HUTCHINSON®

PRECISION SEALING

O-RINGS, X-RINGS, BONDED SEALS

We make it ***possible***







In-house Manufacturing, Safe Sealing

Hutchinson, O-Ring Division designs and manufactures precision sealing solutions such as O-Rings, X-Rings and Bonded Seals.

Our manufacturing process guarantees the origin and quality of our products and allows us to offer safe and reliable sealing solutions.

Full control of the process: from development to production, our technical expertise in industrial markets and our “zero defect” quality approach avoid any risk of leakage and ensure customers peace of mind.

The commitment of our teams to quality, safety, ethics and respect for the environment has contributed to making Hutchinson, O-Ring Division a leader in the supply of high-tech seals that meet the highest requirements, and this for more than 70 years.

Our sites have received following quality and environmental certifications:

CONTENTS

HUTCHINSON®

INTRODUCTION

We make it ***possible***

1 – HUTCHINSON GROUP

To meet the needs of its global customers on land, in the air and at sea, Hutchinson has been designing, developing and manufacturing high-performance solutions for over 160 years.

Our innovations cover a wide variety of demanding markets: automotive, aerospace, defence, energy, rail and industry in general.

Hutchinson is a global leader in anti-vibration systems, fluid management and sealing solutions, our group stands out for its multi-market and multi-expertise approach, a source of synergies and added value.

A wide spectrum of resources

A corporate Research & Innovation Centre brings together more than 200 engineers and technicians conducting fundamental and applied research. Innovative solutions are developed by combining our key technologies and skills:

- Chemistry and Materials Science
- Mechanical engineering
- Composite Materials
- Transformation processes
- Vibration and Acoustics
- Thermal insulation
- Mechatronics

Our teams in our technical centres around the world develop high added value solutions. They dedicate their resources in applied engineering to our customers.


PRECISION SEALING SYSTEMS


BODY SEALING SYSTEMS


FLUID MANAGEMENT SYSTEMS


MATERIALS AND STRUCTURES


VIBRATION CONTROL


BELT DRIVE SYSTEMS

"Our ambition: participate in the mobility of the future that is safer, more comfortable, and more responsible."


> 44,000
employees


25
countries


100
sites


€211 million
R&D


> €4,314 million
turnover

www.hutchinson.com

oring.hutchinson.fr/en

2 – O-RING DIVISION

Leading manufacturer of precision solutions since 1907, Le Joint Français introduced the O-Ring in Europe in 1948 and has always kept control of all processes, from design to production, in its plants.

Le Joint Français joined Hutchinson in 1987, becoming the O-Rings & Bonded Seals Division (OR&BS) of the Precision Sealing Systems (PSS) activity.

Complete control of the production chain

We design, develop and manufacture sealing solutions such as O-Rings, X-Rings, special shaped seals, bonded seals, flange seals and tailormade seals.

Development of materials, design of optimal solutions, production of tools and parts, we are committed to the entire process to meet the most demanding requirements and guarantee the peace of mind and safety of our customers and users.

Global presence

The O-Ring Division has a global footprint with manufacturing plants in Europe (France, Portugal, Great Britain and Malta), Asia (China) and America (Mexico and Brazil). Our plants are ISO 9001 and IATF 16949 certified. Thanks to the one plant concept, our processes are the same in all the countries we work in, to ensure the same level of quality while keeping production close to our customers.

Alongside constructors and manufacturers around the world, our teams pursue the same objective: zero defects for safe sealing.

Designer and manufacturer of your future sealing solutions

3 – MARKETS

Aerospace

Food

Automotive

Heating

Chemicals

Cosmetics

Drinking water

Energy

Railway

Hydraulics

Off-Road

Oil & Gas

Pharmaceutical / Medical

Industrial pneumatics

Trucks

Power transmission

4 – OUR COMMITMENT TO EXCELLENCE

In-house manufacturing

Compound development

Tooling conception

Parts manufacturing

Reliability

Trusted partner

70 years of experience

World leader in sealing solutions

Wide product range

Wide range of dimensions

All elastomer families

From unit to mass production

Presence

Exclusive contact person

Global presence, local production

Distributors' network

Expertise

Rubber formulation experts

Technical engineering support

Conception of tailormade solutions

Reactivity

5,000 references in stock

3 days express

10 days express

Quality

0 ppm approach

100% inspection

Approvals & certifications

Services

Assembly aid app

E-commerce website

Unit micro-engraving

5 – TOOLS, RESOURCES & DEVELOPMENTS

5.1 – Division website

Our website allows you to download the catalogue, brochures, data sheets, watch our videos, access mobile applications and use the *O-Ring* fitting tool.

In addition, you will find the latest news, upcoming trade fairs, as well as information on our products and markets.

www.oring.hutchinson.fr/en/

5.2 – E-commerce for distributors

An e-commerce website is available for our distributors and access can be given on request by your sales contact.

It offers following features:

- Reference search
- Stock queries
- Price queries
- Determination of delivery time
- Placing orders
- Quick code entry
- Delivery management
- Order template management

www.ecommerce.oring.hutchinson.fr

5.3 – Documentation

Our documentation is available for download on our website.

ORD catalogue and general brochure

Market brochures

- Food industry
- Cosmetics
- Pharmaceutical
- Heating
- Oil & Gas
- Off-road
- Chemicals
- Medical

Product brochures

- Bonded seals
- PFS Flange seals
- Slimline sealing washers
- Surface treatments
- Stainless-steel bonded seals

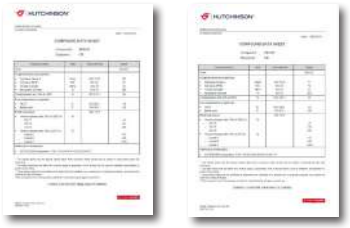
Specific compound flyers

- Drinking water, natural gas, oil & gas, etc.

Services flyers

- Assembly Aid Smartphone App
- Micro-engraving
- E-commerce
- 10 days express

Compound sheets



5.4 – O-Ring assembly aid tool

The O-Ring fitting assistance application allows you to define the groove geometry and select the correct O-Ring. Get it on your smartphone or on our website.

Groove geometry
Determine the machining dimensions according to the type of assembly (shaft, bore, cover, internal or external pressure)

Catalogue Dimensions
Consult the list of standard codes

Measure a seal
Determine the dimensions of an O-Ring using the camera on your smartphone and a coin

Fluid compatibility
Select the elastomer family suited to your fluid

Available on the App Store

GET IT ON Google Play

5.5 – Computer Aided Design (CAD)

The PARTcommunity CAD service is included on our website under the Services tab. It offers the possibility of configuring standard sealing solutions and exporting models in 2D and 3D formats (AutoCAD, Catia, Inventor, SolidWorks, Solid Edge, Creo, NX, etc.).

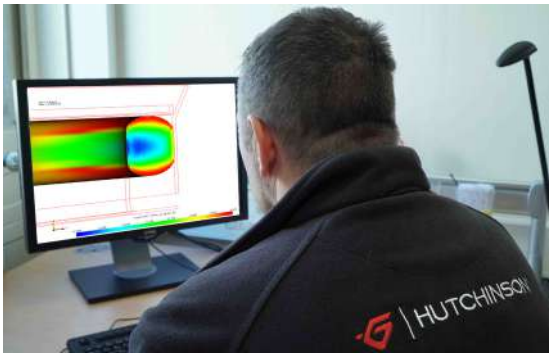
A PARTcommunity account is required to download the CAD model and can be opened directly from our website.

https://www.oring.hutchinson.fr/en/services/cao_services/

5.6 – Technical support

Our application engineers support our customers in the design and development of reliable and optimised sealing solutions:

- Help in the choice of compound
- Dimensional definition of groove and O-Ring
- Definition of seals and shaped parts
- Assembly analysis
- Surface roughness recommendations
- Proposal for surface treatments and cleanliness level
- Packaging adapted for assembly lines
- Development of customised solutions
- Finite Element Method calculations (FEM)
- Study of laboratory analyses
- Analysis after functional trials



Functional validation remains the responsibility of the customer.

Documentation available on request

- Parts drawings
- Material Specification Sheets
- Certificates of Compliance
- Certificates of Approval

Our teams of experts are able to respond to specific requests with recommendations tailored to your environment, application and fluids in contact.

6 – QUALITY

6.1 – Quality controls

Our production process is designed to meet the highest quality requirements with rigorous process parameters.

To move ever closer to 0 ppm, all seals are subject to both visual and automatic inspection.

6.2 – Material characteristics

Each step of the manufacturing process contributes to the quality and final performance of the seal. The final inspection in production ensures that parts comply with customer requirements and allows traceability information to be recorded.

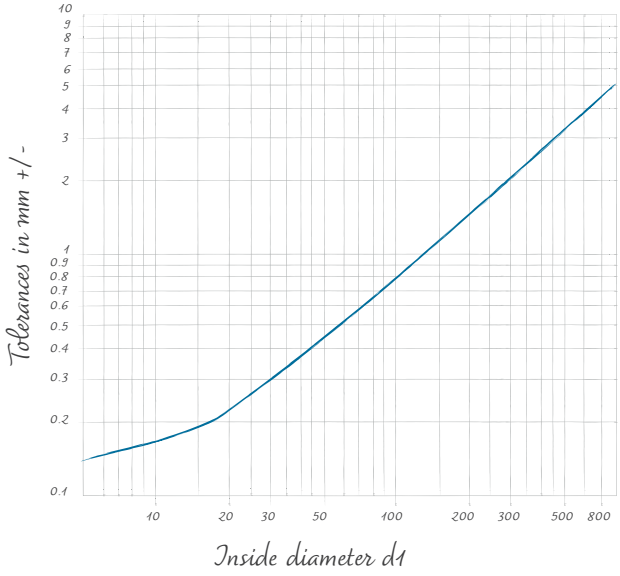
The material characteristics like hardness, density and compression set are measured according to the standards in force.

6.3 – Dimensional tolerances

The dimensional tolerance intervals are in accordance with ISO 3601-1:2012 class B for standard seals.

We can respond to requests for more stringent dimensions and tolerances.

Cross section Ø (mm)		Tolerances (mm)
from	to	
0.80	2.25	± 0.08
2.26	3.15	± 0.09
3.16	4.50	± 0.10
4.51	6.30	± 0.13
≥ 6.30		± 0.15

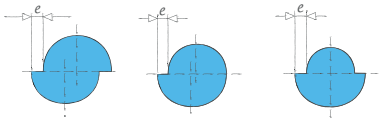
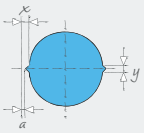
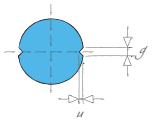
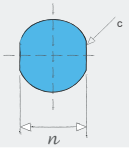
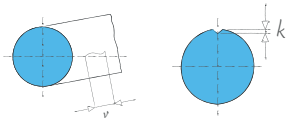
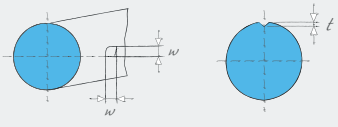


6.4 – Surface imperfections

The table below shows the maximum permissible limits for surface imperfections in standard O-Rings as defined in ISO 3601- 3:2005, N Grade.

These standards define maximum defect limits which do not impact usual industrial applications. Our standard O-Rings meet this standard.

We are also able to meet higher levels of requirements in case of specific needs (technical specifications, special applications, etc.) with S Grade.

Type of surface imperfection	Diagrammatic representation	Limiting dimensions	Maximum defect limits Class N O-Rings cross section diameter d2				
			> 0.8[b] ≤ 2.25	> 2.25 ≤ 3.15	> 3.15 ≤ 4.50	> 4.50 ≤ 6.30	> 6.30 ≤ 8.40[b]
Offset off-register, mismatch		e	0.08	0.10	0.13	0.15	0.15
Combined flash, offset and parting line projection		x	0.10	0.12	0.14	0.16	0.18
		y	0.10	0.12	0.14	0.16	0.18
		a	If the flash can be distinguished it must not exceed 0.07 mm.				
Backrind		g	0.18	0.27	0.36	0.53	0.70
		u	0.08	0.08	0.10	0.10	0.13
Excessive trimming Radial machining marks are not permissible		n	Departure from a circular cross section due to trimming is allowed provided that the resulting surfaces are smoothly blended and are within the size tolerance limits for d².				
Flow marks (radial orientation of flow marks is not permissible)		v	1.5[a]	1.5[a]	6.5[a]	6.5[a]	6.5[a]
		k	0.08	0.08	0.08	0.08	0.08
Non-fills and indentations Including parting line indentations		w	0.6	0.8	1.0	1.3	1.7
		t	0.08	0.08	0.10	0.10	0.10

[a] Or 0.05 times the O-Ring's inside diameter (d1), by using the highest.
[b] Limits of imperfections for cross sections < 0.8 mm or > 8.40 mm shall be agreed upon between manufacturer and customer.
[c] Rounded angles

7 – PACKAGING

As standard, our seals are packaged in bags or translucent microperforated polyethylene sheets.

Depending on customers requirements, we offer different types of bags: UV protective, microperforated, non-microperforated, zipped, translucent, opaque or in different colours.

We also offer packaging that meets severe cleanliness requirements according to ISO 16232-2018, such as double-bagging under laminar flow.

The quantity per bag is optimised as standard, but can be adapted to the customer's needs (unit bagging, for example). Our bags of parts are delivered in Galia boxes (A or C). We will consider requests for specific packaging (plastic tray or other).

Hutchinson has also developed specific packaging to ensure the flatness needed for seals in automatic assembly: inflated bag, tube, plastic shell, etc.

For distributors ordering standard catalogue parts, the quantity of O-Rings per bag is determined by the inner diameter.

8 – STORAGE

8.1 – Storage conditions

We recommend to store the seals in their original packaging until they are used.

Light

Avoid direct exposure to sunlight or intense artificial light.

Temperature

Maintain storage areas at a temperature between 5 and 35°C.

Avoid storing parts next to a heat source (radiator, lamp, etc.).

Atmosphere

Ensure relative humidity between 45 and 70%. The air should not contain aggressive vapours (solvents, acids, etc.). Because ionising radiation and ozone are particularly harmful, the vicinity of any device that is likely to produce ozone is to be avoided (mercury vapour lamps, high-voltage electrical equipment, spark-generating devices, etc.). Any mechanical constraint favours the action of ozone.

Deformation

Avoid stacking and folding bags.

8.2 – Storage time

The international standard ISO 2230-2002 recommends storage periods for elastomer-based products.

The families of materials are classified according to their sensitivity to ageing.

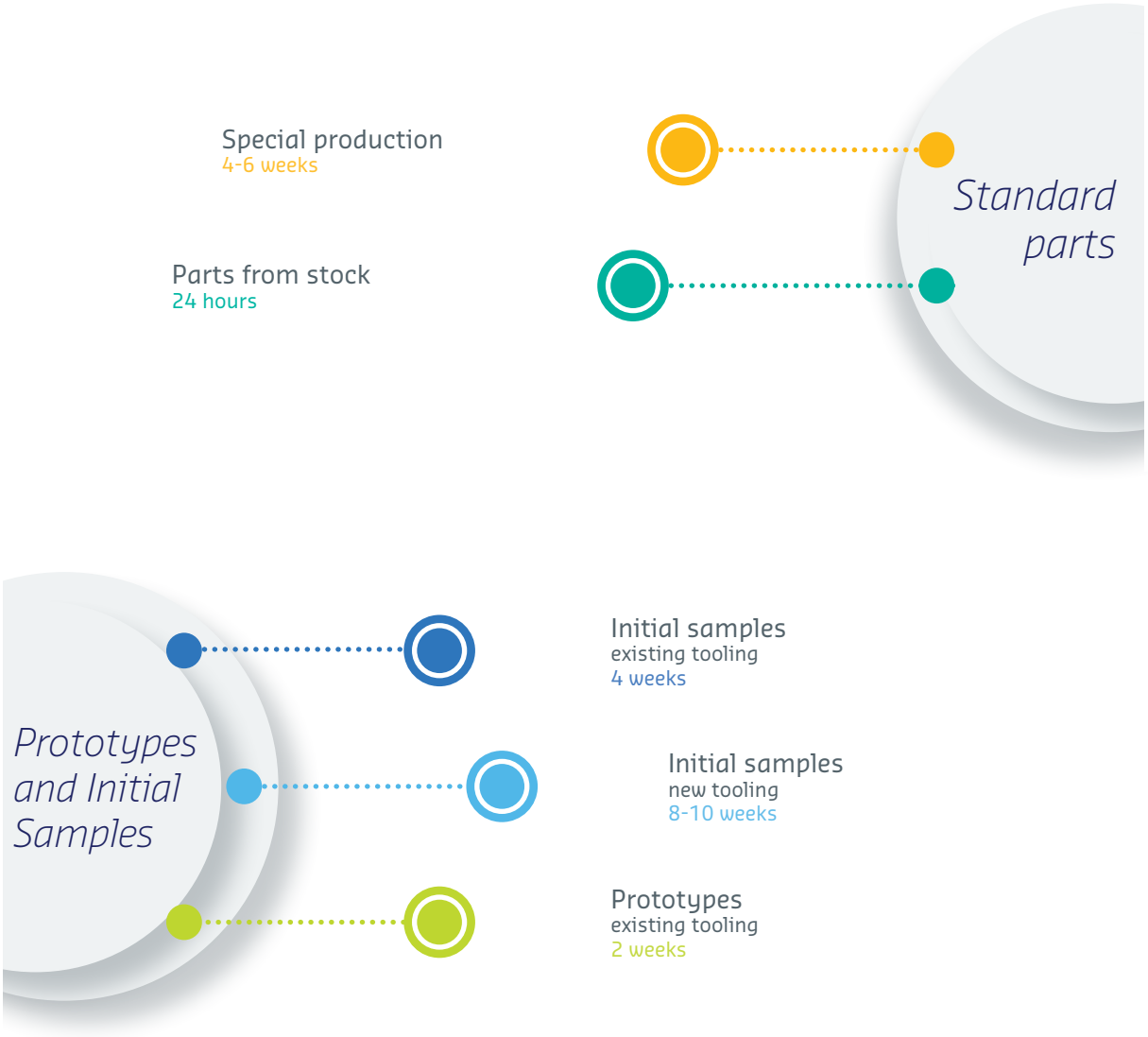
Longevity group	B	C
Storage characteristics	low sensitivity	very low sensitivity
Families of elastomer	NBR, HNBR, NBR/PVC, CR, ACM, AEM, IIR	EPDM, FKM, FVMQ, Q, FFKM
Initial storage period	7 years	10 years
Extended storage period	3 years	5 years

The extension corresponds to the period for which a rubber product, appropriately packaged, may be stored after the initial storage period, before further inspection and re-testing is necessary.

9 – DELIVERY

To meet all needs, we offer a variety of fast production and delivery services.

We ship daily and regular grouped shipments are possible (weekly / monthly).

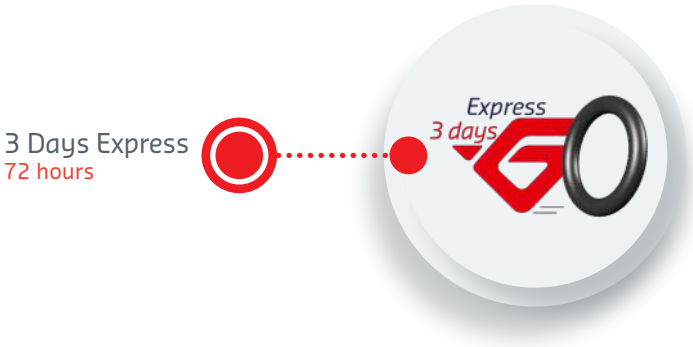


The 10 Days Express service allows delivery in under 10 days, including production and delivery, while maintaining our standard level of service: control, certificate of conformity, etc.

This concerns:

- All our compounds
- All dimensions
- All processes
- Order quantity up to 7,000 parts per reference, depending on the compound and dimensions
- Other possible specifications (cleanliness, packaging, etc.)

Our 3 Days Express service allows you to cope with urgent requirements, as we ship your parts within 72 hours for usually ordered parts, and one week for specific dimensions with mould creation.



With our 10 DAYS EXPRESS and 3 DAYS EXPRESS services, your O-Rings will be manufactured and delivered in just a few days!

HUTCHINSON®

COMPLEMENTARY PRODUCTS & SERVICES

We make it ***possible***

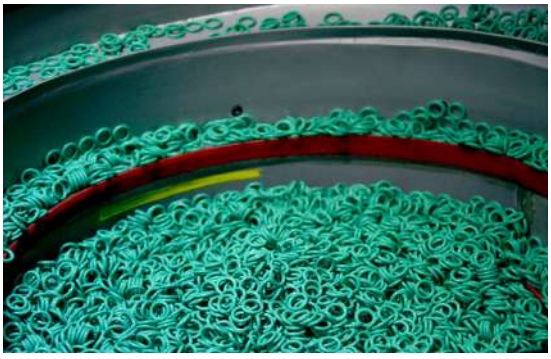
1 – SURFACE TREATMENTS

1.1 – Improved surface efficiency

Hutchinson offers a wide range of high-performance surface treatments. These treatments optimise the seal's surface by adapting it to the required conditions of use. They are tested and validated according to standards and to customers requirements.

We develop and apply all our treatments in our plants using specific processes, thus guaranteeing optimal quality.

Our processes respect the environment, the regulations in force and preserve the properties of the rubber.



Benefits

- Reduce insertion forces
- Reduce friction forces and seal wear for dynamic applications
- Enable distinction between two identical seals (Poka-Yoke)
- Facilitate use in automatic feeding O-Ring distribution systems

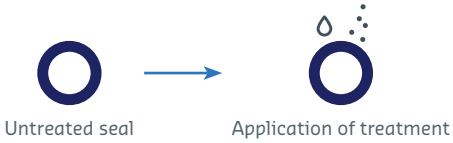
- **Marking**
- **Powders**
- **Wet films**
- **Dry coatings**
- **Chemical treatments**

1.2 – Surface Treatment process

To guarantee optimum quality, the application of surface treatments is always carried out in our plants and follows specific processes:

Specific process for Lubricoats

General process for surface treatments



1.3 – Our surface treatments

Designation	Colour	Aspect	Compatibility with elastomer families	Ease of assembly *Non-persistent product*	Ease of assembly *Persistent product*	Ease of automated fitting	Dynamic applications	Colour identification
Marking (On a side or line on external diameter)	white, blue, yellow, orange, red, green	-	all except silicone	-	-	-	-	++
Talcum	white	mat	all	o	-	++	-	-
Molycoting	silver	very shiny	all	o	-	++	-	-
Lubrifilm SG	transparent	non-oily grease	AEM, EPDM, FKM, FVMQ, HNBR, NBR	++	-	-	-	-
Lubrifilm FP Lubrifilm FP-ST	transparent	greasy, slightly shiny	AEM, EPDM, FKM, FVMQ, HNBR, NBR	++	-	o	-	-
Silicone HF	transparent	greasy, very shiny	all except silicone	++	-	-	-	-
Silicone GE	transparent	greasy, very shiny	all except silicone	++	-	-	-	-
Lubricoat A WB3-N	blue, black, orange, green	dry	AEM, EPDM, FKM, HNBR, NBR	-	++	+	+	++
Lubricoat H	blue, orange, transparent	dry	ACM, AEM, FKM, HNBR, NBR	-	o	+	++	++
Lubricoat I	blue, orange, transparent (slightly milky)	dry	EPDM, FKM, HNBR, NBR	-	+	+	-	++
Lubricoat J	white, blue, orange, red, transparent, green	dry	AEM, EPDM, FKM, HNBR, NBR	-	-	++	-	++
Lubricoat KT	transparent	dry	AEM, EPDM, FKM, HNBR, NBR	-	++	+	-	-
Lubri PB	transparent	dry	mainly NBR	-	o	+	++	-

NOTE: The Silicone HF and Lubricoat I (transparent version) treatments are approved for drinking water.

Key

- \- Not recommended
- o Quite suitable
- \+ Suitable
- ++ Highly suitable

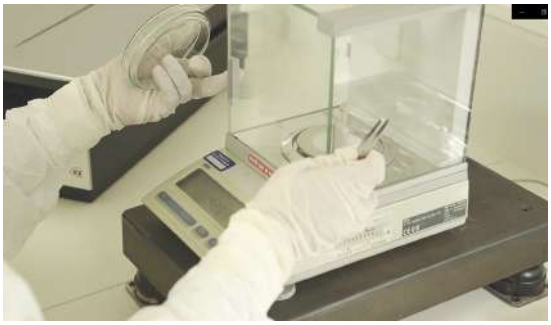
2 – MECHANICAL CLEANLINESS

2.1 – Interest

For many years, Hutchinson has been aware of the requirements for special cleanliness in many fields, such as the automotive market, and has equipped itself with many resources and skills to meet customers' technical specifications.

The absence of particulate pollution in a circuit is recognised as a key factor, essential to the lifespan and reliability of the circuit. The presence of particles, in particular mechanical particles, from the manufacturing process leads to a substantial increase in the wear of the system during initial use and can cause irreversible failures such as sealing problems.

Our production process does not generate abrasive and/or metallic particles, but Hutchinson offers efficient cleaning solutions for its parts.



2.2 – Cleanliness levels

To meet customers requirements, Hutchinson has defined four levels of cleanliness corresponding to specific washing and packaging processes:

- Standard
- Intermediate
- Stringent
- Very stringent

The cleanliness expertise unit analyses the specifications for each need, to establish the appropriate washing and packaging process.

2.3 – Means of production

Washing is carried out using environmentally friendly machines that guarantee the integrity of the seals.

For stringent and very stringent cleanliness, the washing and packaging operations are carried out in in an ISO 7 clean room (according to ISO 14644-1).

2.4 – Test facilities

Hutchinson has specific equipment to enable:

- the extraction of particle contamination from the parts,
- gravimetric measurement (mass of pollutant),
- the quantitative and qualitative measurement of particles

in compliance with the international reference standards, ISO 16232-2018 and VDA19.1.

ISO 7 class					
Maximum allowable concentrations (particles per m3 of air) of particles of size equal to or greater than that given below					
≥0.10µ	≥0.20µ	≥0.30µ	≥0.50µ	≥10µ	≥50µ
-	-	-	352,000	83,200	2,930

3 – TRACEABILITY BY MICRO-ENGRAVING

Micro-engraving keeps traceability information directly on the seals.

A simple search of the engraved identification code on the *O-Ring Info* smartphone app enables to access following traceability information:

- Part code number
- Part dimensions
- Rubber compound
- Date of manufacture
- Hutchinson guarantee of origin

O-RING INFO

Available on the App Store

GET IT ON Google Play

DETECTION OF COUNTERFEITING

TRACEABILITY

GUARANTEE OF ORIGIN

UNIT IDENTIFICATION

4 – URGENT ORDERS

4.1 – 10 Days Express

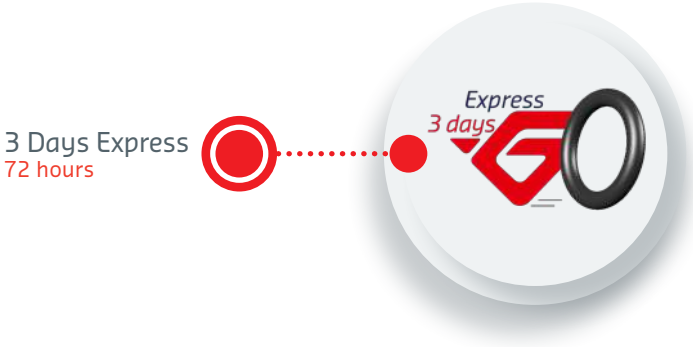
The 10 Days Express service allows delivery in under 10 days, including production and delivery, while maintaining our standard level of service: control, certificate of conformity, etc.

This concerns:

- All our compounds
- All dimensions
- All processes
- Order quantity up to 7,000 parts per reference, depending on compound and dimensions
- Other possible specifications (cleanliness, packaging, etc.)

4.2 – 3 Days Express

Our 3 Days Express service allows you to cope with urgent requirements, as we ship your parts within a time limit of 72 hours for usually ordered parts, and one week for specific dimension with mould creation.



With our 10 DAYS EXPRESS and 3 DAYS EXPRESS services, your O-Rings will be manufactured and delivered in just a few days!

5 – SEAL KITS

5.1 – EPDM 70 – Drinking water and food

Metric

- Elastomer family: EPDM
- Compound: 7EP1197
- Hardness: 70 Sh.A
- Dimensions: 20 sizes,
  inner Ø from 5.70 to 37.30 mm
  cross section Ø from 1.90 to 3.60 mm
- LJF part number: 199071

Imperial

- Elastomer family: EPDM
- Compound: 7EP1197
- Hardness: 70 Sh.A
- Dimensions: 20 sizes,
  inner Ø from 5.28 to 37.47 mm
  cross section Ø from 1.78 to 5.33 mm
- LJF part number: 199072

5.2 – Green FKM 70 – Chemical industry

Metric

- Elastomer family: FKM
- Compound: 7DF2067
- Hardness: 72 Sh.A
- Dimensions: 20 sizes,
  inner Ø from 5.70 to 37.30 mm
  cross section Ø from 1.90 to 3.60 mm
- LJF part number: 199080

Imperial

- Elastomer family: FKM
- Compound: 7DF2067
- Hardness: 72 Sh.A
- Dimensions: 20 sizes,
  inner Ø from 5.28 to 37.47 mm
  cross section Ø from 1.78 to 5.33 mm
- LJF part number: 199073

5.3 – NBR 80 – Gas

Metric

- Elastomer family: NBR
- Compound: PC851
- Hardness: 78 Sh.A
- Dimensions: 20 sizes,
  inner Ø from 5.70 to 37.30 mm
  cross section Ø from 1.90 to 3.60 mm
- LJF part number: 199081

Imperial

- Elastomer family: NBR
- Compound: PC851
- Hardness: 78 Sh.A
- Dimensions: 20 sizes,
  inner Ø from 5.28 to 37.47 mm
  cross section Ø from 1.78 to 5.33 mm
- LJF part number: 199082

5.4 – O-Ring splicing kit

Our O-Ring splicing kit allows the independent assembly of seals from 8 different diameters. Inside the kit you will find all the tools you need to make your own O-Rings: glue, white pencil, aluminium anvil and blade.

- Elastomer family: NBR
- Compound: PB701
- Hardness: 68 Sh.A
- Dimensions: 8 different cord diameters, from 1.90 to 10 mm
- LJF part number: 199001

https://www.oring.hutchinson.fr/en/products/o-ringkits/

HUTCHINSON®

ELASTOMERS & COMPOUNDS

We make it ***possible***

1 – CHARACTERISTICS OF ELASTOMER FAMILIES

A rubber compound is composed of many ingredients in very precise proportions. The elastomer used to make a compound will determine its main physical and chemical characteristics.

In increasingly demanding technical environments, with growing numbers of standards, approvals, and regulations, our Hutchinson O-Ring Division development laboratory brings its expertise and guarantees the best compound characteristics.

Rubber appears in three different forms during its processing:

- **Base gum (polymer):** fragile structure and low elasticity
- **Raw compound**, a dispersion of the following ingredients: the polymer, reinforcing fillers (carbon black, silica, etc.), plasticisers, the vulcanisation system (sulphur, sulphur donor, peroxide, resin, etc.), activators (ZnO, stearic acid, etc.), processing aids, protective agents and colourants if applicable
- **Vulcanisation of the raw compound:** the reaction takes place at high temperature and gives the rubber its final properties. The elasticity is excellent and the compression set is low.

PEROXIDE

SYNTHETIC RUBBER

WAX

STEARIC ACID

COLOURANTS

CARBON BLACK

SILICA

ZINC OXIDE

OIL

SULPHUR

Overview of the elastomer families

Standardised symbols		IIR	EPDM	CR	NBR	VMQ	FVMQ	ACM	FKM	HNBR	AEM
O-Ring Division designation		BU	EP	N	P	SL	SF	DA	DF	DT	DE
Common and chemical elastomer names		Butyl (isobutylene isoprene copolymer)	Ethylene propylene (ethylene propylene diene terpolymer)	Chloroprene (polychloroprene)	Nitrile (acrylonitrile butadiene copolymer)	Silicone	Fluorosilicone	Polyacrylic	Fluorocarbon	Hydrogenated nitrile	Ethylene acrylate
Mechanical properties	Traction										
	Compression set										
Resistance	Air										
	Light										
	Ozone (weather)										
	Heat										
	Cold										
Dielectric use											
Impact of fluids at normal temperatures	Mineral oils and petroleum products										
	Water, dilute bases, dilute non-oxidising acids										
	Strong acids										
	Strong oxidising acids										
	Gas impermeability										
	Glycol (cooling systems, braking)										

Key

Very good to excellent | Good | Quite good | Poor | Low to zero

1.1 – ACM (Polyacrylate)

Good resistance	Aggressive mineral oils
	Atmospheric agents
	Heat
Low resistance	Fuels
	Water
	Low temperatures
Particularities	Average mechanical behaviour
Typical applications	Automatic transmissions
	Reducing gears

1.2 – AEM (Ethylene acrylate copolymer)

Good resistance	Aggressive mineral oils
Particularities	Good mechanical behaviour
Typical applications	Sensors

1.3 – CR (Polychloroprene)

Good resistance	Mineral greases
	Atmospheric agents
Moderate resistance	Mineral oils
	Water up to 70°C
Low resistance	Fuels
	Water vapour
Particularities	Very good mechanical and abrasion resistance
Typical applications	Industrial air conditioning

1.4 – EPDM (Ethylene propylene)

Very good resistance	Water, steam and aqueous solutions
	Synthetic brake fluid
	Atmospheric agents
	Low temperatures
Low resistance	Mineral oils and hydrocarbons
Particularities	Quite good mechanical behaviour
Typical applications	Hot and cold water valves and fittings
	Drinking water
	SF6 circuit breakers
	Cooling systems
	Brake systems
	Heating systems

1.5 – FKM (Fluorocarbon)

Very good resistance	Heat
	Mineral oils
	Household gas
	Atmospheric agents
	Fuels
Good resistance	Chemicals
	Acids
Low resistance	Bases
	Brake fluid
Particularities	Limited resistance to cold
	Quite good mechanical behaviour
	Good impermeability
Typical applications	High vacuum
	High-temperature hydraulic and pneumatic
	Industrial valves and fittings
	Fuel lines
	Fuel injection

1.6 – HNBR (Hydrogenated nitrile)

Good resistance	Aggressive mineral oils
	Atmospheric agents
	Water, steam
	Dilute bases
Low resistance	Fuels
	Brake fluid
Particularities	Very good mechanical behaviour
	Abrasion resistance
Typical applications	Power steering
	Air conditioning

1.7 – IIR (Butyl)

Very good resistance	Water and steam
	Atmospheric agents
Low resistance	Mineral oils and hydrocarbons
Particularities	Very good gas impermeability
	Relatively poor mechanical behaviour
Typical applications	High vacuum
	Dielectric gas

1.8 – FVMQ (Fluorosilicone)

Very good resistance	Cold
	Mineral oils and hydrocarbons
	Atmospheric agents
	Low temperature
Particularities	Poor mechanical behaviour
Typical applications	Fuel fitting seals
	Electrical

1.9 – NBR (Nitrile)

Good resistance	Mineral oils
	Household gases
	Water up to 70°C
	Fuels
Low resistance	Atmospheric agents
	Acids
Particularities	Good mechanical behaviour
	Good impermeability
Typical applications	Hydraulic and pneumatic
	Water and mineral gas valves and fittings
	Mineral oil and fuel lines

1.10 – VMQ (Silicone)

Very good resistance	Heat
	Atmospheric agents
	Water up to 100°C
	Very low temperatures
Moderate resistance	Mineral oils
	Household gases
Low resistance	Fuels
Particularities	High permeability
	Poor mechanical behaviour
Typical applications	Pharmaceutical
	Cosmetics
	Food industry
	Household electrical

2 – MATERIAL CHARACTERISTICS

2.1 – Compression set

Elasticity is the ability of a rubber part to return to its original shape after deformation. The compression set (CS) measures the change in elastic performance over time and under defined operating conditions.

The CS thus measures the permanent (non-elastic) deformation of a material after a force is removed from it.

The elastic properties of rubber can vary depending on time, temperature and the fluids in contact.

Our compounds for O-ring applications have been specially designed to have low CS levels.

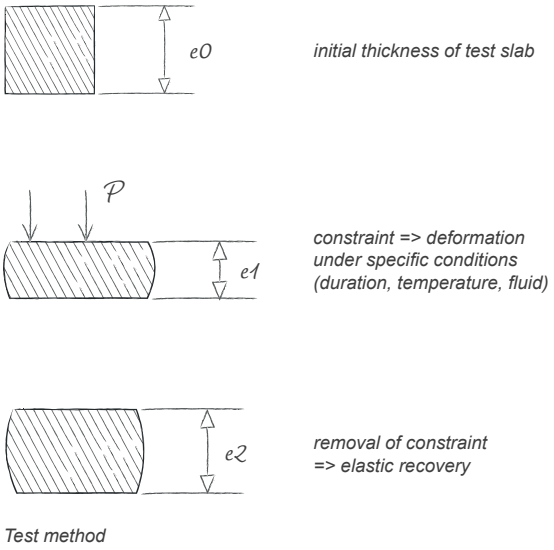
The CS is measured as shown on the adjacent pictures.

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

Perfectly elastic body	e2 = e0
Full creep	e2 = e1

The lower the CS value, the better the rubber sealing performance.

CS tests can be performed according to various specifications and standards (e.g. ISO 815).



Test method

2.2 – Hardness

Hardness characterises the resistance of the material to distortion. It is measured in Shore A (Sh.A) for standardised test pieces and in micro IRHD (International Rubber Hardness Degrees) for parts.

Our range consists of compounds hardness going from 55 to 98 Sh.A.

The hardness directly influences fitting force, assembly force and pressure resistance.

The choice of hardness is a compromise between these influencing factors, while taking into account the fact that excessive pressure can lead to extrusion in case of insufficient hardness. See 3.2 on page 70.

2.2.1 – Limit temperatures

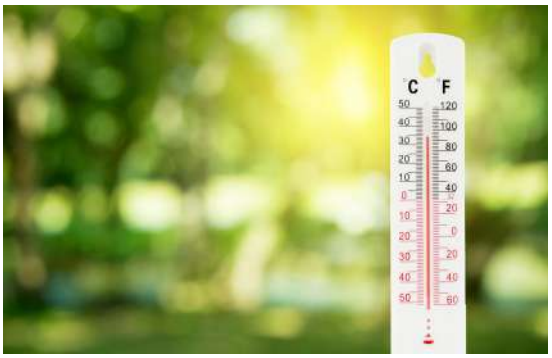
Working temperatures depend on numerous factors:

- Environment
- Operating time
- Assembly conditions

Resistance to low temperature is provided as an indication and corresponds to the preservation of a certain flexibility, at an intermediate level between:

- The brittle temperature as determined by the AFNOR NF T 46-018 standard. The brittle temperature is the temperature below which a rubber compound is brittle (loss of elasticity).
- The TR10 temperature as determined by the standards AFNOR NF T 46-032 and ISO 2921 standards. A rubber sample brought to a temperature below the brittle temperature regains its elasticity when the temperature rises. TR10 is the temperature at which a stretched sample has recovered 10% of the initial stretch.

The low-temperature resistance of a compound can be affected by the action of a fluid in contact. At low temperatures, slight shrinkage and hardening of the material can cause leakage. These phenomena mainly occurs with gas sealing and when the initial compression rate of the parts is low.



Hardening of the material at low temperature is a reversible phenomenon: the rubber completely regains its original properties when the temperature rises.

High temperature changes the properties of rubber (reduction in hardness, increase in CS and hence creep).

Rubbers have higher thermal expansion coefficients than metals. At high temperature, the recommended groove sizes are sufficient to cover the expansion of the material.

2.2.2 – Observations

The conditions of service (temperature, pressure, friction, etc.) and the combination of several products can significantly alter the aggressiveness of fluids in contact.

It is recommended to carry out tests before final selection of a material.

If the temperature of use is too high, an irreversible change in properties is inevitable, resulting in hardening of the material, a loss of elasticity and a strong deterioration of the compression set.

If the maximum recommended temperatures are respected, the normal change in the characteristics of the compounds should ensure the functionality of the seal.

2.3 – Impact of fluids in contact

2.3.1 – Swelling

Swelling is the penetration of a fluid inside the compound, leading to an increase in volume.

If the compound swells excessively, its properties may change, with the risk of extrusion due to a loss of hardness and mechanical resilience.

In static applications, swelling of up to about 30% by volume of the seal can be considered, with a suitable assembly.

In dynamic applications, swelling of 8 to 10% by volume is generally quite well tolerated.

2.3.2 – Extraction

Some fluids have the ability to extract ingredients from the rubber compound with which they are in contact. The result is a loss of volume and deterioration of the physical, chemical and mechanical properties of the compound (loss of elasticity, increased hardness, etc.).

Extraction leads to a risk of leakage by reducing the cross section of the seal, and hence deformation of the seal in the groove.

Dynamic applications are more sensitive to extraction because the initial compression rate is usually lower than for static applications.

If in doubt about the influence of a fluid, a compatibility test should be performed.

2.3.3 – Chemical attack

Independently of volume effects, in the event of chemical incompatibility, a fluid may cause changes to the characteristics of the rubber over time.

The most common signs are:

- Hardness change
- Appearance of cracks
- Compression set increase

3 – COMPOUND RANGE

3.1 – Development and manufacture of our compounds

Our rubber compounds are formulated and developed in our laboratories and manufactured in our factories. We can therefore guarantee the performance and longevity of our parts.

Integrated into our organisation, production monitoring by the laboratory ensures the repeatability of the performance of our elastomers.

In total, more than 300 specific formulations are available to cover any sealing need, from the following elastomer families:

NBR - EPDM - HNBR - FKM - AEM - ACM – IIR - CR - VMQ- FMVQ.

Most of our compounds are approved by our customers in the automotive and industrial sectors and accredited by recognised international organisations in the fields of drinking water, food, gas and oil.
We monitor the regulations applicable to rubber and their evolution (REACH regulations, health standards).

3.2 – Standard compounds from stock

Standard compounds have been selected to meet a wide range of applications.

Seals made from these materials are kept in stock and are available quickly.

