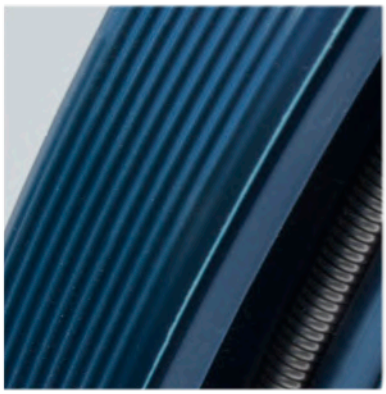


# **Oil Seals** Catalogue

**Epidor**

Seals and
Rubber Technology

# INDEX

## Epidor Seals and Rubber Technology.



## Contents


# COMPANY

## WHO WE ARE

**EPI INDUSTRIES Family of Companies**, a consolidated group of companies with more than sixty years of experience, creates in May 2016 EPIDOR Seals and Rubber Technology.

**Epidor**
Seals and
Rubber
Technology

A new company was born with the mission of continuing to develop the business of sealing and vibration insulation products of Epidor SAU and Lidering SAU, prestigious firms with several decades of experience in the market.

**Epidor Seals and Rubber Technology** inherits all the knowledge of the product and the market and is oriented to the development of its specialties to offer to the equipment manufacturers (OEM) solutions of contrasted quality as those that we cite next:

- Design and development of innovative technical solutions for high quality mechanical engineering components.
- Technical and logistical services associated with the product in the ranges of sealing and vibration isolation.
- A qualified team of experienced and skilled people focused on the needs of the **C**lient.
- A firm commitment to providing value-added solutions.
- A strong presence in the Iberian Península and subsidiaries in 5 countries.
- An internal business culture to promote corporate values and principles to all *stakeholders*.
- Our effort to be recognized as a reliable partner that provides with guarantee and optimum quality to the **C**ustomer.

AENOR
ER
Empresa
Registrada
ISO 9001

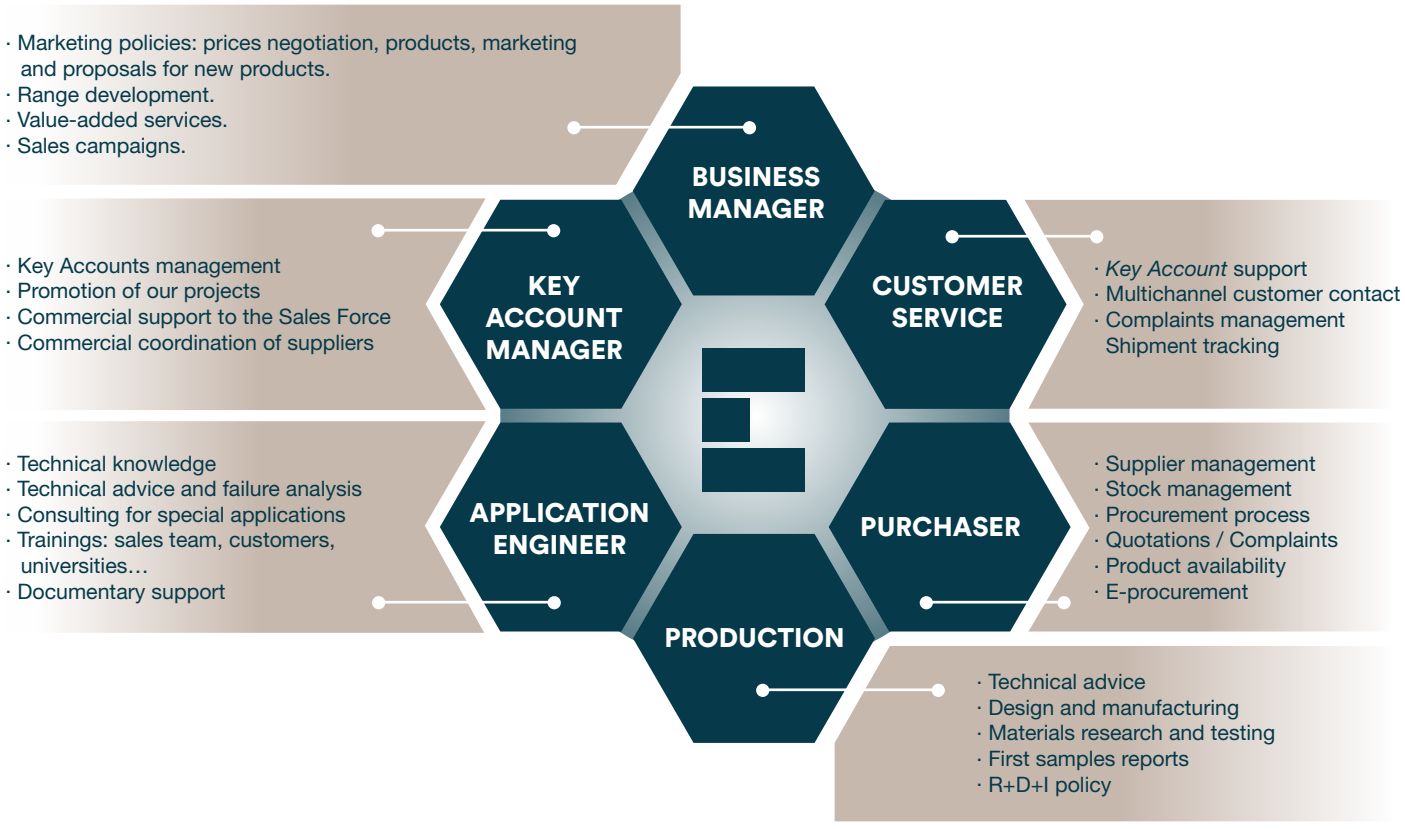
**Epidor Seals and Rubber Technology** offers equipment manufacturers (OEMs) a wide range of product-related services:

- Customized trainings adapted to each need.
- Technical support in the design of their equipments.
- Product failure analysis.
- Reports of first samples and quality controls.
- Vibration isolation for the protection of persons, equipment and working environments.
- Customized logistics: special tags, kits for spare parts or assembly, stock of material, packaging adapted to each product.

## OUR TEAM AND RESOURCES

Our proven experience in all industrial sectors together with a team of skilled people allows us to provide solutions adapted to each point of application of the product. We are a supplier who specializes in a wide range of mechanical engineering components, assisting the **C**ustomer with value-added solutions, generating satisfaction and confidence.

At **Epidor Seals and Rubber Technology** our Sales force, application engineers, buyers, production and R&D&I departments are all of them focused on **C**ustomer satisfaction. As members of EPI INDUSTRIES Family of Companies we have central services for product quality control and adapted logistics to any need.



# OUR CLIENTS

## ENGINEERING SERVICES:

### FOR ORIGINAL EQUIPMENT MANUFACTURERS

**Product development**

- Advice in the design phase.
- Supply of functional samples for manufacturing.
- Rapid readjustment of the design in the homologation phase.
- Short series for prototypes (48 hours)

**Equipment manufacturing**

- Supply of small and medium series without the cost of moulds or tooling.
- Manufacturing service to cover emergencies in 24 hours.
- Product reliability. Adaptation of control guidelines to customer needs.

**After-sales market**

- Supply of small series.
- Individualized packaging.
- Personalized marking of pieces.
- Failure analysis.
- Training.

### FOR MACHINE MAINTENANCE

**Manufacturing and consulting in standard solutions**

- Standard range manufacture in 24 hours.
- Adaptation of the seals to cover functional changes of the equipment.
- Individualized marking and packaging.
- Reverse engineering.
- Failure analysis.

## MARKETS:

- Agriculture.
- Food.
- Mechanical Construction.
- Packaging.
- Pharmaceutical industry.
- Chemical Industry.
- Oil & Gas.
- Engineering.
- Public Works.
- Automotive industry.
- Marine.
- Siderurgy and Metal.
- Transformation.
- Water treatment and distribution networks.
- Industrial vehicles.

## APPLICATIONS:

They are generally used in sealing of rotating shafts, wheel hubs, bearing housings of:

- Drive motors and combustion engines.
- Mobile and agricultural agricultural machinery.
- Gearboxes and variable speed drives.
- Pumps, compressors and generators.
- Machine tools.
- Heavy industry, wind turbines.
- Industrial washing machines and household appliances.

# MAIN PRODUCTS

Since the middle of the 20th century, we have established close cooperation with the world's leading manufacturers of sealing and vibration isolation products. From this collaboration is born a very wide range of products and solutions.

In the whole product range we have the ability to make tailor-made solutions.

