.575	6.00 6.05	9.15 9.20	
200006	<b>5</b>	6.07	9.63	1.78	9.30 9.50	6.15 6.35	2	1.575	6.35 6.40	9.50 9.55	
200007	<b>5 A</b>	6.65	10.21	1.78	9.90 10.15	6.75 7.00	2	1.575	6.90 7.00	10.05 10.15	
200008	<b>6</b>	7.65	11.21	1.78	10.90 11.15	7.75 8.00	2	1.575	7.90 8.00	11.05 11.25	
200009	<b>6 A</b>	8.70	12.26	1.78	11.95 12.25	8.80 9.10	2	1.575	8.95 9.05	12.10 12.20	
200010	<b>7</b>	9.25	12.81	1.78	12.50 12.85	9.35 9.70	2	1.575	9.50 9.60	12.65 12.75	
200011	<b>7 A</b>	9.70	13.26	1.78	12.95 13.30	9.80 10.15	2	1.575	9.90 10.05	13.05 13.20	
200232	<b>113</b>	10.82	14.38	1.78	14.10 14.45	10.95 11.30	2	1.575	11.05 11.15	14.20 14.30	
200738	<b>114</b>	12.42	15.98	1.78	15.70 16.15	12.55 13.00	2	1.575	12.60 12.75	15.75 15.90	
200728	<b>115</b>	14.00	17.56	1.78	17.35 17.85	14.20 14.60	2	1.575	14.15 14.30	17.30 17.45	
200729	<b>116</b>	15.60	19.16	1.78	18.90 19.50	15.75 16.35	2	1.575	15.75 15.90	18.90 19.05	
200730	<b>117</b>	17.17	20.73	1.78	20.60 21.10	17.45 17.95	2	1.575	17.30 17.45	20.45 20.60	
200739	<b>118</b>	18.77	22.33	1.78	22.30 22.75	19.05 19.60	2	1.575	18.85 19.05	22.00 22.20	
200731	<b>119</b>	20.35	23.91	1.78	23.45 24.35	20.60 21.20	2	1.575	20.40 20.65	23.55 23.80	
200732	<b>120</b>	21.95	25.51	1.78	25.05 26.00	22.20 22.85	2	1.575	22.00 22.25	25.15 25.40	
200740	<b>121</b>	23.52	27.08	1.78	26.50 27.60	23.75 24.45	2	1.575	23.55 23.80	26.70 26.95	
201264	<b>122</b>	25.12	28.68	1.78	28.55 29.40	25.40 26.25	2	1.575	25.10 25.40	28.25 28.55	
201265	<b>123</b>	26.70	30.26	1.78	30.15 31.05	27.00 27.90	2	1.575	26.65 26.95	29.80 30.10	
201266	<b>124</b>	28.30	31.86	1.78	31.80 32.75	28.65 29.60	2	1.575	28.25 28.55	31.40 31.70	

The choice of A and B (piston fitting) or E and H (cylinder fitting) within the indicated limits must lead to the groove depth G.

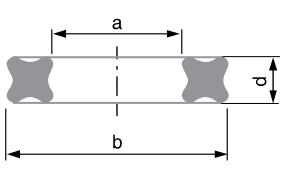
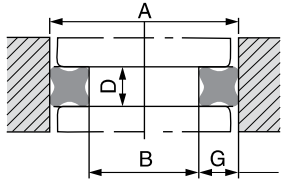
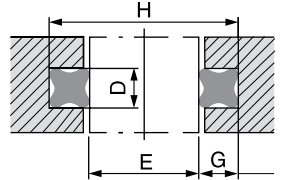
$$G = \frac{A - B}{2} \text{ or } G = \frac{H - E}{2}$$

▲ Fitting the parts in a two-part groove.

		SIZES			RECIPROCATING MOVEMENT FITTING						
REFERENCES for compound 9 PD 31	JF4										
		N°	a	b	d	Seals mounted on pistons		Groove		Seals mounted in cylinders	
						A min A max	B + 0.1 - 0	D + 0.1 - 0	G	E min E max	H + 0 - 0.1
201267	125	29.87	33.43	1.78	33.35 34.35	30.20 31.20	2	1.575	29.80 30.10	32.95 33.25	
201687	137	63.22	66.78	1.78	67.15 69.20	64.00 66.05	2	1.575	62.65 63.30	65.80 66.45	
200012	8	9.19	14.43	2.62	14.00 14.45	9.20 9.65	2.9	2.40	9.45 9.55	14.25 14.35	
200013	8 A	9.80	15.04	2.62	14.70 15.05	9.90 10.25	2.9	2.40	10.00 10.15	14.80 14.95	
200014	9	10.77	16.01	2.62	15.70 16.10	10.90 11.30	2.9	2.40	11.00 11.10	15.80 15.90	
200015	9 A	11.70	16.94	2.62	16.60 17.05	11.80 12.25	2.9	2.40	11.90 12.05	16.70 16.85	
200500	10	12.37	17.61	2.62	17.30 17.75	12.50 12.95	2.9	2.40	12.50 12.70	17.30 17.50	
200501	10 A	12.80	18.04	2.62	17.70 18.20	12.90 13.40	2.9	2.40	12.95 13.15	17.75 17.95	
200502	10 B	13.70	18.94	2.62	18.60 19.10	13.80 14.30	2.9	2.40	13.80 14.00	18.60 18.80	
200503	11	13.94	19.18	2.62	19.15 19.40	14.35 14.60	2.9	2.40	14.10 14.25	18.90 19.05	
200504	11 A	14.70	19.94	2.62	19.65 20.20	14.85 15.40	2.9	2.40	14.85 15.00	19.65 19.80	
200505	12	15.54	20.78	2.62	20.50 21.05	15.70 16.25	2.9	2.40	15.65 16.00	20.45 20.80	
200506	13	17.12	22.36	2.62	22.00 22.55	17.20 17.75	2.9	2.40	17.20 17.40	22.00 22.20	
200507	13 A	17.75	22.99	2.62	22.70 23.40	17.90 18.60	2.9	2.40	17.80 18.05	22.60 22.85	
200508	14	18.72	23.96	2.62	23.70 24.40	18.90 19.60	2.9	2.40	18.80 19.00	23.60 23.80	
200509	14 A	19.60	24.84	2.62	24.60 25.35	19.80 20.55	2.9	2.40	19.65 20.00	24.45 24.80	
200733	217	20.30	25.54	2.62	25.30 26.00	20.50 21.20	2.9	2.40	20.35 20.60	25.15 25.40	
200734	218	21.89	27.13	2.62	26.90 27.70	22.10 22.90	2.9	2.40	21.90 22.15	26.70 26.95	
200735	219	23.47	28.71	2.62	28.50 29.35	23.70 24.55	2.9	2.40	23.50 23.75	28.30 28.55	
201259	220	25.07	30.31	2.62	30.10 31.00	25.30 26.20	2.9	2.40	25.30 25.55	30.10 30.35	
201260	221	26.64	31.88	2.62	31.70 32.65	26.90 27.85	2.9	2.40	26.60 26.90	31.40 31.70	
201261	222	28.24	33.48	2.62	33.30 34.30	28.50 29.50	2.9	2.40	28.15 28.45	32.95 33.25	
201268	223	29.82	35.06	2.62	34.90 35.95	30.10 31.15	2.9	2.40	29.75 30.05	34.55 34.85	
201269	224	31.42	36.66	2.62	36.75 37.65	31.75 32.85	2.9	2.40	31.30 31.65	36.10 36.45	
201270	225	32.99	38.23	2.62	38.10 39.30	33.30 34.50	2.9	2.40	32.85 33.20	37.55 38.00	
201271	226	34.60	39.84	2.62	39.75 40.95	34.95 36.15	2.9	2.40	34.45 34.80	39.25 39.60	
201272	227	36.17	41.41	2.62	40.35 42.60	35.55 37.80	2.9	2.40	36.00 36.35	40.80 41.15	
201273	228	37.77	43.01	2.62	42.95 44.25	38.14 39.45	2.9	2.40	37.55 37.95	42.35 42.75	

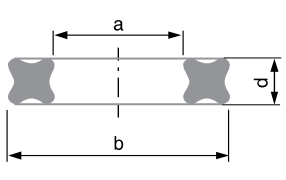
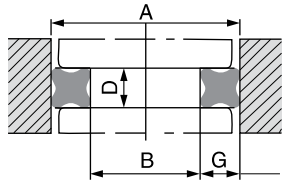
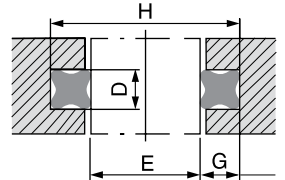
The choice of A and B (piston fitting) or E and H (cylinder fitting) in indicated limits must give the groove height G as shown.