Family	Compound	Hardness Sh.A	Colour	CS (%)	Max peak TºC (ºC)	TR10 (ºC)	Approvals	
NBR	PD501	54	Black	15	120	-30		
NBR	PB701	68	Black	12	120	-20	Gas	EN 549
NBR	7PD1612	74	Black	15*	120	-24	Drinking water Food Gas	CLP, UBA, WRAS... FDA, EC 1935/2004... EN 549
NBR	PC851	78	Black	15	120	-25	Gas	EN 549
EPDM	EP7010	70	Black	12	175	-46		
EPDM	7EP1197	70	Black	12	175	-46	Drinking water, food	CLP, KIWA, WRAS, UBA... FDA, EC 1935/2004... USP Class VI
EPDM	EP856	80	Black	15	175	-46	Drinking water	CLP, UBA, WRAS...
EPDM	EP851	80	Black	12	175	-46		
FKM	7DF2067	72	Green	20	250	-15		
FKM	DF801	79	Black	18	250	-14	Gas	EN 549, EN 682
VMQ	6SL2065	64	Translucent blue	22	225	-45	Food	

Compression Set conditions:

NBR: 24h at 100°C / *: 24h at 125°C; EPDM: 24h at 150°C; FKM: 72h at 200°C; VMQ: 72h at 150°C

3.3 – Compound selection guide

The following criteria should be taken into account when selecting a compound:

3.3.1 – Selecting the family

- Fluids in contact
- Continuous and peak service temperatures
- Special functional requirements (abrasion resistance, ozone resistance, etc.)

3.3.2 – Selecting the hardness

- Service pressure
- Surface roughness
- Type of use (static or dynamic)
- Service temperature

3.3.3 – Approvals & certifications

- Drinking water
- Gas
- Food

Fluid \ Continuous T°C / Peak T°C	< – 50 °C / < – 50 °C	– 50 °C / – 50 °C	– 30 °C / – 40 °C	+ 70 °C / + 100 °C	+ 100 °C / + 125 °C	+ 125 °C / + 150 °C	+ 150 °C / + 175 °C	+ 200 °C / + 250 °C
Water Water vapour Coolant	VMQ	EPDM VMQ	EPDM FKM NBR VMQ	EPDM FKM NBR VMQ	EPDM FKM VMQ	EPDM FKM VMQ	EPDM	
Compressed air	VMQ	VMQ	FKM NBR VMQ	FKM NBR VMQ	FKM VMQ	FKM VMQ	FKM	FKM
Mineral oils Oil & Gas products			FKM NBR	FKM NBR	FKM NBR	FKM	FKM	FKM
Food products			VMQ EPDM NBR approved	VMQ EPDM NBR approved	VMQ EPDM NBR approved	VMQ EPDM approved		

3.4 – Usual compounds overview

In addition to standard compounds from stock, we have a wide range of compounds from many elastomer families.

The following table will help you to make your choice according to your needs. Compounds are classified by family and then by increasing hardness.

Compound	Family	Hardness Sh.A	Approvals	Particularities	Co-lour*	Min T°C	Max cont. T°C	Max peak T°C	CS %	CS conditions	Tensile strength	Elongation at break	TR 10 °C	Brittle T°C
5PD1883	NBR	54			●	-30	100	120	15	24h 100°C	12	400	-30	-40
PD501	NBR	54			●	-30	100	120	15	24h 100°C	12	400	-30	-40
6PB1729	NBR	61	Gas: EN 549 - H3B1		●	-30	100	120	12	24h 100°C	17	450	-26	-35
6PB2053	NBR	61		Diesel resistant Ozone resistant	●	-25	100	120	12	24h 100°C	13	470	-20	-30
6PB2064	NBR	61		Diesel resistant Ozone resistant Colour	●	-25	100	120	11	24h 100°C	17	400	-20	-30
7PB1860	NBR	68		Self-lubricating Ozone resistant	●	-30	100	120	11	24h 100°C	16	350	-27	-35
PB701	NBR	68	Gas: EN549 - H3B2		●	-30	100	120	12	24h 100°C	17	400	-20	-30
7PB1871	NBR	69	Gas: EN682 - GBL	Ozone resistant	●	-35	90	120	12	24h 100°C	18	340	-32	-40
7PB496	NBR	69	Gas: EN549 - H3B1		●	-30	110	130	10	24h 100°C	20	370	-25	-35
7PD1630	NBR	70		Low T°C resistant	●	-50	100	130	12	24h 100°C	18	275	-45	-55
7PD1612	NBR	74	Food: FR, USA Drinking water: DE, FR, GB, USA Gas: EN549 - H3B2		●	-30	100	130	15	24h 125°C	21	225	-24	-35
8PB1390	NBR	74			●	-30	110	130	12	24h 100°C	20	325	-27	-36
9PD31	NBR	78		X-Ring only	●	-30	100	120	15	24h 100°C	17	225	-25	-35
PC851	NBR	78	Gas: EN549 - H3B1		●	-30	100	120	15	24h 100°C	17	225	-25	-35
PD853	NBR	79		Low T°C resistant	●	-40	90	120	15	24h 100°C	17	175	-35	-50
9PC1708	NBR	87			●	-25	90	120	15	24h 100°C	20	170	-25	-30
8PA1393	NBR / PVC	77		Ozone resistant	●	-30	90	120	20	24h 100°C	14	270	-24	-35
6EP1713	EPDM	55		Self-lubricating	●	-55	120	160	17	24h 150°C	12	500	-50	-60
6EP1385	EPDM	60			●	-55	130	175	18	24h 150°C	13	350	-50	-60
6EP1862	EPDM	60	Food: FR, USA Drinking water: DE, FR, GB, IT		●	-55	130	175	18	24h 150°C	13	350	-50	-60
7EP1722	EPDM	65		Self-lubricating	●	-50	125	165	20	24h 150°C	12	280	-46	-55
7EP2106	EPDM	68		Colour	●	-50	140	170	15	24h 150°C	11	330	-50	-55
7EP1197	EPDM	70	Food: FR, USA Drinking water: DE, FR, GB, IT, NL, USA		●	-50	140	175	12	24h 150°C	14	180	-46	-55
7EP1726	EPDM	70			●	-50	110	150	25	24h 125°C	14	350	-46	-55
EP7010	EPDM	70			●	-50	140	175	12	24h 150°C	14	180	-46	-55
8EP2058	EPDM	78		Colour	●	-50	140	175	10	24h 150°C	12	190	-46	-55
8EP2147	EPDM	78		Colour Air conditioning	●	-50	140	170	10	24h 150°C	13	270	-46	-55
EP851	EPDM	80			●	-50	140	175	12	24h 150°C	16	160	-46	-55

Compound	Family	Hardness Sh.A	Approvals	Particularities	Co-lour*	Min T°C	Max cont. T°C	Max peak T°C	CS %	CS conditions	Tensile strength	Elongation at break	TR 10 °C	Brittle T°C
EP856	EPDM	80	Food: FR, USA Drinking water: DE, FR, GB		●	-50	140	175	15	24h 150°C	16	160	-46	-55
9EP2094	EPDM	90			●	-45	140	170	10	24h 150°C	16	95	-46	-55
DF651	FKM	62			●	-25	200	250	22	72h 200°C	11	250	-15	-27
6DF2060	FKM	64		Colour	●	-25	200	250	20	72h 200°C	14	200	-15	-27
6DF1882	FKM	65		Colour	●	-25	200	250	20	72h 200°C	11	180	-18	-30
6DF2087	FKM	66		Improved resistance to fuels containing alcohol	●	-25	200	250	28	72h 200°C	13	250	-13	-23
DF701	FKM	68	Gas: EN549 - H3E1		●	-25	200	250	20	72h 200°C	13	210	-14	-25
7DF2355	FKM	71		Acid resistant	●	-25	200	250	25	72h 200°C	23	320	-17	-27
7DF2067	FKM	72		Colour	●	-25	200	250	20	72h 200°C	14	180	-15	-25
7DF2371	FKM	73	certified ECE R110, ISO 15500-2, ANSI NGV3.1-2014	CNG & LPG applications	●	-40	200	250	25	72h 200°C	16	190	-40	-45
7DF2116	FKM	74		Colour, Low T°C resistant	●	-35	200	250	25	72h 200°C	13	290	-28	-35
7DF2148	FKM	74		Low T°C resistant	●	-35	200	250	23	72h 200°C	18	260	-28	-35
8DF1368	FKM	74			●	-25	200	250	20	72h 200°C	15	175	-15	-25
7DF1719	FKM	75			●	-25	200	250	22	72h 200°C	15	200	-18	-28
7DF2352	FKM	75		Low T°C resistant	●	-40	200	250	25	72h 200°C	16	180	-35	-40
8DF1872	FKM	77		Colour	●	-25	200	250	20	72h 200°C	16	160	-15	-25
7DF2075	FKM	78	Gas: EN549 - H3E1	Colour	●	-25	200	250	23	72h 200°C	14	180	-18	-28
DF801	FKM	79	Gas: EN549 - H3E1, EN682 - H80		●	-25	200	250	18	72h 200°C	15	175	-14	-25
DF851	FKM	84			●	-25	200	250	20	72h 200°C	14	175	-14	-23
DF901	FKM	91			●	-25	200	250	20	72h 200°C	16	140	-14	-23
V95	FKM	95	Oil & Gas: Norsok M710, Total GS PVV 142	Oil & Gas resistant RGD	●	-25	200	250	25	72h 200°C	22	130	-15	-17
6DT2078	HNBR	60		Self-lubricating Improved oil resistance	●	-30	130	170	22	72h 150°C	18	420	-22	-50
7DT1870	HNBR	66	Gas: EN549 - H3C1	Colour	●	-30	130	170	27	72h 150°C	17	350	-22	-50
7DT1877	HNBR	70		Improved oil re-sistance, Colour	●	-30	125	165	22	72h 150°C	22	320	-22	-50
7DT2146	HNBR	70	Gas: EN549 - H3B2, EN682 - GBL	Colour	●	-35	130	160	27	72h 150°C	17	260	-29	-50
7DT1743	HNBR	71		Colour	●	-30	130	170	27	72h 150°C	19	320	-22	-50
7DT1593	HNBR	72			●	-30	130	170	25	72h 150°C	23	260	-20	-50
7DT2072	HNBR	72		Low T°C resistant	●	-40	130	160	34	72h 150°C	18	240	-35	-50
7DT2091	HNBR	72		Colour Low T°C resistant	●	-40	130	170	25	72h 150°C	16	280	-35	-50
7DT2074	HNBR	73		Colour, Self-lubricating, Improved oil resistance	●	-30	125	165	24	72h 150°C	21	340	-21	-50

Compound	Family	Hardness Sh.A	Approvals	Particularities	Co-lour*	Min T°C	Max cont. T°C	Max peak T°C	CS %	CS conditions	Tensile strength	Elongation at break	TR 10 °C	Brittle T°C
7DT1730	HNBR	75		Colour		-30	130	170	27	72h 150°C	20	300	-21	-50
7DT2080	HNBR	75	Gas: EN549 - H3C1	Colour Self-lubricating		-30	130	170	29	72h 150°C	19	300	-22	-50
7DT2373	HNBR	77	certified ECE R110, ISO 15500-2, ANSI NGV3.1-2014	CNG & LPG applications		-35	130	160	35	72h 150°C	19	210	-33	-50
8DT1724	HNBR	82				-30	130	170	22	72h 150°C	22	200	-18	-50
9DT1889	HNBR	90		Colour Improved oil resistance		-30	125	165	24	72h 150°C	22	200	-20	-50
DA65	ACM	55	Gas: EN549 - H2C1			-20	150	175	35	24h 150°C	12	225	-12	-13
7DA1163	ACM	68				-25	150	175	35	24h 150°C	12	200	-20	-22
8DA1398	ACM	71				-25	150	175	35	24h 150°C	13	220	-18	-20
DA80	ACM	75	Gas: EN549 - H3C1			-20	150	175	35	24h 150°C	13	190	-11	-12
6DE2142	AEM	60		No DOTG Self-lubricating		-35	155	175	18	72h 150°C	13	240	-26	-35
6DE2395	AEM	62		Colour		-35	130	160	40	72h 150°C	13	360	-30	-40
7DE2138	AEM	73		No DOTG		-35	160	180	18	72h 150°C	17	230	-26	-40
7DE2144	AEM	73		No DOTG Improved low T°C resistance		-40	160	180	18	72h 150°C	17	230	-32	-45
6N1851	CR	60				-45	90	125	20	24h 100°C	18	350	-44	-50
7N1747	CR	71				-45	90	125	15	24h 100°C	20	250	-42	-50
D706	IIR	67				-45	125	175	10	24h 125°C	13	240	-40	-50
SL1010	VMQ	52		Colour		-50	200	225	20	72h 150°C	6	275	-45	-70
SL1002	VMQ	60	Gas: EN549 - H2E2	Colour		-50	200	225	20	72h 150°C	7	250	-45	-70
6SL2136	VMQ	63	Food: FR, USA	Food contact, Colour		-50	200	225	28	72h 150°C	9	550	-45	-70
6SL2065	VMQ	64	Food: FR, USA	Colour		-50	200	225	22	72h 150°C	10.5	500	-45	-70
6SL2141	VMQ	66		Heat resistant		-50	225	250	50	72h 150°C	9	310	-45	-70
7SL1746	VMQ	71		Colour		-50	200	225	10	72h 150°C	8	320	-45	-70
SL1000	VMQ	72	Gas: EN549 - H3E2	Colour		-50	200	225	15	72h 150°C	8	180	-45	-70
7SF2081	FVMQ	74		Colour		-60	175	200	13	72h 150°C	8	250	-60	-70
7SF2084	FVMQ	74		Colour		-60	175	200	9	72h 150°C	8	250	-60	-70
8SF2062	FVMQ	81		Colour		-60	175	200	15	72h 150°C	9	174	-46	-65

Non-representative colours

3.5 – Chemical compatibility

The following tables indicate the appropriate elastomer families for different products, in the order of recommendation.

The conditions of service (temperature, pressure, friction, etc.) and the combination of several products can significantly change the aggressiveness of fluids in contact.

It is recommended that tests to carry out tests before final selection of an elastomer.

Key:

***: extreme fluid:** No elastomer is unaltered when in contact with this fluid. The specified product families are those with the least poor resistance.

Food

Product	Recommended elastomers
Animal fat	EPDM - NBR - CR
Beer	NBR - CR - EPDM - IIR
Butter	NBR - EPDM - CR - VMQ
Castor oil	IIR - NBR - EPDM - CR
Coffee	EPDM, NBR, FKM, VMQ, HNBR
Cotton oil	NBR - EPDM - VMQ - FKM
Fruit juice	All elastomers
Gelatin	EPDM, NBR, HNBR, VMQ, FKM
Glucose	EPDM, NBR, HNBR, VMQ, FKM
Lard	NBR - CR - FKM
Milk	NBR - CR - EPDM - IIR
Molasses	EPDM - IIR
Olive oil	NBR - IIR - EPDM - CR
Sweet juice	All elastomers
Vegetable fat	EPDM - NBR - CR
Vegetable oil	NBR - EPDM
Vinegar	EPDM - CR - NBR
Water (<70°C)	NBR - EPDM
Water (>70°C)	EPDM - IIR - HNBR
Whisky	EPDM - CR - NBR
Wine	EPDM - CR - NBR

Petroleum derivatives

Product	Recommended elastomers
Aliphatic compounds	NBR - CR - FKM
Aromatic compounds (<40% aromatics)	NBR - FKM - FVMQ
Aromatic compounds (>40% aromatics)	FKM - FVMQ
Asphalt	FKM - NBR
Butadiene	NBR - FKM
Butylene	FKM - NBR
Decahydronaphthalene	FKM - FVMQ
Decaline	FKM - FVMQ
Ethylene	NBR - FKM - FVMQ
Fuel oil	NBR - FKM - FVMQ
Household heating oil	NBR - FKM - FVMQ
Kerosene	NBR - FKM - FVMQ
Mineral greases	NBR - CR - FKM - HNBR
Mineral oils	NBR - FKM - CR - FVMQ
n-Pentane	NBR - FKM
Naphtha (solvent)	NBR - FKM - FVMQ
Naphthalene	FKM - FVMQ
Paraffin	NBR - CR - FKM
Petroleum	NBR - FKM - FVMQ
Tetralin	FKM - FVMQ - NBR

Freons

Product	Recommended elastomers
Freon 11	NBR - FKM - CR
Freon 112	NBR - CR - FKM
Freon 113	NBR - CR - FKM
Freon 114	NBR - CR - FKM
Freon 114 b 2	CR - FKM
Freon 115	EPDM - NBR - CR
Freon 12	NBR - CR - FKM
Freon 13	EPDM - NBR - CR - FKM
Freon 13 b 1	EPDM - NBR - CR - FKM
Freon 134 a	CR - EPDM - HNBR
Freon 142 b	CR - FKM
Freon 152 a	EPDM - NBR - CR
Freon 21	CR
Freon 218	EPDM - NBR - CR
Freon 22	CR
Freon 31	EPDM - CR - IIR
Freon 32	EPDM - CR - IIR
Freon 502	CR - NBR - FKM
Freon BF	NBR - CR
Freon C 316	NBR - CR
Freon C 318	EPDM - NBR - CR
Freon MF	NBR - FKM
Freon TA	EPDM - NBR - CR
Freon TC	EPDM - NBR - CR
Freon TF	NBR - CR

Common gases

Product	Recommended elastomers
Acetylene	NBR - EPDM - FKM
Ammonia (hot gas)	EPDM - VMQ - IIR - HNBR
Ammonia (cold gas)	EPDM - IIR - NBR - VMQ - HNBR
Nitrogen	All elastomers (for impermeability: IIR - NBR)
Carbon dioxide	EPDM - NBR - CR
Butane	NBR - FKM
Moist chlorine	FKM - FVMQ
Dry chlorine	FKM
Ethane	NBR - FKM - FVMQ
Diesel oil	NBR - FKM - FVMQ
Carbon dioxide	EPDM - NBR - CR
Coke oven gas	FKM - VMQ - FVMQ
Blast furnace gas	FKM - NBR - VMQ
Natural gas	NBR - FKM
Helium	All elastomers (for impermeability: IIR - NBR)
Hydrogen	All elastomers (for impermeability: IIR - NBR)
Hydrogen sulphide	EPDM - IIR - CR - HNBR
Krypton	All elastomers (for impermeability: IIR - NBR)
Methane	NBR - FKM - HNBR
Oxygen (hot gas)	VMQ - FKM
Oxygen (cold gas)	EPDM - IIR - FKM - VMQ
Ozone	Depends on concentration
Propane	NBR - FKM
Propene	FKM - NBR
Propylene	FKM - NBR
Water vapour	IIR - EPDM - HNBR
Xenon	All elastomers (for impermeability: IIR - NBR)

Common chemicals

Product	Recommended elastomers
Acetic acid 30%	EPDM - CR - VMQ
Acetone	EPDM
Ammonia	EPDM - CR - IIR - HNBR
Aniline	EPDM - FKM
Benzene	FKM - FVMQ
Bleach	EPDM
Chloroform	FKM - FVMQ
Citric acid	All elastomers
Cyclohexane	NBR - FKM - FVMQ
Denatured alcohol	EPDM - NBR - CR
Dimethyl ketone	EPDM
Dimethyl sulfoxide	EPDM - VMQ
Ethanol	EPDM - NBR - FKM
Ether	EPDM - IIR - NBR
Ethyl alcohol	EPDM - NBR - FKM
Ethylene glycol	EPDM - IIR
Formaldehyde	EPDM - IIR - FKM - NBR
Formol	EPDM - IIR - FKM - NBR
Glacial acetic acid	EPDM - VMQ
Glycerine	EPDM - CR - NBR
Hydrochloric acid, 37%	EPDM - FKM
Hydrogen peroxide	EPDM - FKM - VMQ
Methyl alcohol	EPDM - NBR - CR
Nitric acid (diluted)	FKM - EPDM
Ordinary alcohol	EPDM - NBR - FKM
Phosphoric acid, 20%	EPDM - FKM
Phosphoric acid, 45%	EPDM
Phosphoric acid, pure	EPDM
Sea water	NBR - EPDM - HNBR - FKM
Sulphuric acid, 60%	FKM
Sulphuric acid, diluted	EPDM - FKM
Turpentine	NBR - FKM - FVMQ

Product	Recommended elastomers
Carbon tetrachloride	FKM - FVMQ
Glycerol	EPDM - CR - NBR
Glycol	EPDM - IIR
Hexane	NBR - FKM - CR
Hexanol	NBR - FKM - EPDM
Hydrogen peroxide	EPDM - FKM - VMQ
Linseed oil	EPDM - NBR
Methanal	EPDM - IIR - FKM - NBR
Methanol	EPDM - NBR - CR
Methyl ethyl ketone	EPDM - IIR
Naphthalene	FKM - FVMQ
Oxygen (liquid)	VMQ - FKM - FVMQ
Pentane*	NBR - FKM
Potash	EPDM - CR - IIR - HNBR
Potassium hydroxide	EPDM - CR - IIR - HNBR
Soap solution	NBR - EPDM - HNBR - FKM
Sodium hydroxide	EPDM - CR - IIR - HNBR
Sodium hydroxide	EPDM - CR - IIR - HNBR
Toluene	FKM - FVMQ
Vaseline	NBR - FKM - FVMQ
White spirit	NBR - FKM - FVMQ
Xylene	FKM - FVMQ

***: extreme fluid:** No elastomer is unaffected in its presence: the specified product families are those with the least poor resistance.

Chemical specialities

Product	Recommended elastomers
Acetaldehyde	EPDM - VMQ
Acetaldehyde	EPDM - VMQ
Acetamide	EPDM - IIR - VMQ
Acetic anhydride	CR - EPDM
Acetic ether	EPDM
Acetonitrile	CR - EPDM - IIR
Acetonitrile	CR - EPDM - IIR
Acetophenone	EPDM - IIR
Acetyl chloride	FKM - FVMQ
Acetylene tetrabromide	FKM - FVMQ - EPDM
Acetylene tetrachloride	FKM - FVMQ
Acetyl ricinoleate / butyl acetyl ricinoleate	EPDM - IIR
Acrolein	EPDM - IIR
Acrylic acid	FKM
Acrylic aldehyde	EPDM - IIR
Acrylic nitrile	CR
Acrylonitrile*	CR
Adipic acid	NBR - FVMQ
Alum	EPDM - NBR
Aluminium acetate	EPDM
Aluminium chloride	EPDM - NBR
Aluminium fluoride	EPDM - CR - NBR
Aluminium nitrate	EPDM - NBR
Aluminium phosphate	EPDM - NBR
Aluminium sulphate	EPDM - NBR
Ammonium carbonate	EPDM - NBR
Ammonium chloride	EPDM - NBR
Ammonium hydroxide	EPDM - CR - IIR - HNBR
Ammonium nitrate	EPDM - NBR
Ammonium nitrite	EPDM - IIR
Ammonium persulphate	EPDM - IIR
Ammonium phosphate	EPDM - NBR
Ammonium sulphate	EPDM - NBR
Amyl alcohol	EPDM - IIR - NBR
Amyl borate	NBR - CR
Aniline oil	EPDM - IIR

Product	Recommended elastomers
Anthracene oil	FKM
Arsenic acid	EPDM - NBR - CR - FKM
Arsenic trichloride	NBR - CR
Barium chloride	EPDM - NBR
Barium hydroxide	EPDM - CR - IIR - HNBR
Barium sulphate	EPDM - NBR
Benzaldehyde	EPDM - IIR
Benzoic acid	FKM - FVMQ - VMQ
Benzoic aldehyde	EPDM - IIR
Benzyl / dibenzyl sebacate	FKM - EPDM
Benzyl alcohol	FKM - EPDM - IIR - FVMQ
Benzyl benzoate	FKM - FVMQ - EPDM
Benzyl chloride	FKM - EPDM - IIR - FVMQ
Borax	EPDM - NBR - FKM
Boric acid	EPDM - NBR - VMQ - FKM
Bromine (anhydrous)	FKM - FVMQ
Bromine water	FKM - FVMQ
Bromobenzene	FKM - FVMQ
Butanol	EPDM - NBR - FKM
Butyl / dibutyl phthalate	FKM - VMQ - EPDM
Butyl / dibutyl sebacate	FKM - EPDM
Butyl acetate	EPDM
Butyl acrylate*	EPDM - IIR
Butylamine	VMQ - EPDM
Butyl benzoate	EPDM - FKM - FVMQ
Butyl carbitol acetate	EPDM - IIR
Butyl carbitol	EPDM - NBR - IIR
Butyl diethylene glycol acetate	EPDM - IIR
Butyl diglycol acetate	EPDM - IIR
Butyl glycol acetate	EPDM - IIR
Butyl glycol	EPDM - IIR
Butyl lactate	NBR
Butyl maleate	EPDM - IIR
Butyl oleate	NBR - FKM
Butyl stearate	NBR
Butyraldehyde	EPDM - CR - IIR

***: extreme fluid:** No elastomer is unaffected in its presence: the specified product families are those with the least poor resistance.

Chemical specialities

Product	Recommended elastomers
Butyric acid	EPDM
Calcium carbonate	EPDM - NBR
Calcium chloride	EPDM - NBR
Calcium hydroxide	NBR - EPDM - CR - HNBR
Calcium hypochlorite	IIR - EPDM
Calcium nitrate	EPDM - NBR
Calcium sulphate	EPDM - NBR
Caprolactam	EPDM - IIR
Carbitol acetate	EPDM - CR - NBR - FKM
Carbitol	EPDM - NBR - IIR
Carbon disulphide	FKM - FVMQ
Carbon disulphide	FKM - FVMQ
Carbonic acid	EPDM - NBR - CR
Carbonic anhydride	EPDM - NBR - CR
Carbon monoxide	NBR - EPDM - IIR
Carbon tetrabromide	FKM - FVMQ
Chlorinated biphenyls	FKM
Chlorine dioxide	FKM - EPDM
Chlorine trifluoride	FKM - FVMQ
Chloroacetic acid	EPDM - CR - FKM
Chlorobenzene	FKM - FVMQ
Chlorobromomethane	FKM - FVMQ - EPDM
Chloroethane	FKM - EPDM - NBR - FVMQ
Chloronaphthalene	FKM - FVMQ
Chloropropionic acid	EPDM - IIR - FKM
Chlorotoluene	FKM
Chromic acid	EPDM
Chromic anhydride	FKM
Cobalt chloride	EPDM - NBR
Copper acetate	EPDM - IIR
Copper chloride	EPDM
Copper sulphate	EPDM
Creosote oil	NBR - EPDM - IIR
Cresols	FKM - IIR
Cumene	FKM - FVMQ
Cyclohexanecarboxylic acid	FKM - NBR
Cyclohexanol	CR - FKM - FVMQ

Product	Recommended elastomers
Cyclohexanone	IIR
Cyclohexyl acetate	EPDM - IIR
Decane	NBR - FKM - FVMQ
Diacetone alcohol	EPDM - IIR
Diacetone	EPDM - IIR
Dibenzyl ether	EPDM - IIR
Dibromodifluoromethane	FKM
Dibromoethylene	FKM
Dibromomethane	FKM
Dibutyl diethylene glycol	EPDM - IIR
Dibutyl ethylene glycol	EPDM - IIR
Dibutyl glycol	EPDM - IIR
Dibutyl phthalate	FKM - VMQ - EPDM
Dibutyl sebacate	FKM - EPDM
Dibutyl “carbitol”	EPDM - IIR
Dichloroacetic acid	EPDM - FKM
Dichlorobenzene	FKM
Dichlorodifluoromethane	FKM
Dichloroethane	FKM
Dichloroisopropyl ether	ACM
Dichloromethane	FKM - EPDM
Dicyclohexylamine*	NBR
Diethanolamine*	NBR
Diethylamine	VMQ
Diethylbenzene	FKM - FVMQ
Diethylene glycol acetate	EPDM - CR - NBR - FKM
Diethylene glycol	EPDM - CR
Diethylene glycol stearate	NBR
Diethyl ether	EPDM - IIR - NBR
Diglycol acetate	EPDM - CR - NBR - FKM
Diisobutylene	NBR - FKM
Diisopropyl benzene	FKM - FVMQ
Diisopropyl ketone	EPDM - IIR
Dimethylamine	EPDM - VMQ
Dimethylaniline	EPDM
Dimethylformamide	EPDM
Dinitrotoluene*	FKM

***: extreme fluid:** No elastomer is unaffected in its presence: the specified product families are those with the least poor resistance.

Chemical specialities

Product	Recommended elastomers
Dioxalane	EPDM
Dioxane	EPDM - IIR
Dipentene	FKM - NBR
Diphenyl	FKM - FVMQ
Diphenyl oxide	EPDM - FKM
Diphenyl oxide	FVMQ - FKM
Dry cleaning products	FKM - FVMQ
Ethanolamine	EPDM - NBR - VMQ
Ethyl / diethyl sebacate	FKM - EPDM - VMQ
Ethyl acetate	EPDM
Ethyl acetoacetate	EPDM - IIR
Ethyl acetoacetate	EPDM - IIR
Ethyl acrylate*	EPDM - IIR
Ethyl aldehyde	EPDM - VMQ
Ethylbenzene	FKM - FVMQ
Ethyl benzoate	EPDM - FKM - FVMQ
Ethyl cellulose	NBR - CR - EPDM
Ethyl chloride	EPDM - NBR - FKM
Ethyl chlorocarbonate	FKM - FVMQ
Ethyl chloroformate	FKM - FVMQ
Ethylene chloride	FKM - FVMQ - EPDM
Ethylenediamine	EPDM - NBR - CR - VMQ
Ethylene glycol acetate	EPDM - IIR
Ethylene glycol acrylate*	EPDM - IIR
Ethylene oxide*	EPDM - IIR - VMQ
Ethyl formate	EPDM - FKM
Ethyl glycol acetate	EPDM - IIR
Ethyl glycol acetate	EPDM - IIR
Ethyl glycol acrylate*	EPDM - IIR
Ethyl glycol	EPDM - IIR
Ethyl lactate	NBR
Ethyl mercaptan	FKM
Ethyl pentachlorobenzene	FKM - FVMQ
Ethyl propyl acrolein	IIR
Ethyl silicate	EPDM - NBR - CR - FKM
Ferric chloride	EPDM - CR - NBR
Ferric nitrate	NBR - EPDM

Product	Recommended elastomers
Ferric sulphate	EPDM - NBR
Fluoboric acid	EPDM - NBR - CR
Fluoroacetic acid	EPDM - CR
Fluorobenzene	FKM - FVMQ
Fluorochloroethylene	FKM
Fluorosilicic acid	EPDM - CR - NBR
Fluorotrichloromethane	FKM
Formic acid	EPDM - CR
Formic aldehyde	EPDM - IIR - FKM - NBR
Furan*	EPDM
Furfural	EPDM - IIR - CR
Furfuran	EPDM - IIR
Furfurol	IIR - EPDM
Gallic acid	FKM - FVMQ
Glycol acetate	EPDM - IIR
Hexachlorobenzene	FKM
Hexachlorocyclohexane	FKM
Hexachloroethane	FKM
Hexachlorophene	FKM
Hexanal	EPDM - IIR - VMQ
Hexene	NBR - FKM - CR
Hexyl alcohol	NBR - FKM - EPDM
Hexyl aldehyde	EPDM - IIR - VMQ
Hydrazine hydrate	IIR - EPDM
Hydrazine	IIR - EPDM
Hydrobromic acid	EPDM - FKM
Hydrocyanic acid	NBR - EPDM - FKM
Hydrofluoric acid	FKM - EPDM
Hydrogen sulphide	EPDM - NBR
Hydroquinone	EPDM - IIR - CR
Iodoform	EPDM - IIR
Isobutyl alcohol	EPDM - NBR - FKM
Isooctane	NBR - FKM
Isophorone	EPDM - IIR
Isopropyl acetate	EPDM - IIR
Isopropyl alcohol	EPDM - NBR
Isopropyl chloride	FKM - FVMQ

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Chemical specialities

Product	Recommended elastomers
Isopropyl ether	CR - NBR
Lactic acid	EPDM - NBR - CR
Lead acetate	EPDM - IIR
Lead nitrate	EPDM - NBR
Magnesium chloride	EPDM - NBR
Magnesium hydroxide	EPDM - CR - IIR
Magnesium sulphate	EPDM - NBR
Maleic acid	FKM
Maleic anhydride	FKM
Malic acid	NBR - CR - VMQ
Mercuric chloride	EPDM - NBR
Mercurous chloride	EPDM - NBR
Mercury	All elastomers
Mesityl oxide	EPDM - IIR
Methacrylic acid	EPDM - CR - FKM
Methyl / dimethyl phthalate	EPDM - IIR
Methyl acetate	EPDM - IIR
Methyl acrylate*	EPDM - IIR
Methylacrylic acid	EPDM - CR - FKM
Methyl bromide	FKM - FVMQ
Methyl butyl ketone	EPDM
Methyl chloride	FKM - EPDM
Methyl cyanide	CR - EPDM - IIR
Methylcyclopentane	NBR - FVMQ - FKM
Methylene chloride	FKM - EPDM
Methyl formate	EPDM - IIR - CR
Methyl isobutyl ketone*	EPDM
Methyl methacrylate*	VMQ
Methyl oleate	NBR - FKM
Methyl salicylate	EPDM - IIR
Monochlorobenzene	FKM - FVMQ
Monochloroethane	FKM - EPDM - NBR - FVMQ
Monoethanolamine	EPDM - IIR - VMQ
Naphthenic acid	FKM - NBR
Naphthoic acid	FKM - NBR - FVMQ
Nickel acetate	EPDM
Nickel chloride	EPDM - NBR
Nickel sulphate	EPDM - NBR

Product	Recommended elastomers
Nitrobenzene	FKM - EPDM
Nitroethane	EPDM - IIR
Nitrogen peroxide*	IIR - EPDM
Nitromethane	EPDM - IIR
Nitropropane	EPDM - IIR
Nitrotoluene	FKM
Octane	NBR - FKM - FVMQ
Octyl / dioctyl phthalate	NBR - EPDM
Octyl / dioctyl sebacate	FKM - EPDM
Octyl acetate	EPDM
Octyl adipate	NBR - FVMQ
Octyl alcohol	FKM - EPDM
Oleic acid	EPDM - NBR - FKM
Oxalic acid	EPDM - NBR - FKM
Palmitic acid	NBR - CR - EPDM
Paradichlorobenzene	FKM - FVMQ
Perchloric acid	EPDM - FKM
Perchlorobenzene	FKM
Perchloroethylene	FKM - FVMQ
Petroleum ether	NBR - FKM
Phenol	FKM - EPDM
Phenylhydrazine	FKM
Phorone	EPDM - IIR
Picric acid, pure	FKM
Picric acid in solution	NBR - EPDM
Pinene	FKM - NBR
Polyglycols	EPDM
Potassium acetate	EPDM - IIR
Potassium chloride	EPDM - NBR
Potassium cyanide	EPDM - NBR
Potassium nitrate	EPDM - NBR
Potassium sulphate	EPDM - NBR
Propionic acid	IIR - EPDM - FKM
Propyl acetate	EPDM - IIR
Propyl alcohol	EPDM - NBR
Propyl chloride	FKM
Propylene chloride	FKM
Propylene glycol	EPDM - IIR

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Chemical specialities

Product	Recommended elastomers
Prussic acid	NBR - EPDM - FKM
Pyridine	IIR - EPDM
Pyroligneous acid	EPDM - CR
Pyrrole	VMQ - FVMQ
Salicylic acid	EPDM - NBR - FKM
Sebacic oils	NBR - FKM
Sewage	EPDM - NBR - IIR
Silicic oils	CR - FKM - FVMQ
Silicone oil	All elastomers except VMQ
Silicones (oils and greases)	All elastomers except VMQ
Sodium acetate	EPDM - IIR
Sodium bicarbonate	NBR - EPDM - IIR
Sodium borate	EPDM - NBR - FKM
Sodium carbonate	EPDM - NBR
Sodium chloride	NBR - EPDM
Sodium cyanide	EPDM - NBR
Sodium hypochlorite	EPDM
Sodium metaphosphate	EPDM - IIR - NBR
Sodium nitrate	EPDM - IIR
Sodium perborate	EPDM - IIR
Sodium peroxide	EPDM - IIR - FKM
Sodium phosphate	EPDM - NBR
Sodium silicate	EPDM - NBR - CR - FKM
Sodium sulphate	EPDM - NBR
Sodium thiosulphate	EPDM - NBR
Stannous chloride	NBR - FKM
Stearic acid	EPDM - NBR - CR
Stearine	EPDM - NBR - CR
Styrene	FKM - FVMQ
Sulphur chloride	FKM - FVMQ
Sulphur	EPDM - IIR - FKM
Sulphur hexafluoride	CR - EPDM - IIR
Sulphuric anhydride	FKM - EPDM
Sulphurous acid	FKM
Sulphurous anhydride	FKM - EPDM
Tannic acid	EPDM - NBR - CR - FKM
Tannin	EPDM
Tartaric acid	NBR - EPDM - CR - FKM

Product	Recommended elastomers
Terpene	FKM
Terpineol	FKM
Terpinolene	FKM
Tetrabromoethane	FKM - FVMQ
Tetrabromomethane	FKM - FVMQ
Tetrachloroethane	FKM - FVMQ
Tetrachloroethylene	FKM - FVMQ
Tetrachloromethane	FKM - FVMQ
Tetraethyl lead	NBR - FKM - FVMQ
Tetrahydrofuran	EPDM - IIR
Tetrahydronaphthalene	FKM - FVMQ
Thionyl chloride	FKM
Thymol	EPDM
Titanium tetrachloride	FKM - FVMQ
Toluol	FKM - FVMQ
Triacetin	EPDM - NBR - CR
Triacetin glycerol	EPDM - NBR - CR
Tributyl phosphate	EPDM - IIR
Tributylphosphate	EPDM - IIR
Trichloroacetic acid	EPDM - NBR - CR
Trichloroethane	FKM - FVMQ
Trichloroethylene	FKM - FVMQ
Trichlorofluoromethane	FKM - FVMQ
Tricresyl phosphate	EPDM - FKM
Tricresyl phosphate	EPDM - FKM
Triethanolamine	NBR - EPDM - CR - IIR
Triethylamine	CR
Trinitrotoluene	FKM - CR - FVMQ
Trioctyl phosphate	EPDM - FKM
Trioctylphosphate	EPDM - FKM
Turpentine	NBR - FKM - FVMQ
Vinyl acetate	EPDM - IIR
Vinyl chloride	FKM - EPDM
Vinylidene chloride	FKM
Xylidine*	NBR
Zinc acetate	EPDM - IIR
Zinc chloride	EPDM
Zinc sulphate	EPDM - NBR

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3.6 – Official market approvals

3.6.1 – Food

To ensure consumer safety, the regulations concerning rubbers coming in contact with water or food products for human consumption have changed considerably in recent years. The changes have strengthened requirements and led to systematic checks on parts and means of production.

With its dedicated teams of experts, Hutchinson is able to understand and monitor these regulations and can offer compounds with the most recent approvals for drinking water or food.

Official certificates are provided to our customers on request.

Decree of 25.11.1992 (France)

Order concerning silicone materials and products in contact with foodstuffs, food products and beverages.

Decree of 05.08.2020 (France)

Order concerning rubber materials and products in contact with foodstuffs, food products and beverages. (replace the decree 09.11.94)

FDA (USA)

Compliance with FDA requirements for components of articles intended for contact with foodstuffs, in particular FDA-21CFR §177.2600 “Rubber articles intended for repeated use”.

European regulations (EC)

Compliance with EC Regulations No. 1935/2004 of 27.10.2004 and No. 2023/2006 of 22.12.2006.

Family	Compound	Hardness Sh.A	FDA	FR Order 25.11.92	FR Decree 05.08.2020	EC 1935/2004
EPDM	6EP1862	60	✓		✓	✓
EPDM	7EP1197	70	✓		✓	✓
EPDM	EP856	80	✓		✓	✓
Silicone	6SL2136	63	✓	✓		✓
Silicone	6SL2136	64	✓	✓		✓

3.6.2 – Drinking water

ACS (France)

Health certificate certifying materials and equipment in contact with water for human consumption.

DM 174 (Italy)

Migration tests, according to Ministerial Decree 06.04.2004 N174 for use in contact with drinking water on vulcanised rubber sheets.

EN681-1 (Europe)

Requirements for vulcanised elastomer seals for drinking water pipes.

KIWA BRL17504 II and III (Netherlands)

Certifies vulcanised elastomer products for cold and hot drinking water applications in accordance with BRL 17504.

NSF 61 (United States)

Certifies the compliance of components of drinking water systems and their effects on health as required by the standard.

ÖNORM (Austria)

Guarantees limited bacterial growth to prevent infections from hot water networks.

UBA Leitlinie / KTW (Germany)

UBA replaces KTW and specifies the requirements for elastomers in contact with drinking water, as defined by the independent German body DVGW.

W270 (Germany)

Bacteriological growth standard supplementing the KTW certificate in accordance with DVGW sheet W270. Testing and certification by TZW.

W534 (Germany)

Certifies elastomer materials used in drinking water installations with or without coating in accordance with DVGW sheet W534.

WRAS (Great Britain)

Suitability of non-metallic products for use in contact with drinking water in accordance with standard BS 6920-1 / 2000.

Family	Compound	Hardness Sh.A	ACS	DM174	EN681-1	KIWA BRL 17504 II and III	UBA	W270	W534	NSF / ANSI61	ÖNORM	WRAS
NBR	7PD1612	74	✓	✓			✓	✓		✓		✓
EPDM	EP856	80	✓	✓	✓		✓	✓	✓			✓
EPDM	6EP1862	60	✓	✓				✓				✓
EPDM	7EP1197	70	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

3.6.3 – Domestic gas

Family	Compound	Hardness Sh.A	EN 549	EN 682
NBR	6PB1729	61	H3B1	
NBR	PB701	68	H3B2	
NBR	7PB1871	69		GBL
NBR	7PB496	69	H3B1	
NBR	7PD1612	74	H3B2	
NBR	PC851	78	H3B1	
FKM	DF701	68	H3E1	
FKM	7DF2075	78	H3E1	
FKM	DF801	79	H3E1	H80
HNBR	7DT1870	66	H3C1	
HNBR	7DT2146	70	H3D2	GBL
HNBR	7DT2080	75	H3C1	
ACM	DA65	55	H2C1	
ACM	DA80	75	H3C1	
VMQ	SL1002	60	H2E2	
VMQ	SL1000	72	H3E2	

EN 549

European Directive certifying rubber materials for seals and diaphragms for gas appliances and gas equipment

EN 682

European Directive certifying materials for seals used in pipes and fittings carrying gas and hydrocarbon fluids.

3.6.4 – NGV and LPG fuels

Our 7DF2371 and 7DT2373 compounds respond to the latest market developments and offer optimal behaviour at very low temperature and under the high pressure of natural gas engines.

Both compounds have been tested by TÜV and received ECE R110, ISO 15500-2 and ANSI NGV3.1-2014 certifications.