## SEALING FOR HYDRAULICS AND PNEUMATICS

The experience accumulated over more than 50 years in the design, manufacture and marketing of sealing solutions for hydraulic and pneumatic cylinders, allows us to offer a wide range of collars, wipers and guides for low, medium and high pressure environments of the fluid to be sealed.

## ROTARY SHAFT SEALING

Dynamic sealing solutions for shafts in the process and automotive industry: oil seals, lip seals, V-rings, bearing isolators and bushings for shaft protection or recovery of damaged shafts.

## STATIC SEALING

Static sealing solutions, including **O-rings**, **X-Ring**, **gaskets** of various shapes and materials, aseptic seals and energized seals, among other solutions.

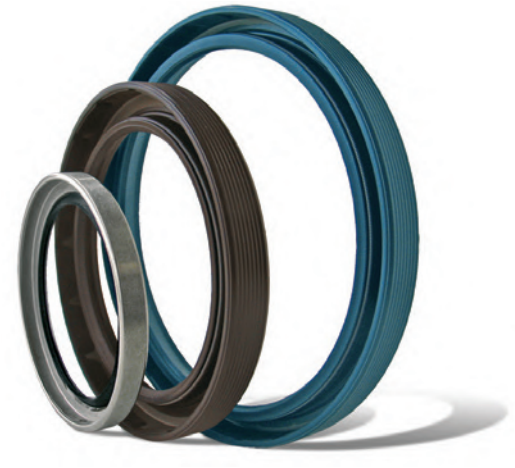
## OTHER PRODUCT RANGES

We offer the **C**ustomer a wide range of products adapted to his requirements. The knowledge of the moulding processes, extrusion or injection allows us to contribute solutions in very diverse forms and materials. Extruded profiles and molded parts such as membranes, bellows and vacuum cups.

## VIBRATIONS ISOLATION

Mounts for machinery protection, equipment and working environments by designing the best solution for the control and isolation of vibrations.

# INTRODUCTION



Oil seals are used to radially seal shafts (rotating elements) with respect to a fixed part.

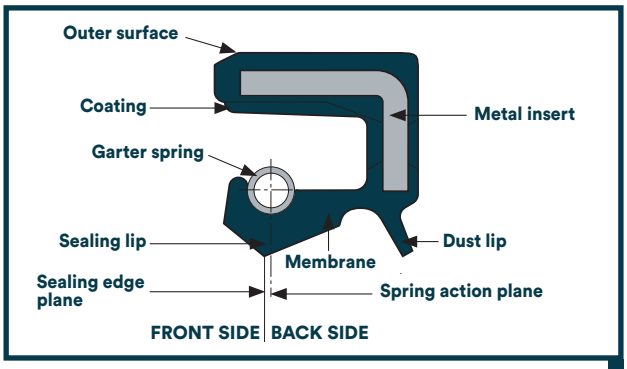
The oil seal has a lip that is in continuous contact with the shaft, preventing lubricant leakage.

Oil seals are used in the process industry, in industrial machinery and in the automotive industry, among other segments.

The purpose of an oil seal is to ensure tightness between the sealing edge / shaft and between its outer surface / housing.

The distinctive components of an oil seal are:

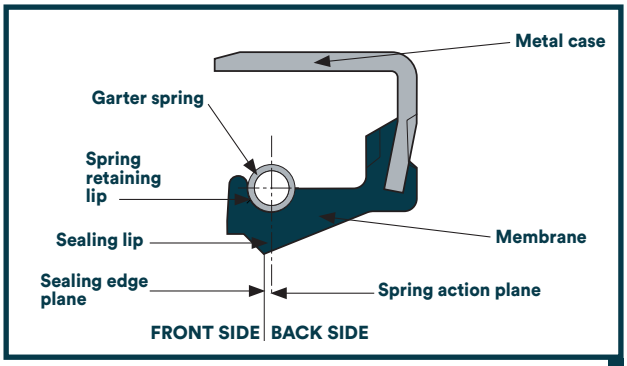
- Elastomer-coated (Figure 1) or non-coated (Figure 2) metal body. Exposed metal case versions are supplied with the outer surface rectified and calibrated.
- There are oil seals that replace the metal case with a fabric-reinforced heel that allows a split seal design (Figure 3).
- Usually, the elastomer membrane has a spring on the vertical of the sealing edge to maintain the shaft tightness, whether in operation or stopped.
- Optional “dust lip” for protection against external dust and debris (Figure 1).




Oil seal with elastomere coated case and dust lip. **Figure 1**

Radial shaft seals must, in addition to ensuring good sealing, meet other requirements such as:

- Reliability.
- Long service life.
- Easy assembly.
- Chemical resistance against the process fluid.
- Low friction.

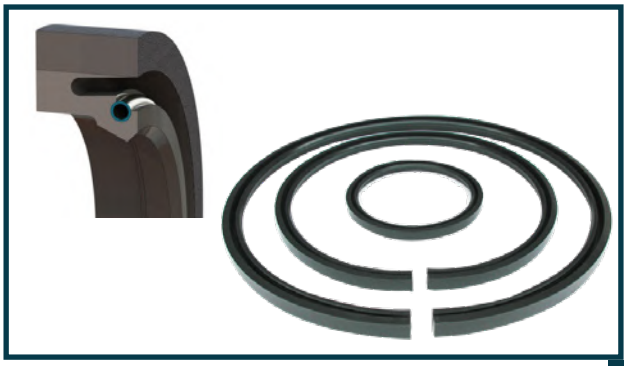



Oil seal with outer metal case and sealing lip with steel garter spring. **Figure 2**

On the other hand, the fluids to be sealed are liquids with variable viscosity and, rarely, gases.

Most commonly they are lubricants, such as oils and greases, but also hydraulic oils (according to DIN 51524), pressure fluids that are hardly flammable (according to VDMA 24317 and 24320) and even silicone oils with poor lubricating properties.

Chemically aggressive fluids with low lubricating properties, such as acids, lyes or organic solvents, can also be used.



Detail of reinforcement heel and split oil seals. **Figure 3**

## STANDARDS

The DIN 3760 / 3761 standards define the basic aspects of the design of radial seals such as measurements, materials, assemblies and surface protection, among others.

Radial seals are classified into 4 types:

- **Type A:** with the outer surface of elastomer.
- **Type B:** with metal outer case..
- **Type C:** with double metal case.
- **Type S:** with additional dust lip to any previous type (AS, BS y CS).

### OTHER STANDARDS

- **ISO 6194–1:2007**: specifies nominal dimensions and tolerances for oil seals, housings and shafts as well as a dimensional identification code.
- **ISO 6194-2:2009:** establishes the own vocabulary for elastomer lip oil seals.
- **ISO 6194-3:2009:** informs about the requirements for storage, handling and assembly of oil seals, warning of their risks and how to avoid them.
- **ISO 6194-4:2009:** defines the tests conditions to be carried out on oil seals.
- **ISO 6194-5:2008:** defines and classifies visual defects that can impair the oil seal performance.

## OPERATING CONDITIONS

To select the oil seal, it is necessary to correctly define the service conditions and know the requirements of the application.

Basic parameters to define:

- Shaft diameter (mm).
- Temperature (ºC).
- Rotation speed (r.p.m.).
- Pressure (MPa / bar).

### OTHER CONSIDERATIONS:

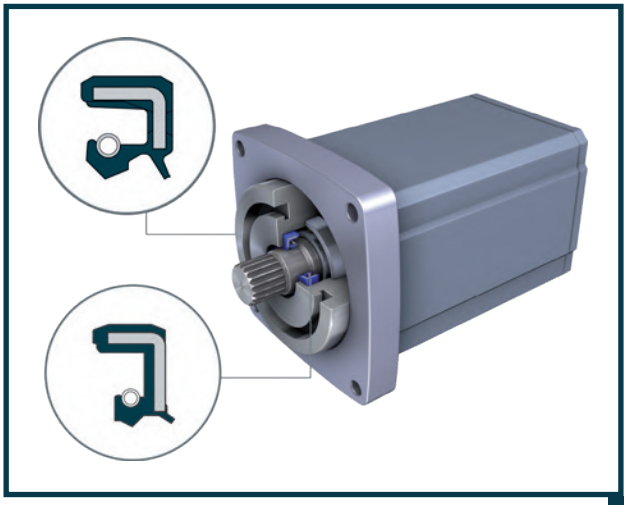
- Dirt on the outside.
- Vibration level.
- About the fluid to be sealed:
  - Mineral or synthetic based lubricating oils.
  - Lubricating greases in mineral or synthetic base.