$$G = \frac{A - B}{2} \text{ or } G = \frac{H - E}{2}$$

		SIZES			RECIPROCATING MOVEMENT FITTING						
REFERENCES for compound 9 PD 31	JF4										
		N°	a	b	d	Seals mounted on pistons		Groove		Seals mounted in cylinders	
						A min A max	B + 0,1 - 0	D + 0.1 - 0	G	E min E max	H + 0 - 0.1
201274	<b>229</b>	39.34	44.58	2.62	44.55 45.90	39.75 41.10	2.9	2.40	39.10 39.50	43.90 44.30	
201275	<b>230</b>	40.94	46.18	2.62	46.15 47.60	41.35 42.80	2.9	2.40	40.70 41.10	45.50 45.90	
201688	<b>231</b>	42.52	47.76	2.62	47.75 49.25	42.95 44.45	2.9	2.40	42.25 42.70	47.05 47.50	
203105	<b>261</b>	139.37	144.61	2.62	145.55 150.45	140.75 145.65	2.9	2.40	137.50 138.95	142.30 143.75	
200510	<b>15</b>	18.64	25.70	3.53	25.40 26.10	18.85 19.55	3.9	3.275	18.70 19.00	25.25 25.55	
200511	<b>16</b>	20.22	27.28	3.53	27.00 27.65	20.45 21.10	3.9	3.275	20.30 20.60	26.85 27.15	
200512	<b>16 A</b>	20.90	27.96	3.53	27.70 28.40	21.15 21.85	3.9	3.275	21.00 21.20	27.55 27.75	
200513	<b>17</b>	21.82	28.88	3.53	28.50 29.35	21.95 22.80	3.9	3.275	21.85 22.15	28.40 28.70	
200514	<b>18</b>	23.39	30.45	3.53	30.00 30.80	23.45 24.25	3.9	3.275	23.45 23.70	30.00 30.25	
200515	<b>18 A</b>	23.99	31.05	3.53	30.85 31.55	24.30 25.00	3.9	3.275	24.00 24.30	30.55 30.85	
201000	<b>19</b>	24.99	32.05	3.53	31.85 32.55	25.30 26.00	3.9	3.275	25.00 25.40	31.55 31.95	
201001	<b>19 A</b>	25.90	32.96	3.53	32.75 33.20	26.20 26.65	3.9	3.275	25.85 26.20	32.40 32.75	
201002	<b>20</b>	26.57	33.63	3.53	33.40 34.10	26.85 27.55	3.9	3.275	26.50 27.00	33.05 33.55	
201003	<b>20 A</b>	27.57	34.63	3.53	34.40 34.85	27.85 28.30	3.9	3.275	27.50 28.00	34.05 34.55	
201004	<b>21</b>	28.17	35.23	3.53	34.95 36.10	28.40 29.55	3.9	3.275	28.15 28.45	34.70 35.00	
201005	<b>22</b>	29.74	36.80	3.53	36.50 37.75	29.95 31.20	3.9	3.275	29.60 30.05	36.15 36.60	
201006	<b>23</b>	31.34	38.40	3.53	38.00 39.00	31.45 32.45	3.9	3.275	31.25 31.65	37.80 38.20	
201007	<b>23 A</b>	32.04	39.10	3.53	39.05 39.60	32.50 33.05	3.9	3.275	31.90 32.35	38.45 38.90	
201008	<b>24</b>	32.92	39.98	3.53	39.75 40.50	33.20 33.95	3.9	3.275	32.80 33.25	39.35 39.80	
201009	<b>24 A</b>	33.80	40.86	3.53	40.65 41.20	34.10 34.65	3.9	3.275	33.65 34.10	40.20 40.65	
201010	<b>25</b>	34.52	41.58	3.53	41.35 42.65	34.80 36.10	3.9	3.275	34.40 35.00	40.95 41.55	
201011	<b>26</b>	36.09	43.15	3.53	42.95 44.30	36.40 37.75	3.9	3.275	36.00 36.40	42.55 42.95	
201012	<b>27</b>	37.69	44.75	3.53	44.50 46.10	37.95 39.55	3.9	3.275	37.50 38.00	44.05 44.55	
201262	<b>323</b>	40.87	47.93	3.53	47.75 49.15	41.20 42.60	3.9	3.275	40.65 41.15	47.20 47.70	
201689	<b>324</b>	44.05	51.11	3.53	50.95 52.50	44.40 45.95	3.9	3.275	43.80 44.30	50.35 50.85	
201690	<b>325</b>	47.22	54.28	3.53	54.15 55.80	47.60 49.25	3.9	3.275	46.92 47.45	53.45 54.00	

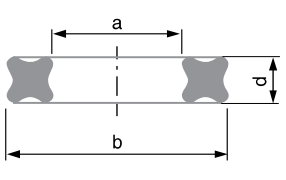
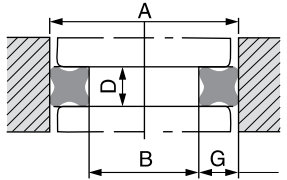
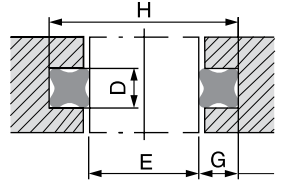
The choice of A and B (piston fitting) or E and H (cylinder fitting) in indicated limits must give the groove height G as shown.

$$G = \frac{A - B}{2} \text{ or } G = \frac{H - E}{2}$$

		SIZES			RECIPROCATING MOVEMENT FITTING						
REFERENCES for compound 9 PD 31	JF4										
		N°	a	b	d	Seals mounted on pistons		Groove		Seals mounted in cylinders	
						A min A max	B + 0,1 - 0	D + 0.1 - 0	G	E min E max	H + 0 - 0.1
201693	<b>326</b>	50.39	57.45	3.53	57.35 59.10	50.80 52.55	3.9	3.275	50.05 50.60	56.60 57.15	
201694	<b>327</b>	53.57	60.63	3.53	60.55 62.40	54.00 55.85	3.9	3.275	53.15 53.80	59.70 60.35	
201691	<b>328</b>	56.75	63.81	3.53	63.75 65.75	57.20 59.20	3.9	3.275	56.30 59.95	62.85 63.50	
201692	<b>329</b>	59.92	66.98	3.53	66.95 69.05	60.40 62.50	3.9	3.275	59.45 60.10	66.00 66.65	
201695	<b>330</b>	63.09	70.15	3.53	70.15 72.35	63.60 65.80	3.9	3.275	62.55 63.25	69.10 69.80	
202159	<b>331</b>	66.27	73.33	3.53	73.35 75.65	66.80 69.10	3.9	3.275	65.70 66.40	72.25 72.95	
202160	<b>332</b>	69.44	76.50	3.53	76.55 78.95	70.00 72.40	3.9	3.275	68.80 69.55	75.35 76.10	
202161	<b>333</b>	72.62	79.68	3.53	79.75 82.30	73.20 75.75	3.9	3.275	71.95 72.75	78.50 79.30	
202162	<b>334</b>	75.80	82.86	3.53	82.95 85.60	76.40 79.05	3.9	3.275	75.05 75.90	81.60 82.45	
202163	<b>335</b>	78.97	86.03	3.53	86.15 88.90	79.60 82.35	3.9	3.275	78.20 79.05	84.75 85.60	
202157	<b>336</b>	82.15	89.21	3.53	89.35 92.20	82.80 85.65	3.9	3.275	81.30 82.20	87.85 88.75	
202164	<b>337</b>	85.32	92.38	3.53	92.55 95.50	86.00 88.95	3.9	3.275	84.45 85.35	91.00 91.90	
202165	<b>338</b>	88.49	95.55	3.53	95.75 98.85	89.20 92.30	3.9	3.275	87.55 88.50	94.10 95.05	
202166	<b>339</b>	91.67	98.73	3.53	98.95 102.15	92.40 95.60	3.9	3.275	90.70 91.70	97.25 98.25	
202635	<b>340</b>	94.84	101.90	3.53	102.15 105.45	95.60 98.90	3.9	3.275	93.80 94.85	100.35 101.40	
202632	<b>341</b>	98.02	105.08	3.53	105.35 108.75	98.80 102.20	3.9	3.275	96.95 98.00	103.50 104.55	
202633	<b>342</b>	101.20	108.26	3.53	108.55 112.10	102.00 105.55	3.9	3.275	100.10 101.15	106.65 107.70	
202634	<b>348</b>	120.25	127.31	3.53	127.75 131.95	121.20 125.40	3.9	3.275	118.85 120.10	125.40 126.65	
203596	<b>363</b>	183.74	190.80	3.53	191.75 198.15	185.21 191.60	3.9	3.275	181.40 183.30	187.95 189.85	
201013	<b>28</b>	37.47	48.13	5.33	47.75 49.20	37.75 39.20	6.1	5.00	37.45 38.00	47.45 48.00	
201014	<b>28 A</b>	39.64	50.30	5.33	50.00 50.70	40.00 40.70	6.1	5.00	39.50 40.10	49.50 50.10	
201015	<b>29</b>	40.64	51.30	5.33	51.00 52.00	41.00 42.00	6.1	5.00	40.50 41.10	50.50 51.10	
201500	<b>29 A</b>	41.80	52.46	5.33	52.10 53.80	42.10 43.80	6.1	5.00	41.65 42.25	51.65 52.25	
201501	<b>30</b>	43.82	54.48	5.33	54.00 55.20	44.00 45.20	6.1	5.00	43.65 44.30	53.65 54.30	
201502	<b>30 A</b>	45.04	55.70	5.33	55.35 57.00	45.35 47.00	6.1	5.00	44.90 45.50	54.90 55.50	
201503	<b>30 B</b>	45.84	56.50	5.33	57.15 57.40	47.15 47.40	6.1	5.00	45.60 46.25	55.60 56.25	
201504	<b>31</b>	46.99	57.65	5.33	57.50 58.50	47.50 48.50	6.1	5.00	46.90 47.40	56.90 57.40	