ECE R110

Regulation No. 110 of the Economic Commission for Europe of the United Nations (UN/ECE) Uniform provisions concerning the approval of (i) specific components of motor vehicles using compressed natural gas (CNG) in their propulsion system; (ii) vehicles with regard to the installation of specific components of an approved type for the use of compressed natural gas (CNG) in their propulsion system.

ISO 15500-2

Specifies the performance and general test methods for components of compressed natural gas (CNG) fuel systems.

ANSI NGV 3.1-2014

Requirements for components of recently produced compressed natural gas fuel systems for use on natural gas vehicles.

Family	Compound	Hardness Sh.A	ECE R110	ISO 15500-2	ANSI NGV 3.1-2014
FKM	7DF2371	73	✓	✓	✓
HNBR	7DT2373	77	✓	✓	✓

3.6.5 – Oil & Gas

Numerous HNBR and FKM compounds have been tested and certified to NORSOK M-710 and TOTAL PVV-142 for their resistance to rapid gas decompression (RGD).

Other NBR, HNBR and FKM compounds are also suitable for oil & gas applications. Some are kept in stock.

NORSOK M-710

The Norsok M-710 standard, developed by the Norwegian oil industry, defines the requirements for elastomer sealing materials for permanent underwater use, such as well completion, Christmas trees (oil wells), valves and control systems, as well as topside valves in critical gas systems.

TOTAL PVV-142

The TOTAL PVV-142 standard defines the requirements and procedures for testing the resistance of sealing materials to rapid gas decompression.

Family	Compound	Vulcanisation	Hardness (Sh.A)	Norsok M-710	Total PVV-142
HNBR	T49/TED	Peroxide	98	✓ 1	✓ 3
HNBR	T48/TED	Peroxide	90		✓ 3
FKM	T57/VED	Bisphenol	90	✓ 1	✓ 3
FKM	T57/GED	Peroxide	90	✓ 1	✓ 3
FKM	T57/FED	Peroxide	90		✓ 3
FKM	V95	Peroxide	95	✓ 1	✓ 4-5-6
FKM	T58/VED	Bisphenol	98	✓ 1-2	✓ 3
FKM	T58/GED	Peroxide	98	✓ 1	✓ 3
FKM	T58/FED	Peroxide	98	✓ 1-2	✓ 3

RGD test conditions

Tests performed on O-ring No. 312 (15.24 x 5.33):

Norsok M710B - CH_4 / CO_2

1. 90/10; 150 bar, 100°C
2. 90/10; 150 bar, 120°C

Total GS PVV 142 03/01 - CH_4 / CO_2

3. 80/20; 190 bar, 75°C
4. 80/20; 400 bar, 90°C
5. 80/15; 5% H_2S, 400 bar, 90°C
6. 80/20; 400 bar, 120°C

3.6.6 – Other regulations

Our compounds comply with the European regulations in force at the date of printing this catalogue.

REACH

Compliance with European Regulation No. 1907/2006, protecting human health and the environment from risks related to chemical substances.

RoHS

Compliance with the European RoHS Directive (2002/95/EC) which aims to limit the use of six hazardous substances in electrical and electronic equipment.

Heavy metals

European Directive 94/62/EC.
Free from cadmium, lead, mercury, chromium VI.

Phthalate free

Free of phthalates.

Some of our compounds also meet the following requirements:

USP Class VI

In vivo and in vitro biological safety tests according to USP, NF39 chapters <87> and <88> and compliance with the bio-compatibility requirements for Class VI plastics.

BSE compliant

The materials are free of Specified Risk Materials: Declaration on the Transmission of Bovine Spongiform Encephalopathy.

Latex free

Free of latex-containing products.

HUTCHINSON®

O-RINGS

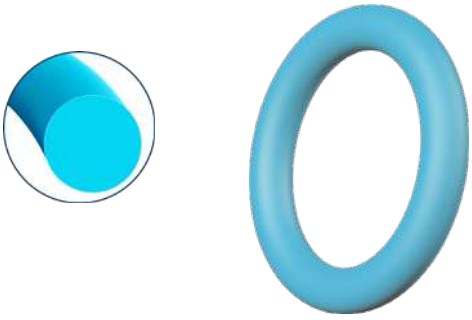
We make it ***possible***

1 – GENERAL INFORMATION

1.1 – Definition

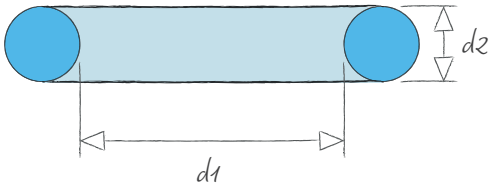
The O-Ring is a circular ring with a round cross section. It represents the simplest sealing system, combining:

- definition by two dimensions: inside diameter d1 and cross section diameter d2
- maximum effectiveness
- a groove that is easy to machine, of small size
- symmetry, avoiding the risk of incorrect fitting
- low cost



It can be used:

- in static or dynamic applications (slow rotary or reciprocating)
- for applications ranging from cryogenic to high temperatures, and commonly in the range - 50°C to + 250°C
- at pressures ranging from high vacuum up to 2,000 bar.



International standardisation makes it possible to guide users towards the most common sizes, generally kept in stock.

To ensure optimal performance of the O-Ring, it is important to choose the right compound and fit it according to the recommendations for use:

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

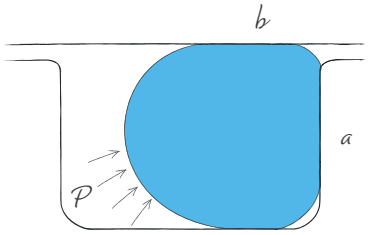
1.2 – Operation of an O-Ring

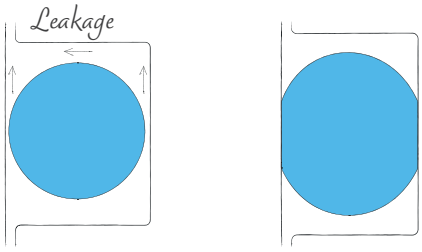
When an O-Ring fitted in a groove is subjected to pressure from a fluid, it is flattened on the opposite side from the pressure. The seal acts as a wedge in the angle that exists between contact surfaces a and b.

Sealing results from the combination of the deformation of the O-Ring and the elastic action of rubber.

The deformation of the O-Ring is a function of pressure; the higher the pressure p, the higher the contact forces at a and b. Sealing is reinforced by the pressure of the circuit.

The O-Ring is usually fitted in its groove with an initial compression rate (the depth of the groove is thus less than the cross section diameter of the O-Ring). The contact forces caused by the change in the O-Ring's shape make it possible to maintain its 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.





No initial compression rate *With initial compression rate*

1.3 – Groove design

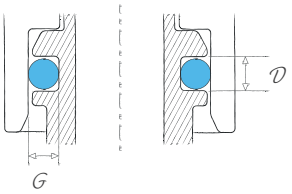
Since rubber is deformable, but incompressible, the volume of the groove must always be greater than the volume of the O-Ring in service. Consideration should be given to:

- the groove at the minimum tolerances
- the O-Ring at the maximum tolerances
- the possible swelling of the compound in contact with the fluid

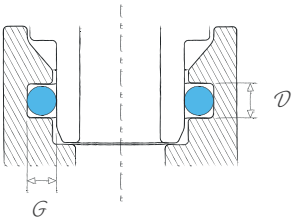
In order to maintain sufficient volume in the groove, the required width of the groove will be larger when the initial compression rate is higher.

2 – FITTING INSTRUCTIONS

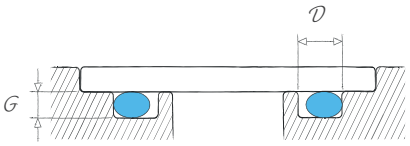
O-Rings are fitted in three main types of assembly:



Shaft fitting radial compression



Bore fitting radial compression



Cover fitting - axial compression

Compression

The compression is the compression of the O-Ring's cross section installed in its housing, which can be applied in a radial or axial direction:

- radial compression, perpendicular to the O-Ring axis (bore and shaft applications).
- axial compression, in the O-Ring axis (cover applications, internal or external pressure).

There are also mixed assemblies combining radial and axial compression, which is notably the case for triangular grooves. (see section 2.3 on page 67).

The compression rate corresponds to the deformation from flattening divided by the initial cross section.

$$\text{Compression rate (\%)} = \frac{\text{cross section Ø - depth of groove G}}{\text{cross section Ø}} \times 100$$

To guarantee sealing, a positive compression rate must be ensured over the entire range of dimensional tolerances of the O-Ring and its housing.

The recommended compression rate depends on the type of assembly and the application.

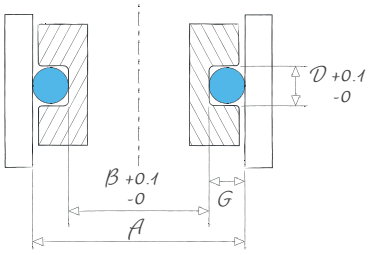
2.1 – Radial assembly shaft/bore

Shaft application

To avoid the risk of pinching of the seal during assembly, it is recommended to plan extension of the O-Ring.

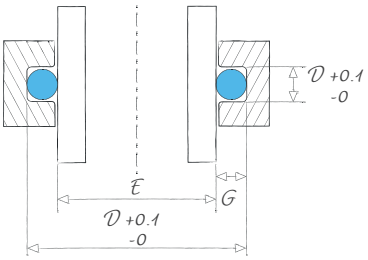
In practice, a 3% elongation is enough, but it is possible to go up to 10% without damaging it. This elongation causes a decrease in cross section diameter.

For X% elongation, the reduction in cross section diameter is approximately: $\frac{X}{2}$ %



Bore application

When the groove has been made in the bore, the O-Rings should be fitted with slight compression on their external diameter.



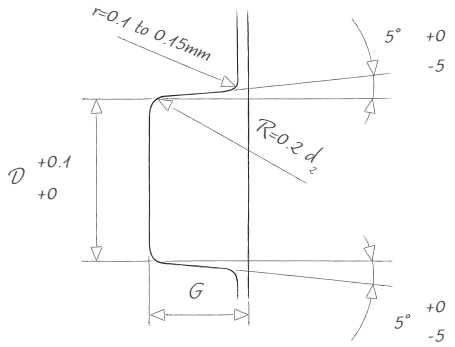
2.1.1 – Groove dimensions and shape for static applications

Rectangular grooves

In shaft / bore applications, the compression rate is radial and the grooves are usually rectangular. The lead angles and the base of the groove should be rounded.

The dimension R is indicated in terms of the cross section diameter d2. Dimensions D and G are shown in the table below.

The grooves may have parallel walls or a taper of up to 5°, which is added to the dimensions on each side of the groove.



Groove dimensions for radial (shaft / bore) assembly in static applications

Determination of groove dimensions in static applications - radial assembly shaft/bore

The table opposite shows the groove dimensions for the most common cross section diameters (see diagrams page 68).

Shaft application - Calculation of dimension B

B = A - 2G

Bore application - Calculation of dimension H

H = E + 2G

While the dimensions shown will suit most applications, the combined effects of temperature, pressure and the fluid mean that validation by testing is required (O-Ring compound and dimensions).

Dimensional tolerance of O-Rings: refer to section 6.3 on page 14 of this catalogue.

See the list of sizes on page 72 with O-Rings sorted by increasing inside diameter.

For clearance fit, the ISO H7f7 (pressure < 80 bar) and ISO H7g6 (pressure > 80 bar) tolerances can be allowed.

NOTE: Dimensions for cross section diameters not shown in the table may be found by interpolation between two existing values.

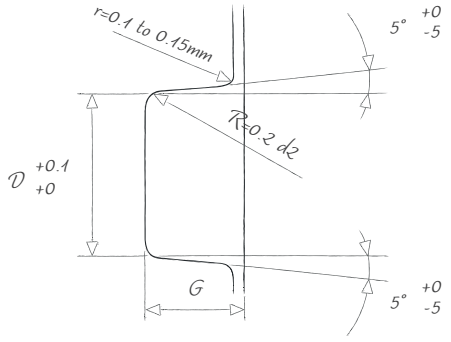
Cross section Ø d2 (mm)	D (mm) +0.1-0	G (mm)
1.00	1.40	0.78
1.25	1.70	0.98
1.50	2.10	1.18
1.60	2.20	1.26
1.78	2.40	1.41
1.90	2.60	1.51
2.00	2.70	1.59
2.20	3.00	1.75
2.40	3.30	1.91
2.50	3.40	2.00
2.62	3.60	2.10
2.70	3.70	2.16
3.00	4.10	2.42
3.15	4.30	2.54
3.53	4.80	2.84
3.60	4.90	2.92
4.00	5.40	3.26
4.50	6.10	3.67
5.00	6.80	4.10
5.33	7.10	4.35
5.70	7.70	4.70
6.00	8.10	4.98
6.99	9.50	5.84
8.00	10.80	6.85

2.1.2 – Groove dimensions and shape for dynamic applications - reciprocating

O-Rings can be fitted either on the shaft or in the bore.

For dynamic sealing, the compression rate must be lower than for static applications (deeper groove).

Deviations can be considered for each application to favour one or more of the operating criteria (e.g. reduced assembly force, lower friction, etc.).



Groove dimensions for radial (shaft / bore) assembly in dynamic applications.

Determination of groove dimensions in dynamic applications - radial shaft / bore assembly

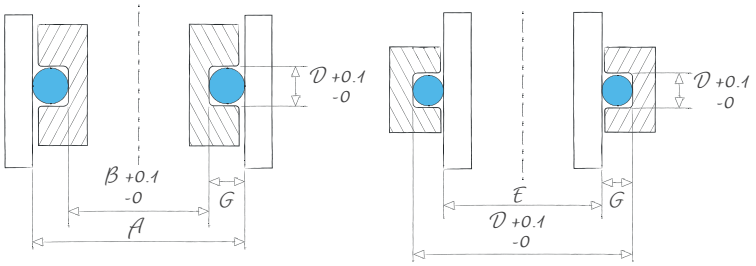
The table opposite shows the groove dimensions for radial (shaft / bore) assembly in dynamic applications for the most common cross section diameters.

Shaft application - Calculation of dimension B

B = A - 2G

Bore application - Calculation of dimension H

H = E + 2G



Shaft assembly *Bore assembly*

While the dimensions shown will suit most applications, the combined effects of temperature, pressure and the fluid mean that validation by testing is required (O-Ring compound and dimensions).

Dimensional tolerance of O-Rings: refer to section 6.3 on page 14 of this catalogue.

Clearance fit: we recommend ISO H7/g6 tolerances.

Cross section Ø d2 (mm)	D +0.1-0	G (mm)
1.00	1.30	0.80
1.25	1.60	1.00
1.50	2.00	1.20
1.60	2.10	1.29
1.78	2.30	1.45
1.90	2.50	1.56
2.00	2.60	1.65
2.20	2.80	1.84
2.40	3.10	2.01
2.50	3.20	2.11
2.62	3.30	2.21
2.70	3.40	2.28
3.00	3.80	2.57
3.15	4.00	2.68
3.53	4.50	3.02
3.60	4.60	3.08
4.00	5.00	3.46
4.50	5.60	3.94
5.00	6.20	4.37
5.33	6.60	4.67
5.70	7.10	4.99
6.00	7.50	5.28
6.99	8.70	6.15
8.00	10.00	7.05

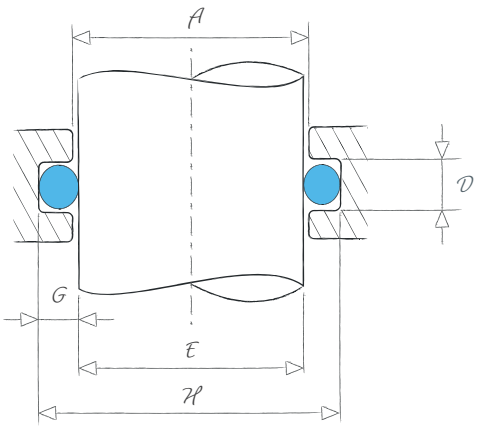
NOTE: Dimensions for cross section diameters not shown in the table may be found by interpolation between two existing values.

2.1.3 – Groove dimensions and shape for dynamic applications - low-speed rotary

Due to heat effects caused by the speed of rotation, the use of O-Rings is generally recommended only for low-speed or occasionnal rotative applications, such as 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:

- Choose an O-Ring with an inside diameter (d1) no more than 5% greater than the shaft diameter (E).
- The O-Ring will be subject to radial compression of 5 to 10%. The depth of the groove must therefore be 5 to 10% less than the cross section diameter d2 of the O-Ring.
- The width of the groove must be 5% greater than the cross section diameter d2 of the O-Ring.



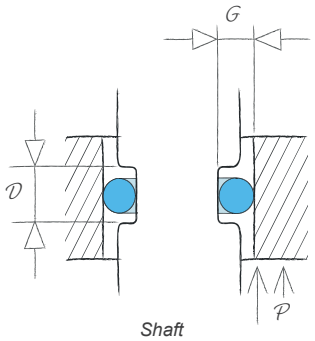
2.1.4 – Groove dimensions and shape for dynamic applications - floating assembly

Floating assembly is reserved for circuits that can tolerate a leak at start-up (non-toxic gases), such as a compressed air tools.

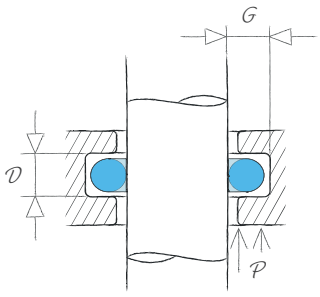
In the case of low-pressure air (10 bar max.), a floating assembly may offer a low coefficient of friction:

- The grooves are machined in such a way that the O-Ring cross section is not compressed when the assembly is at rest and without pressure.
- The inner or outside diameter of the O-Ring is in permanent contact with the floating section.

The table below specifies the D and G dimensions to be observed for the most commonly used cross section diameters d2 (use extrapolation for intermediate cross section diameters).



Shaft



Bore

Groove dimensions and shape

Cross section Ø d2 (mm)	D (mm)	G (mm)
1.90	2.00	2.20
2.70	2.80	3.00
3.60	3.75	4.00
5.33	5.50	5.80
6.99	7.25	7.50

Selection of O-Rings for floating assembly

Shaft application

O-Ring outer ø = bore ø +1 to 2%

Bore application

O-Ring inner ø = shaft ø -1 to -2%

2.2 – Axial cover assembly

2.2.1 – Groove dimensions and shape - rectangular grooves

In cover assemblies, the compression rate is axial and the grooves are usually rectangular. The lead angles and the base of the groove should be rounded.

The dimension R is indicated in terms of the cross section diameter d2. Dimensions D and G are shown in the table opposite.

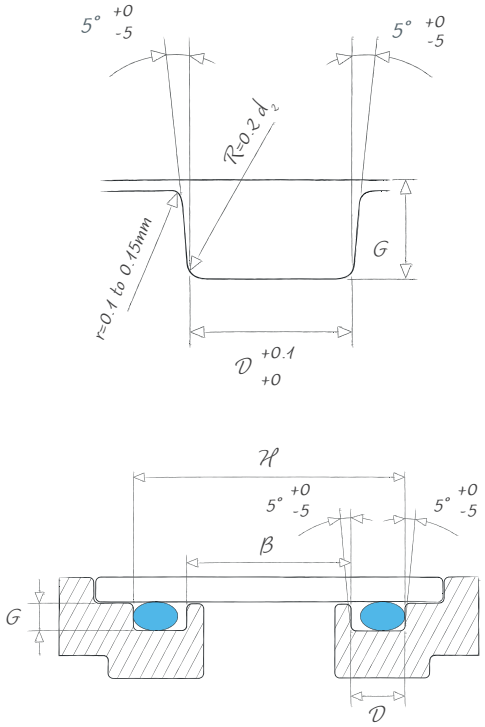
The grooves may have parallel walls or a taper of up to 5°, which is added to the dimensions on each side of the groove.

If pressure is exerted:

- from the inside towards the outside: the O-Ring will have an outside diameter slightly greater than dimension H, against which it will be seated (see diagram).
- from the outside towards the inside: the O-Ring will be fitted slightly stretched, seated against dimension B.

While the dimensions shown will suit most applications, the combined effects of temperature, pressure and the fluid mean that validation by testing is required (O-Ring compound and dimensions).

Dimensional tolerance of O-Rings: refer to section 6.3 on page 14 of this catalogue.



Groove dimensions for axial assembly (cover)

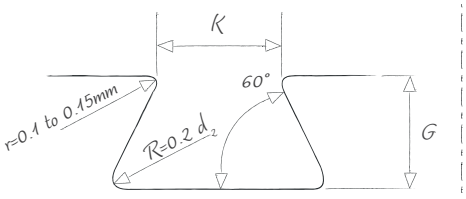
Cross section Ø d2 (mm)	D +0.1 -0	G (mm) +0.1 -0
1.78	2.60	1.25
1.90	2.80	1.35
2.00	2.90	1.45
2.20	3.20	1.60
2.40	3.40	1.75
2.50	3.60	1.85
2.62	3.80	1.95
2.70	3.90	2.00
3.00	4.30	2.15
3.15	4.50	2.35
3.53	5.00	2.70
3.60	5.10	2.75
4.00	5.60	3.10
4.50	6.30	3.50
5.00	6.70	3.90
5.33	7.40	4.20
5.70	7.90	4.50
6.00	8.30	4.80
6.99	9.70	5.70
8.00	11.00	6.55

NOTE: Dimensions for cross section diameters not shown in the table may be found by interpolation between two existing values.

2.2.2 – Groove dimensions and shape - dovetail grooves

To be used when the O-Ring is to be held in its groove to prevent it from falling, e.g. a door seal.

Cross section Ø (mm)	K (mm) -0.05	G (mm) +/-0.05	R (mm)	r (mm)
1.78	1.27	1.42	0.2	0.10
2.62	2.03	2.16	0.3	0.15
3.53	2.82	2.92	0.3	0.15
5.33	4.90	4.00	0.5	0.25
6.99	6.40	5.20	0.7	0.30
8.00	7.30	6.00	0.8	0.40

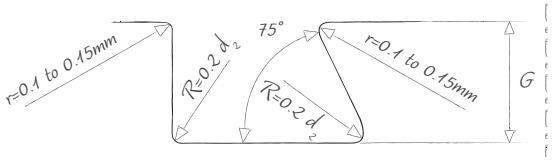


2.2.3 – Groove dimensions and shape - half-dovetail grooves

If the O-Ring must be held firmly in its groove without risk of falling, it may be easier to create a half-dovetail groove, and this will make the O-Ring easier to fit.

The seal is significantly stretched to be held in the side of the groove at 75°.

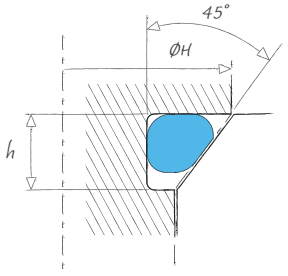
This groove is therefore a combination of a dovetail groove on one side and a rectangular groove on the other. The undercut angle is 75°. This type of groove can be used when machining the end of a tube to fit an O-Ring.



2.3 – Triangular grooves

The outside diameter of the O-Ring will be slightly greater than the outside diameter of the chamfered section, dimension H, against which it will be seated.

h = cross section Ø d2 of the O-Ring x 1.35 to 1.40



3 – ADDITIONAL TECHNICAL INFORMATION

3.1 – Tolerances and fit

Dynamic usage

We recommend an H7g6 mechanical fit.

An O-Ring used for sealing purposes should not be used as a guide in a moving assembly. Moving parts must be guided using a mechanical seating.

Static usage

Pressure below 80 bar: ISO H7f7 tolerances can be allowed.

Pressure above 80 bar:
We recommend ISO H7g6 tolerances.

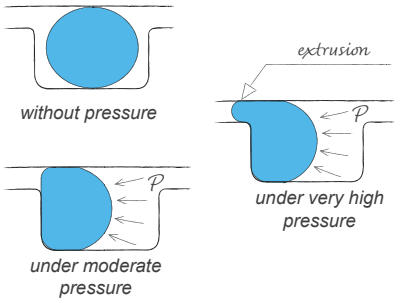
3.2 – Mechanical clearance - extrusion

Extrusion is the passage of material into the mechanical clearance.

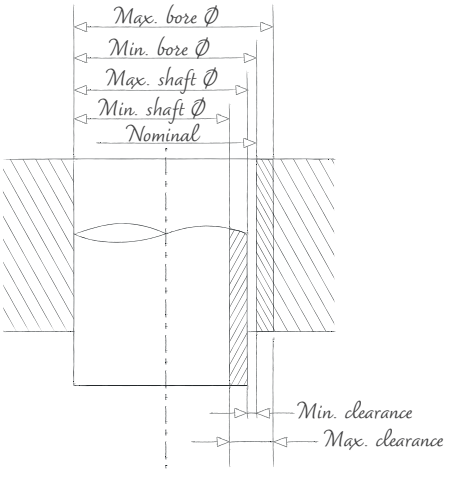
Pressure pulses, high temperatures, chemical incompatibility of the rubber, rapid translational motion and long strokes – and a combination of these factors – can exacerbate O-Ring extrusion.

There are several solutions to prevent extrusion:

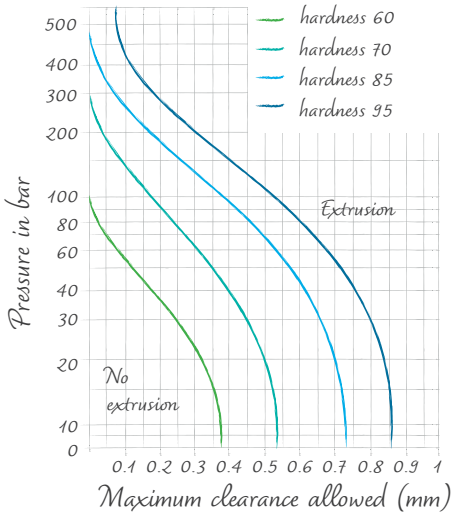
- Reduce the clearance fit: the risk of extrusion is zero if there is no clearance
- Increase the hardness of the rubber
- Check the flatness of the assembled parts (in the case of a cover application)
- Use an anti-extrusion washer (back-up ring)



The higher the pressure, the more the clearance needs to be reduced, the more the hardness needs to be increased.



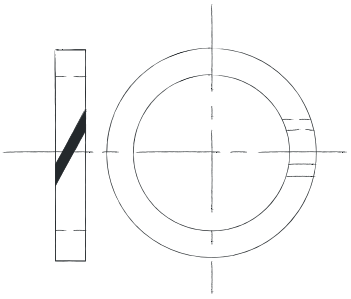
Graph showing the extrusion of an O-Ring according to the hardness of the rubber, the clearance fit and the pressure. These values are to be put into perspective for small cross section diameters.



Anti-extrusion washer ("Back-up Ring")

The back-up ring is made of PTFE, a material with excellent chemical inertness and an extremely low coefficient of friction. It extends the useful life of O-Rings in high-pressure applications.

Back-up rings are rectangular in cross section. They are split for fitting in unopened grooves.



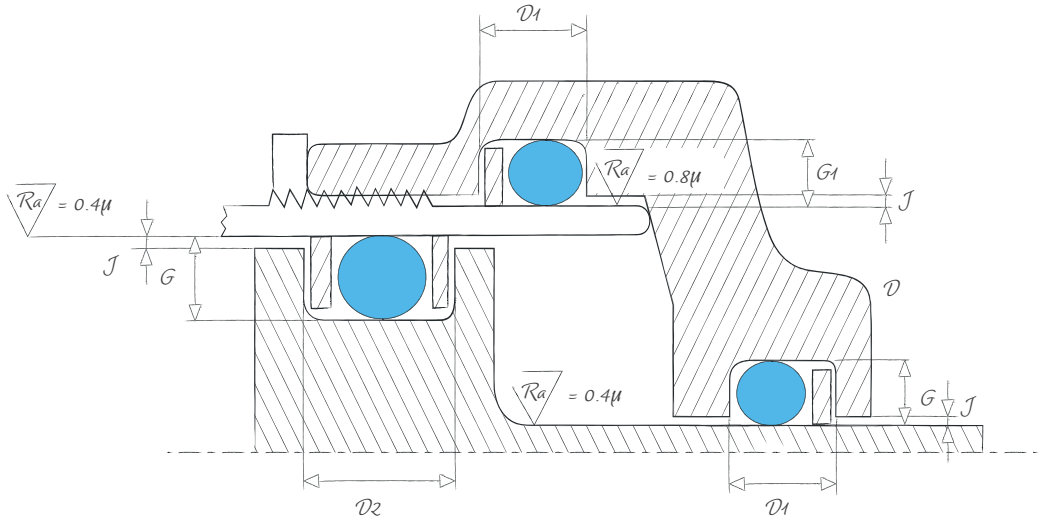
Fitting back-up rings

The width of the groove D must be increased by the thickness of one back-up ring (D1) or two back-up rings (D2).

This applies in static or dynamic assemblies.

Groove dimensions

Cross section Ø (mm)	J max. (mm)	G or G1 (mm)
1.78 - 1.90	0.13	1.55
2.62 - 2.70	0.13	2.30
3.53 - 3.60	0.15	3.20
5.33 - 5.35	0.15	4.75
6.99 - 7.00	0.18	6.10



3.3 – Surface roughness

In fully static assemblies, with no moving parts in contact with the O-Ring, a surface roughness Ra in the range 0.8-1.6µ is sufficient.

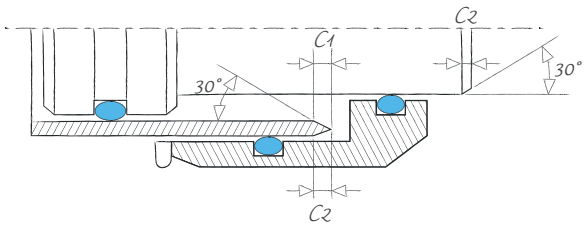
A surface roughness Ra of 0.4µ is recommended for O-Rings subject to internal micro-friction (or friction on the housing wall) during deformation due to variations in fluid pressure or temperature.

To obtain a very good level of sealing with gases, particular attention should be paid to the surface roughness (Ra 0.2 to 0.4µ). The same is true to obtain a high vacuum.

The surface roughness can be improved with a polished or burnished finish, which smooths out the peaks.

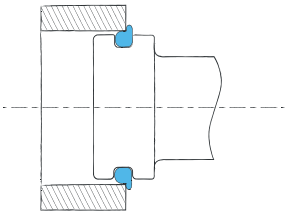
3.4 – Chamfers

Lead-in chamfers are essential to avoid damaging the O-Rings during installation. An angle of 20 to 30° represents the best compromise.



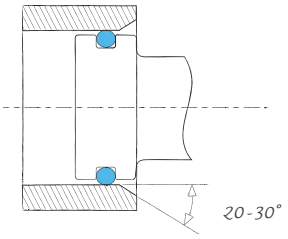
Chamfer dimensions

Cross section Ø (mm)	C1 (mm) cylinder	C2 (mm) shaft
≤ 3.60	1.5	2.5
from 3.61 to 5.33	2.5	4.0
> 5.33	3.0	4.0

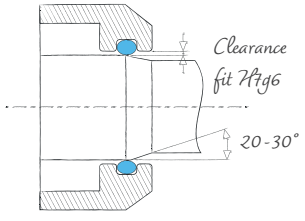


Pinching of the O-Ring due to the absence of chamfers

Shaft assembly

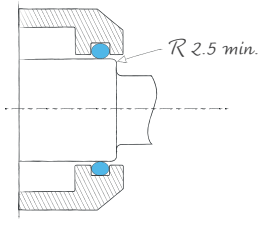


Recommended chamfers



Recommended chamfers

Bore assembly



Recommended radius

3.5 – Installation

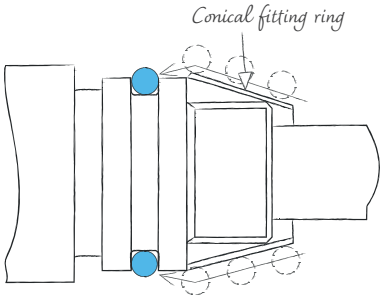
Take particular care to ensure that the workspace is clean, avoiding dusty environments.

Use blunt tools, without sharp edges.

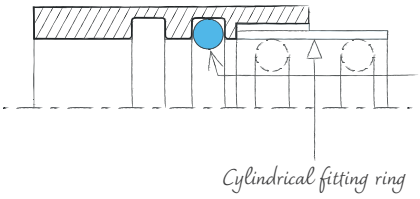
Insert the O-Ring into the groove, sliding it into position while taking following precautions:

- avoid passing it over rough areas, threads, or sharp edges: use conical or cylindrical fitting rings, as shown in the sketches opposite
- do not distort the O-Ring by rolling, oscillating or twisting it
- avoid excessive stretching of the O-Ring

Make sure that the O-Ring is correctly positioned, making particularly sure that there is no twisting in relation to the flash line.



Protection against a thread

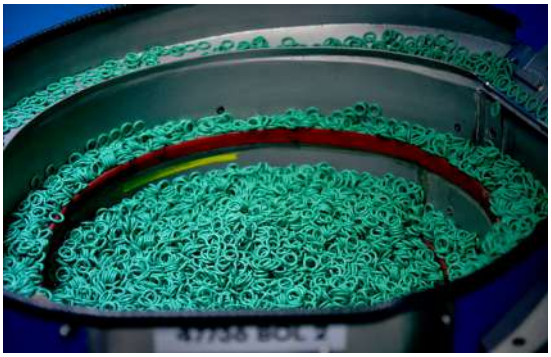


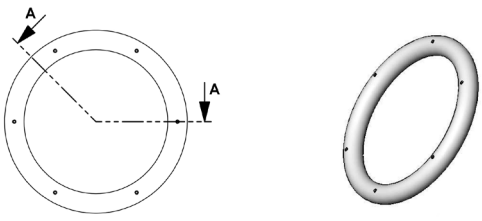
Protection against a tapping

3.6 – Automated installation

Various solutions are offered to improve supply to installation machines:

- Surface treatments: sliding is made easier by reducing the friction force. (see page 22)
- Specific packaging to ensure the flatness of the O-Ring during handling and storage: under a plastic shell, on a tube, or in an inflated bag. (see page 16)
- Picot seals: a specially designed surface facilitates the fitting and sliding of seals in distribution systems by preventing seals from sticking to each other and forming tubes.





4 – SIZE CHARTS

The following list of dimensions gives the standard codes kept in stock for more than 1.000 sizes and in our eight standard compounds.

The nominal dimensions of the O-Rings in the catalogue are valid for PB701 and PC851 compounds.

Other compounds show slightly different shrinkage, which can lead to variations in the nominal dimensions.

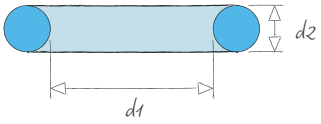
Dimensions		Standard compound codes				NEW			
Inner Ø d1 (mm)	Cross-section Ø d2 (mm)	PC851	PB701	EP851	DF801	7EP1197	EP856	7DF2067	7PD1612
0.74	1.00	100100	100101	100103	100104				
1.07	1.27	101203	101204	101206	101207				
1.15	1.00	101100	101101	101103	101104	101088	101089	101090	101091
1.25	1.25	101213	101214	101216	101217				
1.40	1.25	101218	101219	101221	101222				
1.42	1.52	101300	101301	101303	101304				
1.60	1.25	101223	101224	101226	101227				
1.60	1.60	101400	101401	101403	101404				
1.78	1.78	101405	101406	101408	101409				
1.80	1.00	101105	101106	101108	101109				
1.80	1.25	101228	101229	101231	101232				
1.80	1.50	101305	101306	101308	101309				
1.90	2.55	101710	101701	101711	101702				
2.00	1.25	102200	102201	101233	101234				
2.00	1.60	102400	102401	101415	101416				
2.06	2.62	102746	102747	102701	102748				
2.20	1.00	102146	102145	102147	102144				
2.20	1.60	102403	102404	102406	102407	102313	102314	102315	102316
2.40	1.90	102413	102414	102416	102417	102317	102318	102319	102320
2.50	1.25	102210	102211	102212	102213				
2.50	1.60	102418	102419	102421	102422				
2.57	1.78	102423	102424	102426	102427				
2.60	1.00	102100	102101	102103	102104				
2.60	1.90	102428	102429	102431	102432	102321	102322	102323	102324
2.75	1.60	102433	102434	102436	102437	102325	102326	102327	102328
2.84	2.62	102749	102750	102751	102752				
2.90	1.20	102217	102218	102219	102220				
2.90	1.78	102443	102444	102446	102447	102264			102286
3.00	1.00	103109	103127	103128	103126				
3.10	1.60	103403	103404	103406	103407				
3.30	2.40	103600	103601	103603	103604				

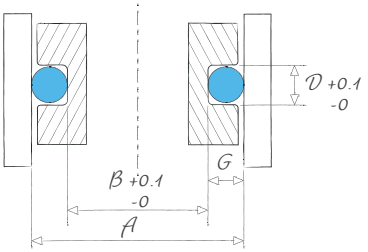
NEW

We have added new standard codes for four compounds.