The oil seals decision tree on page 40, guides in the pre-selection of the most common seals. The field of application of each model is detailed in the product's Technical Data Sheet, starting on page 42.

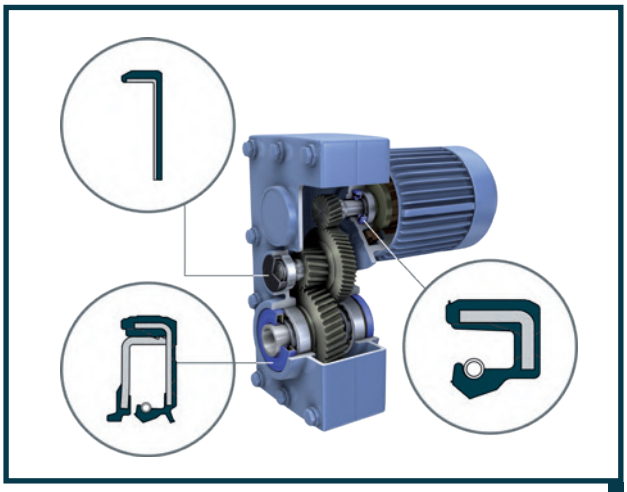
Oil seals are used to seal fluids in rotating machines. The sealing is done whether the rotating machine is stopped or running (shaft in rotation).

The list of applications is numerous. The most frequent are mentioned below:

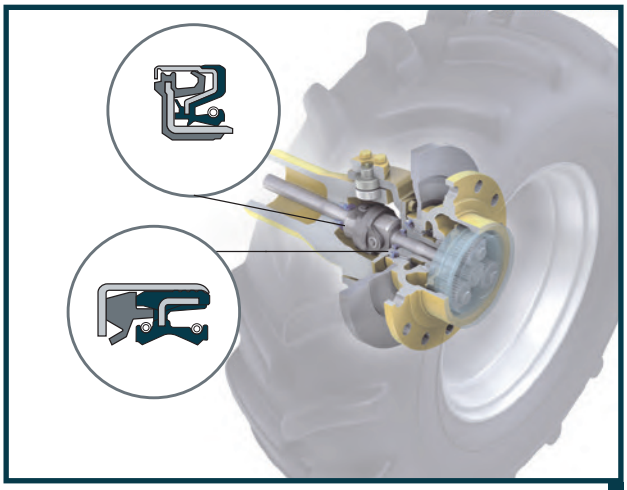
- Motors (sealing of crankshafts and cams).
- Mobile machinery (transmissions, gearboxes, differentials, shafts, wheel hubs).
- Speed reducers and multipliers (input and output shafts).
- Pumps, agitators, screw compressors.
- Heavy industry (machinery in cement plants, steel mills, wind power plants).
- Shipbuilding (watertightness of rudders).
- Machinery for food industry.
- Machinery for chemical industry.
- Machinery for domestic use and industrial washing.



Rotary movement, under pressure, in hydraulic pumps and motors. **Figure 4**



Oil seals and sealing covers in gearboxes. **Figure 5**

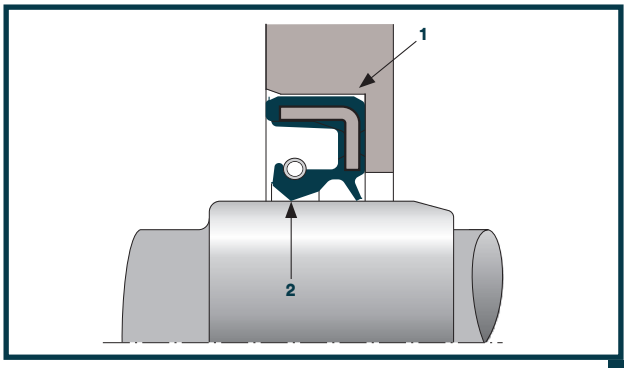


Oil seals on transmission shafts. **Figure 6**

# SEALING MECHANISMS

An oil seal must ensure the tightness of the shaft on which it is installed as well as in its housing as shown in Figure 7:

1. Sealing in the housing.
2. Selaing on the shaft.




Oil seal sealing. **Figure 7**

## STATIC SEALING

It refers to the ability of the oil seal to seal the shaft, as it does not rotate. When the system is in standby, sealing is achieved by contact between the lip seal and the shaft, thanks to the elastomeric deformation of the lip and the compression force exerted by the spring.

In addition, the outer surface of the seal, by fitting into the machined housing of the machine body, prevents lubricant leaks through that point and guarantees a sufficiently firm fit of the seal therein. And all this without hindering its assembly.

Depending on the mechanical design of the point to be sealed, as well as the assembly and operating conditions, there are different models of oil seals

For problem-free assembly, the oil seal outer surface must be provided with a suitable chamfer (DIN 3760 / 3761) or be rounded. Its outside dimension must allow a press fit on the nominal diameter. Mounting tolerances for oil seals according to DIN 3760 A, B and C are shown in the following table:

**Table 1. Tolerances of oil seals outer dimensions.**

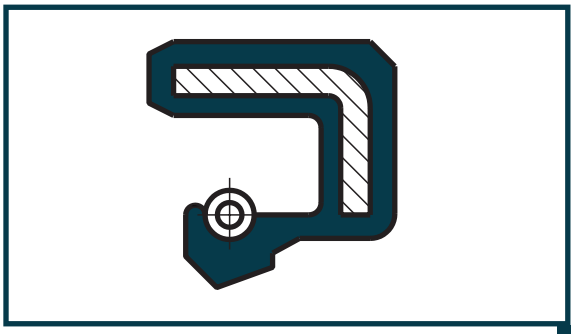
| Nominal outside diameter range (mm) | - 50 | 50 80 | 80 120 | 120 180 | 180 300 | 300 400 | 300 400 | 500 630 | 630 800 | 800 1000 | 1000 1250 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Type A, smooth and fine grooved (mm) | +0,30 +0,15 | +0,35 +0,20 | +0,35 +0,20 | +0,45 +0,25 | +0,45 +0,25 | +0,55 +0,30 | +0,55 +0,30 | +0,65 +0,35 | +0,75 +0,40 | +0,85 +0,45 | +1,00 +0,55 |
| Type A, with thick grooving (mm) | +0,40 +0,20 | +0,45 +0,25 | +0,45 +0,25 | +0,55 +0,30 | +0,55 +0,30 | +0,65 +0,35 | +0,65 +0,35 | +0,75 +0,40 | +0,85 +0,45 | +0,95 +0,50 | +1,10 +0,60 |
| Types B and C (mm) | +0,20 +0,10 | +0,23 +0,13 | +0,25 +0,15 | +0,28 +0,18 | +0,30 +0,20 | +0,35 +0,23 | +0,35 +0,23 | +0,43 +0,28 | +0,48 +0,33 | +0,53 +0,38 | +0,60 +0,45 |

In terms of groove design, the factors described below should be considered.

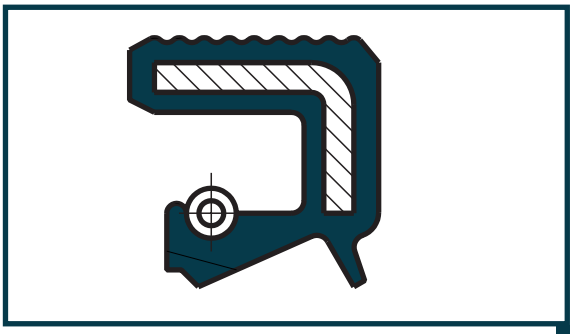
### OIL SEAL WITH COATED ELASTOMERIC METAL CASE (VERSION A ACCORDING TO DIN 3760)

Thanks to the outer elastomer surface, this oil seal offers the best conditions for static sealing when the housings are split; metallic (with greater thermal expansion) or in applications under pressure as well as in the sealing of low-viscosity fluids.

The same oil seal can be manufactured with a corrugation or grooves on its outer diameter which, during the assembly stage, prevents possible displacements and rotations of the oil seal in the bore. In this way, a greater pre-adjustment of positioning is achieved, improving static tightness, and particularly, in housings with high thermal expansion.