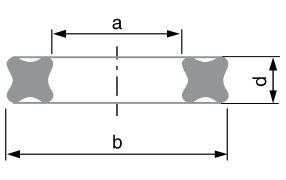
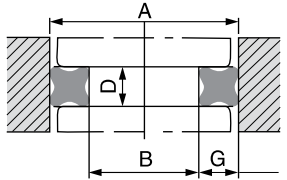
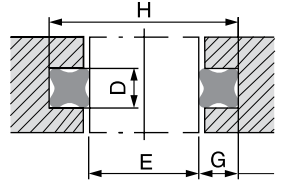
The choice of A and B (piston fitting) or E and H (cylinder fitting) in indicated limits must give the groove height G as shown.

$$G = \frac{A - B}{2} \text{ or } G = \frac{H - E}{2}$$

		SIZES			RECIPROCATING MOVEMENT FITTING						
REFERENCES for compound 9 PD 31	JF4										
		N°	a	b	d	Seals mounted on pistons		Groove		Seals mounted in cylinders	
						A min A max	B + 0,1 - 0	D + 0.1 - 0	G	E min E max	H + 0 - 0.1
201505	31 A	47.80	58.46	5.33	58.70 60.00	48.70 50.00	6.1	5.00	47.50 48.20	57.50 58.20	
201506	32	50.17	60.83	5.33	60.50 62.00	50.50 52.00	6.1	5.00	50.00 50.60	60.00 60.60	
201507	32 A	52.00	62.66	5.33	62.40 63.50	52.40 53.50	6.1	5.00	51.90 52.40	61.90 62.40	
201508	33	53.34	64.00	5.33	63.75 64.70	53.75 54.70	6.1	5.00	53.00 53.75	63.00 63.75	
201509	33 A	54.50	65.16	5.33	65.00 66.50	55.00 56.50	6.1	5.00	54.00 55.00	64.00 65.00	
201510	34	56.52	67.18	5.33	67.00 67.50	57.00 57.50	6.1	5.00	56.00 57.00	66.00 67.00	
201511	34 A	57.52	68.18	5.33	68.00 69.50	58.00 59.50	6.1	5.00	57.40 58.00	67.40 68.00	
201512	35	59.69	70.35	5.33	70.00 71.70	60.00 61.70	6.1	5.00	59.30 60.00	69.30 70.00	
201513	35 A	61.54	72.20	5.33	72.00 73.00	62.00 63.00	6.1	5.00	61.00 62.00	71.00 72.00	
201514	36	62.87	73.53	5.33	73.40 74.80	63.40 64.80	6.1	5.00	62.50 63.20	72.50 73.20	
201515	36 A	64.59	75.25	5.33	75.00 76.50	65.00 66.50	6.1	5.00	64.00 65.00	74.00 75.00	
202000	37	66.04	76.70	5.33	76.60 77.80	66.60 67.80	6.1	5.00	65.50 66.40	75.50 76.40	
202001	37 A	67.64	78.30	5.33	78.00 79.20	68.00 69.20	6.1	5.00	67.00 68.00	77.00 78.00	
202002	38	69.22	79.88	5.33	79.80 81.00	69.80 71.00	6.1	5.00	68.60 69.50	78.60 79.50	
202003	38 A	70.64	81.30	5.33	81.50 82.50	71.50 72.50	6.1	5.00	70.00 71.00	80.00 81.00	
202004	39	72.39	83.05	5.33	83.00 84.40	73.00 74.40	6.1	5.00	72.00 72.70	82.00 82.70	
202005	39 A	73.84	84.50	5.33	84.50 85.70	74.50 75.70	6.1	5.00	73.00 74.20	83.00 84.20	
202006	40	75.57	86.23	5.33	86.00 89.00	76.00 79.00	6.1	5.00	74.90 76.00	84.90 86.00	
202007	41	78.74	89.40	5.33	89.50 90.80	79.50 80.80	6.1	5.00	78.00 79.00	88.00 89.00	
202008	41 A	80.09	90.75	5.33	91.00 92.70	81.00 82.70	6.1	5.00	79.50 80.35	89.50 90.35	
202009	42	81.92	92.58	5.33	92.80 94.30	82.80 84.30	6.1	5.00	81.00 82.20	91.00 92.20	
202010	42 A	83.39	94.05	5.33	94.50 95.75	84.50 85.75	6.1	5.00	82.50 83.50	92.50 93.50	
202011	43	85.09	95.75	5.33	96.00 97.40	86.00 87.40	6.1	5.00	84.00 85.40	94.00 95.40	
202012	43 A	86.64	97.30	5.33	97.50 98.90	87.50 88.90	6.1	5.00	86.00 87.00	96.00 97.00	
202013	44	88.27	98.93	5.33	99.00 100.40	89.00 90.40	6.1	5.00	87.80 89.00	97.80 99.00	
202014	44 A	89.59	100.25	5.33	100.50 102.00	90.50 92.00	6.1	5.00	89.00 90.50	99.00 100.50	
202015	45	91.44	102.10	5.33	102.30 105.00	92.30 95.00	6.1	5.00	91.00 93.00	101.00 103.00	

The choice of A and B (piston fitting) or E and H (cylinder fitting) in indicated limits must give the groove height G as shown.

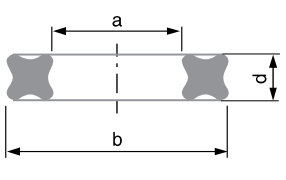
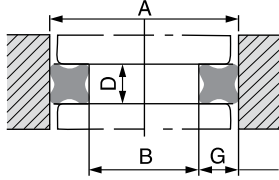
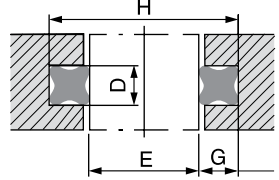
$$G = \frac{A - B}{2} \text{ or } G = \frac{H - E}{2}$$