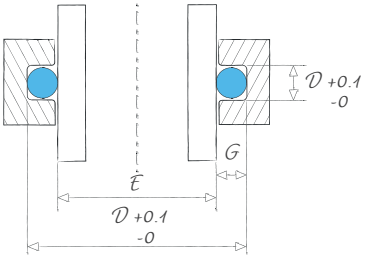
Custom development on request

Dimensional standards	Shaft		Bore		Dynamic app.	Two-part groove assembly
	A min.	A max.	E min.	E max.		
BS1806-001 / AS568-001	2.34	2.41	0.73	0.84	□	△
BS1806-002 / AS568-002	3.10	3.20	1.18	1.29	□	△
R000	2.75	2.85	1.20	1.30	□	△
	3.25	3.36	1.34	1.45	□	△
	3.40	3.53	1.47	1.59	□	△
BS1806-003 / AS568-003	3.88	4.01	1.51	1.64	□	△
	3.60	3.74	1.65	1.77	□	△
	4.19	4.34	1.68	1.82	□	△
BS1806-004 / AS568-004	4.66	4.82	1.87	2.03	□	△
	3.40	3.56	1.78	1.90	□	△
	3.80	3.96	1.83	1.96	□	△
	4.20	4.36	1.87	2.02	□	△
	6.18	6.36	1.95	2.16	□	△
	4.00	4.18	2.01	2.14	□	△
	4.59	4.77	2.04	2.19	□	△
BS1806-103 / AS568-103	6.46	6.65	2.24	2.46	□	△
	3.80	4.00	2.22	2.35	□	△
R00	4.79	4.99	2.32	2.48	□	△
R0	5.48	5.69	2.56	2.75	□	△
	4.50	4.73	2.55	2.70	□	△
	5.09	5.32	2.60	2.77	□	△
BS1806-005 / AS568-005	5.45	5.68	2.69	2.88	□	△
	4.20	4.43	2.59	2.72	□	
R1	5.68	5.91	2.75	2.94	□	△
R1 BIS	5.34	5.59	2.82	3.00	□	△
BS1806-104 / AS568-104	7.24	7.50	2.95	3.19	□	△
	4.82	5.08	2.90	3.06	□	△
BS1806-006 / AS568-006	5.78	6.04	3.00	3.19	□	△
	4.60	4.87	2.95	3.10	□	
	5.69	5.97	3.14	3.33	□	△
	7.28	7.58	3.39	3.63	□	△





Shaft



Bore

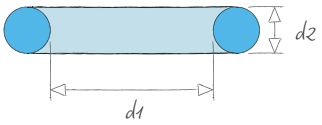
Key

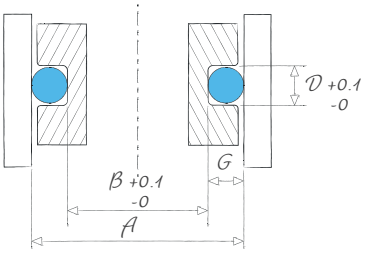
□ Recommended for dynamic applications

△ Two-part groove assembly required

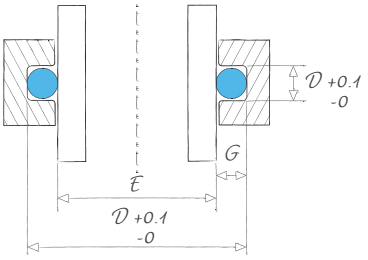
Dimensions		Standard compound codes				NEW			
Inner Ø d1 (mm)	Cross-section Ø d2 (mm)	PC851	PB701	EP851	DF801	7EP1197	EP856	7DF2067	7PD1612
3.35	1.60	103413	103414	103416	103417				
3.40	1.90	103500	103501	103503	103504	103219	103221	103222	103223
3.50	1.50	103314	103313	103129	103317				
3.55	1.60	103418	103419	103421	103422				
3.60	2.40	103605	103606	103608	103609				
3.68	1.78	103423	103424	103426	103427	103225	103226	103227	103228
3.75	1.60	103428	103429	103431	103432				
3.80	1.30	103318	103319	103320	103321				
4.00	1.00	104100	104102	103103	103112				
4.00	1.50	104300	104301	103300	103301				
4.00	1.80	104859	104860	104861	104862				
4.00	2.00	104500	104501	103505	103506				
4.10	1.60	104400	104401	104403	104404				
4.20	1.90	104503	104504	104506	104507	104280	104281	104282	104283
4.25	2.00	104508	104509	104511	104512				
4.30	2.40	104600	104601	104603	104604				
4.42	2.62	104129	104130	104132	104131				
4.47	1.78	104405	104406	104408	104409	104285	104286	104287	104288
4.50	1.00	104113	104112	104114	104115	104492			
4.50	1.50	104340	104310	104341	104342				
4.50	2.00	104513	104514	104516	104517				
4.65	2.62	104703	104705	104701	104746				
4.70	1.42	104303	104304	104306	104307	104290	104291	104292	104293
4.75	2.00	104518	104519	104521	104522				
4.90	1.90	104523	104524	104526	104527	104295	104296	104297	104298
5.00	1.00	105135	105123	105140	105138				
5.00	1.50	105300	105301	104308	104309				
5.00	1.80	105739	105740	105741	105742				
5.00	2.00	105500	105501	104528	104529				
5.00	2.50	105136	105137	105141	105139				
5.00	3.00	105800	105804	104812	104803				
5.10	1.60	105409	105400	105450	105451				
5.28	1.78	105401	105402	105404	105405	105291	105292	105293	105294
5.30	2.00	105515	105516	105518	105519				
5.30	2.40	105600	105601	105603	105604				
5.50	1.00	105120	105145	105146	105144				
5.50	1.50	105323	105324	105325	105326				
5.60	1.80	105429	105430	105431	105432				
5.60	2.40	105605	105606	105608	105609				
5.70	1.20	105201	105208	105209	105210				

Dimensional standards	Shaft		Bore		Dynamic app.	Two-part groove assembly
	A min.	A max.	E min.	E max.		
	5.94	6.24	3.37	3.57	☐	△
R2	6.48	6.78	3.47	3.69	☐	△
	5.90	6.22	3.52	3.71	☐	△
	6.14	6.46	3.55	3.75	☐	△
	7.58	7.91	3.66	3.91	☐	△
BS1806-007 / AS568-007	6.56	6.89	3.70	3.92	☐	△
	6.34	6.68	3.73	3.94	☐	△
	5.88	6.22	3.74	3.94	☐	
	5.60	5.92	3.86	4.04	☐	
	6.40	6.72	3.97	4.18	☐	
	6.92	7.24	4.00	4.23	☐	△
	7.32	7.64	3.96	4.20	☐	△
	6.69	7.02	4.05	4.27	☐	
R3	7.28	7.61	4.20	4.44	☐	△
	7.57	7.91	4.19	4.44	☐	△
	8.28	8.63	4.30	4.57	☐	△
BS1806-106 / AS568-106	8.82	9.18	4.39	4.68	☐	△
BS1806-008 / AS568-008	7.35	7.71	4.42	4.66	☐	
	6.10	6.46	4.32	4.51	☐	
	6.90	7.26	4.43	4.65	☐	
	7.82	8.18	4.42	4.67	☐	△
	9.05	9.42	4.60	4.90	☐	△
AS568-901	6.97	7.35	4.59	4.82	☐	
	8.07	8.45	4.64	4.91	☐	△
R4	7.98	8.37	4.84	5.10	☐	
	6.60	7.00	4.77	4.98	☐	
	7.40	7.80	4.88	5.12	☐	
	7.92	8.32	4.91	5.17	☐	
	8.32	8.72	4.87	5.14	☐	
	9.20	9.60	4.90	5.20	☐	△
	10.04	10.44	4.97	5.30	☐	△
	7.69	8.10	5.13	5.42	☐	
BS1806-009 / AS568-009	8.16	8.59	5.34	5.65	☐	
	8.62	9.04	5.33	5.65	☐	
	9.28	9.71	5.41	5.76	☐	△
	7.10	7.54	5.38	5.64	☐	
	7.90	8.34	5.51	5.80	☐	
	8.52	8.96	5.64	5.96	☐	
	9.58	10.03	5.69	6.05	☐	△
	7.62	8.08	5.61	5.90	☐	





Shaft



Bore

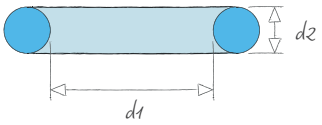
Key

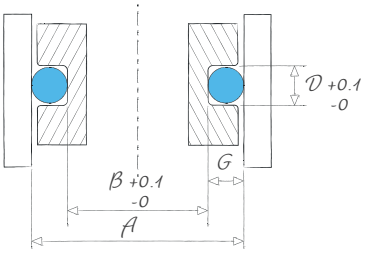
☐ Recommended for dynamic applications

△ Two-part groove assembly required

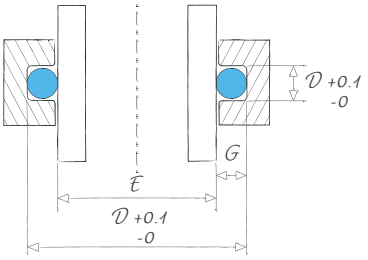
Dimensions		Standard compound codes							
Inner Ø d1 (mm)	Cross-section Ø d2 (mm)	PC851	PB701	EP851	DF801	7EP1197	EP856	7DF2067	7PD1612
5.70	1.90	105508	105509	105511	105512	105296	105297	105298	105299
6.00	1.00	106100	106101	105100	105101				
6.00	1.50	106300	106301	105303	105304				
6.00	2.00	106500	106501	105513	105514	106995			
6.00	2.20	106600	106601	105610	105611	106693	106694	106695	106696
6.00	3.00	106800	106801	106805	106806				
6.07	1.63	106400	106401	106403	106404	106750	106751	106752	106753
6.07	1.78	106405	106406	106408	106409	106698	106699	106745	106746
6.30	2.00	106503	106504	106506	106507				
6.30	2.40	106603	106604	106606	106607				
6.35	1.78	106412	106413	106415	106416	106763	106764	106766	106767
6.40	1.90	106508	106509	106511	106512	106769	106770	106771	106772
6.60	2.40	106608	106609	106611	106612				
6.70	2.00	106513	106514	106516	106517				
6.75	1.78	106417	106418	106420	106421				
7.00	1.50	107127	107131	107136	107133				
7.00	3.00	106131	106132	106134	106133				
7.10	1.60	107400	107401	107403	107404				
7.10	1.80	107424	107425	107426	107427				
7.10	2.00	107500	107501	107503	107504				
7.20	1.90	107505	107506	107508	107509	107857	107866	107867	107868
7.30	2.40	107600	107601	107603	107604				
7.30	2.70	107801	107800	107809	107810				
7.50	1.80	107428	107429	107430	107431				
7.50	2.00	107510	107511	107513	107514				
7.59	2.62	107757	107706	107758	107759	107870	107871	107872	107873
7.60	2.40	107605	107606	107608	107609				
7.65	1.63	107405	107406	107408	107409	107880	107881	107882	107883
7.65	1.78	107410	107411	107413	107414	107875	107876	107877	107878
7.65	2.54	107700	107701	107703	107704				
7.80	3.60	107913	107914	107915	107916				
8.00	1.00	108154	108155	108156	108134	108571			
8.00	1.50	107128	107130	107137	107134	108572			108769
8.00	1.80	108465	108311	108312	108313				
8.00	1.90	108500	108501	107515	107516	108448	108449	108458	108461
8.00	2.00	108503	108504	107517	107518	108573			108770
8.00	2.40	108600	108601	107610	107645				
8.00	3.00	107129	107132	107138	107135	108574			108771
8.00	5.00	108900	108901	107900	107901	108575			108772
8.10	1.60	108400	108401	108403	108404	108576			

Dimensional standards	Shaft		Bore		Dynamic app.	Two-part groove assembly
	A min.	A max.	E min.	E max.		
R5	8.78	9.23	5.76	6.09	□	
	7.60	8.08	5.84	6.12	□	
	8.40	8.88	5.97	6.29	□	
	9.32	9.80	5.98	6.33	□	
R6 BIS	9.65	10.13	6.02	6.38	□	
	11.04	11.52	6.12	6.54	□	△
AS568-902	8.71	9.20	6.04	6.36	□	
BS1806-010 / AS568-010	8.95	9.44	6.07	6.41	□	
	9.62	10.12	6.26	6.62	□	
	10.28	10.79	6.34	6.73	□	
R5 BIS	9.23	9.74	6.33	6.68	□	
R5 A	9.48	9.99	6.41	6.77	□	
	10.58	11.11	6.62	7.02	□	
	10.02	10.56	6.63	7.01	□	
	9.63	10.17	6.70	7.07	□	
	9.40	9.96	6.90	7.25	□	
	12.04	12.60	7.05	7.51	□	△
	9.69	10.26	6.99	7.35	□	
	10.02	10.58	7.04	7.41	□	
	10.42	10.99	7.00	7.39	□	
R6	10.28	10.85	7.15	7.54	□	
	11.28	11.87	7.27	7.69	□	
	11.84	12.42	7.28	7.72	□	
	10.42	11.02	7.41	7.80	□	
	10.82	11.42	7.38	7.78	□	
BS1806-109 / AS568-109	11.99	12.60	7.53	7.98	□	
	11.58	12.19	7.55	7.98	□	
AS568-903	10.29	10.90	7.51	7.89	□	
BS1806-011 / AS568-011	10.53	11.15	7.54	7.93	□	
	11.92	12.53	7.57	8.02	□	
	13.92	14.54	7.83	8.36	□	△
	9.60	10.24	7.70	8.05		
	10.40	11.04	7.83	8.22	□	
	10.92	11.56	7.87	8.28	□	
R6A	11.08	11.72	7.90	8.31	□	
	11.32	11.96	7.84	8.26	□	
	11.98	12.62	7.92	8.37	□	
	13.04	13.68	7.98	8.47	□	
	16.70	17.34	8.04	8.67	□	△
	10.69	11.34	8.20	8.48	□	





Shaft



Bore

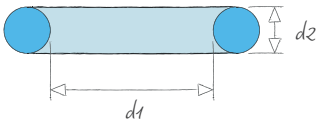
Key

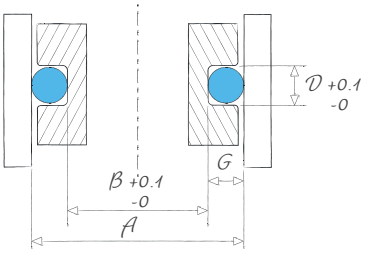
□ Recommended for dynamic applications

△ Two-part groove assembly required

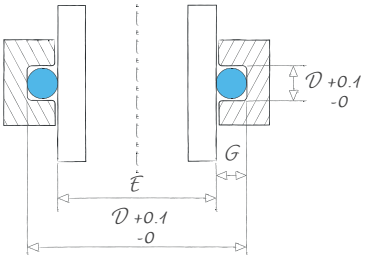
Dimensions		Standard compound codes				NEW			
Inner Ø d1 (mm)	Cross-section Ø d2 (mm)	PC851	PB701	EP851	DF801	7EP1197	EP856	7DF2067	7PD1612
8.30	2.40	108602	108603	108605	108606				
8.50	1.90	108751	108709	108752	108753				
8.60	2.40	108607	108608	108610	108611				
8.73	1.78	108405	108406	108408	108409	108577			108773
8.90	1.90	108511	108512	108514	108515	108466	108467	108468	108469
8.90	2.70	108800	108801	108803	108804	108471	108472	108473	108474
9.00	1.50	109300	109301	108300	108301				
9.00	2.00	109500	109501	108516	108517				
9.00	2.20	109600	109601	108612	108613	109999	110950	110933	110934
9.00	2.50	109135	109121	109128	109124	100018			100330
9.10	1.60	109400	109401	109403	109404				
9.12	3.53	109119	109122	109129	109125				
9.15	3.00	109800	109801	109803	109804	100431			
9.19	2.62	109700	109701	109703	109704	110936	110937	110938	110939
9.25	1.78	109405	109406	109408	109409	110941	110942	110943	110944
9.30	2.40	109603	109604	109606	109607				
9.50	1.40	109303	109304	109306	109307				
9.50	1.60	109850	109415	109130	109126				
9.50	2.00	109503	109504	109506	109507				
9.52	1.78	109410	109411	109413	109414	110946	110947	110948	110949
9.60	2.40	109608	109609	109611	109612				
9.90	1.90	109508	109509	109949	109950				
10.00	1.30	110100	110101	109308	109309				
10.00	1.50	109120	109123	109131	109127				
10.00	1.80	110819	110820	110821	110822				
10.00	2.00	110300	110301	109510	109511				
10.00	2.50	110500	110501	109705	109706	100019			100331
10.00	3.50	110721	110722	110723	110724				
10.10	1.60	110200	110201	110252	110253	100020			100333
10.30	2.40	110410	110400	110414	110415				
10.50	2.00	110303	110304	110306	110307				
10.50	2.70	110602	110603	110605	110606	110907	110914	110915	110916
10.52	1.83	110202	110203	110205	110206	110918	110919	110920	110921
10.60	2.40	110401	110402	110404	110405				
10.77	2.62	110508	110509	110511	110512	110923	110924	110925	110926
10.82	1.78	110207	110208	110210	110211	110928	110929	110930	110931
11.00	1.50	111100	111101	110103	110104				
11.00	2.00	111300	111301	110308	110309				
11.00	2.50	111500	111501	110607	110608	111781			
11.00	5.00	111805	111806	111808	111807				

Dimensional standards	Shaft		Bore		Dynamic app.	Two-part groove assembly
	A min.	A max.	E min.	E max.		
	12.28	12.95	8.53	8.85	☐	
	11.58	12.26	8.67	8.98	☐	
	12.58	13.27	8.81	9.15	☐	
	11.61	12.31	8.85	9.16	☐	
R7	11.98	12.69	9.05	9.37	☐	
R8	13.44	14.15	9.12	9.48	☐	
	11.40	12.12	9.06	9.36	☐	
	12.32	13.04	9.10	9.42	☐	
R7 BIS	12.65	13.37	9.15	9.48	☐	
	13.20	13.92	9.17	9.52	☐	
	11.69	12.42	9.15	9.46	☐	
BS1806-204 / AS568-204	15.12	15.85	9.45	9.86	☐	
	14.19	14.92	9.43	9.81	☐	
BS1806-110 / AS568-110	13.59	14.33	9.38	9.74	☐	
BS1806-012 / AS568-012	12.13	12.87	9.35	9.67	☐	
	13.28	14.03	9.48	9.83	☐	
	11.74	12.50	9.51	9.81	☐	
	12.09	12.85	9.54	9.85	☐	
	12.82	13.58	9.57	9.91	☐	
R8 BIS	12.40	13.17	9.61	9.93	☐	
	13.58	14.35	9.77	10.13	☐	
	12.98	13.77	10.01	10.35	☐	
	12.08	12.88	9.95	10.27		
	12.40	13.20	10.02	10.34	☐	
	12.92	13.72	10.07	10.41	☐	
	13.32	14.12	10.05	10.40	☐	
	14.20	15.00	10.13	10.50	☐	
	15.95	16.75	10.29	10.71	☐	
	12.69	13.50	10.11	10.44	☐	
	14.28	15.11	10.44	10.81	☐	
	13.82	14.66	10.53	10.89	☐	
R9	15.04	15.88	10.65	11.05	☐	
AS568-905	13.48	14.33	10.58	10.93	☐	
	14.58	15.43	10.72	11.11	☐	
BS1806-111 / AS568-111	15.17	16.03	10.89	11.29	☐	
BS1806-013 / AS568-013	13.70	14.57	10.85	11.21	☐	
	13.40	14.28	10.97	11.32	☐	
	14.32	15.20	11.01	11.38	☐	
	15.20	16.08	11.08	11.48	☐	
	19.70	20.58	11.36	11.88	☐	△





Shaft



Bore

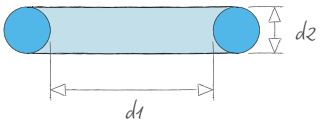
Key

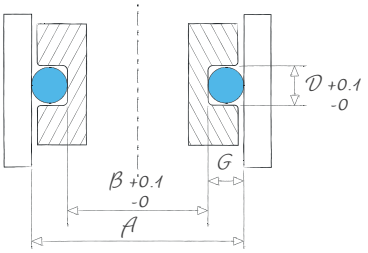
☐ Recommended for dynamic applications

△ Two-part groove assembly required

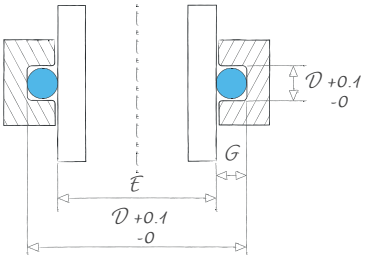
Dimensions		Standard compound codes				NEW			
Inner Ø d1 (mm)	Cross-section Ø d2 (mm)	PC851	PB701	EP851	DF801	7EP1197	EP856	7DF2067	7PD1612
11.10	1.60	111200	111201	110212	110213				
11.10	1.78	111203	111204	110214	110215	111482	111483	111484	111485
11.20	2.50	111503	111504	111506	111507				
11.30	2.40	111400	111401	111403	111404				
11.50	1.50	111103	111104	111106	111107				
11.50	2.00	111321	111322	111323	111324				
11.50	3.00	111708	111709	111711	111710				
11.60	2.40	111405	111406	111408	111409				
11.80	2.50	111508	111509	111511	111512				
11.90	2.62	111513	111514	111516	111517				
12.00	1.00	112127	112128	112130	112129				
12.00	1.50	112110	112102	112111	112112	112787			112871
12.00	2.00	112300	112301	111308	111309	112592	112593	112594	112595
12.00	3.00	112661	112608	112662	111618				
12.10	1.60	112200	112201	111206	111207				
12.10	2.70	112600	112601	111600	111601	112597	112598	112599	112676
12.29	3.53	112702	112703	112704	112705	112678	112680	112681	112682
12.30	2.40	112400	112401	112412	112413	112788			112872
12.37	2.62	112500	112501	112503	112504	112684	112685	112686	112687
12.42	1.78	112203	112204	112206	112207	112689	112690	112691	112693
12.50	1.50	112266	112214	112262	112261				
12.50	2.00	112303	112304	112306	112307				
12.50	2.50	112505	112506	112508	112509	112789			112873
13.00	1.00	113111	113112	113114	113113				
13.00	2.00	113300	113301	112308	112309				
13.00	2.50	113500	113501	112510	112511	113478			113698
13.00	3.00	113746	113747	112617	112616				
13.10	1.60	113200	113201	112208	112209				
13.10	1.80	113350	113351	113353	113352				
13.10	2.62	113503	113504	112512	112513				
13.20	2.50	113506	113507	113509	113510				
13.30	2.40	113400	113401	113403	113404				
13.46	2.08	113303	113304	113306	113307	113387	113388	113389	113391
13.60	2.40	113405	113406	113408	113409				
13.60	2.70	113600	113601	113603	113604	113393	113394	113395	113396
13.80	3.10	113700	113701	113703	113704				
13.87	3.53	113842	113843	113844	113845	113398	113399	113424	113425
13.94	2.62	113511	113512	113514	113515	113446	113447	113448	113449
14.00	1.78	114200	114201	113203	113204	114165	114166	114167	114168
14.00	2.00	114300	114301	113308	113309				

Dimensional standards	Shaft		Bore		Dynamic app.	Two-part groove assembly
	A min.	A max.	E min.	E max.		
	13.69	14.58	11.06	11.42	□	
	13.98	14.87	11.12	11.48	□	
	15.40	16.30	11.27	11.68	□	
	15.28	16.19	11.39	11.79	□	
	13.90	14.82	11.45	11.81		
	14.82	15.74	11.48	11.87	□	
	16.54	17.46	11.67	12.11	□	
	15.58	16.51	11.68	12.09	□	
	16.00	16.94	11.84	12.26	□	
	16.30	17.25	11.97	12.40	□	
	13.60	14.56	11.77	12.12		
	14.40	15.36	11.93	12.30		
AS568-906	15.32	16.28	11.96	12.36	□	
	17.04	18.00	12.15	12.60	□	
	14.69	15.66	12.02	12.40		
R10	16.64	17.60	12.18	12.61	□	
BS1806-206 / AS568-206	18.29	19.27	12.48	12.96	□	
	16.28	17.27	12.35	12.77	□	
BS1806-112 / AS568-112	16.77	17.76	12.42	12.86	□	
BS1806-014 / AS568-014	15.30	16.30	12.38	12.78	□	
	14.90	15.90	12.40	12.79		
	15.82	16.82	12.44	12.85	□	
	16.70	17.70	12.51	12.95	□	
	14.60	15.64	12.73	13.10		
	16.32	17.36	12.92	13.34	□	
	17.20	18.24	12.99	13.44	□	
	18.04	19.08	13.11	13.58	□	
	15.69	16.74	12.97	13.38		
	16.02	17.06	13.03	13.45	□	
	17.50	18.55	13.11	13.57	□	
	17.40	18.46	13.18	13.64	□	
	17.28	18.35	13.30	13.75	□	
AS568-907	16.91	17.99	13.37	13.81	□	
	17.58	18.67	13.59	14.05	□	
R11	18.14	19.22	13.61	14.08	□	
	19.07	20.17	13.83	14.33	□	
BS1806-207 / AS568-207	19.87	20.98	13.99	14.51	□	
BS1806-113 / AS568-113	18.34	19.46	13.92	14.39	□	
BS1806-015 / AS568-015	16.88	18.00	13.89	14.33		
	17.32	18.44	13.87	14.32	□	





Shaft



Bore

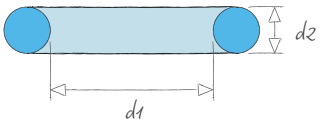
Key

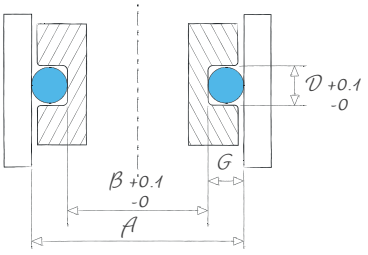
□ Recommended for dynamic applications

△ Two-part groove assembly required

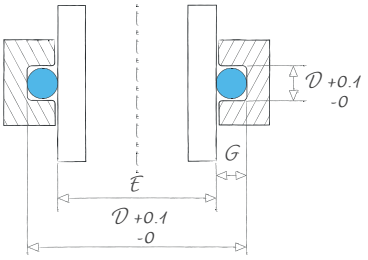
Dimensions		Standard compound codes				NEW			
Inner Ø d1 (mm)	Cross-section Ø d2 (mm)	PC851	PB701	EP851	DF801	7EP1197	EP856	7DF2067	7PD1612
14.00	2.50	114500	114501	113516	113517	114185			114294
14.00	3.00	114620	114619	114644	114645				
14.10	1.60	114203	114204	113205	113206				
14.30	2.40	114400	114401	114403	114404				
14.60	2.40	114405	114406	114408	114409				
15.00	1.00	115000	115001	114000	114001				
15.00	1.50	115100	115102	115108	115109				
15.00	1.80	115212	115213	114210	114211				
15.00	2.00	115300	115301	114303	114304				
15.00	2.50	115500	115501	114503	114504				
15.00	3.00	115612	115713	115724	115725				
15.08	2.62	115503	115504	114505	114506	115690			115919
15.10	2.70	115600	115601	114600	114601	115478	115479	115480	115481
15.12	3.53	115862	115863	115865	115864				
15.20	1.78	115201	115235	115223	115241				
15.20	4.00	115816	115866	115823	115803				
15.30	2.40	115400	115401	115403	115404				
15.47	3.53	115830	115831	115832	115833	115483	115484	115485	115486
15.54	2.62	115506	115507	115509	115510	115488	115489	115490	115491
15.60	1.78	115202	115203	115205	115206	115493	115494	115495	115496
15.60	2.40	115405	115406	115408	115409				
15.88	2.62	115511	115512	115514	115515	115498	115572	115573	115574
16.00	1.25	116003	116004	115004	115005				
16.00	1.90	116300	116301	115303	115304	116257	116258	116259	116260
16.00	2.00	116303	116304	115305	115306	116288			116396
16.00	2.50	116500	116501	115516	115517	116289			116397
16.00	3.00	116710	116630	115618	115648	116290			116398
16.00	3.50	116711	116701	116712	116713				
16.00	4.00	116800	116802	116810	116809				
16.10	1.60	116200	116201	115207	115208				
16.30	2.40	116400	116401	116403	116404				
16.36	2.21	116405	116406	116408	116409	116262	116263	116264	116265
16.60	2.40	116410	116411	116413	116414				
16.90	2.70	116600	116601	116603	116604	116267	116268	116269	116270
17.00	2.00	117300	117301	116306	116307				
17.00	2.50	117500	117501	116503	116504				
17.00	4.00	117812	117813	117815	117814				
17.04	3.53	117713	117714	117715	117716	117279	117280	117281	117282
17.06	1.50	117234	117235	117243	117242				
17.10	1.60	117200	117201	116203	116204				

Dimensional standards	Shaft		Bore		Dynamic app.	Two-part groove assembly
	A min.	A max.	E min.	E max.		
	18.20	19.32	13.95	14.42	☐	
	19.04	20.16	14.06	14.56	☐	
	16.69	17.68	14.10	14.45		
	18.28	19.29	14.45	14.83	☐	
	18.58	19.61	14.74	15.13	☐	
	16.60	17.65	14.81	15.15		
	17.40	18.45	14.97	15.33		
	17.92	18.97	15.03	15.41		
	18.32	19.37	15.02	15.40	☐	
	19.20	20.25	15.10	15.50	☐	
	20.04	21.09	15.23	15.65	☐	
	19.48	20.54	15.21	15.61	☐	
R12	19.64	20.69	15.25	15.66	☐	
	21.12	22.18	15.40	15.85	☐	
	18.08	19.15	15.22	15.60		
	22.16	23.22	15.43	15.89	☐	
	19.28	20.36	15.41	15.81	☐	
BS1806-208 / AS568-208	21.47	22.55	15.74	16.19	☐	
BS1806-114 / AS568-114	19.94	21.03	15.65	16.07	☐	
BS1806-016 / AS568-016	18.48	19.58	15.61	15.99		
	19.58	20.68	15.70	16.11	☐	
	20.28	21.39	15.98	16.40	☐	
	18.00	19.12	15.85	16.22		
R12A	19.08	20.20	16.03	16.43		
	19.32	20.44	15.98	16.38		
	20.20	21.32	16.07	16.49	☐	
	21.04	22.16	16.19	16.63	☐	
	21.95	23.07	16.25	16.71	☐	
	22.96	24.08	16.20	16.68	☐	
	18.69	19.82	16.03	16.42		
	20.28	21.43	16.38	16.80	☐	
AS568-908	20.03	21.17	16.38	16.80	☐	
	20.58	21.75	16.67	17.10	☐	
R13	21.44	22.62	16.98	17.43	☐	
	20.32	21.51	16.95	17.37		
	21.20	22.39	17.03	17.47	☐	
	23.96	25.15	17.17	17.67	☐	
BS1806-209 / AS568-209	23.04	24.23	17.26	17.74	☐	
	19.46	20.65	16.96	17.36		
	19.69	20.89	17.00	17.40		





Shaft



Bore

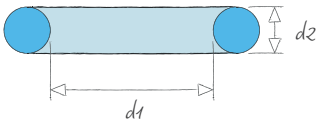
Key

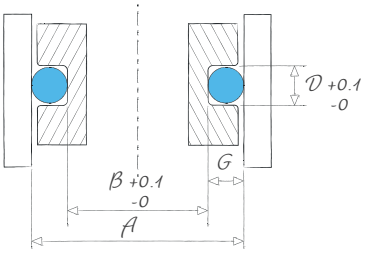
☐ Recommended for dynamic applications

△ Two-part groove assembly required

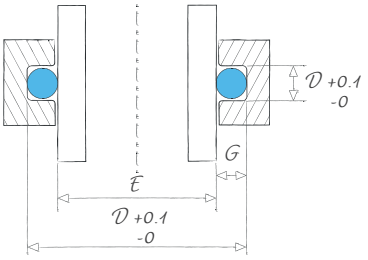
Dimensions		Standard compound codes				NEW			
Inner Ø d1 (mm)	Cross-section Ø d2 (mm)	PC851	PB701	EP851	DF801	7EP1197	EP856	7DF2067	7PD1612
17.12	2.62	117503	117504	116505	116506	117284	117285	117286	117287
17.17	1.78	117203	117204	117206	117207	117289	117290	117291	117292
17.30	2.40	117400	117401	117403	117404				
17.50	1.50	117100	117101	117103	117104				
17.50	2.50	117506	117507	117509	117510				
17.60	2.40	117405	117406	117408	117409				
17.86	2.62	117511	117512	117514	117515				
17.93	2.46	117410	117411	117413	117414	117294	117295	117296	117297
18.00	2.00	118300	118301	117303	117304	118450			118578
18.00	2.20	118400	118401	117415	117416				
18.00	2.50	118500	118501	117516	117517				
18.00	2.65	118520	118521	117524	117525				
18.00	2.80	118763	118764	118765	118865				
18.00	3.00	118767	118769	118773	118771				
18.00	3.15	118700	118701	117700	117701				
18.10	1.60	118200	118201	117208	117209				
18.20	3.00	118905	118661	118906	118907	118451			118579
18.30	3.60	118800	118801	118803	118804	118318	118326	118329	118366
18.40	2.70	118600	118601	118603	118604	118368	118369	118370	118371
18.50	1.60	118203	118331	118332	118333				
18.64	3.53	118703	118704	118706	118707	118373	118374	118375	118376
18.72	2.62	118505	118506	118508	118509	118378	118379	118380	118381
18.77	1.78	118204	118205	118207	118208	118383	118384	118385	118386
18.80	3.00	118768	118770	118774	118772				
19.00	1.50	119100	119101	118100	118101				
19.00	1.80	119200	119201	118209	118210				
19.00	2.50	119500	119501	118503	118504				
19.00	3.15	119700	119701	118708	118709				
19.00	3.55	119706	119707	118717	118718				
19.18	2.46	119400	119401	118408	118409	119146	119147	119148	119149
19.20	3.00	119600	119601	119603	119604	119169			119230
19.50	1.50	119103	119104	119123	119124				
19.60	2.40	119403	119404	119406	119407				
19.80	3.60	119800	119801	119803	119804	119151	119152	119153	119154
20.00	1.50	120251	120252	120254	120253				
20.00	1.80	120206	120207	119210	119211				
20.00	2.00	120300	120301	119300	119301	120191			120299
20.00	2.50	120500	120501	119503	119504				
20.00	2.65	120526	120527	120642	120636				
20.00	3.00	120600	120601	119610	119611	120192			120322

Dimensional standards	Shaft		Bore		Dynamic app.	Two-part groove assembly
	A min.	A max.	E min.	E max.		
BS1806-115 / AS568-115	21.52	22.72	17.18	17.62	□	
AS568-017	20.05	21.26	17.12	17.54		
	21.28	22.50	17.34	17.78	□	
	19.90	21.13	17.38	17.79		
	21.70	22.93	17.51	17.96	□	
	21.58	22.82	17.63	18.08	□	
	22.26	23.51	17.89	18.35	□	
AS568-909	22.01	23.27	17.97	18.42	□	
	21.32	22.58	17.91	18.35		
	21.65	22.91	17.96	18.41		
	22.20	23.46	18.00	18.46	□	
	22.45	23.71	18.03	18.50	□	
	22.70	23.96	18.07	18.54	□	
	23.04	24.30	18.12	18.60	□	
	23.36	24.62	18.09	18.58	□	
	20.69	21.96	17.96	18.39		
	23.24	24.51	18.31	18.80	□	
R15	24.42	25.70	18.49	19.00	□	
R14	22.94	24.22	18.43	18.91	□	
	21.09	22.39	18.35	18.78		
BS1806-210 / AS568-210	24.64	25.95	18.80	19.31	□	
BS1806-116 / AS568-116	23.12	24.43	18.72	19.20	□	
BS1806-018 / AS568-018	21.65	22.97	18.66	19.11		
	23.84	25.16	18.89	19.39	□	
	21.40	22.73	18.83	19.27		
	21.92	23.25	18.89	19.35		
	23.20	24.53	18.96	19.44	□	
	24.36	25.69	19.06	19.57	□	
	25.04	26.37	19.15	19.67	□	
AS568-910	23.26	24.61	19.17	19.65	□	
	24.24	25.58	19.28	19.78	□	
	21.90	23.27	19.31	19.76		
	23.58	24.96	19.56	20.05	□	
R16	25.92	27.31	19.94	20.48	□	
	22.40	23.80	19.80	20.26		
	22.92	24.32	19.86	20.33		
	23.32	24.72	19.84	20.32		
	24.20	25.60	19.93	20.43	□	
	24.45	25.85	19.96	20.47	□	
	25.04	26.44	20.05	20.57	□	





Shaft



Bore

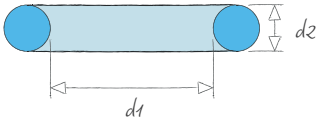
Key

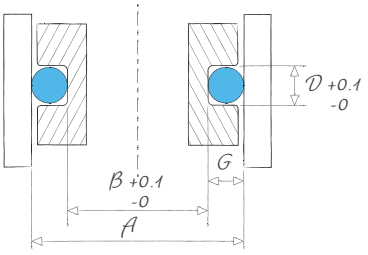
□ Recommended for dynamic applications

△ Two-part groove assembly required

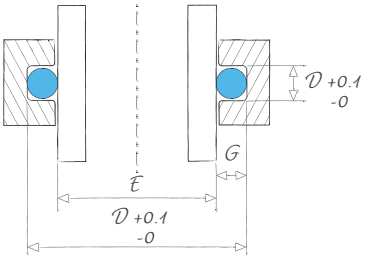
Dimensions		Standard compound codes				NEW			
Inner Ø d1 (mm)	Cross-section Ø d2 (mm)	PC851	PB701	EP851	DF801	7EP1197	EP856	7DF2067	7PD1612
20.00	3.15	120700	120701	119703	119704				
20.22	3.53	120703	120704	120706	120707	120160	120161	120162	120163
20.29	2.62	120510	120511	120513	120514	120165	120166	120167	120168
20.35	1.78	120200	120201	120203	120204	120170	120171	120172	120173
20.63	2.62	120515	120516	120518	120519				
21.00	2.00	121415	121416	121418	121417				
21.00	3.00	121600	121601	121603	121604	121196			121285
21.08	1.50	121265	121264	121266	121263				
21.20	1.90	121300	121301	120303	120304				
21.20	2.50	121500	121501	121503	121504				
21.20	3.15	121700	121701	121703	121704				
21.30	3.60	121800	121801	121803	121804	121150	121151	121152	121153
21.50	3.00	121605	121606	121608	121609				
21.59	5.33	121905	121906	121902	121907	121155	121156	121157	121158
21.60	2.40	121400	121401	121403	121404				
21.80	2.52	121627	121628	121630	121629				
21.82	3.53	121705	121706	121708	121709	121160	121161	121162	121163
21.89	2.62	121505	121506	121508	121509	121165	121166	121167	121168
21.92	2.95	121610	121611	121613	121614	121170	121171	121172	121173
21.95	1.78	121200	121201	121203	121204	121175	121176	121177	121178
22.00	1.50	122214	122101	122216	122215				
22.00	2.00	122300	122301	121303	121304				
22.10	1.60	122200	122201	121205	121206				
22.20	3.00	122600	122601	121615	121616				
22.22	2.62	122503	122504	122506	122507				
22.40	2.50	122508	122509	122511	122512				
22.40	3.15	122700	122701	122703	122704				
22.50	2.00	122303	122304	122309	122315				
22.50	3.00	122603	122604	122606	122607				
23.00	2.50	123510	123511	122513	122514				
23.00	3.60	123800	123801	122800	122801	123198	123199	123205	123210
23.16	5.33	123909	123910	123911	123912	123238	123247	123251	123252
23.20	2.00	123404	123403	123405	123402				
23.39	3.53	123700	123701	123703	123704	123254	123255	123256	123257
23.47	2.62	123500	123501	123503	123504	123259	123260	123261	123262
23.47	2.95	123600	123601	123603	123604	123264	123265	123266	123267
23.52	1.78	123200	123201	123203	123204	123269	123270	123271	123272
23.60	2.50	123505	123506	123508	123509				
23.60	3.15	123705	123706	123708	123709				
24.00	1.50	124102	124101	124104	124105				

Dimensional standards	Shaft		Bore		Dynamic app.	Two-part groove assembly
	A min.	A max.	E min.	E max.		
	25.36	26.76	20.02	20.55	□	
BS1806-211 / AS568-211	26.22	27.64	20.32	20.87	□	
BS1806-117 / AS568-117	24.69	26.11	20.23	20.75	□	
BS1806-019 / AS568-019	23.23	24.66	20.19	20.67		
	25.03	26.48	20.56	21.08	□	
	24.32	25.79	20.81	21.31		
	26.04	27.51	21.02	21.56	□	
	23.48	24.96	20.84	21.32		
	24.28	25.76	21.05	21.55		
	25.40	26.88	21.08	21.61	□	
	26.56	28.04	21.18	21.73	□	
R17	27.42	28.91	21.38	21.95	□	
	26.54	28.05	21.50	22.05	□	
BS1806-316 / AS568-316	30.86	32.38	21.85	22.49	□	
	25.58	27.10	21.49	22.02		
	26.03	27.56	21.67	22.20	□	
BS1806-212 / AS568-212	27.82	29.35	21.87	22.45	□	
BS1806-118 / AS568-118	26.29	27.82	21.78	22.32	□	
AS568-911	26.88	28.41	21.89	22.45	□	
BS1806-020 / AS568-020	24.83	26.37	21.73	22.24		
	24.40	25.94	21.73	22.23		
	25.32	26.86	21.77	22.29		
	24.69	26.24	21.82	22.33		
	27.24	28.79	22.17	22.74	□	
	26.62	28.18	22.10	22.65	□	
	26.60	28.17	22.24	22.79		
	27.76	29.32	22.34	22.91	□	
	25.82	27.40	22.25	22.78		
	27.54	29.12	22.46	23.03	□	
	27.20	28.81	22.82	23.38		
R18	29.12	30.73	23.02	23.63	□	
BS1806-317 / AS568-317	32.43	34.06	23.36	24.04	□	
	26.52	28.14	22.93	23.47		
BS1806-213 / AS568-213	29.39	31.03	23.38	23.99	□	
BS1806-119 / AS568-119	27.87	29.51	23.30	23.88		
AS568-912	28.43	30.07	23.39	23.97	□	
BS1806-021 / AS568-021	26.40	28.05	23.25	23.79		
	27.80	29.45	23.40	23.97		
	28.96	30.61	23.50	24.10	□	
	26.40	28.08	23.66	24.20		





Shaft



Bore

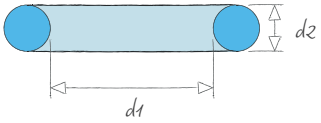
Key

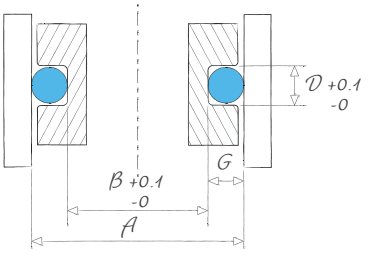
□ Recommended for dynamic applications

△ Two-part groove assembly required

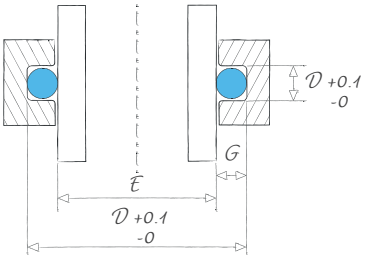
Dimensions		Standard compound codes				NEW			
Inner Ø d1 (mm)	Cross-section Ø d2 (mm)	PC851	PB701	EP851	DF801	7EP1197	EP856	7DF2067	7PD1612
24.00	2.00	124300	124301	123300	123301				
24.00	2.50	124504	124505	123513	123514				
24.00	4.00	123818	123828	123848	123830				
24.20	3.00	124600	124601	123605	123606				
24.50	3.00	124603	124604	124606	124607				
24.60	2.40	124400	124401	124403	124404				
24.60	3.60	124800	124801	124803	124804	123274	123275	123276	123277
24.76	3.00	123761	123767	123769	123768				
24.99	3.53	124700	124701	124703	124704	124250	124251	124252	124253
25.00	2.00	125303	124420	124424	124422				
25.00	2.40	125400	125401	124405	124406	124255	124256	124257	124258
25.00	2.50	125500	125501	124500	124501	124296			124436
25.00	3.15	125700	125701	124705	124706				
25.00	4.00	124854	124867	124869	124868				
25.00	5.00	125921	125901	124903	124907				
25.07	2.62	125503	125504	124502	124503	124260	124261	124262	124263
25.12	1.78	125203	125204	124202	124203	124265	124266	124267	124268
25.50	3.00	125603	125604	125606	125607				
25.80	3.53	125703	125704	125706	125707				
26.00	2.00	124419	124421	124425	124423				
26.00	2.50	125506	125507	125509	125510				
26.20	3.00	125608	125609	125611	125612				
26.20	3.60	125800	125801	125803	125804	124270	124271	124272	124273
26.40	3.00	124756	124758	124762	124760				
26.50	2.50	125511	125512	125514	125515				
26.57	3.53	125713	125714	125716	125717	124297			124437
26.62	2.95	125618	125619	125416	125417				
26.64	2.62	125516	125517	125519	125520	124298			124438
26.70	1.78	125206	125207	125209	125210				
27.00	2.00	126300	126301	125300	125301	125167			125260
27.00	2.50	126500	126501	125521	125522				
27.06	3.00	125766	125726	125767	125753				
27.10	1.60	126200	126201	125211	125212				
27.30	2.50	125668	125669	125671	125670				
27.30	2.70	126600	126601	126603	126604	125357	125358	125359	125261
27.50	3.00	126605	126606	126608	126609				
27.80	3.60	126800	126801	126803	126804	125360	125361	125362	125263
28.00	2.00	126303	126304	126306	126307	125168			125267
28.00	2.50	126503	126504	126506	126507				
28.00	3.00	126621	126627	126634	125765				

Dimensional standards	Shaft		Bore		Dynamic app.	Two-part groove assembly
	A min.	A max.	E min.	E max.		
	27.32	29.00	23.70	24.26		
	28.20	29.88	23.79	24.37		
	30.96	32.64	23.92	24.56	□	
	29.24	30.93	24.10	24.71	□	
	29.54	31.26	24.39	25.00	□	
	28.58	30.31	24.39	24.98		
R19	30.72	32.44	24.57	25.20	□	
	29.80	31.53	24.64	25.26	□	
BS1806-214 / AS568-214	30.99	32.74	24.93	25.57	□	
	28.32	30.07	24.67	25.25		
R19A	28.98	30.73	24.77	25.37		
	29.20	30.95	24.75	25.35		
	30.36	32.11	24.85	25.48	□	
	31.96	33.71	24.89	25.55	□	
	33.70	35.45	25.08	25.78	□	
BS1806-120 / AS568-120	29.47	30.98	25.15	25.61		
BS1806-022 / AS568-022	28.00	29.51	25.08	25.51		
	30.54	32.07	25.67	26.15	□	
	31.80	33.35	26.04	26.53	□	
	29.32	30.88	25.93	26.38		
	30.20	31.76	26.03	26.49		
	31.24	32.81	26.36	26.84	□	
R20	32.32	33.89	26.45	26.95	□	
	31.44	33.02	26.55	27.04	□	
	30.70	32.29	26.51	26.99		
BS1806-215 / AS568-215	32.57	34.17	26.79	27.29	□	
	31.58	33.17	26.75	27.24	□	
BS1806-121 / AS568-121	31.04	32.64	26.68	27.16		
BS1806-023 / AS568-023	29.58	31.19	26.62	27.07		
	30.32	31.94	26.91	27.37		
	31.20	32.82	27.00	27.48		
	32.10	33.72	27.19	27.69	□	
	29.69	31.32	26.95	27.41		
	31.50	33.14	27.29	27.78		
R20 TER	31.84	33.47	27.35	27.84		
	32.54	34.19	27.62	28.13	□	
R21	33.92	35.59	28.01	28.53	□	
	31.32	33.00	27.88	28.36		
	32.20	33.88	27.98	28.47		
	33.04	34.72	28.11	28.62	□	