BAUM oil seal type (A DIN 3760)
Smooth outer coating. **Figure 8**



BAFUDSLX7 oil seal type (A DIN 3760)
Corrugated outer coating. **Figure 9**

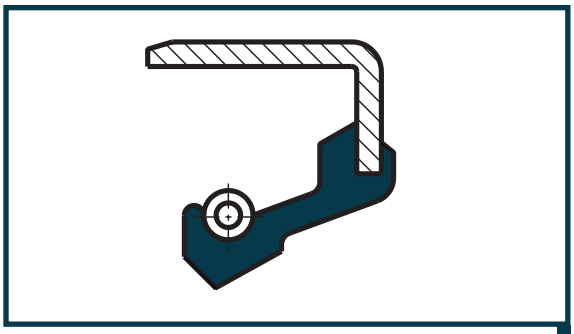
## OIL SEAL WITH VISIBLE METAL CASING

To avoid leaks caused by relevant thermal changes (contractions and expansions), oil seals with metal casings are used, and ideally, are made of the same material as the bore. This achieves uniform expansion and contraction of the oil seal-bore assembly.

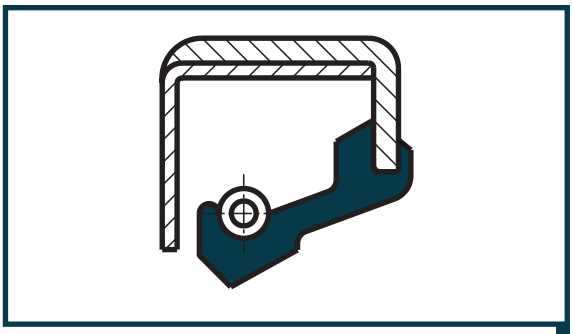
To guarantee the static tightness of the equipment in more difficult working conditions such as very low viscosity fluids, gases or services under pressure, it is advisable to apply some drops of sealant lacquer in the sealing adjustment area.

For large sizes of oil seals or when experience shows that assembly is complex, a double metal case oil seal is used (model B2) whose inner case reinforces the outer one with the result of providing a higher radial stiffness.

Metal cased oil seals should not be installed in split bores and care should be taken when pressing-in into light-metal bores as they may score them.



B1FUD oil seal type (B DIN 3760). **Figure 10**



B2 oil seal type (C DIN 3760). **Figure 11**

## DYNAMIC SEALING

It refers to the ability of the oil seal to prevent leaks of the working fluid through the shaft when it begins its movement and reaches the normal working regime. The process fluid performs, at the point of contact of the lip with the shaft, two essential functions:

**a)** Lip lubrication and cooling to prevent excessive wear.

A higher rotation of the shaft corresponds to a greater friction and, consequently, the area to be sealed will suffer a local increase in temperature.

This fact can mean a premature degradation of the lip and a reduction in the oil seal lifetime. Hence the importance of the quality and quantity of lubricant, since it also acts as a coolant.

**b)** Tightness thanks to its surface tension that generates a fluid meniscus and blocks the passage of the liquid itself.

For the formation of the meniscus, the appropriate lubrication conditions must be given, determined in turn by the performance of the materials and by the working conditions. The most relevant, in this case, will be the shaft rotation speed.

On the other hand, the oil seal lip sealing mechanism in the area of contact with the shaft will be a function of:

- The compound and design of the sealing lip;
- Tthe interference of the lip with the shaft;
- The surface finish of the shaft;
- Particles present in the fluid that accumulate between the lip and the shaft.

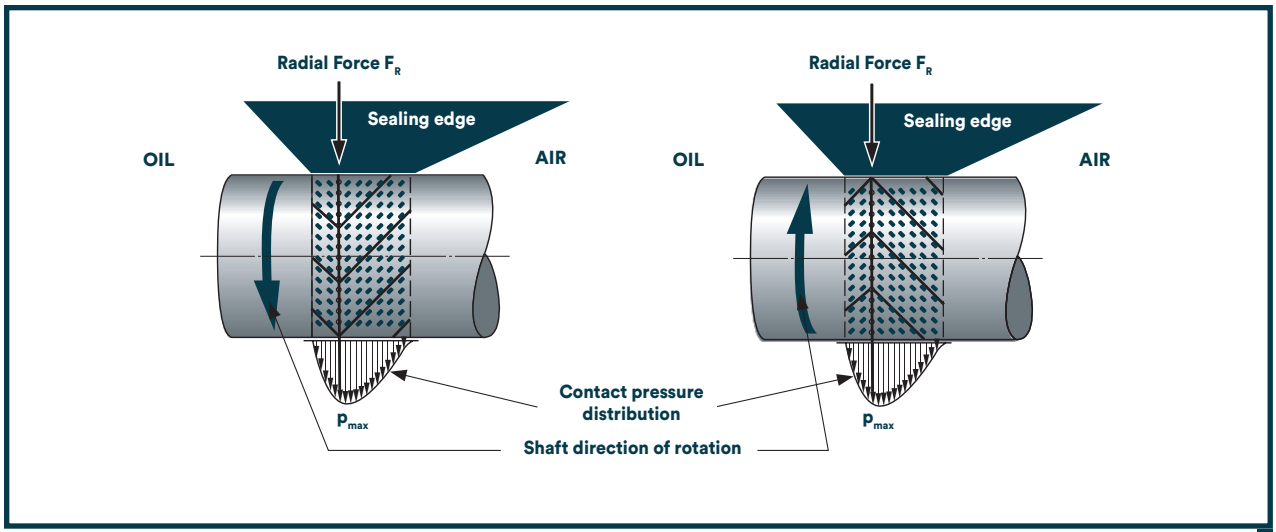
The design of the lip concerns exclusively the oil seal manufacturer, who may modify it depending on the compound, size, geometry and the application for which it is intended. The parameters to take into account are the length of the lip and the thickness of the membrane, the action space of the spring, the angle of the sealing lip and its radial force.

The lip produces a radial force on the shaft that is distributed on it depending on the angles of the lip; of the spring action and the sealing edge. The spring tightening is established based on some shaft measurements to exert an optimal radial force that allows the appearance of the meniscus and minimizes the wear of the seal. In this sense, it is very important to respect the dimensional tolerances of the shaft when selecting and mounting the oil seal (see Table 1, page 10).

The radial force, thanks to the angles formed by the sealing edge, is distributed differently on the OIL side and on the AIR side. The irregular distribution is essential to achieve a good sealing mechanism.

When the shaft starts to rotate, the static sealing gradually loses its effectiveness.

As in the case of bushings, the increasing speed of the shaft with respect to the lip of the oil seal makes it go through a state of friction, limit friction and mixed friction up to lip dilation and hydrodynamic friction.



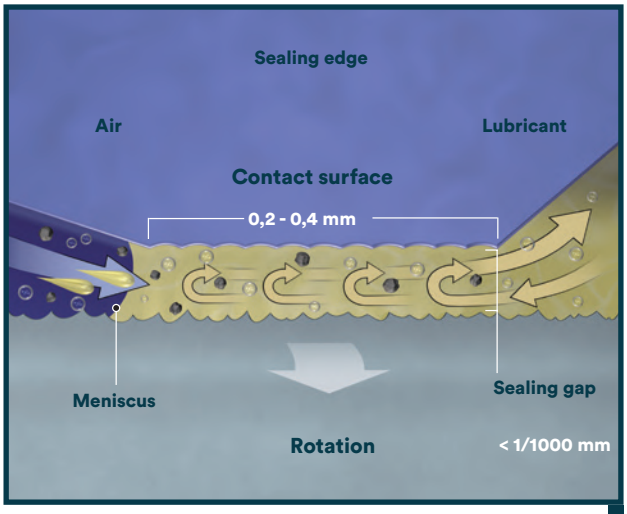

Sealing edge pressure gradient. **Figure 12**

In this way a meniscus is formed that acts as a border between the liquid medium and the air.

For the meniscus to remain, the drag stream must cause a depression on the AIR side, which is counteracted by the capillary pressure.

This balance can be disturbed by small damage to the lip, particles in the medium or a surface hardening of the oil seal in the contact area, causing the liquid to pass through this area and causing leakage.

An important factor in the sealing mechanism is that, together with the pressure gradient of the sealing edge, the elastomer has a certain longitudinal orientation or acquires it during the rotational movement of the shaft as an effect of deformation. This property occurs in increasing proportion depending on the quality of the elastomer.



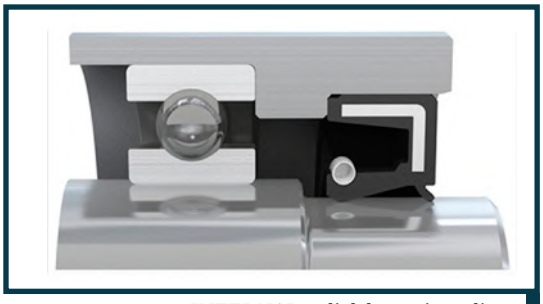

Dynamic sealing mechanism. **Figure 13**

## RADIAL DYNAMIC SEALING

Although a shaft has several diameters, the oil seal acts only one of them. Three situations are distinguished:

### INTERNAL radial dynamic sealing

By far it is the most widely used. The oil seal is confined in its housing and cannot move or rotate with the shaft. The sealing operation is radial, around the entire perimeter of the shaft, and is carried out by the (INNER) contact lip.