		SIZES			RECIPROCATING MOVEMENT FITTING						
REFERENCES for compound 9 PD 31	JF4										
		N°	a	b	d	Seals mounted on pistons		Groove		Seals mounted in cylinders	
						A min A max	B + 0,1 - 0	D + 0.1 - 0	G	E min E max	H + 0 - 0.1
202500	46	94.62	105.28	5.33	105.50 108.50	95.50 98.50	6.1	5.00	94.00 96.00	104.00 106.00	
202501	47	97.99	108.65	5.33	109.00 111.70	99.00 101.70	6.1	5.00	97.00 99.50	107.00 109.50	
202502	48	100.97	111.63	5.33	112.00 113.30	102.00 103.30	6.1	5.00	100.00 101.50	110.00 111.50	
202503	48 A	102.34	113.00	5.33	113.50 114.90	103.50 104.90	6.1	5.00	101.70 103.00	111.70 113.00	
202504	49	104.14	114.80	5.33	115.00 116.00	105.00 106.00	6.1	5.00	103.50 104.50	113.50 114.50	
202505	49 A	105.80	116.46	5.33	116.50 118.50	106.50 108.50	6.1	5.00	105.00 107.00	115.00 117.00	
202506	50	107.32	117.98	5.33	119.00 121.00	109.00 111.00	6.1	5.00	107.00 109.00	117.00 119.00	
202507	51	110.49	121.15	5.33	121.50 124.50	111.50 114.50	6.1	5.00	109.50 112.20	119.50 122.20	
202508	52	113.67	124.33	5.33	124.70 127.00	114.70 117.00	6.1	5.00	112.60 115.50	122.60 125.50	
202636	450	116.84	127.50	5.33	128.00 130.45	118.00 120.45	6.1	5.00	115.85 118.80	125.85 128.80	
202637	451	120.02	130.68	5.33	131.20 133.75	121.20 123.75	6.1	5.00	119.00 122.00	129.00 132.00	
202638	452	123.19	133.85	5.33	134.40 137.00	124.40 127.00	6.1	5.00	122.10 125.20	132.10 135.20	
202639	453	126.37	137.03	5.33	137.65 140.30	127.65 130.30	6.1	5.00	125.25 128.40	135.25 138.40	
202640	454	129.54	140.20	5.33	140.85 143.55	130.85 133.55	6.1	5.00	128.40 131.60	138.40 141.60	
203106	455	132.72	143.38	5.33	144.05 146.85	134.05 136.85	6.1	5.00	131.50 134.80	141.50 144.80	
203107	456	135.89	146.55	5.33	147.25 150.10	137.25 140.10	6.1	5.00	134.65 138.00	144.65 148.00	
203108	457	139.07	149.73	5.33	150.45 153.40	140.45 143.40	6.1	5.00	137.80 141.25	147.80 151.25	
202509	88	113.67	127.65	6.99	127.70 129.60	114.70 116.60	7.9	6.50	112.50 115.50	125.50 128.50	
202510	52 A	115.84	129.82	6.99	129.80 130.60	116.80 117.60	7.9	6.50	115.60 117.00	128.60 130.00	
202511	53	116.84	130.82	6.99	130.80 133.50	117.80 120.50	7.9	6.50	117.00 119.00	130.00 132.00	
202512	54	120.02	134.00	6.99	134.00 137.00	121.00 124.00	7.9	6.50	119.50 122.00	132.50 135.00	
202513	55	123.19	137.17	6.99	137.20 140.00	124.20 127.00	7.9	6.50	122.50 125.00	135.50 138.00	
202514	56	126.37	140.35	6.99	140.50 143.50	127.50 130.50	7.9	6.50	125.50 128.50	138.50 141.50	
202515	57	129.54	143.52	6.99	143.75 146.50	130.75 133.50	7.9	6.50	129.00 131.50	142.00 144.50	
203000	58	132.72	146.70	6.99	147.00 149.50	134.00 136.50	7.9	6.50	132.00 135.00	145.00 148.00	
203001	59	135.89	149.87	6.99	150.00 153.00	137.00 140.00	7.9	6.50	135.50 138.00	148.50 151.00	
203002	60	139.07	153.05	6.99	153.20 156.00	140.20 143.00	7.9	6.50	138.50 141.00	151.50 154.00	

The choice of A and B (piston fitting) or E and H (cylinder fitting) in indicated limits must give the groove height G as shown.

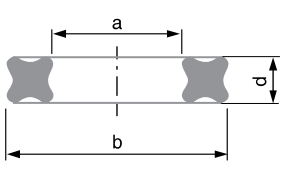
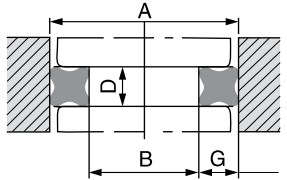
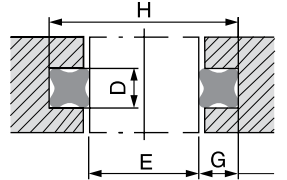
$$G = \frac{A - B}{2} \text{ or } G = \frac{H - E}{2}$$



		SIZES			RECIPROCATING MOVEMENT FITTING						
REFERENCES for compound 9 PD 31	JF4										
		N°	a	b	d	Seals mounted on pistons		Groove		Seals mounted in cylinders	
						A min A max	B + 0,1 - 0	D + 0.1 - 0	G	E min E max	H + 0 - 0.1
203003	61	142.24	156.22	6.99	156.50 159.50	143.50 146.50	7.9	6.50	141.50 144.00	154.50 157.00	
203004	62	145.42	159.40	6.99	159.70 162.90	146.70 149.90	7.9	6.50	144.50 147.00	157.50 160.00	
203005	63	148.59	162.57	6.99	163.00 166.30	150.00 153.30	7.9	6.50	147.50 150.50	160.50 163.50	
203006	64	151.77	165.75	6.99	166.40 168.40	153.40 155.40	7.9	6.50	151.00 153.50	164.00 166.50	
203007	64 A	155.02	169.00	6.99	169.00 172.50	156.00 159.50	7.9	6.50	154.00 156.50	167.00 169.50	
203008	65	158.12	172.10	6.99	172.70 175.40	159.70 162.40	7.9	6.50	157.00 159.50	170.00 172.50	
203009	65 A	161.02	175.00	6.99	175.50 178.80	162.50 165.80	7.9	6.50	160.00 162.50	173.00 175.50	
203010	66	164.47	178.45	6.99	179.00 181.50	166.00 168.50	7.9	6.50	163.00 166.00	176.00 179.00	
203011	66 A	167.02	181.00	6.99	181.70 185.00	168.70 172.00	7.9	6.50	166.50 168.50	179.50 181.50	
203012	67	170.82	184.80	6.99	185.30 187.80	172.30 174.80	7.9	6.50	169.00 172.50	182.00 185.50	
203013	67 A	173.52	187.50	6.99	188.00 191.00	175.00 178.00	7.9	6.50	173.00 175.50	186.00 188.50	
203014	68	177.17	191.15	6.99	191.40 194.00	178.40 181.00	7.9	6.50	176.00 178.50	189.00 191.50	
203015	68 A	180.52	194.50	6.99	195.00 197.80	182.00 184.00	7.9	6.50	179.00 182.50	192.00 195.50	
203500	69	183.52	197.50	6.99	198.00 200.30	185.00 187.30	7.9	6.50	183.00 185.50	196.00 198.50	
203501	69 A	186.02	200.00	6.99	200.50 204.00	187.50 191.00	7.9	6.50	186.00 188.00	199.00 201.00	
203502	70	189.87	203.85	6.99	204.20 206.40	191.20 193.40	7.9	6.50	189.00 192.00	202.00 205.00	
203503	70 A	192.02	206.00	6.99	206.50 210.50	193.50 197.50	7.9	6.50	192.50 194.00	205.50 207.00	
203504	71	196.22	210.20	6.99	210.75 213.30	197.75 200.30	7.9	6.50	195.00 198.50	208.00 211.50	
203505	71 A	199.02	213.00	6.99	213.50 217.00	200.50 204.00	7.9	6.50	199.00 201.00	212.00 214.00	
203506	72	202.57	216.55	6.99	217.50 221.00	204.50 208.00	7.9	6.50	202.00 205.00	215.00 218.00	
203507	72 A	206.80	220.78	6.99	221.30 226.00	208.30 213.00	7.9	6.50	205.50 209.00	218.50 222.00	
203508	72 B	211.02	225.00	6.99	226.50 229.50	213.50 216.50	7.9	6.50	209.50 213.50	222.50 226.50	
203509	73	215.27	229.25	6.99	230.00 233.50	217.00 220.50	7.9	6.50	214.00 218.00	227.00 231.00	
203510	73 A	219.02	233.00	6.99	233.70 238.30	220.70 225.30	7.9	6.50	218.50 221.00	231.50 234.00	
203511	73 B	223.50	237.48	6.99	238.00 242.00	225.00 229.00	7.9	6.50	222.00 226.00	235.00 239.00	
203512	74	227.97	241.95	6.99	242.50 245.00	229.50 232.00	7.9	6.50	226.50 230.50	239.50 243.50	
203513	74 A	231.02	245.00	6.99	245.50 249.50	232.50 236.50	7.9	6.50	231.00 233.50	244.00 246.50	

The choice of A and B (piston fitting) or E and H (cylinder fitting) in indicated limits must give the groove height G as shown.