Shaft



Bore

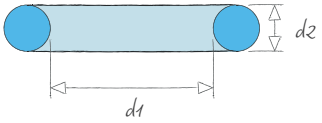
Key

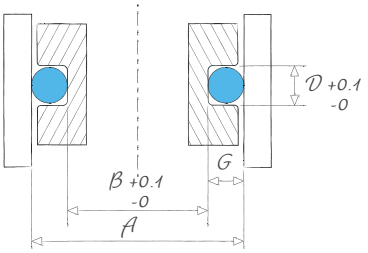
□ Recommended for dynamic applications

△ Two-part groove assembly required

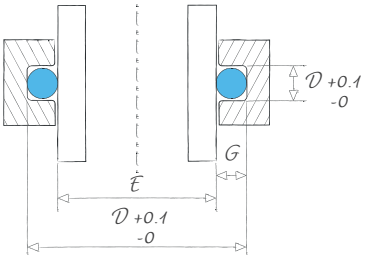
Dimensions		Standard compound codes				NEW			
Inner Ø d1 (mm)	Cross-section Ø d2 (mm)	PC851	PB701	EP851	DF801	7EP1197	EP856	7DF2067	7PD1612
28.00	3.15	126700	126701	126703	126704				
28.00	5.00	126908	126909	126910	126911	125169			125268
28.17	3.53	126705	126706	126708	126709	125149	125150	125151	125152
28.24	2.62	126508	126509	126511	126512	125170			125269
28.30	1.78	126203	126204	126206	126207				
29.10	1.60	127100	127101	126208	126209				
29.10	2.55	127200	127201	126513	126514	126350	126351	126352	126286
29.20	3.00	127300	127301	126610	126611				
29.30	3.60	127500	127501	127503	127504	126161	126162	126163	126164
29.50	3.00	127303	127304	127306	127307				
29.60	2.40	127203	127204	127206	127207				
29.74	2.95	127308	127309	127311	127312				
29.74	3.53	127400	127401	127403	127404	126180			126287
29.82	2.62	127208	127209	127211	127212				
29.87	1.78	127103	127104	127106	127107				
30.00	2.00	127108	127109	127111	127112	126181			126288
30.00	2.50	127213	127214	127216	127217				
30.00	2.70	127313	127314	127316	127317				
30.00	3.00	127318	127319	127321	127322				
30.00	4.00	127505	127506	127508	127509				
30.80	3.60	127510	127511	127513	127514	126182	126353	126354	126289
31.00	2.50	126410	126411	126413	126412				
31.12	5.33	128751	128752	128753	128754	127388	127291		127498
31.34	3.53	128400	128401	128403	128404	127389			127494
31.42	2.62	128200	128201	128203	128204	127374	127375	127376	127377
31.47	1.78	128100	128101	128103	128104				
31.50	3.00	128300	128301	128303	128304				
31.50	3.15	128405	128406	128408	128409				
31.60	2.40	128205	128206	128208	128209				
32.00	1.50	127166	127115	127156	127155				
32.00	2.00	128105	128106	128108	128109				
32.00	2.50	128265	128264	128246	128346				
32.10	1.60	128110	128111	128113	128114				
32.20	3.00	128305	128306	128308	128309				
32.50	1.90	128115	128116	128118	128119				
32.50	3.00	128310	128311	128313	128314				
32.50	3.60	128505	128506	128508	128509	127679	127680	127681	127497
32.92	3.53	128410	128411	128413	128414				
32.99	2.62	128210	128211	128213	128214	127369	127370	127371	127372
33.00	3.00	128566	128567	128569	128568				

Dimensional standards	Shaft		Bore		Dynamic app.	Two-part groove assembly
	A min.	A max.	E min.	E max.		
	33.36	35.04	28.09	28.60	□	
	36.70	38.38	28.35	28.92	□	
BS1806-216 / AS568-216	34.17	35.86	28.35	28.88	□	
BS1806-122 / AS568-122	32.64	34.34	28.24	28.74		
BS1806-024 / AS568-024	31.18	32.88	28.18	28.66		
	31.69	33.44	28.90	29.39		
R20A	33.38	35.13	29.06	29.57		
	34.24	35.99	29.28	29.81		
R22	35.42	37.18	29.47	30.02	□	
	34.54	36.31	29.57	30.11		
	33.58	35.36	29.56	30.07		
AS568-916	34.70	36.48	29.79	30.33		
BS1806-217 / AS568-217	35.74	37.53	29.88	30.43	□	
BS1806-123 / AS568-123	34.22	36.01	29.78	30.31		
BS1806-025 / AS568-025	32.75	34.55	29.71	30.21		
	33.32	35.12	29.83	30.34		
	34.20	36.00	29.93	30.45		
	34.54	36.34	29.98	30.51		
	35.04	36.84	30.06	30.60		
	36.96	38.76	30.09	30.66	□	
R23	36.92	38.77	30.93	31.50	□	
	35.20	37.06	30.90	31.44		
	40.39	42.26	31.46	32.09	□	
BS1806-218 / AS568-218	37.34	39.22	31.44	32.02	□	
BS1806-124 / AS568-124	35.82	37.71	31.34	31.89		
BS1806-026 / AS568-026	34.35	36.24	31.27	31.80		
	36.54	38.43	31.52	32.09		
	36.86	38.75	31.50	32.07	□	
	35.58	37.48	31.51	32.05		
	34.40	36.32	31.73	32.25		
	35.32	37.24	31.78	32.32		
	36.20	38.12	31.88	32.43		
	34.69	36.62	31.83	32.36		
	37.24	39.17	32.21	32.78		
	35.58	37.53	32.31	32.86		
	37.54	39.49	32.50	33.08		
R24	38.62	40.57	32.59	33.18	□	
BS1806-219 / AS568-219	38.92	40.90	32.98	33.58	□	
BS1806-125 / AS568-125	37.39	39.37	32.87	33.45		
	38.04	40.02	32.99	33.57		





Shaft



Bore

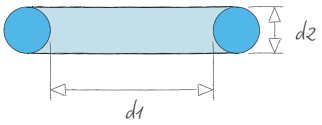
Key

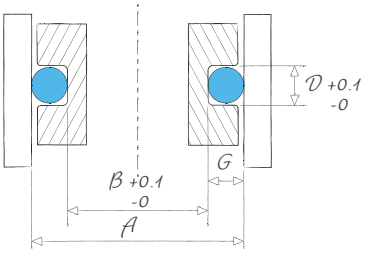
□ Recommended for dynamic applications

△ Two-part groove assembly required

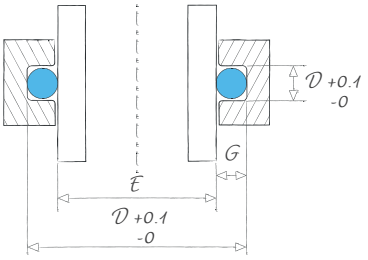
Dimensions		Standard compound codes				NEW			
Inner Ø d1 (mm)	Cross-section Ø d2 (mm)	PC851	PB701	EP851	DF801	7EP1197	EP856	7DF2067	7PD1612
33.05	1.78	129100	129101	128120	128121				
33.50	3.15	129400	129401	129403	129404				
33.50	4.00	129500	129501	129503	129504	128285			128374
34.00	2.00	128267	128268	128270	128269				
34.00	3.00	129300	129301	129303	129304				
34.00	5.00	128811	128812	128814	128813				
34.10	3.60	129505	129506	129508	129509	128196	128197	128198	128199
34.20	3.00	129305	129306	129308	129309	128385			
34.29	5.33	129614	129615	129616	129617				
34.50	3.00	129315	129316	129318	129319				
34.52	3.53	129405	129406	129408	129409				
34.59	2.62	129200	129201	129203	129204				
34.60	2.40	129205	129206	129208	129209				
34.65	1.78	129103	129104	129106	129107	128286			128375
35.00	2.00	130100	130101	129108	129109	129193			
35.00	2.50	130229	130228	130230	130231				
35.00	3.00	130300	130301	129320	129321				
35.00	5.30	130600	130601	129600	129601				
35.10	1.60	130103	130104	129110	129111				
35.50	3.00	130303	130304	130306	130307				
35.50	3.15	130400	130401	130403	130404				
35.50	4.00	130500	130501	130503	130504				
35.60	3.60	130505	130506	130508	130509	129388	129389	129390	129294
36.00	2.00	129242	129248	129250	129249				
36.09	3.53	130405	130406	130408	130409				
36.17	2.62	130200	130201	130203	130204				
36.30	2.00	129264	129262	129267	129256				
36.50	2.65	130206	130207	130208	130209				
36.50	3.00	130313	130314	130316	130317				
37.10	1.60	131100	131101	130106	130107				
37.30	3.60	131500	131501	130510	130511	130175	130176	130177	130178
37.40	1.80	131103	131104	131106	131107				
37.46	3.00	131300	131301	131303	131304				
37.47	5.33	131600	131601	131603	131604	130188	130352	130353	130276
37.50	3.15	131400	131401	131403	131404				
37.50	4.00	131503	131504	131506	131507				
37.60	1.20	131004	131005	131006	131007				
37.60	2.40	131200	131201	131203	131204				
37.69	3.53	131405	131406	131408	131409				
37.70	2.00	130250	130252	130256	130254				

Dimensional standards	Shaft		Bore		Dynamic app.	Two-part groove assembly
	A min.	A max.	E min.	E max.		
BS1806-027 / AS568-027	35.93	37.92	32.81	33.36		
	38.86	40.87	33.45	34.05		
	40.46	42.47	33.50	34.13	□	
	37.32	39.36	33.73	34.30		
	39.04	41.08	33.96	34.56		
	42.70	44.74	34.20	34.86	□	
R25	40.22	42.27	34.15	34.77	□	
	39.24	41.29	34.16	34.76		
BS1806-324 / AS568-324	43.56	45.62	34.55	35.23	□	
	39.54	41.61	34.45	35.06		
BS1806-220 / AS568-220	40.52	42.59	34.54	35.16	□	
BS1806-126 / AS568-126	38.99	41.07	34.43	35.03		
	38.58	40.66	34.43	35.02		
BS1806-028 / AS568-028	37.53	39.61	34.37	34.94		
	38.32	40.42	34.71	35.29		
	39.20	41.30	34.80	35.40		
	40.04	42.14	34.94	35.55		
	44.22	46.32	35.24	35.92	□	
	37.69	39.80	34.75	35.33		
	40.54	42.67	35.42	36.05		
	40.86	42.99	35.40	36.03		
	42.46	44.59	35.45	36.11	□	
R26	41.72	43.86	35.61	36.25	□	
	39.32	41.48	35.68	36.28		
BS1806-221 / AS568-221	42.09	44.26	36.07	36.72	□	
BS1806-127 / AS568-127	40.57	42.74	35.97	36.59		
	39.62	41.80	35.97	36.58		
	40.95	43.14	36.30	36.93		
	41.54	43.73	36.40	37.04		
	39.69	41.92	36.70	37.31		
R27	43.42	45.66	37.27	37.94	□	
	40.32	42.56	37.06	37.67		
	42.50	44.75	37.33	37.99		
R28 / BS1806-325 / AS568-325	46.74	48.99	37.65	38.37	□	
	42.86	45.11	37.35	38.01		
	44.46	46.71	37.40	38.09	□	
	39.52	41.78	37.08	37.68		
	41.58	43.84	37.36	37.99		
BS1806-222 / AS568-222	43.69	45.95	37.63	38.30	□	
	41.02	43.28	37.34	37.96		





Shaft



Bore

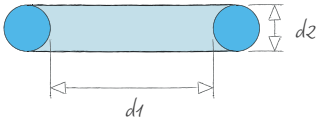
Key

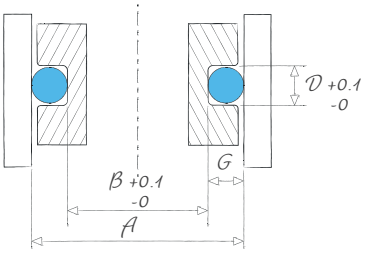
□ Recommended for dynamic applications

△ Two-part groove assembly required

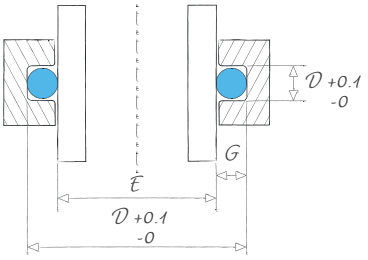
Dimensions		Standard compound codes				NEW			
Inner Ø d1 (mm)	Cross-section Ø d2 (mm)	PC851	PB701	EP851	DF801	7EP1197	EP856	7DF2067	7PD1612
37.77	2.62	131205	131206	131208	131209				
37.82	1.78	131108	131109	131111	131112				
38.10	3.00	130567	130568	130570	130569				
38.30	4.00	130716	130718	130722	130720				
38.70	2.00	130251	130253	130257	130255				
38.80	4.00	130717	130719	130723	130721				
39.00	3.00	132300	132301	131310	131311				
39.34	2.62	132200	132201	131210	131211				
39.50	3.00	132306	132307	132309	132310				
39.60	2.40	132203	132204	132206	132207				
39.69	3.53	132400	132401	132403	132404	131177	131178	131179	131180
39.80	2.00	131267	131269	131275	131271				
40.00	1.50	132006	132007	132008	132009				
40.00	2.50	132208	132209	132211	132212				
40.00	3.00	132316	132315	132319	131340				
40.00	3.15	132405	132406	132408	132409				
40.00	4.00	132500	132501	132503	132504				
40.20	2.00	131268	131270	131276	131274				
40.64	5.33	132600	132601	132603	132604	131197	131398	131399	131359
40.87	3.53	132410	132411	132413	132414	131196			131364
40.95	2.62	132213	132214	132216	132217				
41.00	1.78	133100	133101	132100	132101				
41.10	2.00	132262	132263	132268	132267				
41.40	5.30	133600	133601	132605	132606	132149	132150	132151	132152
41.50	3.00	133300	133301	133303	133304				
41.60	2.40	133200	133201	133203	133204				
42.00	2.00	133107	133111	133121	133122				
42.00	4.00	132731	132741	132749	132743				
42.20	3.00	133305	133306	133308	133309				
42.50	3.00	133310	133311	133313	133314				
42.50	3.15	133400	133401	133403	133404				
42.50	4.00	133500	133501	133503	133504				
42.50	5.30	133613	133610	133612	133611				
42.52	2.62	133205	133206	133208	133209				
42.86	3.53	133405	133406	133408	133409				
43.00	3.00	134300	134301	133315	133316				
43.40	3.60	134500	134501	133505	133506	133189	133190	133191	133162
43.69	3.00	134303	134304	134306	134307				
43.70	3.55	134413	134414	134415	134416				
43.82	5.33	134600	134601	134603	134604	133127	133192	133193	133163

Dimensional standards	Shaft		Bore		Dynamic app.	Two-part groove assembly
	A min.	A max.	E min.	E max.		
BS1806-128 / AS568-128	42.17	44.44	37.53	38.18		
BS1806-029 / AS568-029	40.70	42.97	37.46	38.08		
	43.14	45.43	37.96	38.62		
	45.26	47.56	38.18	38.88	□	
	42.02	44.34	38.31	38.95		
	45.76	48.09	38.67	39.37	□	
	44.04	46.38	38.84	39.51		
BS1806-129 / AS568-129	43.74	46.10	39.06	39.73		
	44.54	46.91	39.32	40.01		
	43.58	45.96	39.31	39.97		
	45.69	48.07	39.58	40.28	□	
	43.12	45.51	39.39	40.04		
	42.40	44.80	39.53	40.17		
	44.20	46.60	39.68	40.35		
	45.04	47.44	39.81	40.50		
	45.36	47.76	39.79	40.48		
	46.96	49.36	39.84	40.56	□	
	43.52	45.53	40.00	40.44		
R29 / BS1806-326 / AS568-326	49.91	51.95	41.00	41.51	□	
BS1806-223 / AS568-223	46.87	48.91	40.97	41.45	□	
	45.35	47.40	40.86	41.33		
BS1806-030 / AS568-030	43.88	45.93	40.79	41.23		
	44.42	46.48	40.88	41.33		
R29A	50.62	52.69	41.74	42.26	□	
	46.54	48.62	41.51	41.99		
	45.58	47.66	41.49	41.95		
	45.32	47.42	41.76	42.22		
	48.96	51.06	42.04	42.54	□	
	47.24	49.35	42.20	42.68		
	47.54	49.67	42.49	42.98		
	47.86	49.98	42.47	42.96		
	49.46	51.59	42.53	43.04	□	
	51.72	53.85	42.82	43.35	□	
BS1806-131 / AS568-131	46.92	49.05	42.40	42.88		
	48.86	51.00	42.92	43.42	□	
	48.04	50.19	42.98	43.47		
R29 TER	49.52	51.69	43.47	43.97	□	
AS568-924	48.73	50.91	43.66	44.15		
	49.74	51.92	43.75	44.26	□	
R30 / BS1806-327 / AS568-327	53.09	55.29	44.12	44.66	□	





Shaft



Bore

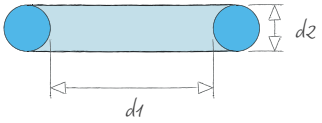
Key

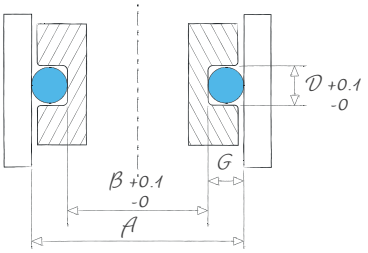
□ Recommended for dynamic applications

△ Two-part groove assembly required

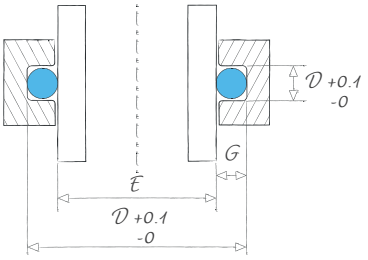
Dimensions		Standard compound codes							
Inner Ø d1 (mm)	Cross-section Ø d2 (mm)	PC851	PB701	EP851	DF801	7EP1197	EP856	7DF2067	7PD1612
44.00	2.00	133245	133246	133248	133247	133098			133165
44.05	3.53	134400	134401	134403	134404	133099			133166
44.12	2.62	134200	134201	134203	134204	133124			133167
44.17	1.78	134100	134101	134103	134104				
44.20	3.00	134308	134309	134311	134312				
44.20	5.70	134700	134701	134703	134704				
44.45	1.56	134000	134001	134003	134004				
44.60	2.40	134205	134206	134208	134209				
44.64	3.00	133520	133521	133524	133523				
44.64	3.52	133617	133618	133620	133619				
45.00	2.00	134241	135130	134244	134243	134084			134139
45.00	2.50	135240	135227	135241	135242				
45.00	3.15	135400	135401	134405	134406				
45.00	4.00	135500	135501	134503	134504	134085			134140
45.30	5.70	135700	135701	134710	134711				
45.54	3.60	135508	135509	135510	135504				
45.69	2.62	135200	135201	135203	135204	134086			134141
46.00	2.00	135100	135101	135103	135104				
46.00	3.00	135300	135301	135303	135304				
46.50	2.50	135205	135206	135208	135209				
46.99	5.33	135600	135601	135603	135604	134074	134075	134076	134077
47.00	2.00	136100	136101	135105	135106				
47.00	4.00	136519	136514	136520	136521				
47.20	3.00	135511	135512	135514	135513				
47.22	3.53	136400	136401	135403	135404	135136			135167
47.29	2.62	136200	136201	135210	135211	135091	135092	135093	135094
47.34	1.78	136103	136104	135107	135108				
47.50	3.15	136403	136404	136406	136407				
47.60	2.40	136203	136204	136206	136207	135145			135168
47.63	3.53	136408	136409	136411	136412				
48.00	2.00	136106	136107	136109	136110	135146			135169
48.00	3.00	136300	136301	136303	136304	135147			135170
48.90	2.62	136208	136209	136211	136212	135148			135171
49.20	5.70	137700	137701	136700	136701	136095			136011
49.21	3.53	137400	137401	136413	136414				
49.50	2.00	136252	136253	136255	136254				
49.50	3.00	137300	137301	137303	137304				
49.60	2.40	137200	137201	137203	137204				
50.00	3.15	137403	137404	137406	137407				
50.00	4.00	137500	137501	137503	137504				

Dimensional standards	Shaft		Bore		Dynamic app.	Two-part groove assembly
	A min.	A max.	E min.	E max.		
	47.32	49.52	43.72	44.20		
	50.05	52.25	44.09	44.60	□	
BS1806-132 / AS568-132	48.52	50.73	43.97	44.46		
BS1806-031 / AS568-031	47.05	49.26	43.89	44.37		
	49.24	51.45	44.16	44.66		
	54.12	56.33	44.57	45.13	□	
	46.98	49.20	44.09	44.57		
	48.58	50.81	44.43	44.92		
	49.68	51.91	44.59	45.09		
	50.62	52.86	44.66	45.18	□	
	48.32	50.57	44.70	45.19		
	49.20	51.45	44.80	45.30		
	50.36	52.61	44.92	45.43		
	51.96	54.21	44.98	45.51	□	
	55.22	57.48	45.65	46.22	□	
	51.66	53.94	45.57	46.09	□	
BS1806-133 / AS568-133	50.09	52.38	45.51	46.02		
	49.32	51.62	45.68	46.18		
	51.04	53.34	45.92	46.44		
	50.70	53.03	46.27	46.79		
R31 / BS1806-328 / AS568-328	56.26	58.61	47.22	47.80	□	
	50.32	52.67	46.66	47.17		
	53.96	56.31	46.94	47.49	□	
	52.24	54.60	47.10	47.63		
BS1806-225 / AS568-225	53.22	55.58	47.19	47.74	□	
BS1806-134 / AS568-134	51.69	54.06	47.08	47.60		
	50.22	52.59	47.00	47.51		
	52.86	55.23	47.37	47.91		
	51.58	53.96	47.37	47.89		
	53.63	56.01	47.60	48.14		
	51.32	53.72	47.64	48.16		
	53.04	55.44	47.88	48.42		
BS1806-135 / AS568-135	53.30	55.75	48.66	49.20		
	59.12	61.58	49.47	50.08	□	
	55.21	57.67	49.14	49.71		
	52.82	55.30	49.11	49.65		
	54.54	57.02	49.35	49.91		
	53.58	56.06	49.33	49.87		
	55.36	57.86	49.82	50.38		
	56.96	59.46	49.88	50.46	□	





Shaft



Bore

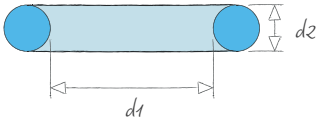
Key

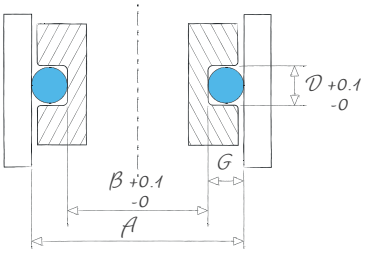
□ Recommended for dynamic applications

△ Two-part groove assembly required

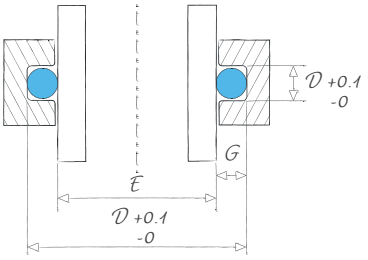
Dimensions		Standard compound codes							
Inner Ø d1 (mm)	Cross-section Ø d2 (mm)	PC851	PB701	EP851	DF801	7EP1197	EP856	7DF2067	7PD1612
50.00	5.00	137600	137601	137603	137604	136096			136165
50.17	5.33	137605	137606	137608	137609	136099	136195	136196	136166
50.40	3.53	137408	137409	137411	137412	136098			136167
50.47	2.62	137205	137206	137208	137209				
50.52	1.78	137100	137101	137103	137104				
50.80	3.53	137413	137414	137416	137417				
51.00	2.50	138200	138201	137210	137211				
51.60	2.40	138203	138204	138206	138207				
52.00	2.00	138100	138101	138103	138104				
52.00	3.00	138305	138306	138308	138309				
52.07	2.62	138208	138209	138211	138212				
52.30	5.70	138700	138701	138703	138704				
53.00	3.00	138515	138518	138517	138516				
53.00	4.00	139500	139501	138500	138501	138071			138087
53.10	3.00	139300	139301	138310	138311				
53.34	5.33	139603	139604	138602	138603	138059	138060	138061	138062
53.57	3.53	139400	139401	139403	139404				
53.64	2.62	139200	139201	139203	139204				
53.69	1.78	139100	139101	139103	139104				
53.90	4.00	138712	138713	138715	138714				
53.98	3.53	139405	139406	139408	139409				
54.00	2.00	139105	139106	139108	139109				
54.00	3.00	139303	139304	139306	139307				
54.20	5.70	139700	139701	139703	139704				
54.40	5.30	139606	139607	139609	139610	138126	138127	138128	138088
54.50	3.00	139308	139309	139311	139312				
54.60	2.40	139205	139206	139208	139209				
55.00	2.00	140100	140101	139110	139111				
55.00	2.50	139452	139453	139461	139459				
55.00	3.50	140400	140401	139410	139411				
55.25	2.62	140200	140201	139210	139211				
55.30	5.70	140700	140701	139710	139711				
55.50	3.00	140300	140301	139313	139314				
55.56	3.53	140403	140404	140406	140407				
56.00	4.00	140500	140501	140503	140504				
56.00	5.00	140600	140601	140603	140604				
56.52	5.33	140605	140606	140608	140609	139078	139153	139154	139090
56.75	3.53	140408	140409	140411	140412	139077			139091
56.82	2.62	140203	140204	140206	140207				
56.87	1.78	140103	140104	140106	140107				

Dimensional standards	Shaft		Bore		Dynamic app.	Two-part groove assembly
	A min.	A max.	E min.	E max.		
	58.70	61.20	50.10	50.70	□	
R32 / BS1806-329 / AS568-329	59.44	61.95	50.34	50.95	□	
	56.40	58.92	50.31	50.88		
BS1806-136 / AS568-136	54.87	57.40	50.19	50.75		
BS1806-033 / AS568-033	53.40	55.93	50.11	50.66		
	56.80	59.34	50.70	51.28		
	55.20	57.75	50.68	51.24		
	55.58	58.16	51.29	51.85		
	55.32	57.92	51.56	52.12		
	57.04	59.64	51.80	52.38		
BS1806-137 / AS568-137	56.47	59.08	51.76	52.34		
	62.22	64.83	52.51	53.15	□	
	58.04	60.69	52.78	53.37		
	59.96	62.61	52.82	53.43	□	
	58.14	60.80	52.88	53.47		
R33 / BS1806-330 / AS568-330	62.61	65.28	53.45	54.09	□	
BS1806-227 / AS568-227	59.57	62.25	53.42	54.02		
BS1806-138 / AS568-138	58.04	60.72	53.30	53.89		
	56.57	59.26	53.22	53.79		
	60.86	63.56	53.70	54.32	□	
	59.98	62.68	53.82	54.43		
	57.32	60.02	53.52	54.10		
	59.04	61.74	53.76	54.36		
	64.12	66.83	54.37	55.03	□	
R33A	63.62	66.34	54.48	55.13	□	
	59.54	62.27	54.25	54.86		
	58.58	61.31	54.23	54.82		
	58.32	61.07	54.50	55.09		
	59.20	61.95	54.60	55.20		
	60.95	63.70	54.81	55.43		
BS1806-139 / AS568-139	59.65	62.41	54.88	55.48		
	65.22	67.98	55.45	56.12	□	
	60.54	63.32	55.23	55.85		
	61.56	64.34	55.37	55.99		
	62.96	65.76	55.76	56.40	□	
	64.70	67.50	55.98	56.64	□	
R34 / BS1806-331 / AS568-331	65.79	68.62	56.56	57.23	□	
	62.75	65.59	56.53	57.17		
BS1806-140 / AS568-140	61.22	64.06	56.42	57.04		
BS1806-035 / AS568-035	59.75	62.60	56.34	56.94		





Shaft



Bore

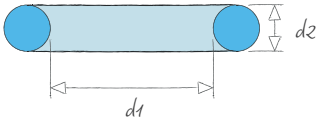
Key

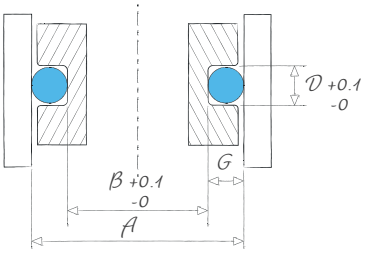
□ Recommended for dynamic applications

△ Two-part groove assembly required

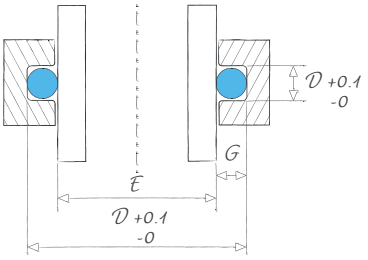
Dimensions		Standard compound codes				NEW			
Inner Ø d1 (mm)	Cross-section Ø d2 (mm)	PC851	PB701	EP851	DF801	7EP1197	EP856	7DF2067	7PD1612
57.00	2.80	141300	141301	140303	140304				
57.00	3.10	141400	141401	140413	140414				
57.50	2.00	141100	141101	140108	140109				
57.60	2.40	141200	141201	141203	141204				
58.00	3.00	141303	141304	141306	141307				
58.00	3.55	141421	141423	141424	141425				
58.40	4.00	140744	140743	140745	140742				
58.42	2.62	141205	141206	141208	141209				
58.58	7.00	140801	140802	140804	140803				
58.74	3.53	141406	141407	141409	141410	140043			140053
59.20	2.50	142200	142201	141210	141211				
59.20	5.70	142700	142701	141700	141701				
59.36	3.00	142300	142301	141308	141309				
59.69	5.33	142600	142601	142603	142604	141073			141075
59.92	3.53	142400	142401	142403	142404				
59.99	2.62	142208	142209	142211	142212				
60.00	4.00	142500	142501	142503	142504				
60.00	5.00	142605	142606	142608	142609				
60.04	1.78	142100	142101	142103	142104				
60.40	3.00	141510	141511	141513	141512			141080	
60.50	2.00	142112	142110	142113	142114				
61.60	2.40	143200	143201	142213	142214				
61.60	2.62	143203	143204	142215	142216				
61.91	3.53	143400	143401	143403	143404	142054			142064
62.00	3.00	143300	143301	143303	143304				
62.00	3.50	143405	143406	143408	143409				
62.87	5.33	143600	143601	143603	143604	142055			142065
63.00	2.00	144100	144101	143100	143101				
63.00	4.00	144500	144501	143500	143501				
63.10	3.53	144400	144401	143410	143411	143056			143079
63.17	2.62	144200	144201	143206	143207	143048	143049	143050	143051
63.22	1.78	144103	144104	143102	143103	143057			143080
64.50	3.00	144300	144301	144303	144304				
64.60	2.40	144203	144204	144206	144207				
64.77	2.62	144208	144209	144211	144212	143058			143081
65.00	2.00	144264	144265	144250	144266				
65.00	3.00	145300	145301	144305	144306				
65.09	3.53	145400	145401	144403	144404				
66.04	5.33	145600	145601	145603	145604	144049			144059
66.27	3.53	145403	145404	145406	145407				

Dimensional standards	Shaft		Bore		Dynamic app.	Two-part groove assembly
	A min.	A max.	E min.	E max.		
	61.70	64.55	56.64	57.27		
	62.27	65.12	56.67	57.30		
	60.82	63.70	56.95	57.57		
	61.58	64.46	57.17	57.79		
	63.04	65.94	57.68	58.32		
	64.04	66.94	57.76	58.41		
	65.36	68.28	58.11	58.78	□	
BS1806-141 / AS568-141	62.82	65.74	57.99	58.62		
	70.90	73.83	58.81	59.53	□	
	64.74	67.68	58.48	59.14		
	63.40	66.36	58.72	59.36		
	69.12	72.08	59.27	59.98	□	
AS568-932	64.40	67.37	59.01	59.67		
R35 / BS1806-332 / AS568-332	68.96	71.95	59.67	60.37	□	
BS1806-229 / AS568-229	65.92	68.92	59.64	60.31		
BS1806-142 / AS568-142	64.39	67.39	59.52	60.18		
	66.96	69.96	59.68	60.36	□	
	68.70	71.70	59.90	60.60	□	
BS1806-036	62.92	65.93	59.44	60.08		
	65.44	68.46	60.03	60.70		
	63.82	66.85	59.89	60.54		
	65.58	68.66	61.09	61.75		
BS1806-143 / AS568-143	66.00	69.08	61.10	61.77		
	67.91	71.01	61.59	62.28		
	67.04	70.14	61.60	62.28		
	67.95	71.05	61.67	62.36		
R36 / BS1806-333 / AS568-333	72.14	75.29	62.79	63.52	□	
	66.32	69.47	62.34	63.01		
	69.96	73.11	62.62	63.33	□	
	69.10	72.26	62.76	63.46		
BS1806-144 / AS568-144	67.57	70.73	62.64	63.32		
BS1806-037 / AS568-037	66.10	69.26	62.56	63.23		
	69.54	72.77	64.05	64.76		
	68.58	71.81	64.03	64.72		
BS1806-145 / AS568-145	69.17	72.41	64.21	64.91		
	68.32	71.57	64.30	64.99		
	70.04	73.29	64.54	65.25		
	71.09	74.35	64.71	65.43		
R37 / BS1806-334 / AS568-334	75.31	78.62	65.89	66.66	□	
BS1806-231 / AS568-231	72.27	75.58	65.86	66.60		





Shaft



Bore

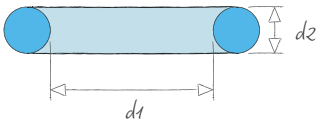
Key

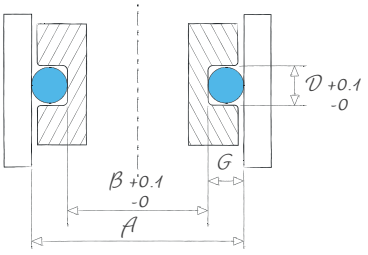
□ Recommended for dynamic applications

△ Two-part groove assembly required

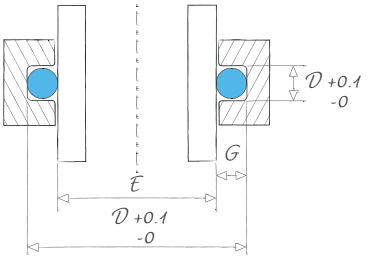
Dimensions		Standard compound codes							
Inner Ø d1 (mm)	Cross-section Ø d2 (mm)	PC851	PB701	EP851	DF801	7EP1197	EP856	7DF2067	7PD1612
66.34	2.62	145200	145201	145203	145204	144048			144060
66.39	1.78	145100	145101	145103	145104				
67.00	2.50	146200	146201	145205	145206				
67.60	2.40	146203	146204	145207	145208				
67.95	2.62	146206	146207	146209	146210				
68.00	2.00	146109	146102	146110	146106				
68.00	3.00	146300	146301	146303	146304				
68.00	4.00	145731	145732	145734	145733				
68.00	5.00	145801	145802	145804	145803				
68.26	3.53	146400	146401	146403	146404				
69.20	5.70	147700	147701	146700	146701				
69.22	5.33	147600	147601	146603	146604	146047			146055
69.45	3.53	147400	147401	146405	146406				
69.52	2.62	147200	147201	146211	146212				
69.57	1.78	147100	147101	146100	146101	146046			146056
69.85	3.53	147403	147404	147406	147407				
70.00	2.00	147108	146242	146244	146243				
70.00	2.50	147206	147207	147209	147210				
70.00	3.00	146506	146507	146509	146508				
70.00	5.00	146804	146805	146807	146806				
71.00	3.55	148408	148409	147412	147413				
71.00	5.00	148600	148601	147603	147604				
71.12	2.62	148200	148201	147211	147212				
71.50	2.50	148208	148209	147213	147214				
72.00	3.00	148300	148301	148303	148304				
72.39	5.33	148603	148604	148606	148607	147051			147054
72.62	3.53	148400	148401	148403	148404	147038			147055
72.69	2.62	148203	148204	148206	148207				
72.74	1.78	148100	148101	148103	148104				
73.00	4.00	149507	149508	149509	149510				
73.03	3.53	149400	149401	148405	148406				
74.00	2.00	148230	148231	148233	148232				
74.00	3.00	149300	149301	149303	149304	148027			148033
74.20	5.70	149700	149701	149703	149704				
74.30	5.70	149705	149706	149708	149709				
74.61	3.53	149403	149404	149406	149407				
74.85	3.00	148505	148506	148508	148507				
75.00	2.00	150100	150101	149100	149101	149091			149130
75.00	4.00	150500	150501	149500	149501				
75.00	5.00	150600	150601	149605	149606				

Dimensional standards	Shaft		Bore		Dynamic app.	Two-part groove assembly
	A min.	A max.	E min.	E max.		
BS1806-146 / AS568-146	70.74	74.06	65.75	66.46		
	69.27	72.59	65.67	66.37		
	71.20	74.55	66.36	67.08		
	71.58	74.96	66.97	67.69		
BS1806-147 / AS568-147	72.35	75.75	67.32	68.06		
	71.32	74.72	67.24	67.96		
	73.04	76.44	67.48	68.22		
	74.96	78.36	67.52	68.28	□	
	76.70	80.10	67.74	68.52	□	
	74.26	77.67	67.81	68.57		
	79.12	82.58	69.07	69.88	□	
R38 / BS1806-335 / AS568-335	78.49	81.96	69.01	69.81	□	
	75.45	78.92	68.98	69.74		
BS1806-148 / AS568-148	73.92	77.40	68.86	69.61		
BS1806-039 / AS568-039	72.45	75.93	68.78	69.52		
	75.85	79.34	69.37	70.14		
	73.32	76.82	69.20	69.94		
	74.20	77.70	69.30	70.05		
	75.04	78.54	69.44	70.20		
	78.70	82.20	69.70	70.50	□	
	77.04	80.59	70.50	71.28		
	79.70	83.25	70.68	71.49	□	
BS1806-149 / AS568-149	75.52	79.08	70.43	71.19		
	75.70	79.28	70.77	71.54		
	77.04	80.64	71.40	72.18		
R39 / BS1806-336 / AS568-336	81.66	85.28	72.11	72.95	□	
BS1806-233 / AS568-233	78.62	82.25	72.09	72.88		
BS1806-150 / AS568-150	77.09	80.73	71.97	72.75		
	75.62	79.26	71.89	72.65		
	79.96	83.61	72.42	73.23	□	
	79.03	82.68	72.49	73.29		
	77.32	81.02	73.12	73.90		
	79.04	82.74	73.36	74.16		
	84.12	87.83	73.97	74.83	□	
	84.22	87.93	74.07	74.93	□	
	80.61	84.34	74.04	74.85		
	79.89	83.63	74.19	75.00		
	78.32	82.07	74.10	74.89		
	81.96	85.71	74.38	75.21	□	
	83.70	87.45	74.60	75.45	□	





Shaft



Bore

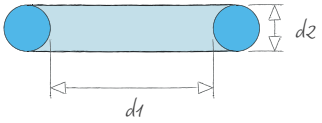
Key

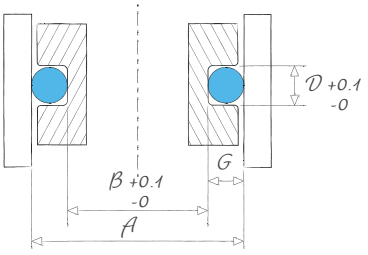
□ Recommended for dynamic applications

△ Two-part groove assembly required

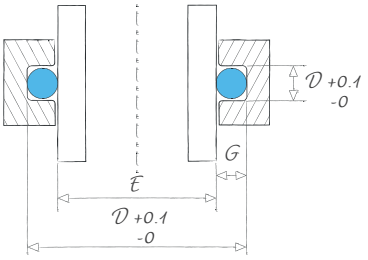
Dimensions		Standard compound codes				NEW			
Inner Ø d1 (mm)	Cross-section Ø d2 (mm)	PC851	PB701	EP851	DF801	7EP1197	EP856	7DF2067	7PD1612
75.54	3.53	149639	149640	149642	149641				
75.57	5.33	150603	150604	149607	149608	149081	149082	149083	149084
75.79	3.53	150400	150401	150403	150404	149092			149131
75.87	2.62	150200	150201	150203	150204				
75.92	1.78	150103	150104	150106	150107				
76.93	2.62	149428	149427	149429	149426				
78.00	3.00	150300	150301	150303	150304				
78.30	2.00	149213	149212	149214	149211				
78.74	5.33	150606	150607	150609	150610				149132
78.97	3.53	150405	150406	150408	150409				
79.20	5.70	150700	150701	150703	150709				
79.50	3.00	150305	150306	150308	150309				
79.77	5.33	150611	150612	150614	150615				
80.00	2.00	150228	150230	150234	150232				
80.00	2.65	151210	151211	150211	150212				
80.00	4.00	151500	151501	150503	150504				
80.00	5.00	151600	151601	150616	150617	150082			150098
80.50	2.20	151200	151201	150205	150206				
81.00	3.00	151300	151301	151303	151304				
81.92	5.33	151603	151604	151606	151607	150069	150070	150071	150072
82.00	2.00	151100	151101	151103	151104				
82.15	3.53	151400	151401	151403	151404				
82.22	2.62	151203	151204	151206	151207				
82.27	1.78	151105	151106	151108	151109				
84.00	3.00	151305	151306	151308	151309				
84.02	2.00	150229	150231	150235	150233				
84.11	5.72	150837	150838	150840	150839				
84.50	3.00	151310	151311	151313	151314				
84.53	2.62	150466	151226	150460	150459				
85.00	2.00	152100	152101	151110	151111				
85.00	5.00	152600	152601	151608	151609				
85.00	6.30	152800	152801	151803	151804				
85.09	5.33	152603	152604	151610	151611	151095			151151
85.30	4.00	151749	151750	151752	151751				
85.32	3.53	152400	152401	151405	151406				
86.15	1.25	151909	151908	151910	151907				
87.20	2.50	152200	152201	152203	152204				
87.90	3.00	151511	151512	151514	151513				
88.27	5.33	152606	152607	152609	152610				151152
88.50	3.53	152403	152404	152406	152407				