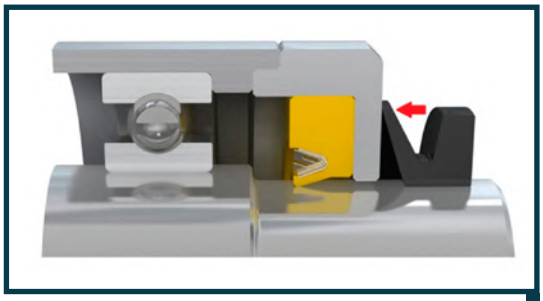
INTERNAL radial dynamic sealing. Oil seal with dust lip. **Figure 14**

### FRONT dynamic sealing

It is usually a complement to the own sealing of the main oil seal. It is carried out with an elastomeric ring called “splash” or V-ring seal that rejects splashes, dust or other contaminants.

The V-ring seal consists of a body and a front sealing lip. The elasticity of the body, together with the interference with the shaft, keeps the seal in place and rotating in solidarity with it, without the need for a specific housing.

The sealing operation of the V-ring is RADIAL, around the entire perimeter of the shaft, and FRONT, which is carried out by the contact lip against a surface perpendicular to the shaft, which, as in the image, is the bearing cover.



FRONT dynamic sealing by auxiliary V-ring. **Figure 15**

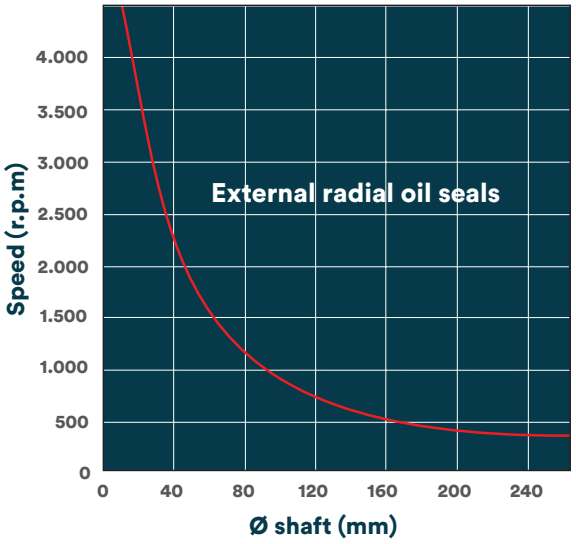
... DYNAMIC SEALING. Radial Dynamic Sealing.
... GO ON

## EXTERNAL radial dynamic sealing

Currently, there are very few machine designs that incorporate this type of sealing. The shaft on which the oil seal is installed remains static, and what rotates is its housing.

In these cases, if a conventional radial oil seal is mounted, from a certain speed, the sealing edge of the oil seal rises due to the centrifugal force of the housing since the tightening exerted by the spring is overcome.

Depending on the diameter of the service shaft, the area under the curve in Graph 1 indicates the safe working area for a oil seal with INTERNAL radial sealing.




Working area for an external radial oil seal. **Graph 1**

External oil seal KLOZURE® type 111. **Figure 16**

Above the curve, the angular speed is greater than the maximum admissible by the oil seal and the sealing lip separates from the shaft. In this situation, an oil seal with EXTERNAL radial sealing must be used.

## AXIAL DYNAMIC SEALING

Typical of rods with alternating forward and backward movement, as in the case of hydraulic and pneumatic cylinders and is not the subject of this catalog.

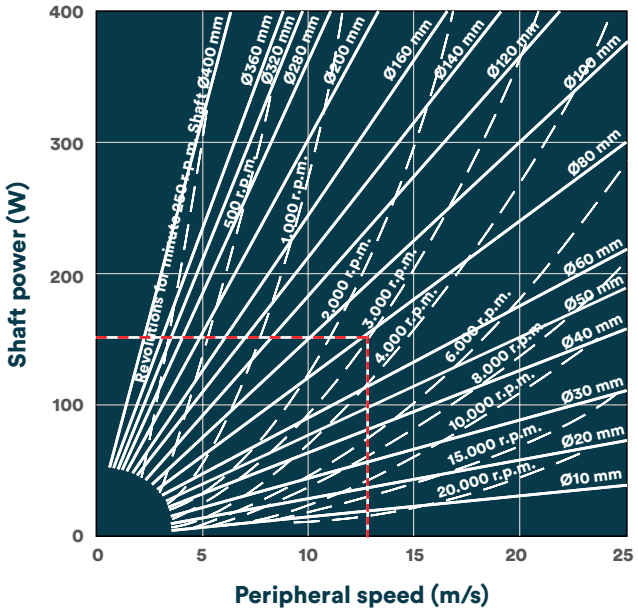
# LUBRICATION AND FRICTION

Sealing lip wearing will be minimal if and only if lubrication is sufficient. ***Under no circumstances should the lip of an oil seal run dry***. During the oil seal installation onto the shaft, said lubrication will be ensured by means of a previous greasing or oiling of both.

The medium to be sealed, however, not only acts as a lubricant, but at the same time acts as a refrigerant, dissipating the heat generated by friction. From the beginning of the movement, the flow of fluid to the lip must be sufficient to achieve its cooling.

In operation, some types of bearings (tapered) have a sucking effect on the lubricant. And they can create local lubricant deficits that jeopardize the lubrication of the sealing lip. It is advisable to provide for this circumstance by providing the casing with additional lubrication channels or holes.

There is a close relationship between lubrication and seal friction. As has already been said before, to achieve sealing, sufficient pressure on the sealing lip is necessary. However, the magnitude of this pressure will affect the amount of friction on the lip.




Friction losses *vs* peripheral speed. **Graph 2**

Graph 2 shows the lip friction, working with SAE20 engine oil at 100 °C. The data has been obtained with a total lubrication of the sealing lip.

In the case of an oil seal installed on a Ø80 mm shaft and rotating at 3.000 r.p.m. (12,6 m/s), the consumed power is approximately 160 W.

Due to the multiple factors that influence the friction of the sealing lip, the friction losses shown in the graph should not be used as absolute values but as guidelines.

# INFLUENCING FACTORS WHEN SELECTING A RADIAL SHAFT SEAL

As stated in the Introduction, the factors that influence the radial oil seal lifetime are the working conditions as well as its environment.

## TEMPERATURE EFFECT

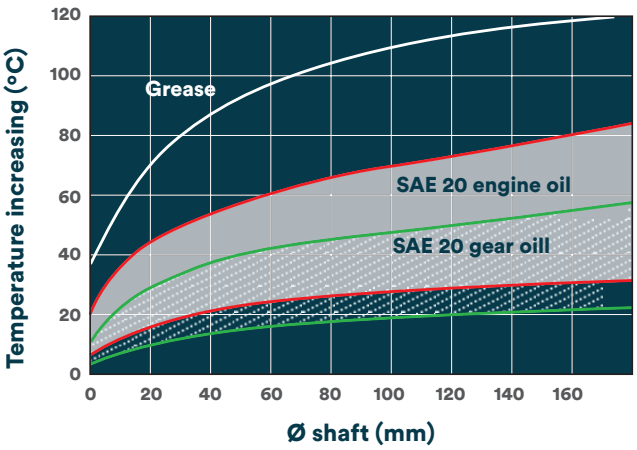
The amount of fluid present in the bearing housing will determine the greater or lesser dissipation of the heat generated and, consequently, this will affect the temperature of the sealing edge.

In Graph 3, the areas defined by the curves in red and green correspond to overheating of shafts totally bathed in the medium to be sealed (lower curve) and submerged by 25 % (upper curve), working at a nominal speed of 3.000 rpm and no pressure.

For example, the lip of an oil seal installed on a 120 mm diameter shaft and totally immersed in SAE 20 motor oil, overheats by 20 ºC. But if only 25 % of the shaft diameter is immersed, the overheating of the sealing edge is approximately 50 ºC.

Regarding grease, overheating is even greater, from 20 ºC to 115 ºC.

If the working oil seal is made of NBR ($T_{MAX}$ = 100 ºC) it will not suffer any problem with SAE 20 engine oil, even if the shaft is submerged by 25 %.




Overheatings in function of working fluid. **Graph 3**

However, if the fluid is grease, the increase in temperature that the lip will experience will deteriorate it. Grease lubricates but does not cool.