$$G = \frac{A - B}{2} \text{ or } G = \frac{H - E}{2}$$

		SIZES			RECIPROCATING MOVEMENT FITTING						
REFERENCES for compound 9 PD 31	JF4										
		N°	a	b	d	Seals mounted on pistons		Groove		Seals mounted in cylinders	
						A min A max	B + 0,1 - 0	D + 0.1 - 0	G	E min E max	H + 0 - 0.1
203514	<b>74 B</b>	235.00	248.98	6.99	250.00 255.00	237.00 242.00	7.9	6.50	234.00 238.00	247.00 251.00	
203515	<b>75</b>	240.67	254.65	6.99	255.50 257.50	242.50 244.50	7.9	6.50	239.00 243.00	252.00 256.00	
204000	<b>75 A</b>	243.02	257.00	6.99	258.00 261.00	245.00 248.00	7.9	6.50	244.00 246.00	257.00 259.00	
204001	<b>75 B</b>	248.00	261.98	6.99	262.00 268.00	249.00 255.00	7.9	6.50	247.00 251.00	260.00 264.00	
204002	<b>76</b>	253.37	267.35	6.99	268.50 273.50	255.50 260.50	7.9	6.50	252.00 256.50	265.00 269.50	
204003	<b>76 A</b>	259.00	272.98	6.99	274.00 280.00	261.00 267.00	7.9	6.50	257.00 262.00	270.00 275.00	
204004	<b>77</b>	266.07	280.05	6.99	280.50 287.50	267.50 274.50	7.9	6.50	264.50 269.00	277.50 282.00	
204005	<b>77 A</b>	273.10	287.08	6.99	288.00 293.00	275.00 280.00	7.9	6.50	271.50 276.00	284.50 289.00	
204006	<b>78</b>	278.77	292.75	6.99	293.50 299.50	280.50 286.50	7.9	6.50	277.00 282.00	290.00 295.00	
204007	<b>78 A</b>	284.00	297.98	6.99	300.00 303.00	287.00 290.00	7.9	6.50	283.00 287.00	296.00 300.00	
204008	<b>78 B</b>	287.50	301.48	6.99	303.50 306.00	290.50 293.00	7.9	6.50	288.00 290.50	301.00 303.50	
204009	<b>79</b>	291.47	305.45	6.99	306.50 312.50	293.50 299.50	7.9	6.50	291.00 295.00	304.00 308.00	
204010	<b>79 A</b>	298.00	311.98	6.99	313.00 318.50	300.00 305.50	7.9	6.50	296.00 301.00	309.00 314.00	
204011	<b>80</b>	304.17	318.15	6.99	319.00 325.50	306.00 312.50	7.9	6.50	302.00 307.00	315.00 320.00	
204012	<b>80 A</b>	310.00	323.98	6.99	326.00 332.00	313.00 319.00	7.9	6.50	308.00 313.00	321.00 326.00	
204013	<b>81</b>	316.87	330.85	6.99	332.50 338.50	319.50 325.50	7.9	6.50	315.00 320.00	328.00 333.00	
204014	<b>81 A</b>	323.50	337.48	6.99	339.00 344.50	326.00 331.50	7.9	6.50	322.00 327.00	335.00 340.00	
204015	<b>82</b>	329.57	343.55	6.99	345.00 351.50	332.00 338.50	7.9	6.50	328.00 333.00	341.00 346.00	
204500	<b>82 A</b>	336.50	350.48	6.99	352.00 357.00	339.00 344.00	7.9	6.50	334.00 340.00	347.00 353.00	
204501	<b>83</b>	342.27	356.25	6.99	357.50 363.00	344.50 350.00	7.9	6.50	341.00 346.00	354.00 359.00	
204502	<b>83 A</b>	348.50	362.48	6.99	363.50 370.00	350.50 357.00	7.9	6.50	347.00 352.00	360.00 365.00	
204503	<b>84</b>	354.97	368.95	6.99	370.50 377.50	357.50 364.50	7.9	6.50	353.00 359.00	366.00 372.00	
204504	<b>84 A</b>	362.50	376.48	6.99	378.00 383.00	365.00 370.00	7.9	6.50	360.00 366.00	373.00 379.00	
204505	<b>85</b>	367.67	381.65	6.99	383.50 389.50	370.50 376.50	7.9	6.50	367.00 372.00	380.00 385.00	
204506	<b>85 A</b>	374.00	387.98	6.99	390.00 396.00	377.00 383.00	7.9	6.50	373.00 378.00	386.00 391.00	
204507	<b>86</b>	380.37	394.35	6.99	396.50 403.00	383.50 390.00	7.9	6.50	379.00 384.00	392.00 397.00	
204508	<b>86 A</b>	387.50	401.48	6.99	403.50 408.50	390.50 395.50	7.9	6.50	385.00 392.00	398.00 405.00	
204509	<b>87</b>	393.07	407.05	6.99	409.00 415.00	396.00 402.00	7.9	6.50	393.00 397.00	406.00 410.00	
204510	<b>87 A</b>	401.00	414.98	6.99	416.00 423.00	403.00 410.00	7.9	6.50	398.00 405.00	411.00 418.00	

The choice of A and B (piston fitting) or E and H (cylinder fitting) in indicated limits must give the groove height G as shown.

$$G = \frac{A - B}{2} \text{ or } G = \frac{H - E}{2}$$





We make it *possible*

**In-house Manufacturing, Authentic Sealing**

**Bonded seals**



**HUTCHINSON®**

**Precision Sealing**

# 1 - DEFINITIONS - GENERAL INFORMATION

The bonded seal is a rectangular section, metal washer, with a trapezoidal shaped ring of vulcanised rubber bonded to the inside (see figure below).

The choice of metal and rubber can vary to suit a particular application. The choice will depend upon the application type of fluid, temperature and pressure.

Bonded seals are particularly suitable for sealing under the heads of bolts and screws, for pipe couplings (both high and low pressure). It has the advantage of being removable and reusable, as opposed to other seals (ex: copper washers).

## 1.1 - SELF-CENTRALISING BONDED SEAL

### • Self-centralising bonded seal

The centralising feature is a thin membrane, the inner diameter of which equals the core diameter of the locating thread. The membrane offers little assembly resistance and ensures that the seal is concentrically located.

The main advantages are as follows:

First, the action of the lip:

- eliminates seal offset;
- enables ease of installation;
- reduces assembly time;
- prevents the seal from slipping out during disassembly

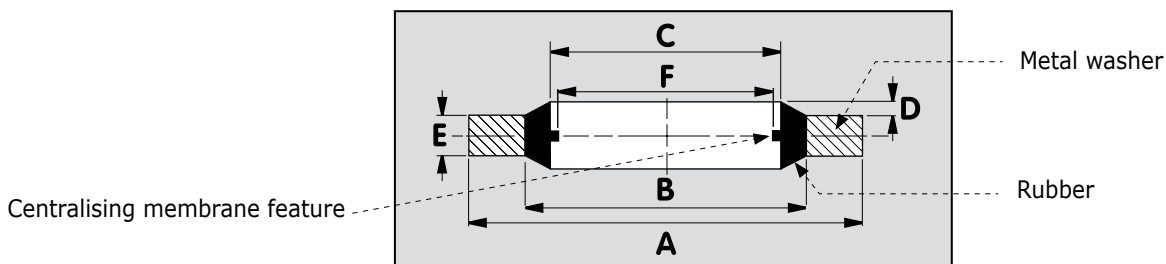
Moreover, the simplified assembly requirements, avoids needing to create a counter-bore and thus machining costs.

### • Washer

The metal washer is in mild carbon steel (cold-rolled pressed strip) with a tensile strength of 540 MPA, protected by an anticorrosive surface finish.

### • Rubber

The standard quality available on stock is in nitrile NBR 85.

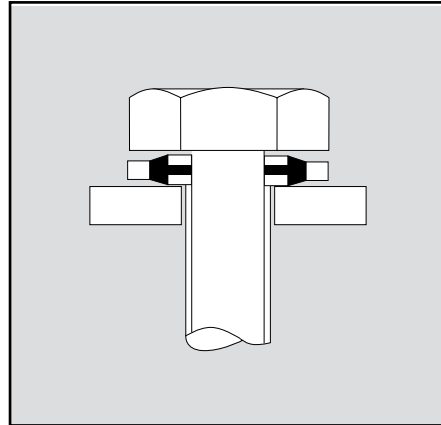


## 2 - ASSEMBLY

### 2.1 - TORQUE LOADING

Satisfactory performance of the seal depends on correct torque loading during the assembly. The following table indicates the required torque loading in order to guarantee the proper functioning of the seal.