Dimensional standards	Shaft		Bore		Dynamic app.	Two-part groove assembly
	A min.	A max.	E min.	E max.		
	81.54	85.32	74.95	75.77		
R40 / BS1806-337 / AS568-337	84.84	88.62	75.23	76.09	□	
BS1806-234 / AS568-234	81.79	85.58	75.19	76.02		
BS1806-151 / AS568-151	80.27	84.07	75.09	75.90		
BS1806-041 / AS568-041	78.80	82.60	75.01	75.80		
	81.33	85.18	76.13	76.95		
	83.04	86.94	77.28	78.12		
	81.62	85.54	77.33	78.16		
R41 / BS1806-338 / AS568-338	88.01	91.95	78.34	79.23	□	
BS1806-235 / AS568-235	84.97	88.92	78.31	79.17		
	89.12	93.08	78.87	79.78	□	
	84.54	88.52	78.75	79.61		
	89.04	93.03	79.35	80.25	□	
	83.32	87.32	79.00	79.84		
	84.45	88.45	79.14	80.00		
	86.96	90.96	79.28	80.16	□	
	88.70	92.70	79.50	80.40	□	
	84.15	88.18	79.55	80.40		
	86.04	90.09	80.22	81.09		
R42 / BS1806-339 / AS568-339	91.19	95.29	81.45	82.38	□	
	85.32	89.42	80.96	81.82		
	88.15	92.26	81.42	82.32		
BS1806-152 / AS568-152	86.62	90.73	81.31	82.18		
BS1806-042 / AS568-042	85.15	89.27	81.23	82.09		
	89.04	93.24	83.16	84.06		
	87.34	91.54	82.94	83.82		
	94.06	98.27	83.69	84.64	□	
	89.54	93.77	83.65	84.56		
	88.93	93.16	83.57	84.47		
	88.32	92.57	83.90	84.79		
	93.70	97.95	84.40	85.35	□	
	96.09	100.34	84.56	85.54	□	
R43 / BS1806-340 / AS568-340	94.36	98.62	84.56	85.52	□	
	92.26	96.53	84.47	85.41	□	
BS1806-237 / AS568-237	91.32	95.59	84.53	85.46		
	88.15	92.46	84.88	85.76		
	91.40	95.76	86.16	87.08		
	92.94	97.34	86.98	87.92		
R44 / BS1806-341 / AS568-341	97.54	101.96	87.68	88.67	□	
	94.50	98.93	87.65	88.60		





Shaft



Bore

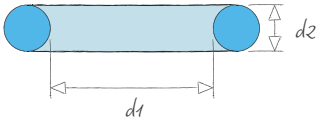
Key

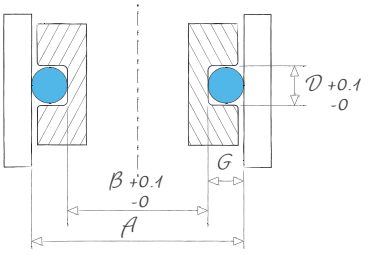
□ Recommended for dynamic applications

△ Two-part groove assembly required

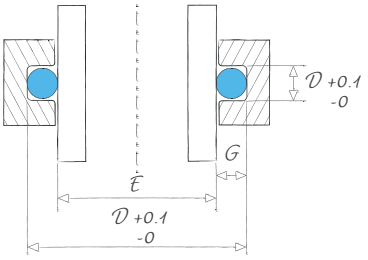
Dimensions		Standard compound codes				NEW			
Inner Ø d1 (mm)	Cross-section Ø d2 (mm)	PC851	PB701	EP851	DF801	7EP1197	EP856	7DF2067	7PD1612
88.57	2.62	152205	152206	152208	152209				
88.62	1.78	152103	152104	152106	152107				
89.00	4.00	152500	152501	152503	152504	151093			151153
89.50	3.00	152300	152301	152303	152304				
89.69	5.33	152611	152612	152614	152615	151159			
90.00	5.00	153600	153601	152616	152617	152077			152120
90.00	6.30	153800	153801	152803	152804				
91.00	3.00	153300	153301	153303	153304				
91.38	4.04	152766	152767	152769	152768				
91.42	3.00	152527	152528	152530	152529				
91.44	5.33	153603	153604	153606	153607	152078			152122
91.67	3.53	153400	153401	153403	153404				
93.66	2.50	152459	152460	152462	152461				
94.10	5.70	153700	153701	153703	153704				
94.50	3.00	153305	153306	153308	153309				
94.62	5.33	153608	153609	153611	153612	152079			152129
94.85	2.00	152241	152240	152242	152239				
94.85	3.53	153405	153406	153408	153409				
94.92	2.62	153200	153201	153203	153204	152080			152130
94.97	1.78	153100	153101	153103	153104				
95.00	5.00	154600	154601	153613	153614				
95.10	2.40	154200	154201	153205	153206				
95.37	2.00	153231	153232	153234	153233				
96.00	4.00	153766	153764	153767	153765				
96.30	3.60	154500	154501	154503	154504				
97.79	5.33	154603	154604	154606	154607	153037	153038	153039	153040
98.00	2.20	154203	154204	154206	154207				
98.02	3.53	154400	154401	154403	154404				
99.30	5.70	154700	154701	154703	154704	153044			153051
99.50	3.00	154300	154301	154303	154304	153045			153052
100.00	2.00	155100	155101	154100	154101				
100.00	5.00	155500	155501	154608	154609				
100.97	5.33	155506	155507	154612	154613	154063			154078
101.00	3.00	155300	155301	154305	154306				
101.20	3.53	155303	155304	155306	155307				
101.27	2.62	155200	155201	155203	155204				
101.32	1.78	155103	155104	155106	155107				
102.00	3.00	154224	155355	154229	154227				
103.30	3.00	154225	154226	154230	154228				
104.00	4.00	155435	155419	155436	155437				

Dimensional standards	Shaft		Bore		Dynamic app.	Two-part groove assembly
	A min.	A max.	E min.	E max.		
BS1806-153 / AS568-153	92.97	97.40	87.53	88.47		
BS1806-043 / AS568-043	91.50	95.93	87.45	88.37		
	95.96	100.41	88.10	89.07	□	
	94.54	99.02	88.55	89.51		
	98.96	103.45	89.07	90.07	□	
	98.70	103.20	89.30	90.30	□	
	101.09	105.59	89.46	90.49	□	
	96.04	100.59	90.02	90.99		
	98.41	102.98	90.44	91.44	□	
	96.46	101.03	90.43	91.41		
R45 / BS1806-342 / AS568-342	100.71	105.29	90.78	91.80	□	
BS1806-239 / AS568-239	97.67	102.25	90.75	91.74		
	97.86	102.54	92.49	93.47		
	104.02	108.72	93.47	94.53	□	
	99.54	104.27	93.45	94.46		
R46 / BS1806-343 / AS568-343	103.89	108.63	93.90	94.95	□	
	98.17	102.91	93.55	94.54		
	100.85	105.59	93.87	94.89		
BS1806-154 / AS568-154	99.32	104.07	93.76	94.76		
BS1806-044 / AS568-044	97.85	102.60	93.68	94.66		
	103.70	108.45	94.20	95.25	□	
	99.08	103.84	93.92	94.92		
	98.69	103.46	94.06	95.06		
	102.96	107.76	94.96	96.00	□	
	102.42	107.24	95.31	96.35		
R47 / BS1806-344 / AS568-344	107.06	111.95	97.01	98.09	□	
	101.65	106.55	96.70	97.72		
BS1806-241 / AS568-241	104.02	108.92	96.98	98.03		
	109.22	114.18	98.57	99.68	□	
	104.54	109.52	98.35	99.41		
	103.32	108.32	98.60	99.64		
	108.70	113.70	99.10	100.20	□	
R48 / BS1806-345 / AS568-345	110.24	114.28	100.68	102.36	□	
	106.04	110.08	100.36	101.96		
	107.20	111.25	100.64	102.26		
BS1806-155 / AS568-155	105.67	109.72	100.51	102.11		
BS1806-045 / AS568-045	104.20	108.26	100.42	102.00		
	107.04	111.12	101.34	102.96		
	108.34	112.47	102.62	104.26		
	110.96	115.12	103.36	105.04		





Shaft



Bore

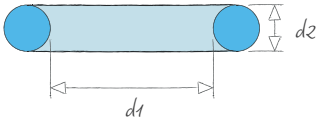
Key

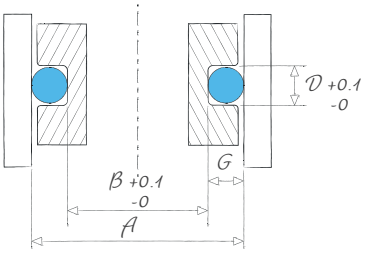
□ Recommended for dynamic applications

△ Two-part groove assembly required

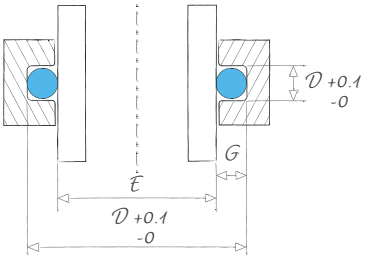
Dimensions		Standard compound codes				NEW			
Inner Ø d1 (mm)	Cross-section Ø d2 (mm)	PC851	PB701	EP851	DF801	7EP1197	EP856	7DF2067	7PD1612
104.14	5.33	155509	155510	155512	155513				154079
104.37	3.53	155308	155309	155311	155312				
104.50	3.00	155313	155314	155316	155317				
104.64	5.05	154518	154519	154521	154520				
105.99	2.00	155126	155127	155129	155128				
106.00	2.50	156200	156201	155205	155206				
107.32	5.33	156503	156504	156506	156507	155029	155030	155031	155032
107.55	3.53	156300	156301	156303	156304				
107.62	2.62	156203	156204	156206	156207				
107.67	1.78	156100	156101	156103	156104				
109.30	5.70	156600	156601	156603	156604				
109.50	3.00	156305	156306	156308	156309				
110.00	2.00	156112	157111	156114	156113				
110.49	5.33	157500	157501	156513	156514	156057			156076
110.72	3.53	157300	157301	156310	156311				
112.00	3.00	157303	157304	157306	157307				
113.67	5.33	157508	157509	157511	157512	156048	156049	156050	156051
113.67	6.99	157705	157706	157708	157709	156058			
113.90	3.53	157308	157309	157311	157312				
113.97	2.62	157200	157201	157203	157204				
114.02	1.78	157100	157101	157103	157104				
114.30	5.70	157600	157601	157603	157604				
115.00	3.00	158300	158301	157318	157319				
116.00	4.00	158400	158401	157400	157401				
116.84	6.99	158700	158701	158703	158704				
117.07	3.53	158303	158304	158306	158307				
117.50	5.33	158505	158506	158508	158509				
118.00	5.30	158521	158522	158523	158524				
118.50	3.00	158308	158309	158311	158312				
119.00	4.00	158403	158404	158406	158407				
119.30	5.70	158600	158601	158603	158604				
119.50	3.00	158313	158314	158316	158317	157034			
120.02	6.99	159700	159701	158710	158711				
120.25	3.53	159300	159301	158318	158319	158047			
120.32	2.62	159200	159201	158200	158201				
120.37	1.78	159100	159101	158100	158101				
123.00	3.00	159303	159304	159306	159307				
123.19	6.99	159703	159704	159706	159707				
123.42	3.53	159308	159309	159311	159312				
123.80	5.33	159511	159512	159514	159515	158066			

Dimensional standards	Shaft		Bore		Dynamic app.	Two-part groove assembly
	A min.	A max.	E min.	E max.		
R49 / BS1806-346 / AS568-346	113.41	117.58	103.80	105.53	□	
BS1806-243 / AS568-243	110.37	114.55	103.76	105.43		
	109.54	113.72	103.80	105.46		
	113.43	117.61	104.23	105.95	□	
	109.31	113.55	105.02	106.67		
	110.20	114.44	105.14	106.80		
R50 / BS1806-347 / AS568-347	116.59	120.89	106.94	108.71	□	
	113.55	117.85	106.89	108.61		
BS1806-156 / AS568-156	112.02	116.33	106.77	108.46		
BS1806-046 / AS568-046	110.55	114.86	106.68	108.35		
	119.22	123.59	108.97	110.78	□	
	114.54	118.92	108.73	110.46		
	113.32	117.72	108.97	110.68		
R51 / BS1806-348 / AS568-348	119.76	124.18	110.06	111.88	□	
BS1806-245 / AS568-245	116.72	121.15	110.01	111.78		
	117.04	121.52	111.19	112.96		
R52 / BS1806-349 / AS568-349	122.94	127.49	113.19	115.06	□	
R53 / BS1806-425 / AS568-425	125.97	130.52	113.43	115.35	□	
	119.90	124.46	113.14	114.96		
BS1806-157 / AS568-157	118.37	122.93	113.02	114.81		
BS1806-047 / AS568-047	116.90	121.46	112.93	114.70		
	124.22	128.79	113.90	115.78	□	
	120.04	124.64	114.15	115.96		
	122.96	127.60	115.18	117.04		
R54 / BS1806-426 / AS568-426	129.14	133.82	116.56	118.52	□	
BS1806-247 / AS568-247	123.07	127.75	116.27	118.13		
	126.77	131.47	116.96	118.89	□	
	127.22	131.94	117.45	119.38	□	
	123.54	128.28	117.59	119.46		
	125.96	130.72	118.14	120.04		
	129.22	133.99	118.82	120.78	□	
	124.54	129.32	118.58	120.46		
R55 / BS1806-427 / AS568-427	132.32	137.12	119.69	121.70	□	
	126.25	131.06	119.40	121.31		
BS1806-158 / AS568-158	124.72	129.53	119.28	121.16		
BS1806-048 / AS568-048	123.25	128.07	119.19	121.05		
	128.04	132.96	122.03	123.96		
R56 / BS1806-428 / AS568-428	135.49	140.42	122.81	124.87	□	
BS1806-249 / AS568-249	129.42	134.36	122.52	124.48		
	133.07	138.03	123.17	125.19	□	





Shaft



Bore

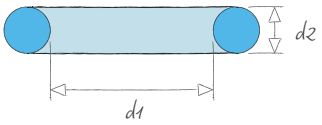
Key

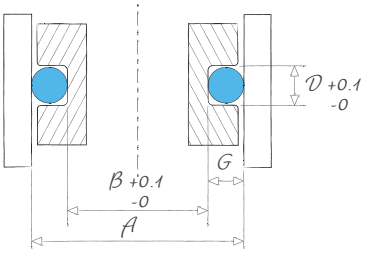
□ Recommended for dynamic applications

△ Two-part groove assembly required

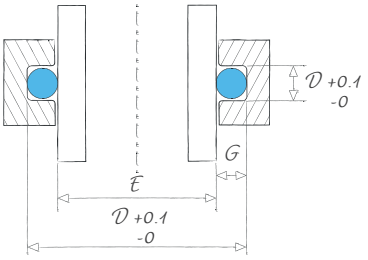
Dimensions		Standard compound codes							
Inner Ø d1 (mm)	Cross-section Ø d2 (mm)	PC851	PB701	EP851	DF801	7EP1197	EP856	7DF2067	7PD1612
124.50	3.00	159313	159314	159316	159317	158048			
125.00	2.00	160100	160101	159103	159104				
125.00	5.00	160500	160501	159516	159517				
126.00	3.00	160300	160301	159318	159319				
126.37	5.33	160503	160504	160506	160507	159064			
126.37	6.99	160700	160701	160703	160704				
126.60	3.53	160303	160304	160306	160307	159037	159038	159039	159040
126.67	2.62	160200	160201	160203	160204				
126.72	1.78	160103	160104	160106	160107				
128.00	3.00	159207	159208	159210	159209				
129.30	5.70	160600	160601	160603	160604				
129.50	3.00	160308	160309	160311	160312				
129.54	5.33	160508	160509	160511	160512				
129.54	6.99	160705	160706	160708	160709				
129.77	3.53	160313	160314	160316	160317				
132.00	3.00	160218	160219	160221	160220				
132.72	5.33	161505	161506	161508	161509				
132.72	6.99	161700	161701	161703	161704				
132.94	3.53	161300	161301	161303	161304				
133.02	2.62	161203	161204	161206	161207				
133.07	1.78	161100	161101	161103	161104				
134.30	5.70	161600	161601	161603	161604				
134.50	3.00	161305	161306	161308	161309				
135.00	4.00	162400	162401	161400	161401				
135.89	6.99	162700	162701	161710	161711				
136.12	3.53	162300	162301	161310	161311				
136.50	5.33	162503	162504	162506	162507				
137.00	3.00	162303	162304	162306	162307				
138.70	1.80	162106	162102	162107	162103				
139.00	4.00	162403	162404	162406	162407				
139.07	6.99	162703	162704	162706	162707	161046			
139.30	3.53	162308	162309	162311	162312	161047			
139.37	2.62	162200	162201	162203	162204				
139.50	3.00	161228	161227	161229	161226				
139.70	5.33	162513	162514	162516	162517				
139.96	3.00	161222	161223	161225	161224				
140.00	5.00	163500	163501	162518	162519				
141.00	3.00	162209	162210	162212	162211				
142.24	5.33	163508	163509	163506	163507				
142.24	6.99	163700	163701	163703	163704				

Dimensional standards	Shaft		Bore		Dynamic app.	Two-part groove assembly
	A min.	A max.	E min.	E max.		
	129.54	134.52	123.50	125.46		
	128.32	133.32	123.75	125.68		
	133.70	138.70	124.28	126.30	□	
	131.04	136.08	124.98	126.96		
BS1806-353 / AS568-353	135.64	140.70	125.70	127.76	□	
R57 / BS1806-429 / AS568-429	138.67	143.73	125.94	128.05	□	
BS1806-250 / AS568-250	132.60	137.67	125.65	127.66		
BS1806-159 / AS568-159	131.07	136.14	125.53	127.51		
BS1806-049 / AS568-049	129.60	134.67	125.44	127.40		
	133.04	138.16	126.95	128.96		
	139.22	144.39	128.67	130.78	□	
	134.54	139.72	128.43	130.46		
BS1806-354 / AS568-354	138.81	144.00	128.82	130.93	□	
R58 / BS1806-430 / AS568-430	141.84	147.02	129.06	131.22	□	
BS1806-251 / AS568-251	135.77	140.96	128.78	130.83		
	137.04	142.32	130.89	132.96		
BS1806-355 / AS568-355	141.99	147.30	131.96	134.11	□	
R59 / BS1806-431 / AS568-431	145.02	150.33	132.20	134.40	□	
BS1806-252 / AS568-252	138.94	144.26	131.90	134.00		
BS1806-160 / AS568-160	137.42	142.74	131.78	133.86		
BS1806-050 / AS568-050	135.95	141.28	131.70	133.75		
	144.22	149.59	133.60	135.78	□	
	139.54	144.92	133.35	135.46		
	141.96	147.36	133.90	136.04		
R60 / BS1806-432 / AS568-432	148.19	153.63	135.32	137.57	□	
BS1806-253 / AS568-253	142.12	147.57	135.03	137.18		
	145.77	151.23	135.68	137.89	□	
	142.04	147.52	135.82	137.96		
	141.62	147.16	137.25	139.38		
	145.96	151.52	137.84	140.04		
R61 / BS1806-433 / AS568-433	151.37	156.94	138.45	140.75	□	
BS1806-254 / AS568-254	145.30	150.87	138.16	140.36		
BS1806-161 / AS568-161	143.77	149.35	138.04	140.21		
	144.54	150.12	138.28	140.46		
	148.97	154.56	138.83	141.09	□	
	145.00	150.60	138.73	140.92		
	148.70	154.30	139.05	141.30	□	
	146.04	151.68	139.76	141.96		
BS1806-358 / AS568-358	151.51	157.20	141.33	143.63	□	
R62 / BS1806-434 / AS568-434	154.54	160.23	141.57	143.92	□	





Shaft



Bore

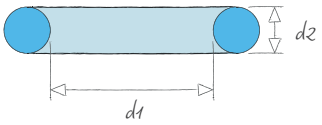
Key

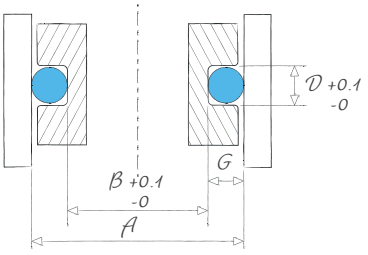
□ Recommended for dynamic applications

△ Two-part groove assembly required

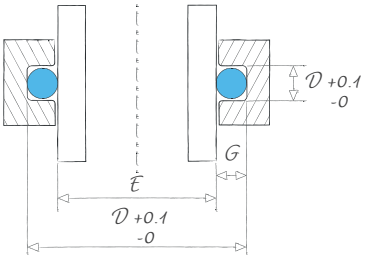
Dimensions		Standard compound codes				NEW			
Inner Ø d1 (mm)	Cross-section Ø d2 (mm)	PC851	PB701	EP851	DF801	7EP1197	EP856	7DF2067	7PD1612
142.47	3.53	163300	163301	163303	163304				
144.00	3.70	163400	163401	163403	163404				
144.30	5.70	163600	163601	163603	163604				
144.50	3.00	163305	163306	163308	163309				
145.00	4.00	164400	164401	163405	163406				
145.42	6.99	164700	164701	163705	163706				
145.64	3.53	164300	164301	163310	163311	163031			
145.72	2.62	164200	164201	163200	163201				
146.10	5.33	164503	164504	163515	163516				
148.00	3.00	163210	163211	163213	163212				
148.59	5.33	164506	164507	164509	164510				
148.59	6.99	164703	164704	164706	164707	163040			
148.82	3.53	164303	164304	164306	164307				
149.20	5.33	164511	164512	164514	164515				
149.30	5.70	163609	163610	163612	163611				
150.00	2.00	164102	164103	164105	164104				
150.00	3.40	165300	165301	164313	164314				
150.00	5.00	165500	165501	164516	164517	164023			
151.00	3.00	165303	165304	164315	164316				
151.77	6.99	165700	165701	165703	165704	164039			
152.00	3.53	165306	165307	165309	165310				
152.07	2.62	165200	165201	165203	165204				
154.30	5.70	165600	165601	165603	165604				
154.50	3.00	165311	165312	165314	165315				
155.00	3.50	166300	166301	165316	165317				
156.00	2.00	165102	165103	165105	165104				
158.12	5.33	166500	166501	166503	166504				
158.12	6.99	166703	166704	166706	166707				
158.34	3.53	166303	166304	166306	166307				
158.42	2.62	166200	166201	166203	166204				
159.30	5.70	166600	166601	166603	166604				
159.50	3.00	166308	166309	166311	166312				
160.00	2.00	167103	167100	167104	167105				
160.00	2.50	167200	167201	166205	166206	166026			
160.00	5.00	167500	167501	166505	166506				
162.50	3.50	167300	167301	167303	167304				
164.10	8.40	167803	167804	167806	167807				
164.30	5.70	167600	167601	167603	167604				
164.47	5.33	168504	168505	167514	167515				
164.47	6.99	167705	167706	167708	167709	166022	166023	166024	166025

Dimensional standards	Shaft		Bore		Dynamic app.	Two-part groove assembly
	A min.	A max.	E min.	E max.		
BS1806-255 / AS568-255	148.47	154.17	141.29	143.53		
	150.29	156.05	142.84	145.11		
	154.22	159.99	143.45	145.78	□	
	149.54	155.32	143.20	145.46		
	151.96	157.76	143.75	146.04		
R63 / BS1806-435 / AS568-435	157.72	163.54	144.71	147.10	□	
BS1806-256 / AS568-256	151.64	157.47	144.41	146.70		
BS1806-162 / AS568-162	150.12	155.95	144.29	146.56		
	155.37	161.22	145.13	147.49	□	
	153.04	158.96	146.65	148.96		
BS1806-360 / AS568-360	157.86	163.81	147.59	149.98	□	
R64 / BS1806-436 / AS568-436	160.89	166.84	147.83	150.27	□	
BS1806-257 / AS568-257	154.82	160.77	147.54	149.88		
	158.47	164.44	148.19	150.59	□	
	159.22	165.19	148.37	150.78	□	
	153.32	159.32	148.37	150.68		
	155.78	161.78	148.67	151.02		
	158.70	164.70	148.90	151.30	□	
	156.04	162.08	149.61	151.96		
R65 / BS1806-437 / AS568-437	164.07	170.14	150.96	153.45	□	
	158.00	164.08	150.67	153.06		
BS1806-163 / AS568-163	156.47	162.55	150.55	152.91		
	164.22	170.39	153.30	155.78	□	
	159.54	165.72	153.05	155.46		
	160.95	167.15	153.62	156.05		
	159.32	165.56	154.28	156.68		
BS1806-362 / AS568-362	167.39	173.72	156.97	159.51	□	
R66 / BS1806-438 / AS568-438	170.42	176.75	157.22	159.80	□	
BS1806-259 / AS568-259	164.34	170.67	156.92	159.40		
BS1806-164 / AS568-164	162.82	169.16	156.80	159.26		
	169.22	175.59	158.22	160.78	□	
	164.54	170.92	157.98	160.46		
	163.32	169.72	158.22	160.68		
	164.20	170.60	158.33	160.80		
	168.70	175.10	158.75	161.30	□	
	168.45	174.95	161.01	163.55		
	178.88	185.45	163.40	166.12	□	
	174.22	180.79	163.15	165.78	□	
BS1806-363 / AS568-363	173.74	180.32	163.23	165.86	□	
R67 / BS1806-439 / AS568-439	176.77	183.35	163.47	166.15	□	





Shaft



Bore

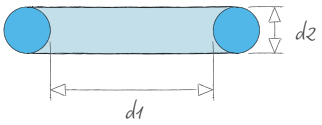
Key

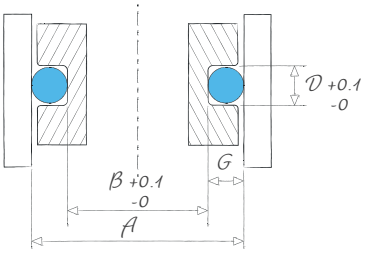
□ Recommended for dynamic applications

△ Two-part groove assembly required

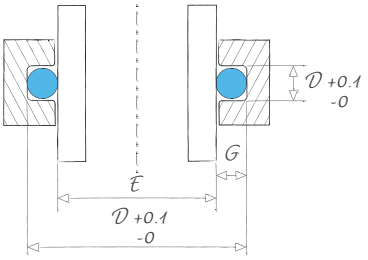
Dimensions		Standard compound codes				NEW			
Inner Ø d1 (mm)	Cross-section Ø d2 (mm)	PC851	PB701	EP851	DF801	7EP1197	EP856	7DF2067	7PD1612
164.50	3.00	167305	167306	167308	167309				
164.70	3.53	167310	167311	167313	167314	166027			
164.77	2.62	167203	167204	167219	167207				
165.00	4.00	167408	167409	167411	167410				
166.70	6.99	168700	168701	168703	168704				
167.00	2.80	168300	168301	168303	168304				
169.30	5.70	168600	168601	168603	168604				
169.50	3.00	168305	168306	168308	168309				
170.00	5.00	169500	169501	168500	168501	168022			
170.82	5.33	169503	169504	168502	168503				
170.82	6.99	169700	169701	168710	168711				
171.05	3.53	169300	169301	168310	168311				
172.00	3.00	169303	169304	169306	169307				
174.50	3.00	169308	169309	169311	169312				
174.60	6.99	169703	169704	169706	169707				
175.00	4.00	170400	170401	169400	169401				
176.00	3.00	170300	170301	169313	169314				
177.17	5.33	170500	170501	170503	170504				
177.17	6.99	170700	170701	170703	170704				
177.40	3.53	170303	170304	170306	170307	169014			
179.30	5.70	170600	170601	170603	170604				
179.50	3.00	170308	170309	170311	170312				
180.00	2.50	171200	171201	170205	170206				
180.00	5.00	171500	171501	170505	170506				
183.52	6.99	171703	171704	171706	171707	170018			
183.74	3.53	171300	171301	171303	171304	170019			
183.82	2.62	171203	171204	171206	171215				
184.00	4.00	171412	171413	171414	171415				
184.30	5.70	171600	171601	171603	171604				
184.50	3.00	171305	171306	171308	171309				
187.33	6.99	171750	171755	171767	171757				
188.00	3.00	172321	172322	172323	172324				
189.30	5.70	172600	172601	172603	172604	171015			
189.87	6.99	172705	172706	172708	172709				
190.00	2.70	173300	173301	172305	172306				
190.00	4.00	173400	173401	172400	172401				
190.00	5.30	173507	173508	173531	173532				
190.10	3.53	173303	173304	172307	172308				
194.50	3.00	173306	173307	173309	173310				
196.22	5.33	174500	174501	173500	173501	173017			

Dimensional standards	Shaft		Bore		Dynamic app.	Two-part groove assembly
	A min.	A max.	E min.	E max.		
	169.54	176.12	162.90	165.46		
	170.70	177.29	163.18	165.76		
BS1806-165 / AS568-165	169.17	175.76	163.06	165.61		
	171.96	178.56	163.45	166.04		
	179.00	185.67	165.67	168.38	☐	
	171.70	178.38	165.31	167.90		
	179.22	185.99	168.07	170.78	☐	
	174.54	181.32	167.83	170.46		
	178.70	185.50	168.60	171.30	☐	
BS1806-364 / AS568-364	180.09	186.93	169.48	172.21	☐	
R68 / BS1806-440 / AS568-440	183.12	189.96	169.73	172.50	☐	
	177.05	183.89	169.44	172.11		
	177.04	183.92	170.29	172.96		
	179.54	186.52	172.75	175.46		
	186.90	193.89	173.45	176.28	☐	
	181.96	188.96	173.30	176.04		
	181.04	188.08	174.23	176.96		
BS1806-365 / AS568-365	186.44	193.53	175.74	178.56	☐	
R69 / BS1806-441 / AS568-441	189.47	196.56	175.98	178.85	☐	
	183.40	190.50	175.69	178.46		
	189.22	196.39	177.92	180.78	☐	
	184.54	191.72	177.68	180.46		
	184.20	191.40	178.03	180.80		
	188.70	195.90	178.45	181.30	☐	
R70 / BS1806-442 / AS568-442	195.82	203.16	182.24	185.20	☐	
BS1806-263 / AS568-263	189.74	197.09	181.94	184.80		
BS1806-168 / AS568-168	188.22	195.57	181.82	184.66		
	190.96	198.32	182.16	185.04		
	194.22	201.59	182.85	185.78	☐	
	189.54	196.92	182.60	185.46		
	199.63	207.13	185.99	189.01	☐	
	193.04	200.56	186.05	188.96		
BS4518-1893-57	199.22	206.79	187.77	190.78	☐	
R71 / BS1806-443 / AS568-443	202.17	209.77	188.49	191.55	☐	
	194.54	202.14	187.93	190.86		
	196.96	204.56	188.07	191.04		
	199.22	206.82	188.37	191.38	☐	
	196.10	203.71	188.20	191.16		
	199.54	207.32	192.45	195.46		
BS1806-368 / AS568-368	205.49	213.34	194.50	197.61	☐	





Shaft



Bore

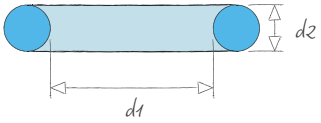
Key

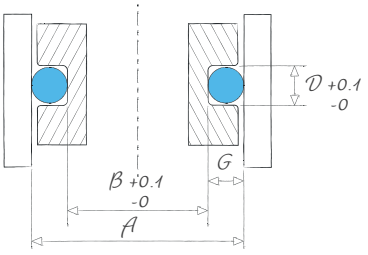
☐ Recommended for dynamic applications

△ Two-part groove assembly required

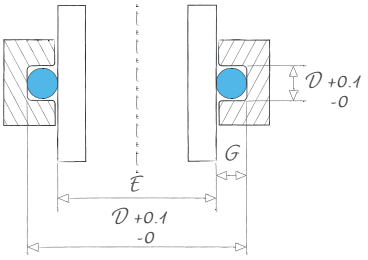
Dimensions		Standard compound codes				NEW			
Inner Ø d1 (mm)	Cross-section Ø d2 (mm)	PC851	PB701	EP851	DF801	7EP1197	EP856	7DF2067	7PD1612
196.22	6.99	174700	174701	173708	173709				
196.45	3.53	174300	174301	173311	173312	173018			
198.80	3.80	174400	174401	174403	174404				
199.30	5.70	174600	174601	174603	174604				
200.00	7.00	174612	174613	174615	174614				
201.75	4.00	174331	174332	174334	174333				
202.57	5.33	175400	175401	175436	175404	174038			
202.57	6.99	175606	175607	175609	175610	174052			
202.80	3.53	175200	175201	175203	175204	174029	174030	174031	174032
204.10	8.40	175700	174734	174735	174733				
209.14	3.53	175210	175211	175213	175214				
209.30	5.70	175500	175501	175503	175504				
209.50	3.00	175215	175216	175218	175219				
210.00	4.00	176300	176301	175300	175301				
212.00	6.30	176600	176601	175616	175617				
214.00	3.00	176200	176201	176203	176204				
215.27	5.33	176400	176401	176403	176404				
215.27	6.99	176603	176604	176606	176607				
215.49	3.53	176205	176206	176208	176209	175023			
221.60	6.99	177600	177601	176608	176609				
221.62	5.33	177400	177401	176405	176406				
221.84	3.53	177200	177201	176215	176216				
224.50	3.00	177203	177204	177206	177207				
226.32	4.00	176321	176322	176324	176323				
227.97	5.33	177403	177404	177406	177407				
227.97	6.99	177608	177609	177611	177612				
228.19	3.53	177208	177209	177211	177212				
229.30	5.70	177500	177501	177503	177504				
233.00	3.00	178200	178201	178203	178204				
234.30	6.99	178600	178601	178603	178604				
234.32	5.33	178400	178401	178403	178404				
234.54	3.53	178205	178206	178208	178209				
234.62	2.62	178100	178101	178103	178104				
235.00	3.00	178210	178211	178213	178214				
236.00	6.30	178605	178606	178608	178609				
240.67	5.33	179428	179429	179430	179431	178022	178023	178024	178025
240.67	6.99	179600	179601	178610	178611				
240.90	3.53	179200	179201	178220	178221				
245.00	3.00	179203	179204	179206	179207				
247.02	6.99	179603	179604	179606	179607				

Dimensional standards	Shaft		Bore		Dynamic app.	Two-part groove assembly
	A min.	A max.	E min.	E max.		
R72 / BS1806-444 / AS568-444	208.52	216.37	194.74	197.90	□	
	202.45	210.31	194.46	197.51		
	205.26	213.21	196.84	199.94		
	209.22	217.19	197.62	200.78	□	
	212.32	220.32	198.47	201.68	□	
	208.71	214.76	199.64	202.79		
BS1806-369 / AS568-369	211.84	217.92	200.76	203.96	□	
R73 / BS1806-445 / AS568-445	214.87	220.95	201.00	204.25	□	
BS1806-266 / AS568-266	208.80	214.89	200.71	203.86		
	218.88	225.01	202.80	206.12	□	
BS1806-267 / AS568-267	215.14	221.42	206.96	210.20		
	219.22	225.50	207.47	210.78	□	
	214.54	220.83	207.23	210.46		
	216.96	223.26	207.77	211.04		
	223.09	229.45	210.14	213.51	□	
	219.04	225.46	211.66	214.96		
BS1806-371 / AS568-371	224.54	231.00	213.27	216.66	□	
R74 / BS1806-446 / AS568-446	227.57	234.03	213.51	216.95	□	
BS1806-268 / AS568-268	221.49	227.96	213.21	216.55		
	233.90	240.55	219.74	223.28	□	
BS1806-372 / AS568-372	230.89	237.54	219.52	223.01	□	
BS1806-269 / AS568-269	227.84	234.50	219.47	222.90		
	229.54	236.28	222.00	225.46		
	233.28	240.07	223.85	227.36		
BS1806-373 / AS568-373	237.24	244.08	225.78	229.36	□	
R75 / BS1806-447 / AS568-447	240.27	247.11	226.02	229.65	□	
BS1806-270 / AS568-270	234.19	241.04	225.72	229.25		
	239.22	246.10	227.17	230.78	□	
	238.04	245.03	230.38	233.96		
	246.60	253.63	232.25	235.98	□	
BS1806-374 / AS568-374	243.59	250.62	232.03	235.71	□	
BS1806-271 / AS568-271	240.54	247.58	231.98	235.60		
BS1806-176 / AS568-176	239.02	246.06	231.86	235.46		
	240.04	247.09	232.35	235.96		
	247.09	254.17	233.78	237.51	□	
BS1806-375 / AS568-375	249.94	257.16	238.29	242.06	□	
R76 / BS1806-448 / AS568-448	252.97	260.19	238.53	242.35	□	
	246.90	254.13	238.24	241.96		
	250.04	257.39	242.20	245.96		
	259.32	266.73	244.78	248.70	□	





Shaft



Bore

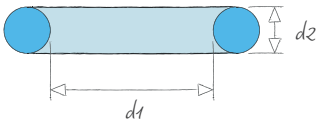
Key

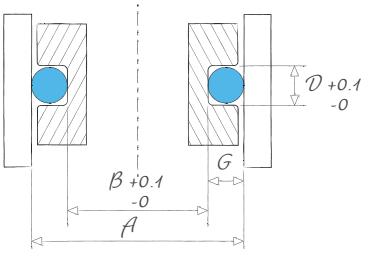
□ Recommended for dynamic applications

△ Two-part groove assembly required

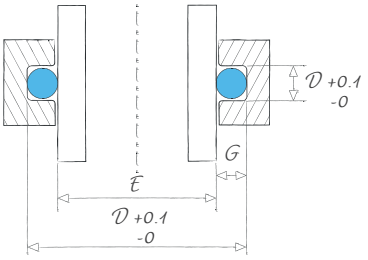
Dimensions		Standard compound codes						NEW	
Inner Ø d1 (mm)	Cross-section Ø d2 (mm)	PC851	PB701	EP851	DF801	7EP1197	EP856	7DF2067	7PD1612
247.24	3.53	179208	179209	179211	179212				
249.30	5.70	179500	179501	179503	179504				
250.00	5.00	180407	180406	180414	180415				
253.37	6.99	180603	180604	180606	180607				
253.59	3.53	180200	180201	180203	180204	179014			
259.30	5.70	180500	180501	180503	180504	179015			
259.72	6.99	180608	180609	180611	180612				
260.00	3.00	181200	181201	180205	180206				
266.07	6.99	181605	181606	181608	181609				
266.29	3.53	181203	181204	181206	181207				
269.30	5.70	181500	181501	181503	181504				
271.00	3.00	182200	182201	181208	181209				
272.42	6.99	182600	182601	181610	181611				
275.00	4.00	182300	182301	182303	182304				
278.77	5.33	182400	182401	182403	182404				
278.77	6.99	182603	182604	182606	182607				
278.99	3.53	182203	182204	182206	182207				
279.30	5.70	182500	182501	182503	182504				
280.00	3.00	183200	183201	182208	182209				
285.12	6.99	183603	183604	183606	183607				
286.45	4.00	182319	182322	182321	182320				
288.00	4.00	183300	183301	183303	183304				
290.00	3.00	184200	184201	183203	183204				
291.47	5.33	184400	184401	183400	183401				
291.47	6.99	184600	184601	183608	183609				
291.69	3.53	184203	184204	183205	183206				
297.82	6.99	184603	184604	184606	184607				
298.00	2.50	184100	184101	184103	184104				
304.17	6.99	185603	185604	185606	185607				
304.39	3.53	185200	185201	185203	185204			184037	
307.00	5.00	185405	185406	185408	185409				
310.00	3.00	185205	185206	185208	185209				
315.00	7.00	185634	185635	185636	185637				
315.00	10.00	185803	185804	185806	185807				
316.87	6.99	185613	185614	185616	185617				
317.50	3.20	185210	185211	185213	185214				
319.30	5.70	185500	185501	185503	185504				
325.00	3.00	186200	186201	185215	185216				
329.57	5.33	186400	186401	186403	186404				
329.57	6.99	186600	186601	186603	186604	185036			

Dimensional standards	Shaft		Bore		Dynamic app.	Two-part groove assembly
	A min.	A max.	E min.	E max.		
BS1806-273 / AS568-273	253.24	260.66	244.48	248.30		
	259.22	266.70	246.87	250.78	□	
	258.70	266.20	247.40	251.30	□	
R77 / BS1806-449 / AS568-449	265.67	273.27	251.04	255.05	□	
BS1806-274 / AS568-274	259.59	267.20	250.74	254.65		
	269.22	277.00	256.72	260.78	□	
	272.02	279.81	257.29	261.40	□	
	265.04	272.84	256.97	260.96		
R78 / BS1806-450 / AS568-450	278.37	286.35	263.55	267.75	□	
BS1806-275 / AS568-275	272.29	280.28	263.25	267.35		
	279.22	287.30	266.57	270.78	□	
	276.04	284.17	267.81	271.96		
	284.72	292.90	269.80	274.10	□	
	281.96	290.21	271.80	276.04		
BS1806-379 / AS568-379	288.04	296.41	275.81	280.16	□	
R79 / BS1806-451 / AS568-451	291.07	299.44	276.06	280.45	□	
BS1806-276 / AS568-276	284.99	293.36	275.76	280.05		
	289.22	297.60	276.42	280.78	□	
	285.04	293.44	276.67	280.96		
	297.42	305.98	282.31	286.80	□	
	293.41	302.00	283.07	287.49		
	294.96	303.60	284.60	289.04		
	295.04	303.74	286.52	290.96		
BS1806-380 / AS568-380	300.74	309.49	288.32	292.86	□	
R80 / BS1806-452 / AS568-452	303.77	312.52	288.57	293.15	□	
BS1806-277 / AS568-277	297.69	306.44	288.27	292.75		
	310.12	319.06	294.82	299.50	□	
	302.20	311.14	294.26	298.80		
R81 / BS1806-453 / AS568-453	316.47	325.60	301.08	305.85	□	
BS1806-278 / AS568-278	310.39	319.52	300.78	305.45		
	315.70	324.91	303.55	308.30		
	315.04	324.34	306.22	310.96		
	327.32	336.77	311.75	316.68	□	
	332.60	342.05	312.38	317.40	□	
R82 / BS1806-454 / AS568-454	329.17	338.68	313.58	318.55	□	
	322.94	332.47	313.60	318.46		
	329.22	338.80	315.82	320.78	□	
	330.04	339.79	321.00	325.96		
BS1806-382 / AS568-382	338.84	348.73	325.85	330.96	□	
R83 / BS1806-455 / AS568-455	341.87	351.76	326.09	331.25	□	