## PERIPHERAL SPEED EFFECT

If the shaft rotates too fast, the sealing edge of the oil seal will wear faster. The gray areas of Graph 4 show the recommended operating zones, depending on the Øshaft and the rotary speed (angular or peripheral) and in conditions of sufficient lubrication (SAE 20), with good heat dissipation.

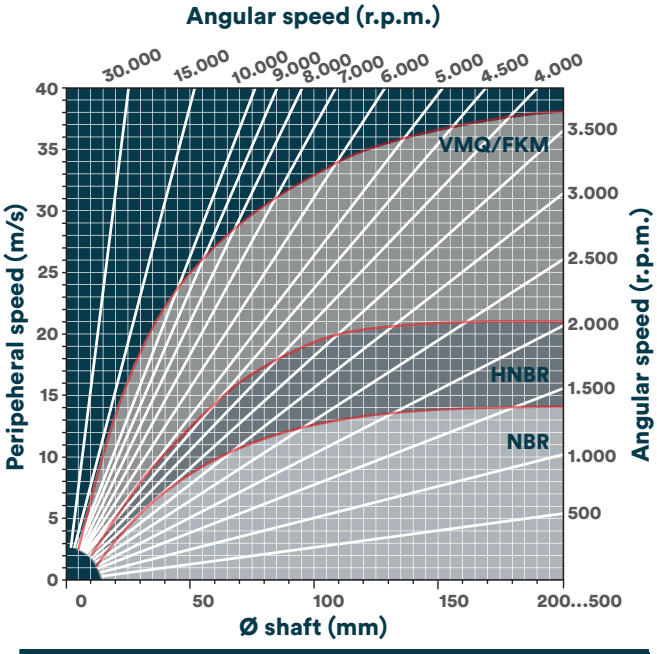
The conversion from angular to peripheral speed is according to the equation:

$$v(m/s) = \frac{\emptyset(mm) \cdot \pi \cdot \omega(r.p.m.)}{60.000}$$

For example, a FPM oil seal installed on Ø120 mm shaft can rotate at a maximum speed of approximately 35 m/s. That is, 5.570 r.p.m. If the compound is NBR, the permissible speed is reduced to 13 m/s, approximately 2.070 r.p.m.

In both cases, at speeds higher than those indicated, the service life of the oil seal will be significantly reduced.

In the event that the oil seal has a dust lip, the maximum working speed is 8 m/s, regardless of the compound used (VMQ, FPM, H-NBR or NBR). If the dust lip has an auxiliary vent hole, then the maximum permissible speed is 15 m/s.

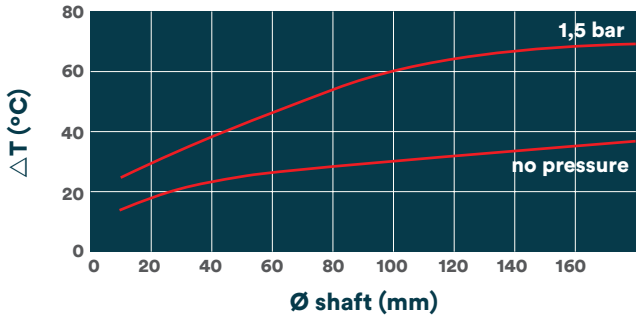



Speeds for NBR, H-NBR and VMQ / FPM. **Graph 4**

## PRESSURE EFFECT

If the fluid to be sealed is pressurized, then the seal lip experiences additional clamping force against the shaft.

As a consequence, the hydrodynamics below the sealing edge (dynamic sealing mechanism) is disturbed and a greater friction is also produced, raising the temperature in the oil seal edge.




Pressure and overheating. **Graph 5**

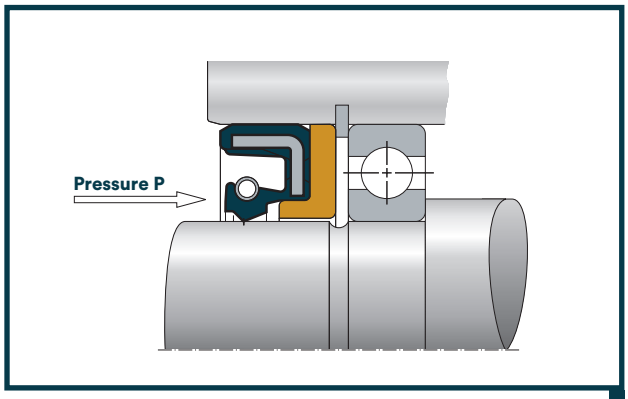
Graph 5 shows the influence of pressure when a NBR oil seal rotating at 3.000 r.p.m. and with the shaft submerged 50 % in SAE 20 oil, it works pressurized and works without pressure, but with good dissipation of the heat generated.

It may happen that, in operation, the bearing unit gets so hot that the air trapped in it creates additional pressure.

In such a case, the installation of a purge or venting valve is recommended.

The oil seal must be installed with its lip facing where there is more pressure (so that the fluid presses the lip against the shaft) and must be secured in such a way that the pressure does not expel it from its housing.

To this end, the back-up rings (orange element Figure 17) specific to each oil seal model are used.




Oil seal with back-up ring installation. **Figure 17**

In the event of fluctuations in negative pressure (vacuum), the lip will tend to lift off the shaft with the consequent leak of lubricant. To prevent leakage, it is recommended to install a 2nd oil seal with the sealing lip facing the AIR side.

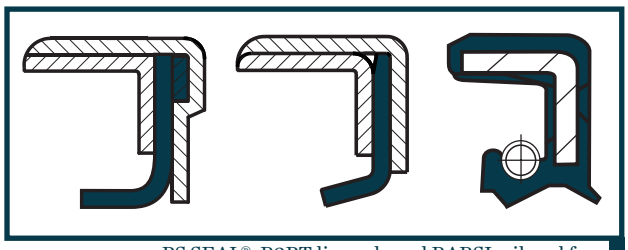
## COMBINED EFFECT OF PRESSURE AND VELOCITY

The pressure (P) and the peripheral speed (v) determine the range of use of the oil seals. When the respective limit values are exceeded, wear will be premature and will lead to a logical reduction in the service life of the oil seal.

Standard oil seals are designed for service at atmospheric pressure or for use at very low pressures relative to atmospheric, between 0,2 and 0,5 bar (0,02 – 0,05 MPa).

However, for applications involving hydraulic pumps, hydraulic motors, screw compressors, agitators or hydrodynamic clutches, options such as the BABSL oil seal or lip seals, capable of withstanding up to 10 bar (1 MPa), have been developed.

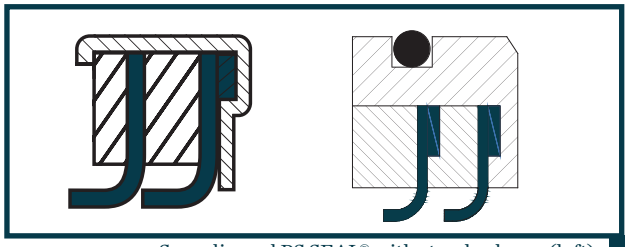
Lip seals consist of a housing containing a very short but flexible sealing lip made of PTFE or restructured PTFE (Gylon®). This design minimizes the increase in sealing lip contact pressure and thus friction (Figure 18).



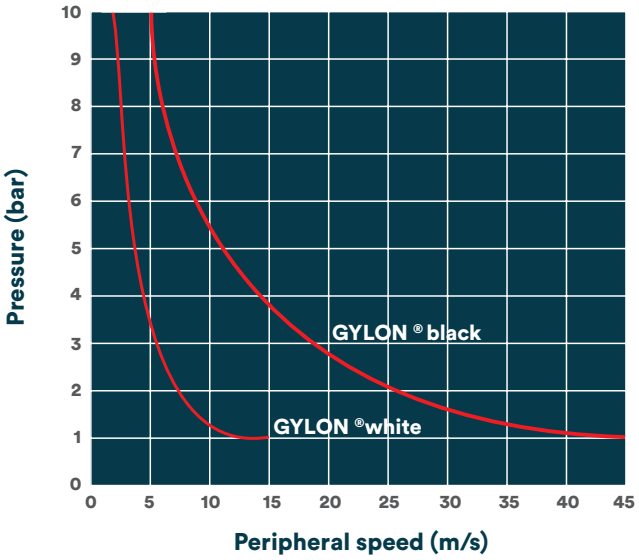
PS SEAL®, B2PT lip seals and BABSL oil seal for 10 bar máximum pressure. **Figure 18**

... COMBINED EFFECT OF PRESSURE AND VELOCITY
... GO ON

Also, there are housing configurations that allow a maximum service pressure of up to 25 bar (2.5 MPa).