For double sealing, additional torque is generally required (double seal factor).



Thread Size			Torque required (Nm)	
metric	BOLT	BSP	Torque single seal	double seal
up to 8	5/16	-	5.3	8.5
10	3/8	1/8	7.1	11.4
11	7/16	-	11.8	15.3
12	1/2	1/4	15.8	20.5
14	9/16	-	22.6	29.4
16	5/8	3/8	30.5	39.7
18	3/4	-	40.7	52.9
20	13/16	1/2	56.5	67.8
22	7/8	5/8	67.8	74.6
24	1.0	3/4	73.4	73.4
from 27	1.1/16	-	79.0	79.0

## 3 - RECOMMENDATION FOR THE SELECTION OF A BONDED SEAL

### 3.1 - METAL WASHER

The metal washer of our standard BS seal is a mild steel pressing with a tensile strength of 540 MPA. We can offer you many alternative washer materials, the most common of these are set out in the following table along with their specifications.

Please contact us for any other materials or specifications.

METAL (FR)	TENSILE STRENGTH MPa minimum	SPECIFICATION
Mild Steel Pressings CS4 BRH5	540	BS EN 10139
Mild Steel Turned EN8	540	BS EN 10083-2
Stainless Steel Pressings T316	540	BS EN 10088-2
Stainless Steel Turned T316	540	BS EN 10088-3
Stainless Steel Turned S1000 Grade T316	1000	BS EN 10088-3
Brass Turned CZ121	380	BS EN 12164
Brass Pressings CZ108	380	BS EN 1652
Aluminium Bronze Turned	700	CA104 & NES 833
Aluminium Pressings Grade 5251-H22	220	BS EN 485-2
Aluminium Alloy Turned	370	L102 & L168
Aluminium Alloy Turned (6082-T6)	295	BS EN 573-3
High Tensile Steel	880	S154

### 3.2 - SURFACE TREATMENTS

The metal washer of our bonded seals may be protected by different anticorrosive surface coatings:

SURFACE TREATMENT	PAMARGAN CODE	SPECIFICATION
Zinc plate - Gold passivate	P0	Def. Stan. 03-20/03-33
Zinc Plate - Trivalent Passivate	P20	8+/-3 microns
Cadmium Plating	P5	Def. Stan. 03-19
Grey Chromic Anodise	P3	Def. Stan. 03-24
Red Chromic Anodise	P4	Def. Stan. 03-24
Zinc Nickel Trivalent Passivate	P13	GMW 4700
Zinc Nickel Trivalent Passivate	P18	12-15% Nickel - 5 Microns Min.
Zinc Nickel Black (Triv.) Passivate	P18	12-15% Nickel - 5 Microns Min.

### 3.3 - RUBBER COMPOUND

● **Remarks**

Please note that operational conditions (temperature, pressure, friction, etc.), as well as combinations of several substances modify, sometimes to a great extent, the aggressiveness of the fluids in contact with the seals.

It is therefore recommended that tests be conducted before the seal is finally selected.

● **Standard rubbers**

4 rubbers are available for a wide range of applications:

- a nitrile (NBR) : NBR85
- a fluorocarbon (FKM) : FKM85
- an hydrogenated nitrile (HNBR): HNBR80
- an ethylene propylene (EPDM) : EPDM80

Note: All of these rubber compounds are black.

Specification of standard rubbers						
Reference	Hardness Shore A	Compression Set		Temperature Range °C		
		Condition	Spec. %	Min	Max continuous	Max peak
NBR85	85 ± 5	22 h 100°C	< 25	-30	100	120
FKM85	85 ± 5	22 h 200 °C	< 20	-25	200	250
HNBR80	80 ± 5	22 h 150°C	< 30	-50	135	175
EPDM80	80 ± 5	22 H 150°C	< 25	-30	125	165

Note: Please contact us for any other qualities

● **Specific rubbers**

4 specific rubbers, homologated by automotive manufacturers are also available:

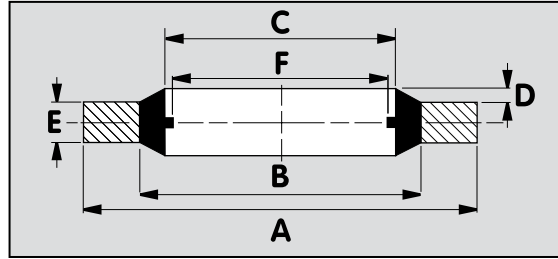
- a nitrile (NBR) : 8PC1714
- a fluorocarbon (FKM) : DF851
- an hydrogenated nitrile (HNBR) : 8DT1706
- an ethylene propylene (EPDM) : 8EP1873

For other compounds or specifications, please contact us.

Characteristics of Specific Rubbers		
Reference	Hardness DIDC / IRDH	ASTMD 2000
8PC1714	85	2BG EA14 B14 EO14 EO34Z Z = Hardness / Shore A ASTM D 2240 80/90
DF851	83	6HK810 A1-10 B38 EF31 F15 hardness / 85
8DT1706	80	3DH820 A26 B16 EO16 EO36 Z Z = not breaking after 3mn at -40°C with ASTMD 2137 method A
8EP1873	80	3DA810 B36 EA14



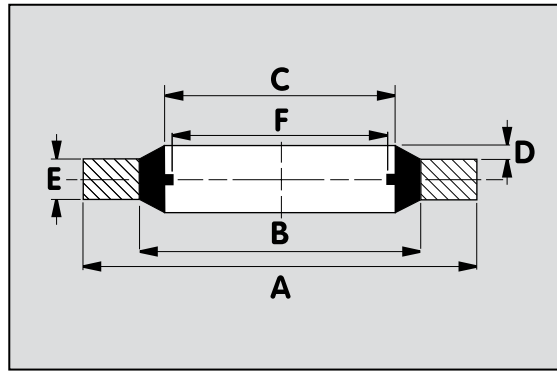
## 4 - LIST OF DIMENSIONS



Catalogue bonded seals are referenced under NBR 85.

LJF reference	N° Seal	A +0.13 -0.00	B +0.10 -0.10	C +0.10 -0.10	D +0.25 -0.00	E +0.10 -0.10	F +0.20 -0.20	Min burst pressure (bar)	Norm	
205112*	AS 2.55	6.35	4.09	3.05	0.20/0.45	1.22	-	2,150	BOLT 6 BA	
205113*	A 3	7.50	5.00	3.60	0.30	1.00	-	1,950	M 3	
205114*	AS 3.5	7.26	5.26	4.12	0.20/0.45	1.22	-	1,570	BOLT 4BA	
205236*	A 3.9	7.00	5.40	4.50	0.30	1.00	3.40	1,250	M 4	
205115*	AS 4.6	8.38	6.35	5.21	0.20/0.45	1.22	-	1,375	BOLT 2BA	
205241	A 5	10.00	7.00	5.60	0.30	1.00	4.50	1,780	M 5	
207390	A 5.10	9.00	6.80	5.70			4.50	1,400	M 5	
205240	AS 5.10	10.00	7.40	5.70			4.50	1,500	M 5	
205237	A 6	11.00	8.00	6.60			4.70	1,680	M 6	
207392	AX 6	11.00	8.20	6.70			4.70	1,510	M 6	
207391	AS 6	10.00	8.00	6.70			4.70	1,130	M 6	
207377	A 6.2	13.21	8.00	6.86			0.20/0.45	1.22	4.70	1,950
205242	AS 7.7	13.34	9.53	8.31	0.30	1.00	6.10	1,700	BOLT 5/16	
207403	AX 8	13.00	10.00	8.60	0.20/0.45	1.22	6.40	1,330	M 8	
207378	A 8.2	14.22	10.04	8,64	0.30	1.00	6.10	1,750	BOLT 5/16	
207393	AS 8	13.00	10.00	8.70	0.30	1.00	6.40	1,330	M 8	
205238	A 8	14.00	10.40	8.70			6.40	1,550	M 8	
207394	A 8.7	13.30	10.50	9.30			6.90	1,200	M 8.5	
206261	B 9.52	15.88	12.00	10.35	0.40	1.50	2.00	8.56	1,450	M 10
206282	B 10	16.00	12.40	10.70			8.05	1,350	M 10	
207410	BX 10	17.00	12.10	10.70			8.56	1,730	M 10	
207395	BS 10	18.00	12.40	10.70			8.05	1,880	M 10	
207379	B 10.16	18.36	12.45	11.26	0.25/0.51	2.03	8.56	1,950	BOLT 2/5	
207396	B 10.3	16.30	12.70	11.40	0.40	1.50	9.80	1,250	M 11	
207404	B 11	18.10	13.20	11.80			9.80	1,600	M 11	
207397	BS 11	18.00	12.40	11.80			8.05	1,770	M 11	
206283	B 12	19.00	14.10	12.70	0.30	2.00	9.73	1,530	M 12	
207398	BS 12	18.00	14.30	12.70	0.40	2.00	9.73	1,250	M 12	
206262	B 12.7	20.57	15.21	13.74	0.25/0.51	2.03	11.45	1,550	BSP 1/4 - BOLT 1/2	
207399	B 13.3	18.70	15.70	14.00	0.40	2.00	11.30	900	M 13.5	
206284	B 14	22.00	16.40	14.70			11.38	1,510	M 14	
207405	BS 14	21.00	16.10	14.70	0.30	1.50	11.38	1,370	M 14	
206295	BS 14.16	22.23	16.39	14.86	0.25/0.51	2.03	11.58	1,575	BOLT 9/16	
206285	BS 15.86	25.40	18.75	16.51			12.90	1,550	BOLT 5/8	
206286	B 16	24.00	18.40	16.70	0.40	1.50	13.41	1,400	M 16	