Shaft



Bore

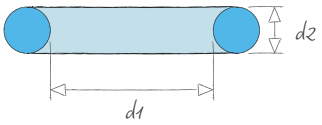
Key

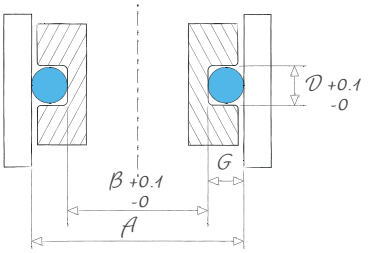
□ Recommended for dynamic applications

△ Two-part groove assembly required

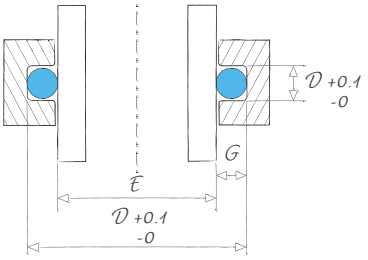
Dimensions		Standard compound codes				NEW			
Inner Ø d1 (mm)	Cross-section Ø d2 (mm)	PC851	PB701	EP851	DF801	7EP1197	EP856	7DF2067	7PD1612
329.79	3.53	186203	186204	186206	186207				
330.00	3.70	186300	186301	186303	186304				
335.00	3.00	186208	186209	186211	186212				
339.30	5.70	186505	186506	186508	186509				
342.27	6.99	186605	186606	186608	186609				
345.00	3.00	186213	186214	186216	186217				
354.97	6.99	187600	187601	187603	187604				
355.00	3.00	187200	187201	187203	187204				
355.00	5.30	187408	187409	187410	187411				
355.19	3.53	187205	187206	187208	187209				
359.30	5.70	187500	187501	187503	187504				
365.00	3.00	187210	187211	187213	187214				
367.67	6.99	187605	187606	187608	187609				
372.00	6.00	187505	187506	187508	187509				
380.37	5.33	188400	188401	188403	188404				
380.37	6.99	188600	188601	188603	188604	187019			
380.59	3.53	188200	188201	188203	188204				
385.00	3.00	188205	188206	188208	188209				
393.07	6.99	188605	188606	188608	188609				
395.00	3.00	188210	188211	188508	188214				
399.30	5.70	188505	188506	189203	188509				
405.26	3.53	189200	189201	189403	189204				
405.26	5.33	189400	189401	189208	189404				
406.40	3.20	189205	189206	189706	189209				
412.00	8.00	189703	189704	188669	189707				
412.48	6.94	188632	188667	189708	188668				
425.00	8.00	190700	190701	190203	189709				
430.66	3.53	190200	190201	190603	190204				
430.66	6.99	190600	190601	190503	190604				
431.50	6.00	190500	190501	190503	190504				
439.00	6.00	190505	190506	190508	190509				
440.00	10.00	190803	190804	190806	190807				
444.00	8.00	190703	190704	190706	190707				
447.00	7.00	189662	189663	189665	189666				
459.00	8.00	191703	191704	191706	191707				
459.30	5.70	191500	191501	191503	191504				
465.00	5.30	191405	191406	191408	191409				
468.00	6.00	191505	191506	192508	191509				
486.00	6.00	192503	192504	192506	192507				
487.00	7.00	192614	192615	192616	192617				

Dimensional standards	Shaft		Bore		Dynamic app.	Two-part groove assembly
	A min.	A max.	E min.	E max.		
BS1806-279 / AS568-279	335.79	345.68	325.80	330.85		
	336.29	346.19	326.05	331.11		
	340.04	350.09	330.85	335.96		
	349.22	359.40	335.52	340.78	□	
R84 / BS1806-456 / AS568-456	354.57	364.84	338.60	343.95	□	
	350.04	360.39	340.70	345.96		
R85 / BS1806-457 / AS568-457	367.27	377.92	351.11	356.65	□	
	360.04	370.69	350.55	355.96		
	364.22	374.87	350.89	356.38	□	
BS1806-280 / AS568-280	361.19	371.85	350.82	356.25		
	369.22	380.00	355.22	360.78	□	
	370.04	380.99	360.40	365.96		
R86 / BS1806-458 / AS568-458	379.97	391.00	363.62	369.35	□	
	382.56	393.72	367.68	373.44	□	
BS1806-384 / AS568-384	389.64	401.06	375.89	381.76		
R87 / BS1806-459 / AS568-459	392.67	404.08	376.13	382.05	□	
	386.59	398.01	375.83	381.65		
	390.04	401.59	380.10	385.96		
R88 / BS1806-460 / AS568-460	405.37	417.16	388.64	394.75	□	
	400.04	411.89	389.95	395.96		
	409.22	421.20	394.62	400.78	□	
BS1806-282 / AS568-282	411.26	419.37	400.13	406.32		
BS1806-385 / AS568-385	414.53	422.64	400.41	406.65		
	411.84	419.97	401.17	407.36		
	426.08	434.32	407.50	413.92	□	
	424.69	432.94	407.75	414.15	□	
	439.08	447.58	420.31	426.92	□	
BS1806-283 / AS568-283	436.66	445.27	425.15	431.72		
BS1806-463 / AS568-463	442.96	451.58	425.67	432.34	□	
	442.06	450.69	426.29	432.94	□	
	449.56	458.34	433.68	440.44	□	
	457.60	466.40	435.50	442.40	□	
	458.08	466.96	439.02	445.92	□	
	459.32	468.26	441.77	448.68	□	
	473.08	482.26	453.80	460.92	□	
	469.22	478.40	453.72	460.78		
	474.22	483.52	459.24	466.38		
	478.56	487.92	462.24	469.44	□	
	496.56	506.28	479.97	487.44	□	
	499.32	509.06	481.17	488.68	□	





Shaft



Bore

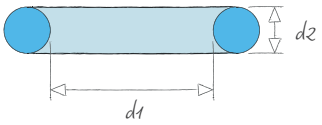
Key

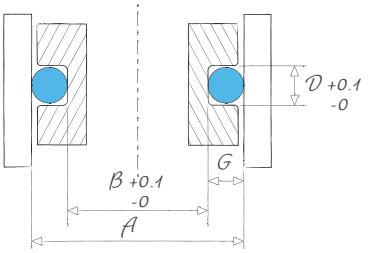
□ Recommended for dynamic applications

△ Two-part groove assembly required

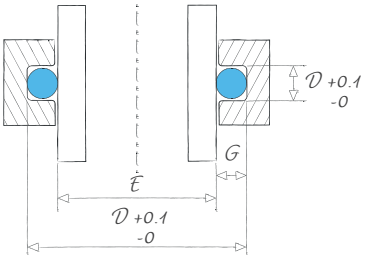
Dimensions		Standard compound codes				NEW			
Inner Ø d1 (mm)	Cross-section Ø d2 (mm)	PC851	PB701	EP851	DF801	7EP1197	EP856	7DF2067	7PD1612
493.72	7.00	191658	191659	191661	191660				
495.00	3.00	192200	192201	192203	192204				
500.00	6.00	193500	193501	192513	192514				
500.00	8.00	193700	193701	192703	192704				
505.00	6.00	193503	193504	192515	192516				
506.81	5.33	193400	193401	193403	193404				
522.00	6.00	193506	193507	193509	193510				
530.00	10.00	193803	193804	193806	193807				
531.00	6.00	193511	193512	193514	193515				
532.21	5.33	193405	193406	193408	193409				
532.26	6.99	193605	193606	193608	193609	192045			
554.00	8.00	193703	193704	193706	193707				
557.66	6.99	193646	193647	193648	193649				
582.68	5.33	193415	193416	193418	193419				
582.68	6.99	193650	193651	193652	193653				
608.08	6.99	194600	194601	194603	194604				
610.00	10.00	194803	194804	194806	194807				
710.00	10.00	195800	195801	195803	195804				
738.00	10.25	195805	195806	195808	195809				
800.00	10.00	196800	196801	195815	195816				

Dimensional standards	Shaft		Bore		Dynamic app.	Two-part groove assembly
	A min.	A max.	E min.	E max.		
	506.04	515.91	487.78	495.40	☐	
	500.04	509.94	488.45	495.96		
	510.56	520.56	493.76	501.44		
	514.08	524.08	494.18	501.92	☐	
	515.56	525.66	498.69	506.44		
	516.08	526.22	500.43	508.20		
	532.56	543.00	515.43	523.44		
	547.60	558.20	524.15	532.40	☐	
	541.56	552.18	524.30	532.44		
	541.48	552.13	525.45	533.60		
BS1806-470 / AS568-470	544.56	555.21	525.74	533.94	☐	
	568.08	579.16	547.37	555.92	☐	
BS1806-471 / AS568-471	569.96	581.12	550.76	559.34	☐	
BS1806-392 / AS568-392	591.95	603.61	575.17	584.07		
BS1806-472 / AS568-472	594.98	606.64	575.41	584.36	☐	
BS1806-473 / AS568-473	620.38	632.54	600.43	609.76	☐	
	627.60	639.80	602.95	612.40	☐	
	727.60	741.80	701.45	712.40	☐	
	756.04	770.80	729.08	740.46	☐	
	817.60	833.60	790.10	802.40	☐	





Shaft



Bore

Key

☐ Recommended for dynamic applications

△ Two-part groove assembly required

HUTCHINSON®

X-RINGS

We make it ***possible***

1 – GENERAL INFORMATION

1.1 – Definition

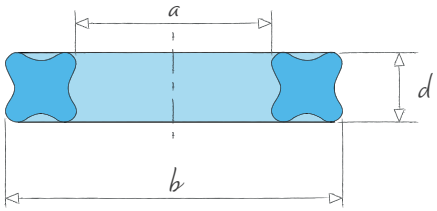
The X-ring has a cross section with 4 lobes, providing a double sealing line especially suitable for hydraulic, pneumatic and oleo-pneumatic devices.

It has no assembly orientation and is defined by two dimensions: inside diameter a and cross section d.

It is particularly suitable for dynamic applications such as:

- reciprocating movements up to 150 bar
- rotating movements up to 1m/s

Beyond these limits, certain assembly and lubrication conditions must be observed.



1.2 – Compound selection

The standard compound for X-Rings is 9PD31, a NBR 78 Sh systematically treated with Lubri PB.

Many other compounds are available in our compounds list (p. 135), subject to feasibility.

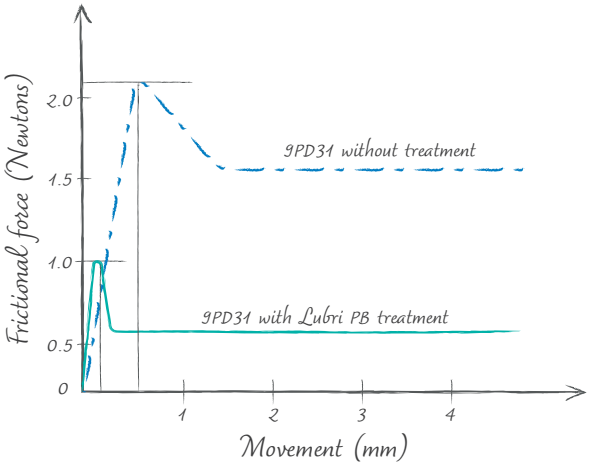
Family	Compound	Colour	Hardness (Sh.A)	Min temp.	Max continuous temp.	Temp. max peak	CS	Conditions
NBR	9PD31	black	78	-30°C	100°C	120°C	15%	24h at 100°C

2 – TECHNICAL BENEFITS

2.1 – Reduced friction

Compared with O-Rings the friction of X-Rings is reduced for several reasons:

- Operating principle based on bending of the lobes and not on compression of the material, which reduces the sticking effect
- Presence of a reserve of lubricant trapped between the lobes
- Special LUBRI PB treatment systematically applied to our X-Rings in 9PD31



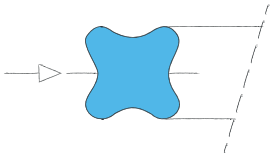
2.2 – Reduced starting torque

Some sub-assemblies require significant starting torque after prolonged downtime.

This force is reduced by about 75% compared with O-Rings.

2.3 – Position of the flash line

The friction surfaces of the X-Rings are free from any trace of flash located in the non-functional area.



Position of the flash line

2.4 – Less wear

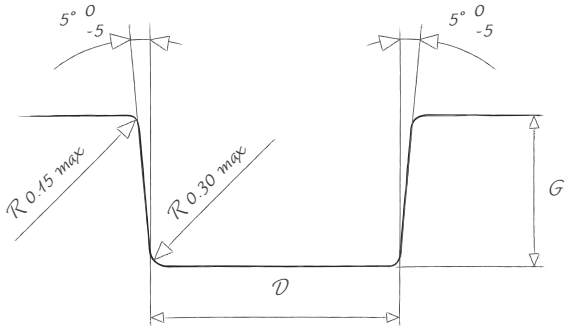
The friction being proportional to the pressure, the wear on an X-Ring is virtually zero when there is no pressure.

2.5 – No twisting

The square section of X-Rings eliminates the risk of twisting on fitting and in operation when installation requirements are observed.

3 – FITTING INSTRUCTIONS

3.1 – Static applications

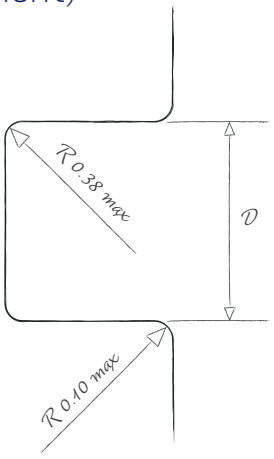


An X-Ring used in a static application should be fitted in a rectangular groove, of depth and width defined according to the cross section of the ring, as shown in the table below.

The groove may have parallel walls or an angle of up to 5° that should be added to the recommended dimensions.

Cross section (mm)	Groove (mm)	
	Depth G	Width D
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

3.2 – Dynamic applications (reciprocating movement)



An X-Ring for dynamic applications is fitted in a rectangular groove, preferably in the bore.

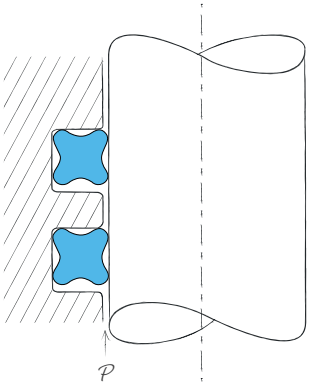
A small radius (from 0.125 mm to 0.380 mm max) is allowed in the base of the groove. It is advisable to have lead-in angles on the friction side.

An X-Ring should not be used as a guide in a moving assembly. Moving parts must be guided using a mechanical seating.

3.3 – Double X-Ring assembly

In some applications, the pressure may come alternately from one side or the other of the X-Ring. At low pressure (up to 7 bar), the use of a single X-Ring is possible.

At medium and high pressure (> 7 bar), it is better to let the same face of the X-Ring receive the pressure. We recommend the use of two X-Rings fitted in two successive grooves.

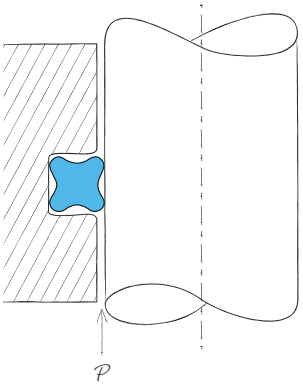


3.4 – Rotary applications

An X-Ring used in rotary applications should be fitted in the fixed part.

A peripheral compression of 5% and radial compression of 3% on the cross section is essential.

The volume of the groove must be approximately 5% greater than that of the seal.



4 – ADDITIONAL TECHNICAL INFORMATION

4.1 – Tolerances and fit

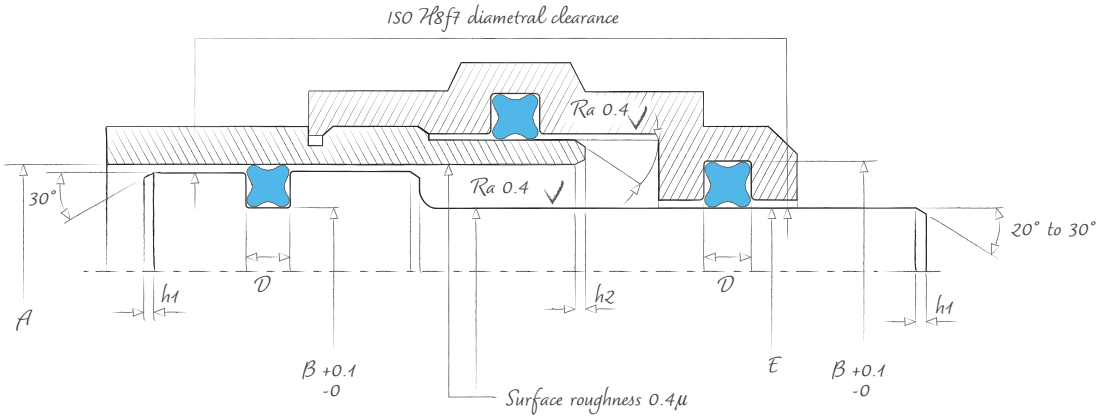
Pressure ≥ 10 bar

Restrict machining tolerances to a strict minimum, ISO H8f7 tolerances are recommended.

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

Pressure ≤ 10 bar

Slightly wider tolerances up to H8e8 can be allowed.



ISO H8f7 diametral clearance

4.2 – Extrusion

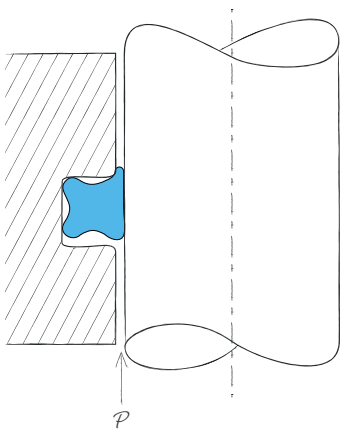
Extrusion is the passage of material into the mechanical clearance.

Pressure pulses, high temperatures, chemical incompatibility of the rubber, rapid translational motion and long strokes – and a combination of these factors – can exacerbate X-Ring extrusion.

There are several ways to prevent extrusion:

- Reduce the clearance fit: the risk of extrusion is zero if there is no clearance
- Increase the hardness of the rubber
- Improve the cylindricity and coaxiality
- Use an anti-extrusion washer (back-up ring)

The higher the pressure, the more the clearance needs to be reduced, the more the hardness needs to be increased.



4.3 – Surface roughness

The surface roughness determines the wear on the X-Ring and hence its lifespan.

We recommend an Ra of 0.4µ.

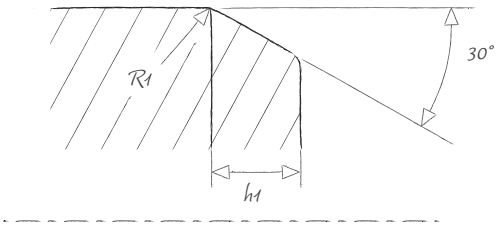
It is recommended to filter all engine fluids and avoid any abrasive deposits on moving parts, as the latter affect the surfaces and lead to rapid deterioration of the seals.

4.4 – Chamfers

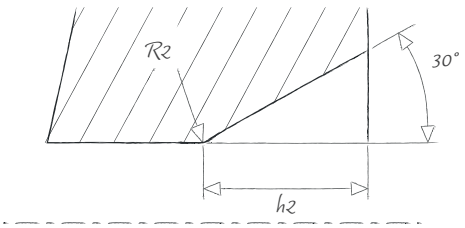
Lead-in chamfers are essential to avoid damaging the X-Ring during installation. An angle of 20 to 30° represents the best compromise.

The dimensions are dependent on the cross section of the X-Ring, as shown in the table below.

Cross section	On shaft		In the bore	
	h1 (mm)	R1 (mm)	h2 (mm)	R2 (mm)
1.78	1.50	3.00	2.50	5.00
2.62	1.50	3.00	2.50	5.00
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



Chamfer on shaft



Chamfer in the bore

5 – SIZE CHARTS

Custom development on request

The selection of an X-Ring can be made directly from the list below according to the assembly recommendations for the usual conditions of use.

The choice of A and B (shaft) or E and H (bore) within the specified limits must lead to the indicated depth of groove G.

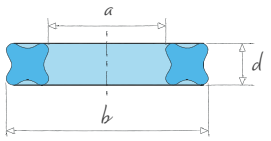
$$G = \frac{A - B}{2} \text{ or } G = \frac{H - E}{2}$$

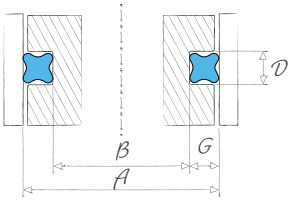
Code in 9PD31	Dimensions				Shaft application			
					Shaft ø		Base of groove	
	No.	a	b	d	Min A	Max A	Min B	Max B
200000	1	2.90	6.46	1.78	6.10	6.20	2.95	3.05
200001	2	3.68	7.24	1.78	6.90	7.00	3.75	3.85
200002	3	4.47	8.03	1.78	7.70	7.80	4.55	4.65
200003	3 A	4.62	8.18	1.78	7.85	8.00	4.70	4.85
200004	4	5.28	8.84	1.78	8.50	8.65	5.35	5.50
200005	4 A	5.70	9.26	1.78	8.95	9.10	5.80	5.95
200006	5	6.07	9.63	1.78	9.30	9.50	6.15	6.35
200007	5 A	6.65	10.21	1.78	9.90	10.15	6.75	7.00
200008	6	7.65	11.21	1.78	10.90	11.15	7.75	8.00
200009	6 A	8.70	12.26	1.78	11.95	12.25	8.80	9.10
200010	7	9.25	12.81	1.78	12.50	12.85	9.35	9.70
200011	7 A	9.70	13.26	1.78	12.95	13.30	9.80	10.15
200232	113	10.82	14.38	1.78	14.10	14.45	10.95	11.30
200738	114	12.42	15.98	1.78	15.70	16.15	12.55	13.00
200728	115	14.00	17.56	1.78	17.35	17.85	14.20	14.60
200729	116	15.60	19.16	1.78	18.90	19.50	15.75	16.35
200730	117	17.17	20.73	1.78	20.60	21.10	17.45	17.95
200739	118	18.77	22.33	1.78	22.30	22.75	19.05	19.60
200731	119	20.35	23.91	1.78	23.45	24.35	20.60	21.20
200732	120	21.95	25.51	1.78	25.05	26.00	22.20	22.85
200740	121	23.52	27.08	1.78	26.50	27.60	23.75	24.45
201264	122	25.12	28.68	1.78	28.55	29.40	25.40	26.25
201265	123	26.70	30.26	1.78	30.15	31.05	27.00	27.90
201266	124	28.30	31.86	1.78	31.80	32.75	28.65	29.60
201267	125	29.87	33.43	1.78	33.35	34.35	30.20	31.20
201687	137	63.22	66.78	1.78	67.15	69.20	64.00	66.05
200012	8	9.19	14.43	2.62	14.00	14.45	9.20	9.65
200013	8 A	9.80	15.04	2.62	14.70	15.05	9.90	10.25
200014	9	10.77	16.01	2.62	15.70	16.10	10.90	11.30
200015	9 A	11.70	16.94	2.62	16.60	17.05	11.80	12.25
200500	10	12.37	17.61	2.62	17.30	17.75	12.50	12.95
200501	10 A	12.80	18.04	2.62	17.70	18.20	12.90	13.40
200502	10 B	13.70	18.94	2.62	18.60	18.60	13.80	14.30
200503	11	13.94	19.18	2.62	19.15	19.40	14.35	14.60
200504	11 A	14.70	19.94	2.62	19.65	20.20	14.85	15.40
200505	12	15.54	20.78	2.62	20.50	21.05	15.70	16.25
200506	13	17.12	22.36	2.62	22.00	22.55	17.20	17.75

Functional validation by testing remains the user's responsibility.

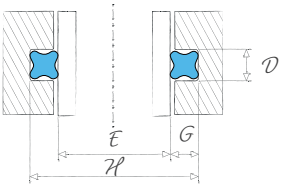
Standard X-Rings from stock are in NBR 78 Sh. - 9PD31 compound.
Other compounds are also available on request.

		Bore application			
Groove Width D	Groove Height G	Shaft ø		Base of groove	
		Min E	Max E	Min H	Max H
2.00	1.58	3.25	-	6.40 ◁	-
2.00	1.58	4.00	4.05	7.15 ◁	7.20 ◁
2.00	1.58	4.75	4.80	7.90 ◁	7.95 ◁
2.00	1.58	4.95	5.00	8.10 ◁	8.15 ◁
2.00	1.58	5.55	5.60	8.70	8.75
2.00	1.58	6.00	6.05	9.15	9.20
2.00	1.58	6.35	6.40	9.50	9.55
2.00	1.52	6.90	7.00	10.05	10.15
2.00	1.58	7.90	8.00	11.05	11.25
2.00	1.58	8.95	9.05	12.10	12.20
2.00	1.58	9.50	9.60	12.65	12.75
2.00	1.58	9.90	10.05	13.05	13.20
2.00	1.58	11.05	11.15	14.20	14.30
2.00	1.58	12.60	12.75	15.75	15.90
2.00	1.58	14.15	14.30	17.30	17.45
2.00	1.58	15.75	15.90	18.90	19.05
2.00	1.58	17.30	17.45	20.45	20.60
2.00	1.58	18.85	19.05	22.00	22.20
2.00	1.58	20.40	20.65	23.55	23.80
2.00	1.58	22.00	22.25	25.15	25.40
2.00	1.58	23.55	23.80	26.70	26.95
2.00	1.58	25.10	25.40	28.25	28.55
2.00	1.58	26.65	26.95	29.80	30.10
2.00	1.58	28.25	28.55	31.40	31.70
2.00	1.58	29.80	30.10	32.95	33.25
2.00	1.58	62.65	63.30	65.80	66.45
2.90	2.40	9.45	9.55	14.25	14.35
2.90	2.40	10.00	10.15	14.80	14.95
2.90	2.40	11.00	11.10	15.80	15.90
2.90	2.40	11.90	12.05	16.70	16.85
2.90	2.40	12.50	12.70	17.30	17.50
2.90	2.40	12.95	13.15	17.75	17.95
2.90	2.40	13.80	14.00	18.60	18.80
2.90	2.40	14.10	14.25	18.90	19.05
2.90	2.40	14.85	15.00	19.65	19.80
2.90	2.40	15.65	16.00	20.45	20.80
2.90	2.40	17.20	17.40	22.00	22.20





Shaft



Bore

Key

Tolerance B: +0.1 / - 0

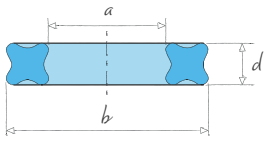
Tolerance H: +0 / - 0.1

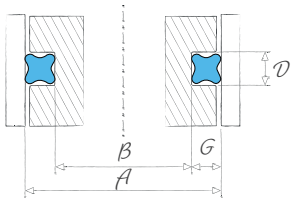
Tolerance D: +0.1 / - 0

◁ Fitting the parts in a two-part groove

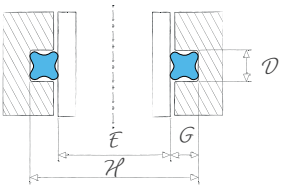
Code in 9PD31	Dimensions				Shaft application			
					Shaft ø		Base of groove	
	No.	a	b	d	Min A	Max A	Min B	Max B
200507	13 A	17.75	22.99	2.62	22.70	23.40	17.90	18.60
200508	14	18.72	23.96	2.62	23.70	24.40	18.90	19.60
200509	14 A	19.60	24.84	2.62	24.60	25.35	19.80	20.55
200733	217	20.30	25.54	2.62	25.30	26.00	20.50	21.20
200734	218	21.89	27.13	2.62	26.90	27.70	22.10	22.90
200735	219	23.47	28.71	2.62	28.50	29.35	23.70	24.55
201259	220	25.07	30.31	2.62	30.10	31.00	25.30	26.20
201260	221	26.64	31.88	2.62	31.70	32.65	26.90	27.85
201261	222	28.24	33.48	2.62	33.30	34.30	28.50	29.50
201268	223	29.82	35.06	2.62	34.90	35.95	30.10	31.15
201269	224	31.42	36.66	2.62	36.75	37.65	31.75	32.85
201270	225	32.99	38.23	2.62	38.10	39.30	33.30	34.50
201271	226	34.60	39.84	2.62	39.75	40.95	34.95	36.15
201272	227	36.17	41.41	2.62	40.35	42.60	35.55	37.80
201273	228	37.77	43.01	2.62	42.95	44.25	38.14	39.45
201274	229	39.34	44.58	2.62	44.55	45.90	39.75	41.10
201275	230	40.94	46.18	2.62	46.15	47.60	41.35	42.80
201688	231	42.52	47.76	2.62	47.75	49.25	42.95	44.45
203105	261	139.37	144.61	2.62	145.55	150.45	140.75	145.65
200510	15	18.64	25.70	3.53	25.40	26.10	18.85	19.55
200511	16	20.22	27.28	3.53	27.00	27.65	20.45	21.10
200512	16 A	20.90	27.96	3.53	27.70	28.40	21.15	21.85
200513	17	21.82	28.88	3.53	28.50	29.35	21.95	22.80
200514	18	23.39	30.45	3.53	30.00	30.80	23.45	24.25
200515	18 A	23.99	31.05	3.53	30.85	31.55	24.30	25.00
201000	19	24.99	32.05	3.53	31.85	32.55	25.30	26.00
201001	19 A	25.90	32.96	3.53	32.75	33.20	26.20	26.65
201002	20	26.57	33.63	3.53	33.40	34.10	26.85	27.55
201003	20 A	27.57	34.63	3.53	34.40	34.85	27.85	28.30
201004	21	28.17	35.23	3.53	34.95	36.10	28.40	29.55
201005	22	29.74	36.80	3.53	36.50	37.75	29.95	31.20
201006	23	31.34	38.40	3.53	38.00	39.00	31.45	32.45
201007	23 A	32.04	39.10	3.53	39.05	39.60	32.50	33.05
201008	24	32.92	39.98	3.53	39.75	40.50	33.20	33.95
201009	24 A	33.80	40.86	3.53	40.65	41.20	34.10	34.65
201010	25	34.52	41.58	3.53	41.35	42.65	34.80	36.10
201011	26	36.09	43.15	3.53	42.95	44.30	36.40	37.75
201012	27	37.69	44.75	3.53	44.50	46.10	37.95	39.55
201262	323	40.87	47.93	3.53	47.75	49.15	41.20	42.60
201689	324	44.05	51.11	3.53	50.95	52.50	44.40	45.95
201690	325	47.22	54.28	3.53	54.15	55.80	47.60	49.25
201693	326	50.39	57.45	3.53	57.35	59.10	50.80	52.55
201694	327	53.57	60.63	3.53	60.55	62.40	54.00	55.85
201691	328	56.75	63.81	3.53	63.75	65.75	57.20	59.20
201692	329	59.92	66.98	3.53	66.95	69.05	60.40	62.50

		Bore application			
		Shaft ø		Base of groove	
Groove Width D	Groove Height G	Min E	Max E	Min H	Max H
2.90	2.40	17.80	18.05	22.60	22.85
2.90	2.40	18.80	19.00	23.60	23.80
2.90	2.40	19.65	20.00	24.45	24.80
2.90	2.40	20.35	20.60	25.15	25.40
2.90	2.40	21.90	22.15	26.70	26.95
2.90	2.40	23.50	23.75	28.30	28.55
2.90	2.40	25.30	25.55	30.10	30.35
2.90	2.40	26.60	26.90	31.40	31.70
2.90	2.40	28.15	28.45	32.95	33.25
2.90	2.40	29.75	30.05	34.55	34.85
2.90	2.40	31.30	31.65	36.10	36.45
2.90	2.40	32.85	33.20	37.55	38.00
2.90	2.40	34.45	34.80	39.25	39.60
2.90	2.40	36.00	36.35	40.80	41.15
2.90	2.40	37.55	37.95	42.35	42.75
2.90	2.40	39.10	39.50	43.90	44.30
2.90	2.40	40.70	41.10	45.50	45.90
2.90	2.40	42.25	42.70	47.05	47.50
2.90	2.40	137.50	138.95	142.30	143.75
3.90	3.28	18.70	19.00	25.25	25.55
3.90	3.28	20.30	20.60	26.85	27.15
3.90	3.28	21.00	21.20	27.55	27.75
3.90	3.28	21.85	22.15	28.40	28.70
3.90	3.28	23.45	23.70	30.00	30.25
3.90	3.28	24.00	24.30	30.55	30.85
3.90	3.28	25.00	25.40	31.55	31.95
3.90	3.28	25.85	26.20	32.40	32.75
3.90	3.28	26.50	27.00	33.05	33.55
3.90	3.28	27.50	28.00	34.05	34.55
3.90	3.28	28.15	28.45	34.70	35.00
3.90	3.28	29.60	30.05	36.15	36.60
3.90	3.28	31.25	31.65	37.80	38.20
3.90	3.28	31.90	32.35	38.45	38.90
3.90	3.28	32.80	33.25	39.35	39.80
3.90	3.28	33.65	34.10	40.20	40.65
3.90	3.28	34.40	35.00	40.95	41.55
3.90	3.28	36.00	36.40	42.55	42.95
3.90	3.28	37.50	38.00	44.05	44.55
3.90	3.28	40.65	41.15	47.20	47.70
3.90	3.28	43.80	44.30	50.35	50.85
3.90	3.28	46.92	47.45	53.45	54.00
3.90	3.28	50.05	50.60	56.60	57.15
3.90	3.28	53.15	53.80	59.70	60.35
3.90	3.28	56.30	59.95	62.85	63.50
3.90	3.28	59.45	60.10	66.00	66.65





Shaft



Bore

Key

Tolerance B: +0.1 / - 0

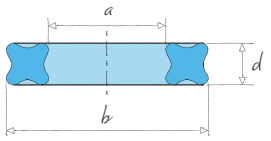
Tolerance H: +0 / - 0.1

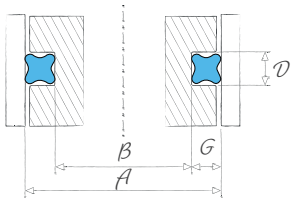
Tolerance D: +0.1 / - 0

◁ Fitting the parts in a two-part groove

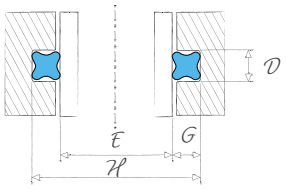
Code in 9PD31	Dimensions				Shaft application			
					Shaft ø		Base of groove	
	No.	a	b	d	Min A	Max A	Min B	Max B
201695	330	63.09	70.15	3.53	70.15	72.35	63.60	65.80
202159	331	66.27	73.33	3.53	73.35	75.65	66.80	69.10
202160	332	69.44	76.50	3.53	76.55	78.95	70.00	72.40
202161	333	72.62	79.68	3.53	79.75	82.30	73.20	75.75
202162	334	75.80	82.86	3.53	82.95	85.60	76.40	79.05
202163	335	78.97	86.03	3.53	86.15	88.90	79.60	82.35
202157	336	82.15	89.21	3.53	89.35	92.20	82.80	85.65
202164	337	85.32	92.38	3.53	92.55	95.50	86.00	88.95
202165	338	88.49	95.55	3.53	95.75	98.85	89.20	92.30
202166	339	91.67	98.73	3.53	98.95	102.15	92.40	95.60
202635	340	94.84	101.90	3.53	102.15	105.45	95.60	98.90
202632	341	98.02	105.08	3.53	105.35	108.75	98.80	102.20
202633	342	101.20	108.26	3.53	108.55	112.10	102.00	105.55
202634	348	120.25	127.31	3.53	127.75	131.95	121.20	125.40
203596	363	183.74	190.80	3.53	191.75	198.15	185.21	191.60
201013	28	37.47	48.13	5.33	47.75	49.20	37.75	39.20
201014	28 A	39.64	50.30	5.33	50.00	50.70	40.00	40.70
201015	29	40.64	51.30	5.33	51.00	52.00	41.00	42.00
201500	29 A	41.80	52.46	5.33	52.10	53.80	42.10	43.80
201501	30	43.82	54.48	5.33	54.00	55.20	44.00	45.20
201502	30 A	45.04	55.70	5.33	55.35	57.00	45.35	47.00
201503	30 B	45.84	56.50	5.33	57.15	57.40	47.15	47.40
201504	31	46.99	57.65	5.33	57.50	58.50	47.50	48.50
201505	31 A	47.80	58.46	5.33	58.70	60.00	48.70	50.00
201506	32	50.17	60.83	5.33	60.50	62.00	50.50	52.00
201507	32 A	52.00	62.66	5.33	62.40	63.50	52.40	53.50
201508	33	53.34	64.00	5.33	63.75	64.70	53.75	54.70
201509	33 A	54.50	65.16	5.33	65.00	66.50	55.00	56.50
201510	34	56.52	67.18	5.33	67.00	67.50	57.00	57.50
201511	34 A	57.52	68.18	5.33	68.00	69.50	58.00	59.50
201512	35	59.69	70.35	5.33	70.00	71.70	60.00	61.70
201513	35 A	61.54	72.20	5.33	72.00	73.00	62.00	63.00
201514	36	62.87	73.53	5.33	73.40	74.80	63.40	64.80
201515	36 A	64.59	75.25	5.33	75.00	76.50	65.00	66.50
202000	37	66.04	76.70	5.33	76.60	77.80	66.60	67.80
202001	37 A	67.64	78.30	5.33	78.00	79.20	68.00	69.20
202002	38	69.22	79.88	5.33	79.80	81.00	69.80	71.00
202003	38 A	70.64	81.30	5.33	81.50	82.50	71.50	72.50
202004	39	72.39	83.05	5.33	83.00	84.40	73.00	74.40
202005	39 A	73.84	84.50	5.33	84.50	85.70	74.50	75.70
202006	40	75.57	86.23	5.33	86.00	89.00	76.00	79.00
202007	41	78.74	89.40	5.33	89.50	90.80	79.50	80.80
202008	41 A	80.09	90.75	5.33	91.00	92.70	81.00	82.70
202009	42	81.92	92.58	5.33	92.80	94.30	82.80	84.30
202010	42 A	83.39	94.05	5.33	94.50	95.75	84.50	85.75

		Bore application			
		Shaft ø		Base of groove	
Groove Width D	Groove Height G	Min E	Max E	Min H	Max H
3.90	3.28	62.55	63.25	69.10	69.80
3.90	3.28	65.70	66.40	72.25	72.95
3.90	3.28	68.80	69.55	75.35	76.10
3.90	3.28	71.95	72.75	78.50	79.30
3.90	3.28	75.05	75.90	81.60	82.45
3.90	3.28	78.20	79.05	84.75	85.60
3.90	3.28	81.30	82.20	87.85	88.75
3.90	3.28	84.45	85.35	91.00	91.90
3.90	3.28	87.55	88.50	94.10	95.05
3.90	3.28	90.70	91.70	97.25	98.25
3.90	3.28	93.80	94.85	100.35	101.40
3.90	3.28	96.95	98.00	103.50	104.55
3.90	3.28	100.10	101.15	106.65	107.70
3.90	3.28	118.85	120.10	125.40	126.65
3.90	3.28	181.40	183.30	187.95	189.85
6.10	5.00	37.45	38.00	47.45	48.00
6.10	5.00	39.50	40.10	49.50	50.10
6.10	5.00	40.50	41.10	50.50	51.10
6.10	5.00	41.65	42.25	51.65	52.25
6.10	5.00	43.65	44.30	53.65	54.30
6.10	5.00	44.90	45.50	54.90	55.50
6.10	5.00	45.60	46.25	55.60	56.25
6.10	5.00	46.90	47.40	56.90	57.40
6.10	5.00	47.50	48.20	57.50	58.20
6.10	5.00	50.00	50.60	60.00	60.60
6.10	5.00	51.90	52.40	61.90	62.40
6.10	5.00	53.00	53.75	63.00	63.75
6.10	5.00	54.00	55.00	64.00	65.00
6.10	5.00	56.00	57.00	66.00	67.00
6.10	5.00	57.40	58.00	67.40	68.00
6.10	5.00	59.30	60.00	69.30	70.00
6.10	5.00	61.00	62.00	71.00	72.00
6.10	5.00	62.50	63.20	72.50	73.20
6.10	5.00	64.00	65.00	74.00	75.00
6.10	5.00	65.50	66.40	75.50	76.40
6.10	5.00	67.00	68.00	77.00	78.00
6.10	5.00	68.60	69.50	78.60	79.50
6.10	5.00	70.00	71.00	80.00	81.00
6.10	5.00	72.00	72.70	82.00	82.70
6.10	5.00	73.00	74.20	83.00	84.20
6.10	5.00	74.90	76.00	84.90	86.00
6.10	5.00	78.00	79.00	88.00	89.00
6.10	5.00	79.50	80.35	89.50	90.35
6.10	5.00	81.00	82.20	91.00	92.20
6.10	5.00	82.50	83.50	92.50	93.50