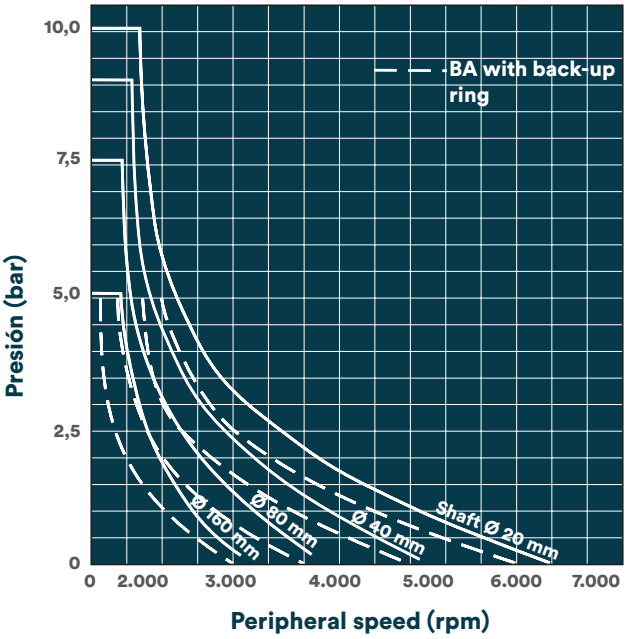
Same lip seal PS SEAL® with standard case (left) and reinforced for 25 bar (right). **Figura 19**




P x v diagram for PS SEAL®. **Graph 6**

The following graphs show P x v curves, whose area under the curve determines the recommended working zone.

A degraded lubricant, lack of lubricant or even dry running, forces to reduce the maximum acceptable P x v value, as well as the need to use a suitable sliding surface.

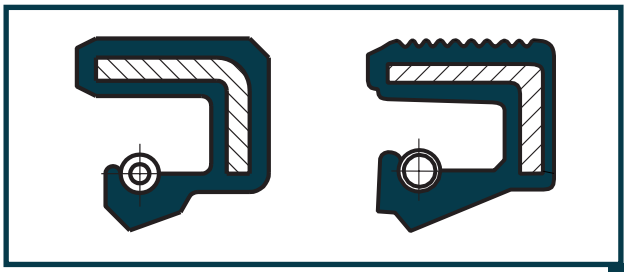



P x v diagram for BABSL and BA with back-up ring. **Graph 7**

## LIP DESIGN

The geometry of the lip affects its wear. Given a certain pressure of the medium, the total force perceived by the sealing edge is the sum of the spring tightening force plus that corresponding to its surroundings.

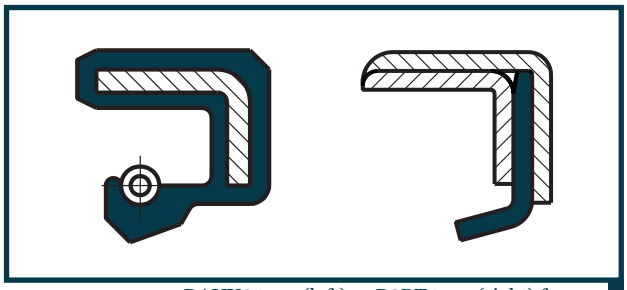
Under the same pressure conditions, when comparing two seals of the same elastomer, the one with a membrane with a smaller surface area will lead to less friction, which will also mean a smaller radial force and a longer service life.



BAUX2 type (left) with a membrane of smaller surface area than BAFUDX7 type (right). **Figure 20**

However, if the service pressure is high, what is of interest is to achieve a sufficiently high radial force on the sealing edge to guarantee sealing.

Thus, in this case, the most important parameter is the length of the lip. A shorter lip (with less contact surface) will be less affected by pressure than a longer one. And materials with a low coefficient of friction will be used, such as PTFE or restructured PTFE's.



BAUX2 type (left) vs B2PT type (right) for up to 10 bar pressure. **Figure 21**

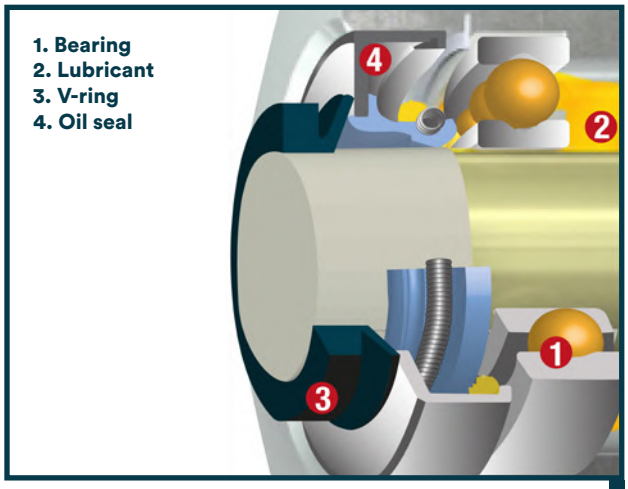
## DIRT IN THE WORKING ENVIRONMENT

Faced with dirt or humidity from the outside, it is advisable to apply a radial oil seal with a dust lip.

The space between the dust lip and the sealing lip must be filled with grease before mounting. This grease is not only necessary for the lubrication of the dust lip, but also for the protection of the shaft against moisture corrosion. The key aspects for selecting the most suitable solution are:

- Dirtiness amount of environment.
- Peripheral speed (m/s).
- Temperature (ºC).
- Axial motion.
- Assembly procedure.

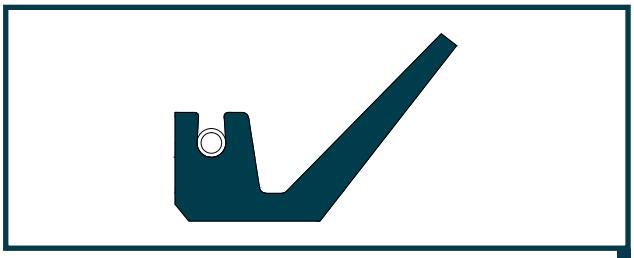
If contamination is of some importance, the use of two radial oil seals mounted in series or the same double lip seal in tandem is recommended. An oil seal can also be combined with a "gutter" or V-ring seal.



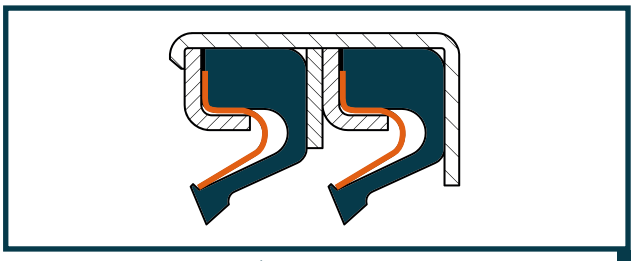

Sealing configuration of V-ring seal and a radial oil seal. **Figure 22**

Instead, if the dirt is extreme, then a CASSETTE assembly consisting of an oil seal and an integrated counterpart that includes a protective labyrinth is recommended.

On the other hand, in conventional oil seals there is the possibility of covering the friction zone of the sealing lip with a layer made of PTFE with bronze filler to increase the oil seal service life.



V-ring with garter spring KLOZURE® type 145. **Figure 23**



Oil sela with lips set in tándem configuration and finger spring KLOZURE® type 53 T2. **Figure 24**

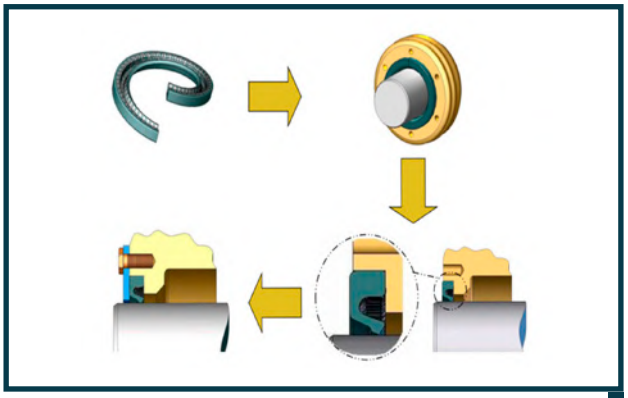
CASSETTE type 2 oil seal for extreme dirt. **Figure 25**

## SPLIT OIL SEALS

On large equipment it can be difficult and costly to dismount the bearing unit to change the oil seal. In these cases, we recommend the use of split seals that allow their installation from outside the equipment, without the need to open the machine and with the consequent reduction in intervention time and the cost of equipment downtime.