\* For technical reasons, these bonded seals are only available as non self-centralsing bonded seals.



Catalogue bonded seals are referenced under NBR 85.

LJF reference	N° seal	A +0.13 -0.00	B +0.10 -0.10	C +0.10 -0.10	D +0.25 -0.00	E +0.10 -0.10	F +0.20 -0.20	Min burst pressure (bar)	Norm	
207406	BS 16	23.00	18.10	16.70	0.30	1.50	13.41	1,240	M 16	
206263	B 17.06	23.80	18.75	17.28	0.25/0.51	2.03	14.96	1,260	BSP 3/8	
207400	B 16.6	24.00	19.20	17.40	0.40	1.50	13.08	1,150	M 17	
207231	CS 17.50	25.40	19.69	18.16	0.25/0.51	2.50	14.50	1,320	BOLT 11/16	
207232	CS 18	26.00	20.40	18.70	0.40	1.50	14.76	1,275	M 18	
207242	CS 19	26.92	21.21	19.69	0.25/0.51	2.50	15.80	1,260	BOLT 3/4	
207233	CS 20	28.00	22.50	20.70	0.40	1.50	16.76	1,150	M 20	
207210	C 20.63	28.58	23.01	21.54	0.25/0.51	2.50	18.64	1,150	BSP 1/2 - BOLT 13/16	
207204	CS 22	30.00	24.40	22.70	0.40	2.00	18.74	1,100	M 22	
207407	C 22	31.00	24.40	22.70			18.74	1,240	M 22	
207211	C 22.75	31.75	24.97	23.49	0.25/0.51	2.50	20.60	1,250	BSP 5/8 - BOLT 7/8	
207380	C 23.56	33.27	26.04	24.26			20.20	1,275	BOLT 15/16	
207235	CS 24	32.00	26.40	24.70	0.40	2.00	20.11	1,050	M 24	
207408	C 24	33.00	26.40	24.70			20.11	1,160	M 24	
207401	C 26	35.00	28.40	26.70			22.30	1,050	M 26	
207212	C 26.32	34.93	28.53	27.05			24.13	1,060	BSP 3/4 - BOLT 1	
207381	C 27.12	38.61	30.61	27.82	0.25/0.51	2.50	22.90	1,250	BOLT 1.1/16	
208174	C 30.10	38.10	32.29	30.81			27.89	900	BSP 7/8 - BOLT 1.3/16	
207382	C 31.94	41.40	35.69	32.64			3.38	27.10	800	BOLT 1.1/4
207383	C 33.16	42.80	36.88	33.89	0.40	2.00	2.50	30.30	810	BSP 1 - BOLT 1.5/16
207384	D 34.94	44.45	38.99	35.94			3.38	29.50	700	BOLT 1.3/8
207402	C 36	46.00	38.80	36.70			2.00	31.10	880	M 36
207409	D 36	48.00	39.60	37.00			2.50 ±	31.10	1,010	M 36
207385	C 37.96	47.75	42.04	38.96	0.25/0.51	2.50	3.38	32.70	700	BOLT 1.1/2
208176	D 41.30	52.38	45.93	42.93			2.50	38.96	690	BSP 1.1/4 - BOLT 1.5/8
208189	D 42	54.00	45.60	43.00	0.40	2.50 ±	36.50	890	M 42	
207386	D 44.34	57.15	48.39	45.34	0.25/0.51	2.50	3.38	37.90	875	BOLT 1.3/4
208177	D 47.40	58.60	51.39	48.44			2.50	44.86	690	BSP 1.1/2 - BOLT 1.7/8
207387	D 53.86	69.85	58.30	54.89			3.38	50.80	950	BSP 1.3/4 - BOLT 2.1/8
207336	D 59.45	73.03	63.63	60.58			2.50	56.67	700	BSP 2.0
207388	D 75.08	90.17	79.38	76.08			3.38	72.20	680	BSP 2.1/2
208190	D 88	101.47	92.84	89.09			3.38	85.00	550	BSP 3.0

# 5 - SPECIAL BONDED SEALS

## 5.1 - CONDITIONS OF ASSEMBLY OF NON SELF-CENTRALISING SEALS

Non self-centralising bonded seals do not have the thin membrane on the inner diameter to self-centre. Observe the following recommendations in order to fit them properly:

• **Radial clearance**

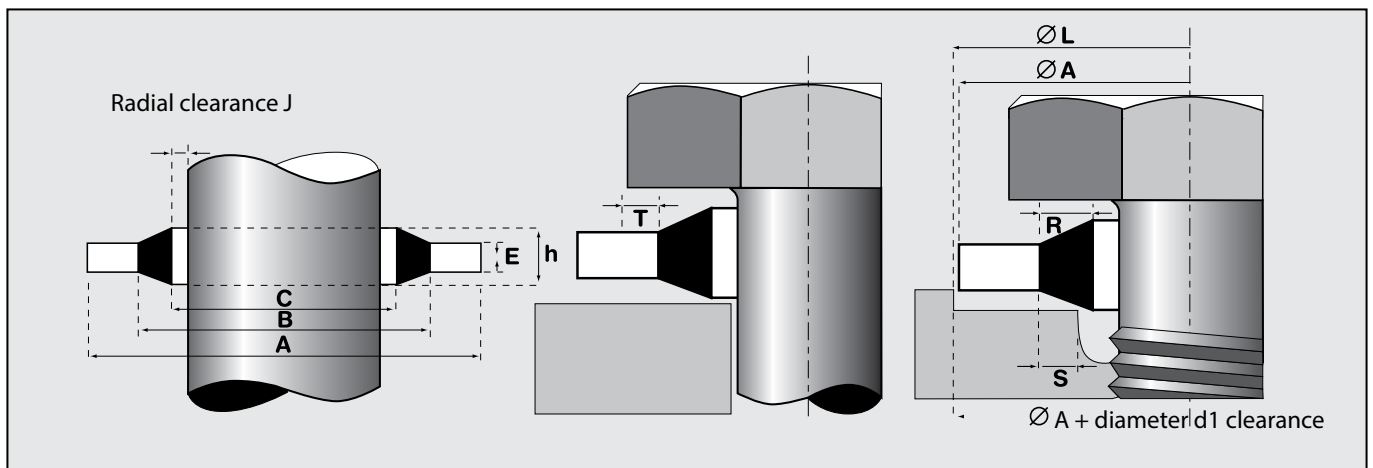
Metric	Max. radial clearance (J) in mm
M 3 to M 8.5	0.30
M 9 to M 33	0.35
M 34 to M 60	0.50

If the instructions above cannot be applied, it is recommended to provide a seating for the external diameter of the bonded seal.

• **Counter-bore**

Metric	Ø L in mm
M 3 to M 8.5	Ø A + 0.20
M 9 to M 33	Ø A + 0.40
M 34 to M 60	Ø A + 0.60

The support T for the metal ring must be a minimum of 0.7mm wide and at least 75% of the rubber ring must be covered ( $S \geq 0.75 R$ ).





We make it *possible*



**In-house Manufacturing, Authentic Sealing**

# Our Commitment for Excellence



**HUTCHINSON®**

**Precision Sealing**

# 1- DESIGNER & MANUFACTURER OF YOUR FUTURE SEALING SOLUTIONS

Hutchinson Precision Sealing is a division of the Hutchinson Group whose registered office is located at Château-Gontier, in France (Mayenne). We design and manufacture in our plants sealing solutions such as o-rings, four-lips seals, dual compound seals, with tailor-made cross-sections for both industrial and automotive markets throughout the world.