Shaft



Bore

Key

Tolerance B: +0.1 / - 0

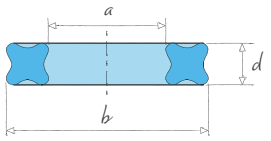
Tolerance H: +0 / - 0.1

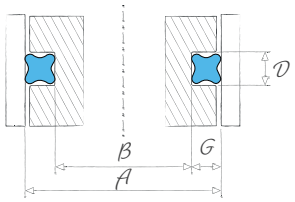
Tolerance D: +0.1 / - 0

◁ Fitting the parts in a two-part groove

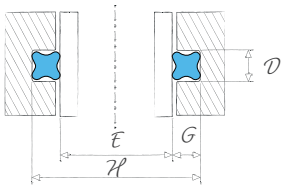
Code in 9PD31	Dimensions				Shaft application			
					Shaft ø		Base of groove	
	No.	a	b	d	Min A	Max A	Min B	Max B
202011	43	85.09	95.75	5.33	96.00	97.40	86.00	87.40
202012	43 A	86.64	97.30	5.33	97.50	98.90	87.50	88.90
202013	44	88.27	98.93	5.33	99.00	100.40	89.00	90.40
202014	44 A	89.59	100.25	5.33	100.50	102.00	90.50	92.00
202015	45	91.44	102.10	5.33	102.30	105.00	92.30	95.00
202500	46	94.62	105.28	5.33	105.50	108.50	95.50	98.50
202501	47	97.99	108.65	5.33	109.00	111.70	99.00	101.70
202502	48	100.97	111.63	5.33	112.00	113.30	102.00	103.30
202503	48 A	102.34	113.00	5.33	113.50	114.90	103.50	104.90
202504	49	104.14	114.80	5.33	115.00	116.00	105.00	106.00
202505	49 A	105.80	116.46	5.33	116.50	118.50	106.50	108.50
202506	50	107.32	117.98	5.33	119.00	121.00	109.00	111.00
202507	51	110.49	121.15	5.33	121.50	124.50	111.50	114.50
202508	52	113.67	124.33	5.33	124.70	127.00	114.70	117.00
202636	450	116.84	127.50	5.33	128.00	130.45	118.00	120.45
202637	451	120.02	130.68	5.33	131.20	133.75	121.20	123.75
202638	452	123.19	133.85	5.33	134.40	137.00	124.40	127.00
202639	453	126.37	137.03	5.33	137.65	140.30	127.65	130.30
202640	454	129.54	140.20	5.33	140.85	143.55	130.85	133.55
203106	455	132.72	143.38	5.33	144.05	146.85	134.05	136.85
203107	456	135.89	146.55	5.33	147.25	150.10	137.25	140.10
203108	457	139.07	149.73	5.33	150.45	153.40	140.45	143.40
202509	+88	113.67	127.65	6.99	127.70	129.60	114.70	116.60
202510	52 A	115.84	129.82	6.99	129.80	130.60	116.80	117.60
202511	+53	116.84	130.82	6.99	130.80	133.50	117.80	120.50
202512	+54	120.02	134.00	6.99	134.00	137.00	121.00	124.00
202513	+55	123.19	137.17	6.99	137.20	140.00	124.20	127.00
202514	+56	126.37	140.35	6.99	140.50	143.50	127.50	130.50
202515	+57	129.54	143.52	6.99	143.75	146.50	130.75	133.50
203000	+58	132.72	146.70	6.99	147.00	149.50	134.00	136.50
203001	+59	135.89	149.87	6.99	150.00	153.00	137.00	140.00
203002	+60	139.07	153.05	6.99	153.20	156.00	140.20	143.00
203003	+61	142.24	156.22	6.99	156.50	159.50	143.50	146.50
203004	+62	145.42	159.40	6.99	159.70	162.90	146.70	149.90
203005	+63	148.59	162.57	6.99	163.00	166.30	150.00	153.30
203006	+64	151.77	165.75	6.99	166.40	168.40	153.40	155.40
203007	64 A	155.02	169.00	6.99	169.00	172.50	156.00	159.50
203008	+65	158.12	172.10	6.99	172.70	175.40	159.70	162.40
203009	65 A	161.02	175.00	6.99	175.50	178.80	162.50	165.80
203010	+66	164.47	178.45	6.99	179.00	181.50	166.00	168.50
203011	66 A	167.02	181.00	6.99	181.70	185.00	168.70	172.00
203012	+67	170.82	184.80	6.99	185.30	187.80	172.30	174.80
203013	67 A	173.52	187.50	6.99	188.00	191.00	175.00	178.00
203014	+68	177.17	191.15	6.99	191.40	194.00	178.40	181.00
203015	68 A	180.52	194.50	6.99	195.00	197.80	182.00	184.00

		Bore application			
		Shaft ø		Base of groove	
Groove Width D	Groove Height G	Min E	Max E	Min H	Max H
6.10	5.00	84.00	85.40	94.00	95.40
6.10	5.00	86.00	87.00	96.00	97.00
6.10	5.00	87.80	89.00	97.80	99.00
6.10	5.00	89.00	90.50	99.00	100.50
6.10	5.00	91.00	93.00	101.00	103.00
6.10	5.00	94.00	96.00	104.00	106.00
6.10	5.00	97.00	99.50	107.00	109.50
6.10	5.00	100.00	101.50	110.00	111.50
6.10	5.00	101.70	103.00	111.70	113.00
6.10	5.00	103.50	104.50	113.50	114.50
6.10	5.00	105.00	107.00	115.00	117.00
6.10	5.00	107.00	109.00	117.00	119.00
6.10	5.00	109.50	112.20	119.50	122.20
6.10	5.00	112.60	115.50	122.60	125.50
6.10	5.00	115.85	118.80	125.85	128.80
6.10	5.00	119.00	122.00	129.00	132.00
6.10	5.00	122.10	125.20	132.10	135.20
6.10	5.00	125.25	128.40	135.25	138.40
6.10	5.00	128.40	131.60	138.40	141.60
6.10	5.00	131.50	134.80	141.50	144.80
6.10	5.00	134.65	138.00	144.65	148.00
6.10	5.00	137.80	141.25	147.80	151.25
7.90	6.50	112.50	115.50	125.50	128.50
7.90	6.50	115.60	117.00	128.60	130.00
7.90	6.50	117.00	119.00	130.00	132.00
7.90	6.50	119.50	122.00	132.50	135.00
7.90	6.50	122.50	125.00	135.50	138.00
7.90	6.50	125.50	128.50	138.50	141.50
7.90	6.50	129.00	131.50	142.00	144.50
7.90	6.50	132.00	135.00	145.00	148.00
7.90	6.50	135.50	138.00	148.50	151.00
7.90	6.50	138.50	141.00	151.50	154.00
7.90	6.50	141.50	144.00	154.50	157.00
7.90	6.50	144.50	147.00	157.50	160.00
7.90	6.50	147.50	150.50	160.50	163.50
7.90	6.50	151.00	153.50	164.00	166.50
7.90	6.50	154.00	156.50	167.00	169.50
7.90	6.50	157.00	159.50	170.00	172.50
7.90	6.50	160.00	162.50	173.00	175.50
7.90	6.50	163.00	166.00	176.00	179.00
7.90	6.50	166.50	168.50	179.50	181.50
7.90	6.50	169.00	172.50	182.00	185.50
7.90	6.50	173.00	175.50	186.00	188.50
7.90	6.50	176.00	178.50	189.00	191.50
7.90	6.50	179.00	182.50	192.00	195.50





Shaft



Bore

Key

Tolerance B: +0.1 / - 0

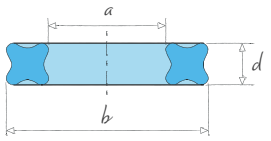
Tolerance H: +0 / - 0.1

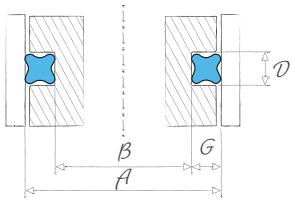
Tolerance D: +0.1 / - 0

◁ Fitting the parts in a two-part groove

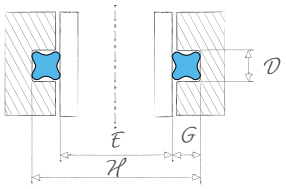
Code in 9PD31	Dimensions				Shaft application			
					Shaft ø		Base of groove	
	No.	a	b	d	Min A	Max A	Min B	Max B
203500	+69	183.52	197.50	6.99	198.00	200.30	185.00	187.30
203501	69 A	186.02	200.00	6.99	200.50	204.00	187.50	191.00
203502	+70	189.87	203.85	6.99	204.20	206.40	191.20	193.40
203503	70 A	192.02	206.00	6.99	206.50	210.50	193.50	197.50
203504	+71	196.22	210.20	6.99	210.75	213.30	197.75	200.30
203505	71 A	199.02	213.00	6.99	213.50	217.00	200.50	204.00
203506	+72	202.57	216.55	6.99	217.50	221.00	204.50	208.00
203507	72 A	206.80	220.78	6.99	221.30	226.00	208.30	213.00
203508	72 B	211.02	225.00	6.99	226.50	229.50	213.50	216.50
203509	+73	215.27	229.25	6.99	230.00	233.50	217.00	220.50
203510	73 A	219.02	233.00	6.99	233.70	238.30	220.70	225.30
203511	73 B	223.50	237.48	6.99	238.00	242.00	225.00	229.00
203512	+74	227.97	241.95	6.99	242.50	245.00	229.50	232.00
203513	74 A	231.02	245.00	6.99	245.50	249.50	232.50	236.50
203514	74 B	235.00	248.98	6.99	250.00	255.00	237.00	242.00
203515	+75	240.67	254.65	6.99	255.50	257.50	242.50	244.50
204000	75 A	243.02	257.00	6.99	258.00	261.00	245.00	248.00
204001	75 B	248.00	261.98	6.99	262.00	268.00	249.00	255.00
204002	+76	253.37	267.35	6.99	268.50	273.50	255.50	260.50
204003	76 A	259.00	272.98	6.99	274.00	280.00	261.00	267.00
204004	+77	266.07	280.05	6.99	280.50	287.50	267.50	274.50
204005	77 A	273.10	287.08	6.99	288.00	293.00	275.00	280.00
204006	+78	278.77	292.75	6.99	293.50	299.50	280.50	286.50
204007	78 A	284.00	297.98	6.99	300.00	303.00	287.00	290.00
204008	78 B	287.50	301.48	6.99	303.50	306.00	290.50	293.00
204009	+79	291.47	305.45	6.99	306.50	312.50	293.50	299.50
204010	79 A	298.00	311.98	6.99	313.00	318.50	300.00	305.50
204011	+80	304.17	318.15	6.99	319.00	325.50	306.00	312.50
204012	80 A	310.00	323.98	6.99	326.00	332.00	313.00	319.00
204013	+81	316.87	330.85	6.99	332.50	338.50	319.50	325.50
204014	81 A	323.50	337.48	6.99	339.00	344.50	326.00	331.50
204015	+82	329.57	343.55	6.99	345.00	351.50	332.00	338.50
204500	82 A	336.50	350.48	6.99	352.00	357.00	339.00	344.00
204501	+83	342.27	356.25	6.99	357.50	363.00	344.50	350.00
204502	83 A	348.50	362.48	6.99	363.50	370.00	350.50	357.00
204503	+84	354.97	368.95	6.99	370.50	377.50	357.50	364.50
204504	84 A	362.50	376.48	6.99	378.00	383.00	365.00	370.00
204505	+85	367.67	381.65	6.99	383.50	389.50	370.50	376.50
204506	85 A	374.00	387.98	6.99	390.00	396.00	377.00	383.00
204507	+86	380.37	394.35	6.99	396.50	403.00	383.50	390.00
204508	86 A	387.50	401.48	6.99	403.50	408.50	390.50	395.50
204509	+87	393.07	407.05	6.99	409.00	415.00	396.00	402.00
204510	87 A	401.00	414.98	6.99	416.00	423.00	403.00	410.00

		Bore application			
		Shaft ø		Base of groove	
Groove Width D	Groove Height G	Min E	Max E	Min H	Max H
7.90	6.50	183.00	185.50	196.00	198.50
7.90	6.50	186.00	188.00	199.00	201.00
7.90	6.50	189.00	192.00	202.00	205.00
7.90	6.50	192.50	194.00	205.50	207.00
7.90	6.50	195.00	198.50	208.00	211.50
7.90	6.50	199.00	201.00	212.00	214.00
7.90	6.50	202.00	205.00	215.00	218.00
7.90	6.50	205.50	209.00	218.50	222.00
7.90	6.50	209.50	213.50	222.50	226.50
7.90	6.50	214.00	218.00	227.00	231.00
7.90	6.50	218.50	221.00	231.50	234.00
7.90	6.50	222.00	226.00	235.00	239.00
7.90	6.50	226.50	230.50	239.50	243.50
7.90	6.50	231.00	233.50	244.00	246.50
7.90	6.50	234.00	238.00	247.00	251.00
7.90	6.50	239.00	243.00	252.00	256.00
7.90	6.50	244.00	246.00	257.00	259.00
7.90	6.50	247.00	251.00	260.00	264.00
7.90	6.50	252.00	256.50	265.00	269.50
7.90	6.50	257.00	262.00	270.00	275.00
7.90	6.50	264.50	269.00	277.50	282.00
7.90	6.50	271.50	276.00	284.50	289.00
7.90	6.50	277.00	282.00	290.00	295.00
7.90	6.50	283.00	287.00	296.00	300.00
7.90	6.50	288.00	290.50	301.00	303.50
7.90	6.50	291.00	295.00	304.00	308.00
7.90	6.50	296.00	301.00	309.00	314.00
7.90	6.50	302.00	307.00	315.00	320.00
7.90	6.50	308.00	313.00	321.00	326.00
7.90	6.50	315.00	320.00	328.00	333.00
7.90	6.50	322.00	327.00	335.00	340.00
7.90	6.50	328.00	333.00	341.00	346.00
7.90	6.50	334.00	340.00	347.00	353.00
7.90	6.50	341.00	346.00	354.00	359.00
7.90	6.50	347.00	352.00	360.00	365.00
7.90	6.50	353.00	359.00	366.00	372.00
7.90	6.50	360.00	366.00	373.00	379.00
7.90	6.50	367.00	372.00	380.00	385.00
7.90	6.50	373.00	378.00	386.00	391.00
7.90	6.50	379.00	384.00	392.00	397.00
7.90	6.50	385.00	392.00	398.00	405.00
7.90	6.50	393.00	397.00	406.00	410.00
7.90	6.50	398.00	405.00	411.00	418.00





Shaft



Bore

Key

Tolerance B: +0.1 / - 0

Tolerance H: +0 / - 0.1

Tolerance D: +0.1 / - 0

◁ Fitting the parts in a two-part groove

HUTCHINSON®

METAL-RUBBER BONDED SEALS

We make it ***possible***

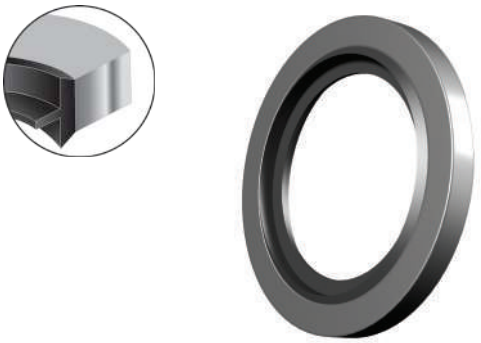
1 – BONDED SEALS

1.1 – General information

The bonded seal consists of a metal washer of rectangular cross section with a bonded and vulcanised inner rubber lip of trapezoidal cross section.

The type of metal and rubber family are selected according to the application, fluid or gas to be sealed, temperature and pressure.

The bonded seal is particularly suitable for sealing under screw heads, bolts and in pipe fittings (high and low pressure). It has the advantage of being removable and reusable, unlike other seals such as copper washers.

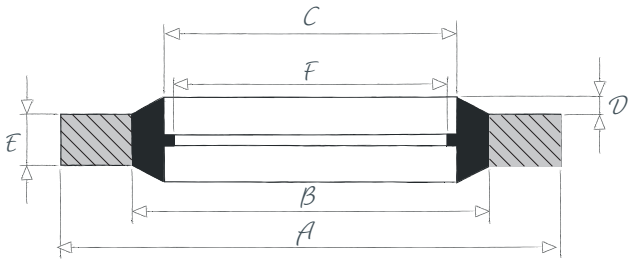


1.1.1 – Self-centralisation

The centred positioning of the bonded seal is achieved by a thin membrane with an inside diameter equal to the core diameter of the locating thread.

Benefits of self-centralisation:

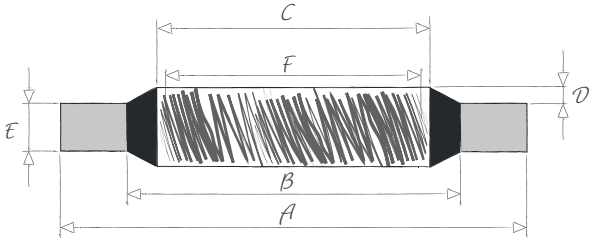
- Correct positioning of the ring and retention on disassembly
- Ease of installation
- Reduced assembly time
- Reduced machining costs (no counter-bore required)



Bonded seal without self-centralisation

The bonded seal can also be made in a version without self-centralisation.

This version does not have a lip to ensure centralisation, so the recommendations in section 1.2.2 on page 147 should be followed for correct positioning.



1.1.2 – Metal washer

Hutchinson offers two standard metal washers for bonded seals:

- Rolled cold-worked steel with a tensile strength of 540MPa protected by an anti-corrosion treatment
- Cold-worked T316 stainless steel

Other metals are listed in the table below with their specifications.

The metal must be softer than the sub-assembly in which it is fitted.

Be careful of combinations of metals that form a bimetallic couple.

Metal	Tensile strength (MPa min.)	Specification
Cold-worked mild steel DC01 (standard)	540	BS EN 10139
Machined mild steel EN8	540	BS EN 10083-2
Cold-worked stainless steel T316 (standard)	540	BS EN 10088-2
Machined stainless steel T316	540	BS EN 10088-3
Machined stainless steel S1000, T316 grade	1000	BS EN 10088-3
Machined brass CZ121	380	BS EN 12164
Cold-worked brass CZ108	380	BS EN 1652
Machined cupro-aluminium alloy	700	CA104 & NES 833
Cold-worked aluminium, 5251-H22 grade	220	BS EN 485-2
Machined aluminium alloy	370	L102 & L168
Machined aluminium alloy (6082-T6)	295	BS EN 573-3
High-tensile steel	880	S154
Super duplex steel	750	UNS S32760

1.1.3 – Surface treatments

The metal insert can be protected by anti-corrosion surface treatment:

Surface treatment	Code	Specification
Trivalent zinc nickel passivation	P18 (standard)	12-15% nickel - min 5 microns
Trivalent zinc nickel passivation (black)	P26	12-15% nickel - min 5 microns

1.1.4 – Rubber

The bonded seals in the following compounds are available in standard dimensions from stock, listed on p. 151. They are available in the combinations STEEL + NBR 85 and STAINLESS STEEL + compounds for food, gas or chemicals.

Bonded seals can be made with most of the compounds in our range. (see pages 41 to 43)

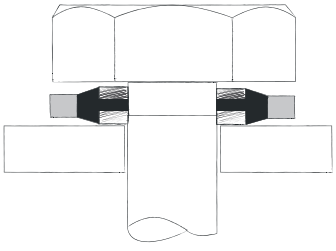
Family	Compound	Colour	Hardness (Sh.A)	Temperature of use			CS	
				Min (ºC)	Max continuous temp. (ºC)	Max peak temp. (Cº)	CS (%)	Conditions
NBR	PC851	black	78	-30	100	120	15	24h at 100°C
EPDM	7EP1197	black	70	-50	140	175	12	24h at 150°C
FKM	7DF2075	green	78	-25	200	250	23	72h at 200°C

1.2 – Fitting instructions

1.2.1 – Compression rate torque

The performance of the bonded seal depends on the quality of the fitting and the compression rate. The table opposite shows the torque required to ensure correct operation of the seal.

For double sealing, additional torque is generally required (Double ring torque).



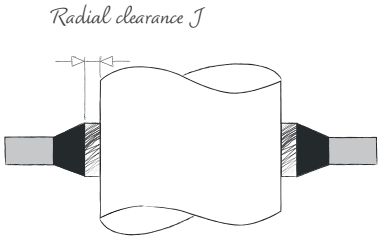
Dimensions			Recommended torque	
Metric	BOLT	BSP	Torque single ring (Nm)	Torque double ring (Nm)
< M 8	5/16	-	5.3	8.5
M 10	3/8	1/8	7.1	11.4
M 11	7/16	-	11.8	15.3
M 12	1/2	1/4	15.8	20.5
M 14	9/16	-	22.6	29.4
M 16	5/8	3/8	30.5	39.7
M 18	3/4	-	40.7	52.9
M 20	13/16	1/2	56.5	67.8
M 22	7/8	5/8	67.8	74.6
M 24	1.0	3/4	73.4	73.4
> M 27	1 1/16	-	79.0	79.0

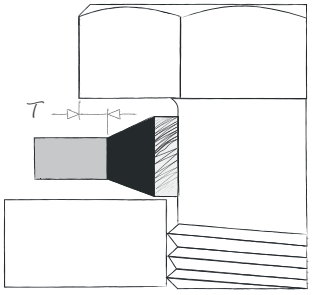
1.2.2 – Fitting seal without self-centralisation

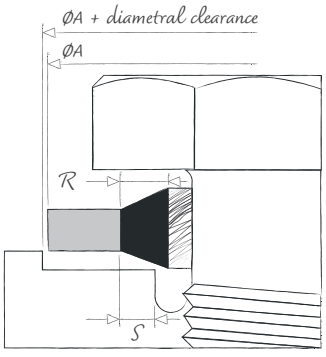
If the maximum radial clearance cannot be respected, the seal must be centred on its outside diameter by using a counter-bore.

In all cases, the overlapping (T) of the metal ring must be a minimum of 0.7mm and the overlapping of the rubber ring at least 75% (S ≥ 0.75 R).

Counter-bore = Diameter A + Diametral clearance (mm)







Metric	Max. clearance J at radius (mm)	Counter-bore (mm)
M 3 to M 8.5	0.30	Ø A + 0.20
M 9 to M 33	0.35	Ø A + 0.40
M 34 to M 60	0.50	Ø A + 0.60

1.3 – Size charts

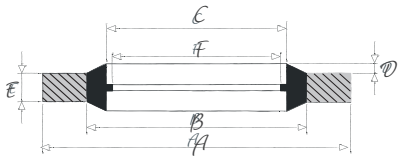
The following list of dimensions gives the catalogue codes of our steel bonded seals as well as our range of stainless-steel bonded seals with compounds for food, gas or chemicals.

NEW

Size standard	Seal number	Self-centralising*	LJF part number by metal-rubber combination			
			STEEL + PC851	S/STEEL + 7EP1197	S/STEEL + PC851	S/STEEL + 7DF2075
BOLT 6 BA	AS 2.55	no	205112	205484	205566	205525
M 3	A 3	no	205113	205464	205545	205504
BOLT 4BA	AS 3.5	no	205114	205485	205567	205526
M 4	A 3.9	no	205236	205465	205546	205505
BOLT 2BA	AS 4.6	no	205115	205486	205568	205527
M 5	A 5	yes	205241	205466	205548	205506
M 5	A 5.10	yes	207390	205467	205549	205507
M 5	AS 5.10	yes	205240			
M 6	A 6	yes	205237	205468	205550	205508
M 6	AS 6	yes	207391	205469	205551	205509
M 6	AX 6	yes	207392			
BOLT 1/4	A 6.2	yes	207377	205487	205569	205528
BOLT 5/16	AS 7.7	yes	205242	205488	205570	205529
M 8	AX 8	yes	207403			
BOLT 5/16	A 8.2	yes	207378			
M 8	AS 8	yes	207393	205471	205553	205511
M 8	A 8	yes	205238	205470	205552	205510
M 8.5	A 8.7	yes	207394			
M 10	B 9.52	yes	206261			
M 10	B 10	yes	206282	205472	205554	205512
M 10	BX 10	yes	207410			
M 10	BS 10	yes	207395	205473	205555	205513
BOLT 2/5	B 10.16	yes	207379	205489	205571	205530
M 11	B 10.3	yes	207396			
M 11	B 11	yes	207404			
M 11	BS 11	yes	207397			
M 12	BS 12	yes	207398	205475	205557	205516
M 12	B 12	yes	206283	205474	205556	205515
BSP 1/4 - BOLT 1/2	B 12.7	yes	206262	205490	205572	205531
M 13.5	B 13.3	yes	207399			
M 14	BS 14	yes	207405			
M 14	B 14	yes	206284	205476	205558	205517
BOLT 9/16	BS 14.16	yes	206295	205491	205573	205532
BOLT 5/8	BS 15.86	yes	206285	205492	205574	205533
M 16	BS 16	yes	207406	205478	205560	205519
M 16	B 16	yes	206286	205477	205559	205518
BSP 3/8	B 17.06	yes	206263	205493	205575	205534

Custom development on request

Dimensions						Min. burst pressure (bar)
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	
6.35	4.09	3.05	0.20 / 0.45	1.22	-	2150
7.50	5.00	3.60	0.30	1.00	-	1950
7.26	5.26	4.12	0.20 / 0.45	1.22	-	1570
7.00	5.40	4.50	0.30	1.00	3.40	1250
8.38	6.35	5.21	0.20 / 0.45	1.22	-	1375
10.00	7.00	5.60	0.30	1.00	4.50	1780
9.00	6.80	5.70	0.30	1.00	4.50	1400
10.00	7.40	5.70	0.30	1.00	4.50	1500
11.00	8.00	6.60	0.30	1.00	4.70	1680
10.00	8.00	6.70	0.30	1.00	4.70	1130
11.00	8.20	6.70	0.30	1.00	4.70	1510
13.21	8.00	6.86	0.20 / 0.45	1.22	4.70	1950
13.34	9.53	8.31	0.20 / 0.45	1.22	6.10	1700
13.00	10.00	8.60	0.30	1.00	6.40	1330
14.22	10.04	8.64	0.20 / 0.45	1.22	6.10	1750
13.00	10.00	8.70	0.30	1.00	6.40	1330
14.00	10.40	8.70	0.30	1.00	6.40	1550
13.30	10.50	9.30	0.30	1.00	6.90	1200
15.88	12.00	10.35	0.40	2.00	8.56	1450
16.00	12.40	10.70	0.40	1.50	8.05	1350
17.00	12.10	10.70	0.30	1.50	8.56	1730
18.00	12.40	10.70	0.40	1.50	8.05	1880
18.36	12.45	11.26	0.25 / 0.51	2.03	8.56	1950
16.30	12.70	11.40	0.40	1.50	9.80	1250
18.10	13.20	11.80	0.30	1.50	9.80	1600
19.10	13.50	11.80	0.40	1.50	9.80	1770
18.00	14.30	12.70	0.40	2.00	9.73	1250
19.00	14.10	12.70	0.30	1.50	9.73	1530
20.57	15.21	13.74	0.25 / 0.51	2.03	11.45	1550
18.70	15.70	14.00	0.40	1.50	11.30	900
21.00	16.10	14.70	0.30	1.50	11.38	1370
22.00	16.40	14.70	0.40	2.00	11.38	1510
22.23	16.39	14.86	0.25 / 0.51	2.03	11.58	1575
25.40	18.75	16.51	0.25 / 0.51	2.03	12.90	1550
23.00	18.10	16.70	0.30	1.50	13.41	1240
24.00	18.40	16.70	0.40	1.50	13.41	1400
23.80	18.75	17.28	0.25 / 0.51	2.03	14.96	1260



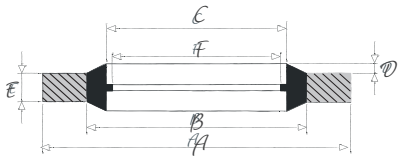
Key

* for technical reasons, some bonded seals are only available without self-centralisation

NEW

Size standard	Seal number	Self-centralising*	LJF part number by metal-rubber combination			
			STEEL + PC851	S/STEEL + 7EP1197	S/STEEL + PC851	S/STEEL + 7DF2075
M 17	B 16.6	yes	207400			
BOLT 11/16	CS 17.50	yes	207231	205494	205576	205535
M 18	CS 18	yes	207232	205479	205561	205520
BOLT 3/4	CS 19	yes	207242	205495	205577	205536
M 20	CS 20	yes	207233			
BSP 1/2 - BOLT 13/16	C 20.63	yes	207210	205496	205578	205537
M 22	CS 22	yes	207204	205480	205562	205521
M 22	C 22	yes	207407			
BSP 5/8 - BOLT 7/8	C 22.75	yes	207211	205497	205579	205538
BOLT 15/16	C 23.56	yes	207380	205498	205580	205539
M 24	CS 24	yes	207235	205481	205563	205522
M 26	C 26	yes	207401	205482	205564	205523
BSP 3/4 - BOLT 1	C 26.32	yes	207212	205499	205581	205540
BOLT 1.1/16	C 27.12	yes	207381			
BSP 7/8 - BOLT 1.3/16	C 30.10	yes	208174	205500	205582	205541
BOLT 1.1/4	C 31.94	yes	207382			
BSP 1 - BOLT 1.5/16	C 33.16	yes	207383	205501	205583	205542
BOLT 1.3/8	D 34.94	yes	207384	205502	205584	205543
M 36	C 36	yes	207402			
M 36	D 36	yes	207409			
BOLT 1.1/2	C 37.96	yes	207385			
BSP 1.1/4 - BOLT 1.5/8	D 41.30	yes	208176	205503	205585	205544
M 42	D 42	yes	208189	205483	205565	205524
BOLT 1.3/4	D 44.34	yes	207386			
BSP 1.1/2 - BOLT 1.7/8	D 47.40	yes	208177			
BSP 1.3/4 - BOLT 2.1/8	D 53.86	yes	207387			
BSP 2.0	D 59.45	yes	207336			
BSP 2.1/2	D 75.08	yes	207388			
BSP 3.0	D 88	yes	208190			

Dimensions						Min. burst pressure (bar)
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	
24.00	19.20	17.40	0.40	1.50	13.08	1150
25.40	19.69	18.16	0.25 / 0.51	2.50	14.50	1320
26.00	20.40	18.70	0.40	1.50	14.76	1275
26.92	21.21	19.69	0.25 / 0.51	2.50	15.80	1260
28.00	22.50	20.70	0.40	1.50	16.76	1150
28.58	23.01	21.54	0.25 / 0.51	2.50	18.64	1150
30.00	24.40	22.70	0.40	2.00	18.74	1100
31.00	24.40	22.70	0.40	2.00	18.74	1240
31.75	24.97	23.49	0.25 / 0.51	2.50	20.60	1250
33.27	26.04	24.26	0.25 / 0.51	2.50	20.20	1275
32.00	26.40	24.70	0.40	2.00	20.11	1050
35.00	28.40	26.70	0.40	2.00	22.30	1050
34.93	28.53	27.05	0.25 / 0.51	2.50	24.13	1060
38.61	30.61	27.82	0.25 / 0.51	2.50	22.90	1250
38.10	32.29	30.81	0.25 / 0.51	2.50	27.89	900
41.40	35.69	32.64	0.25 / 0.51	3.38	27.10	800
42.80	36.88	33.89	0.25 / 0.51	2.50	30.30	810
44.45	38.99	35.94	0.25 / 0.51	3.38	29.50	700
46.00	38.80	36.70	0.40	2.00	31.10	880
48.00	39.60	37.00	0.40	2.50	31.10	1010
47.75	42.04	38.96	0.25 / 0.51	3.38	32.70	700
52.38	45.93	42.93	0.25 / 0.51	2.50	38.96	690
54.00	45.60	43.00	0.40	2.50	36.50	890
57.15	48.39	45.34	0.25 / 0.51	3.38	37.90	875
58.60	51.39	48.44	0.25 / 0.51	2.50	44.86	690
69.85	58.30	54.89	0.25 / 0.51	3.38	50.80	950
73.03	63.63	60.58	0.25 / 0.51	2.50	56.67	700
90.17	79.38	76.08	0.25 / 0.51	3.38	72.20	680
101.47	92.84	89.09	0.25 / 0.51	3.38	85.00	550



Key

* for technical reasons, some bonded seals are only available without self-centralisation

2 – SLIMLINE SEALING WASHERS

2.1 – General information

HVAC applications

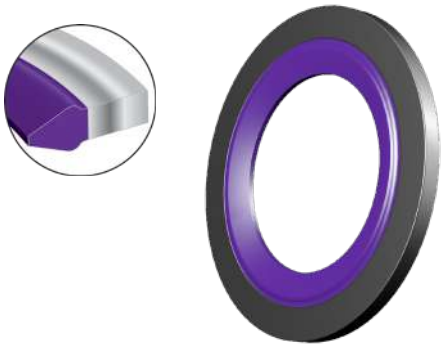
The Slim Line sealing washer (SLSW) is a sealing solution for axial application in HVAC connection as an alternative to radial O-Ring sealing (automotive A/C connectors). It is compatible with both types of refrigerants : R134a and R1234yf.

Material

The SLSW is a bimaterial seal made of a metal washer and a special shape vulcanised rubber lip.

Our purple EPDM offers optimised chemical resistance to R1234yf fluid and is certified by many OEMs such as BMW, Daimler and GM. Other EPDM or HNBR compounds are available on request.

The metal insert is made of carbon steel (cold-rolled and cold-worked strip) and protected by anti-corrosive zinc nickel coating. Other materials are available on request: aluminium, stainless steel, etc.



Dimensions

Standard dimensions corresponding to the global generic connector system:

Part number	Thickness	Tube outside diameter	Int. / Ext dimensions
205367	2.03	3/8"	8.13 x 16.00
205364	2.03	1/2"	11.18 x 19.10
205366	2.13	5/8"	15.49 x 23.62
205365	2.13	3/4"	17.16 x 25.26

2.2 – Technical advantages

- Very low permeability
- Improved sealing performance
- No groove machining - savings on the connector's total cost
- Easier installation (no assembly force)
- No risk of damaging the seal during assembly
- Poka-Yoke thanks to the colours of the compounds

3 – PFS FLANGE SEALS

3.1 – General information

Specially designed for any type of pipe, the PFS flange seal is made of a stainless-steel washer and a vulcanised rubber lip.

With its double lip, the PFS flange seal ensures permanent sealing, eliminates fugitive emissions and reduces downtime during maintenance operations. It is the ideal solution for all bolted flange gaskets.

This innovative product developed by Hutchinson can easily replace SWG (Spiral Wounded Gasket). The PFS flange seal guarantees durable, safe and economical sealing. Because of its design, it can be considered as reusable and a life long system.

General information

- Dimensions: from 15 mm
- Temperature: -50°C to 200°C (depending on the rubber)
- Various combinations of rubbers and metal inserts (aluminium, stainless steel, etc.)
- Possibility of using materials that meet the standards for drinking water, food and Oil & Gas industry

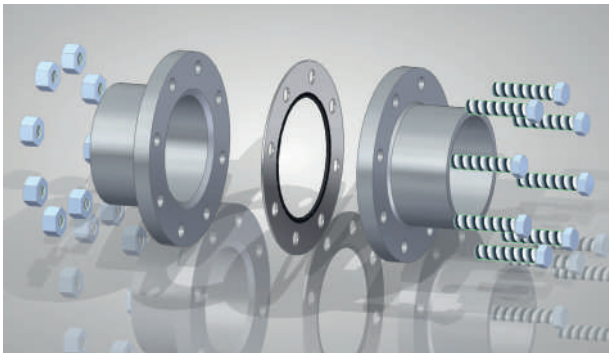
Application markets

- Food industry
- Oil & Gas
- Hydraulic
- Manufacturing & processing industries
- Energy production
- Industrial water & wastewater
- Chemical industry

3.2 – Technical advantages

3.2.1 – Conditions of use

- Compatible with any type of fluid (depending on the rubber)
- Available with or without drilled bolt holes
- Easily replaces existing sealing solutions (flat-faced, raised-face and grooved flanges)
- Can be used on corroded or scratched surfaces
- Withstands extreme field conditions: handling, shocks, dust, etc.



3.2.2 – Benefits

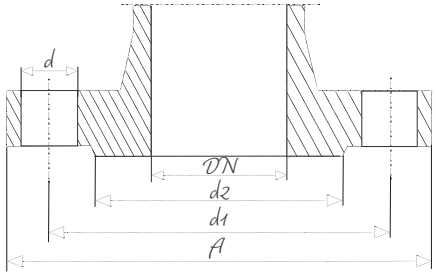
- Reusable sealing solution
- Reduced installation time
- Reduced downtime maintenance and costs
- Improved performance with a double sealing line
- Uniform compression independent of torque
- Fitting without a support ring on GRP flanges
- Compression stop and blow-out preventer

Lloyd's Register

Pressure tested

3.3 – Flange size table DIN EN 1092-1 / DIN 2501-1

	PN6				PN10				PN16				PN25				PN40			
DN	**A**	**d1**	**d2**	**n x d**	**A**	**d1**	**d2**	**n x d**	**A**	**d1**	**d2**	**n x d**	**A**	**d1**	**d2**	**n x d**	**A**	**d1**	**d2**	**n x d**
10	75	50	35	4x11	90	60	40	4x14	90	60	40	4x14	90	60	40	4x14	90	60	40	4x14
15	80	55	40	4x11	95	65	45	4x14	95	65	45	4x14	95	65	45	4x14	95	65	45	4x14
20	90	65	50	4x11	105	75	58	4x14	105	75	58	4x14	105	75	58	4x14	105	75	45	4x14
25	100	75	60	4x11	115	85	68	4x14	115	85	68	4x14	115	85	68	4x14	115	85	68	4x14
32	120	90	70	4x14	140	100	78	4x18	140	100	78	4x18	140	100	78	4x18	140	100	78	4x18
40	130	100	80	4x14	150	110	88	4x18	150	110	88	4x18	150	110	88	4x18	150	110	88	4x18
50	140	110	90	4x14	165	125	102	4x18	165	125	102	4x18	165	125	102	4x18	165	125	102	4x18
65	160	130	110	4x14	185	145	122	4x18	185	145	122	4x18	185	145	122	8x18	185	145	122	8x18
80	190	150	128	4x18	200	160	138	8x18	200	160	138	8x18	200	160	138	8x18	200	160	122	8x18
100	210	170	148	4x18	220	180	158	8x18	220	180	158	8x18	235	190	162	8x22	235	190	162	8x22
125	240	200	178	8x18	250	210	188	8x18	250	210	188	8x18	270	220	188	8x26	270	220	188	8x26
150	265	225	202	8x18	285	240	212	8x22	285	240	212	8x22	300	250	218	8x26	300	250	218	8x26
175					315	270	242	8x22	315	270	242	8x22	330	280	248	12x26	350	295	260	12x30
200	320	280	258	8x18	340	295	268	8x22	340	295	268	12x22	360	310	278	12x26	375	320	285	12x30
250	375	335	312	12x22	395	350	320	12x22	405	355	320	12x26	425	370	335	12x30	450	295	245	12x33
300	440	395	365	12x22	445	400	370	12x22	460	410	378	12x26	485	430	395	16x30				
350	490	445	415	12x22																



Key

A = Outer ø of flange

d2 = Min. ø of support for the seal

d1 = Centre-to-centre distance

n = Number of holes

d = Drilling ø

DN = Nominal ø

	PN64				PN100				PN160				PN250				PN320			
DN	**A**	**d1**	**d2**	**n x d**	**A**	**d1**	**d2**	**n x d**	**A**	**d1**	**d2**	**n x d**	**A**	**d1**	**d2**	**n x d**	**A**	**d1**	**d2**	**n x d**
10	100	70	40	4x14	100	70	40	4x14	100	70	40	4x14	125	85	40	4x18	125	85	40	4x18
15	105	75	45	4x14	105	75	45	4x14	105	75	45	4x14	130	90	45	4x18	130	90	45	4x18
20																				
25	140	100	68	4x18	140	100	68	4x18	140	100	68	4x18	150	105	68	4x22	160	115	68	4x22
32																				
40	170	125	88	4x22	170	125	88	4x22	170	125	88	4x22	185	135	88	4x26	195	145	88	4x26
50	180	135	102	4x22	195	145	102	4x26	195	145	102	4x26	200	150	105	8x26	210	160	102	8x26
65	205	160	122	8x22	220	170	122	8x26	220	170	122	8x26	230	180	122	8x26	255	200	122	8x30
80	215	170	138	8x22	230	180	138	8x26	230	180	138	8x26	255	200	138	8x30	275	220	138	8x30
100	250	200	162	8x26	265	210	162	8x30	265	210	162	8x30	300	235	162	8x33	335	265	162	12x36
125	295	240	188	8x30	315	250	188	8x33	315	250	188	8x33	340	275	188	12x33	380	310	188	12x36
150	345	280	218	8x33	355	290	218	12x33	355	290	218	12x33	390	320	218	12x36				
175	375	310	260	12x33	385	320	260	12x33	390	320	260	12x36								
200	415	345	285	12x36	430	360	285	12x36	430	360	285	12x36	485	400	285	12x42				
250	470	400	345	12x36																

OUR PRESENCE AROUND THE WORLD

Production
Sales office

EUROPE

France

Hutchinson Le Joint Français SNC
Château-Gontier, France

oring@hutchinson.com

Czech Republic

Hutchinson ORD
Prague, Czech Republic

oring@hutchinson.com

Germany

Hutchinson GmbH
Mannheim, Germany

info.mannheim@hutchinson.com

Italy

Hutchinson ORD
Turin, Italy

oring@hutchinson.com

Malta

Hutchinson Pamargan Ltd
Xewkija, Gozo, Malta

oring@hutchinson.com

Portugal

Hutchinson Borrachas de Portugal Lda
Campo Maior, Portugal

oring@hutchinson.com

Spain

Hutchinson ORD
Barcelona, Spain

oring@hutchinson.com

United Kingdom

Hutchinson Pamargan Ltd
Newtown Powys, United Kingdom

oring@hutchinson.com

oring.hutchinson.fr/en

AMERICA

Brazil

Hutchinson Brasil Automotive
Monte Alto, Brazil

precision@hutchinson.com.br

Mexico

Hutchinson Seal De Mexico SA de CV
Ensenada, Baja California, Mexico

sales@hutchinson-seal-mexico.com

United States

Hutchinson Seal – Paulstra Seal Division
Auburn Hills, Michigan, United States

seal@hutchinsonNA.com

Hutchinson Precision Sealing Systems
Houston, Texas, United States

sales@hutchinson-seal-mexico.com

Precision Sealing Systems, Inc
PO, Box 300, 39 Wauregan Rd,
Danielson, CT 06239

seal@hutchinsonna.com

ASIA

China

Hutchinson Industrial Rubber Products
Beijing, China

Hutchinson Industrial Rubber Products
Suzhou, Jiangsu, China

Hutchinson Industrial Rubber Products
Wuhan, Hubei, China

Hutchinson Industrial Rubber Products
Chongqing, China

oring.sales@hutchinson-suzhou.cn

India

Hutchinson Industrial Rubber Products Private ltd.
Chennai, India

oring.india@hutchinson.com

Japan

Hutchinson Japan Co. Ltd
Tokyo, Japan

oring.sales@hutchinsonjapan.com

Thailand

TOTAL Oil Co. Ltd
Bangkok, Thailand

oring.thailand@hutchinson.com

Many environmental factors influence a seal's sealing performance (fluids in contact, materials, manufacturing process, operating conditions, etc.).

This catalogue contains recommendations that should be checked with our teams and that may change depending on the seal's environment. These recommendations do not constitute a commitment on our part and all claims are excluded. It is essential to carry out final validation tests, which remain the customer's responsibility.

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Hutchinson Le Joint Français SNC
1 rue Gutenberg, ZI Ouest Bazouges,
53200 CHÂTEAU-GONTIER – FRANCE
Phone: +33 (0)2 43 09 23 20 Fax: +33 2 43 09 23 10
Email: oring@hutchinson.com
Website: www.oring.hutchinson.fr/en

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Hutchinson - Le Joint Français SNC
1 rue Gutenberg, ZI Ouest de Bazouges 53200 Château-Gontier - France
www.oring.hutchinson.com | oring@hutchinson.com
Phone: +33 2 43 09 23 20