## Trust a worldwide leader in Sealing Solutions :

- The expertise and know-how of a leader
- The highest quality standards: visual and automatic controles, ISO certifications, process management and optimised quality organization
- Cutting-edge industrial equipment, automatic injection presses, cleanrooms and clean industrial equipment
- Local commercial presence in a global organisation
- Excellent Laboratory and compound making facilities
- First class Machine shop for the production of tooling
- Full design and seal development capabilities

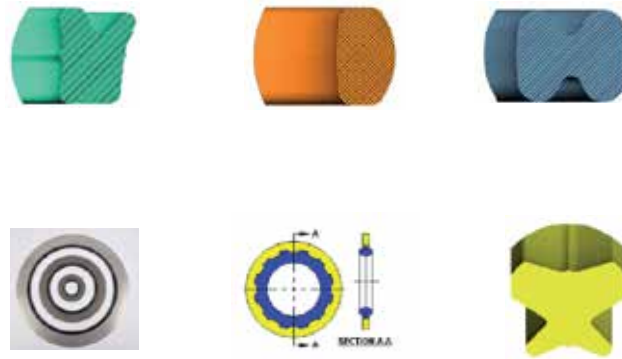
## Worldwide Leader in Sealing Solutions.

### OUR MANUFACTURER'S COMMITMENT TO THE SERVICE OF OUR CUSTOMERS

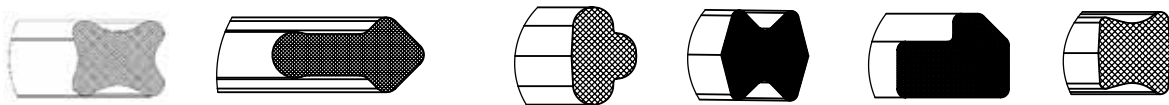
 <p>at your service</p>	 <p>Quick delivery services</p>	 <p>Certifications</p>	<p><b>100%</b></p> <p>Traceability</p>	 <p>Near you throughout the world</p>
 <p>Technical support</p>	 <p>Service rate</p>	 <p>Compound innovations 150 compounds available</p>	<p>Objective</p> <p><b>0</b></p> <p>defect</p>	 <p>Committed team</p>
 <p>Tailor-made solutions</p>	<p><b>100%</b></p> <p>in-house manufacturing</p>	<p><b>5000</b></p> <p>references available on stock</p>	<p><b>100%</b></p> <p>Inspection (auto and visual)</p>	 <p>Eco-responsible</p>

## 2- TAILOR-MADE SOLUTIONS

A range of profiles are available in addition to the standard parts shown in this catalogue.  
We create custom-shaped seals, with profiles specially designed to meet your requirements.  
Please contact our teams to decide which solution suits your application.



### Pushing the boundaries of intelligent sealing even further



## To each challenge, an innovative solution

### Box of "R" O-Ring Seals

(Reference 199.000)

The box comprises 315 "R" O-Ring Seals, in PC851 and in 32 dimensions, distributed as follows:

"R" n° 1 to "R" n° 7: 15 seals of each number (including 5a and 6a).

"R" n° 8 to "R" n° 20:  
10 seals of each  
number.

"R" n° 21 to "R" n° 30:  
5 seals of each  
number.



### And for emergencies:

Our Express Seal Service enables us to handle urgent demands, as we are able to deliver our parts within 48 hours for rubber compounds selected in the user guide (page 10 to 13) and one week for custom specifications (mould to be created).

Phone 0033 243 092 320 and ask for our commercial team.

## 3 - SUBSIDIARIES IN THE WORLD

### **BRAZIL**

#### **HUTCHINSON BRAZIL AUTOMOTIVE**

Rua Dr Carlos Kielander n°2  
POB 135  
15910-000 MONTE ALTO (SP) - BRAZIL  
Tel. (+55) 16 3241-1512 - Fax (+55) 16 342 30 06  
Email: precision@hutchinson.com.br

### **GERMANY**

#### **HUTCHINSON GmbH**

Hansastraße 66//68169 MANNHEIM - GERMANY  
Tel. (+49) 621 3971 0 - Fax (+49) 6 213 971 203  
Email: oring@hutchinson.de  
Website: www.hutchinson.de

### **GREAT-BRITAIN**

#### **HUTCHINSON PAMARGAN**

47 Mochdre Enterprise Park  
UK-SY16 4LE - NEWTOWN, POWYS - UNITED KINGDOM  
Tel. (+44) 1686 625 181 - Fax (+44) 1686 627 849  
Email: sales@pamargan.com  
Website: www.pamargan.co.uk

### **ITALY**

#### **Automotive market**

#### **HUTCHINSON SRL**

Via Natale Bruno 32  
10090 RIVOLI (TURIN) - ITALY  
Tel. (+39) 011 950 7411

### **SPAIN**

#### **HUTCHINSON**

Avda de Catalunya, 132  
08150 PARETS DEL VALLES - SPAIN  
Tel. (+34) 93 573 8294 - Fax (+34) 93 573 8293  
Email: eva.quintana@hutchinson-spain.com  
antonia.pujante@hutchinson-spain.com

### **SWITZERLAND**

#### **HUTCHINSON**

Spinnereistrasse 12  
CH - 8135 LANGNAU  
SWITZERLAND  
Tel. (+41) 44 71 306 72 - Fax (+41) 44 713 04 74  
Email: info@hutchinson.ch

### **UNITED-STATES**

#### **HUTCHINSON SEAL**

1060 Centre Road  
Mi 48326 AUBURN HILLS - UNITED STATES  
Tel. (+1) 248 375 4190 - Fax (+1) 248 375 3767  
Toll free: 866 222 4123

# 4 - A BROAD NETWORK OF DISTRIBUTORS

## 4.1 - DISTRIBUTORS IN FRANCE

In France, we rely on a network of over 100 distributors throughout the country to provide advice and supply our sealing solutions. The expert network of Hutchinson Le Joint Francais is immediately at your service, simply contact us to find your nearest distributor.

## 4.2 - DISTRIBUTORS IN EUROPE

If you are searching for a distributor in Europe, our network of exclusive distributors, who have large stocks and are specialists in sealing solutions are available to you. Please contact us for any request you may have.

### **BELGIUM**

#### **SOTEBA**

5 Rue Buisson aux loups  
1400 NIVELLES - BELGIUM  
Tel. (+32) 67 49 31 44  
Email : info@soteba.be  
Website : www.soteba.be

### **DENMARK**

#### **LOWENER**

Postboks 1330  
2600 GLOSTRUP - DENMARK  
Tel. (+45) 43 200 300 - Fax (+45) 43 43 430 359  
Email: vl@loewener.dk

### **GREAT-BRITAIN**

#### **Pimseal Sealing Solutions**

Brailsford House, Knapp Lane, St James Square  
GL50 3QA - CHELTENHAM - GREAT-BRITAIN  
Tel: (+44) 01 242 222 0000 - Fax (+44) 0 1242 224242  
Email: mail@pimseal.com

### **ITALY**

#### **Industrial markets**

#### **DALMAR S.P.A.**

Via Marconi 1/3  
20090 SEGRATE-MILANO - ITALY  
Tel. (+39) 02 264 9801 - Fax (+39) 022 139 345  
Email: info@dalmar.it  
Website: www.dalmar.it

### **NETHERLANDS**

#### **BENECOM**

Randweg 24  
2941 CG LEKKERKERK  
Tel. (+31) 180 66 13 99 - Fax (+31) 180 66 10 22  
Email : info@benecom.nl  
Website : www.benecom.nl

### **SWEDEN**

#### **KLINGER SWEDEN AB**

Kontovägen 3  
SE-175 62 - JÄRFÄLLA - SWEDEN  
Tel. (+46) 10 199 87 00 - Fax (+46) 87 39 21 30



## 5 - HOW TO REQUEST A PRODUCT?

We hope that this notice enabled you to determine which O-ring seals you need.

Our services are available to you for any additional information and can help you define the best suited O-ring for your application.

For "R" O-ring seals in the dimensions catalogue, list appended hereto, please indicate the six-digit article-code of the selected seal.

For non standard catalogue items, please indicate:

- the dimensions (inside and cross-section diameters) or the references of the standard,
- the rubber reference,
- any special requirements (material and sizing specifications, special tests, etc.).



We make it ***possible***