Considerations to take into account:

- All split seals are for a relative pressure of 0 bar.
- The junction point must be at the top of the housing (at 12 o'clock).
- The level of oil or grease in the crankcase must always be below the split area.
- Its assembly is by interference. Split oil seals are already delivered with the development suitable for assembly.



Split oil seal installation. **Figure 26**

# MATERIALS

The medium to be sealed largely determines the selection of the compound to be used, and also the type of seal, since elastomers can harden or swell due to contact with the working fluid.

An elastomer that works continuously at a temperature higher than that recommended will suffer hardening with loss of elasticity and the formation of cracks in the sealing edge. On the other hand, swelling takes place when the elastomer absorbs the working fluid.

Through tests of specimens immersed in the working fluid, the effect produced by said fluid on the elastomer is known. To do this, elastomer properties such as hardness, tensile strength and elongation at break are measured before immersion. The tests are repeated after immersion and the results obtained are compared.

It is found that the various lubricating media produce variations in elongation at break in certain elastomers. In relation to the service life of the material and therefore also the oil seal one, a decrease in elongation at break of 50 % is taken as the maximum admissible variation.

## REMARKS ABOUT THE PROCESS FLUID

This section points out some considerations about the fluids to be sealed.

### MINERAL OILS

Mineral oils obtained from petroleum fractionation, with low additive content, show good compatibility with working elastomers. Thus, the selection criterion takes into account the operating temperature of the seal. However, in cases of doubt, oil/elastomer compatibility should be checked as stated above.

### HYPOID OILS

They are lubricating oils for high pressures, with a high % of additives that improve their lubricating capacity and prevent the tendency of bearings and gears to seize.

Additives not only have an effect on the gears, but also on the sealing lip. In combination with the corresponding heat generation, carbon deposits appear in the area of the sealing edge.

The lip of these oil seals is designed to obtain minimum friction and prevent carbon deposits.

### SYNTHETIC LUBRICANTS

They are those that are obtained in the laboratory. Experience shows that elastomers tolerate base oils. Like mineral oils, the aggressiveness of synthetic oils depends on the additives and their concentrations and, in case of doubt, compatibility tests should be carried out.

### GREASES

For the bearing sealing working at low speeds and lubricated with grease, it is recommended to fill the maximum available space according to the manufacturers' indications. It is suggested to install one of the oil seals back from the grease. This avoids overpressure due to heating and excessive filling in the lubrication.

When selecting the elastomer, keep in mind that greases are good lubricants but poor coolants (see Graph 3, page 17).

### AGGRESSIVE AND POORLY LUBRICATING MEDIA

Media with a low lubricating power are considered to be washing lyes, process water or the possibility of temporary dry operation.

In these cases, the lip of the seal must be provided with additional grease.

If it is necessary to treat with chemically aggressive media such as organic solvents, acids, alkalis, lyes, fluorinated oils or silicone oils, then the chemical compatibility of the elastomer must be checked beforehand. Restructured PTFE lip seals are also available, which can even run dry.

## CASE, SPRING AND MEMBRANE / LIP

Most seal designs include two materials: metal for the casing, the internal plate (if any) and the spring; and another elastomer for the membrane and lip. The seals for high pressure services are made of PTFE thermoplastic.

The metallic materials are usually carbon steel for housings, although upon request, they can be made of stainless steel. The springs are made of alloy steel or AISI 316 stainless steel, depending on the model. Two types of springs are distinguished:

- Helical or garter spring: used in most designs. It requires a housing in the oil seal membrane to provide the necessary stiffness to the lip (Figure 27).
- Finger or V spring: distributes the load evenly, with independent action of each foil. It can be integrated into the membrane and solve the problem of accumulation of particles on the coils of the garter spring (Figure 28).

There are even oil seals that combine both springs (Figure 29).

On the other hand, the sealing lip will be requested to have:

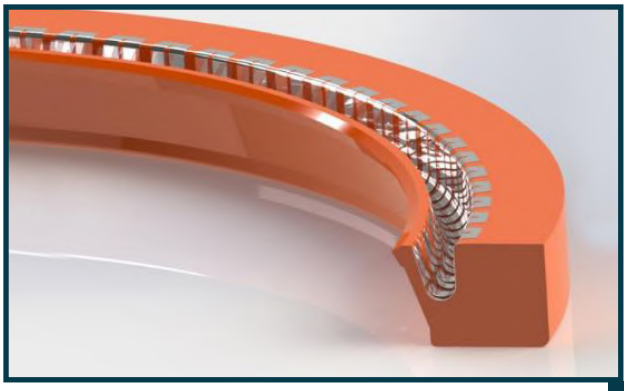
- Flexibility to adapt to the spring clamping force.
- Chemical resistance to the fluid to be sealed.
- Work with sufficient lubrication.

Under these circumstances, the working conditions (P x v) will determine the lip wear. The continuous friction of the sealing edge against the shaft generates heat that affects the lip service life.

Thus, the main selection criterion for the lip material will be the actual working temperature.

Considering the thermal resistance, the elastomers and thermoplastics available are shown below.

Oil seal with garter spring. **Figure 27**



KLOZURE® type 23. **Figure 28**

KLOZURE® type 64. **Figure 29**

## Materials temperature ranges*

| | Material | T / °C | $T_{PIEAK}$ / °C |
|---|---|---|---|
| Compounds | Acrylonitrile butadiene rubber (NBR) | -40 ...+100 | +125 |
| | Hydrogenated acrylonitrile butadiene rubber (H-NBR) | -30 ...+150 | +180 |
| | Fluorcarbon rubber (FPM or FKM) | -30 ...+205 | +235 |
| | Silicone rubber (VMQ) | -60 ...+180 | +205 |
| | Fluorsilicone rubber (FVMQ) | -60 ...+150 | +205 |
| TP** | PTFE | -80 ...+150 | +200 |
| | Restructured PTFE | -90 ...+250 | +260 |

** Specific formulations for oil seals*
*** Thermoplastic*

From Graph 3 (page 16) it can be concluded that the working fluid has a limited capacity to dissipate heat and, therefore, overheating occurs under the sealing edge. Said temperature increase must be added to the nominal working conditions.

Considering the chemical resistance, the fields of application of the materials for exposed grease or oil seals are the following:

## Chemical resistance of various materials *

| | Material | Process fluid |
|---|---|---|
| Compound | Acrylonitrile butadiene rubbe (NBR) | Lubricants in general.<br>Motor oils, EL, L, gears, hypoid gears, ATF and greases.<br>Hydraulic fluids HFA, HFB, HFC and HFD.<br>Not recommended for water or washing lyes. |
| | Hydrogenated acrylonitrile butadiene rubber (H-NBR) | Slightly higher than nitrile one (NBR). |
| | Fluorcarbon rubber (FPM or FKM) | Chemical resistance like the nitrile (NBR) and extended to organic solvents.<br>Not recommended for fluids based on phosphoric esters (e.g. Pydraul 10E). |
| | Silicone rubber (VMQ) | Vegetable oils, oils with a high aniline point, motor and engine oils, gear oils.<br>Medium resistance to swelling in mineral oils and greases.<br>Not suitable for aliphatic and aromatic hydrocarbons. |
| | Fluorsilicone rubber (FVMQ) | Improves the resistance to swelling of silicone in mineral and synthetic oils.<br>Not recommended for aromatic or aliphatic hydrocarbons. |
| TP** | PTFE | Almost universal chemical inertness. |
| | Restructured PTFE | Almost universal chemical inertness. |

** Specific formulations for oil seals*
*** Thermoplastic*

## Preliminary selection of the working elastomer depending on the process fluid

| | Material | Grease / oil | Water / glycol | Outdoor / ozone |
|---|---|---|---|---|
| Oil seal surroundings | FPM | YES | YES | YES |
| | H-NBR | YES | YES | NO |
| | FVMQ | YES | NO | YES |
| | NBR | YES | NO | NO |

Considering the resistance to abrasion, the classification of the presented elastomers and thermoplastics is as follows:

## Abrasion resistance of various materials *

| | Material | Abrasion |
|---|---|---|
| Compound | Acrylonitrile butadiene rubber (NBR) | Moderate |
| | Hydrogenated acrylonitrile butadiene rubber (H-NBR) | Very good |
| | Fluorcarbon rubber (FPM or FKM) | Good |
| | Silicone rubber (VMQ) | Poor |
| | Fluorsilicone rubber (FVMQ) | Poor |
| TP** | PTFE | Regular |
| | PTFE reestructurado | Good depending on load |

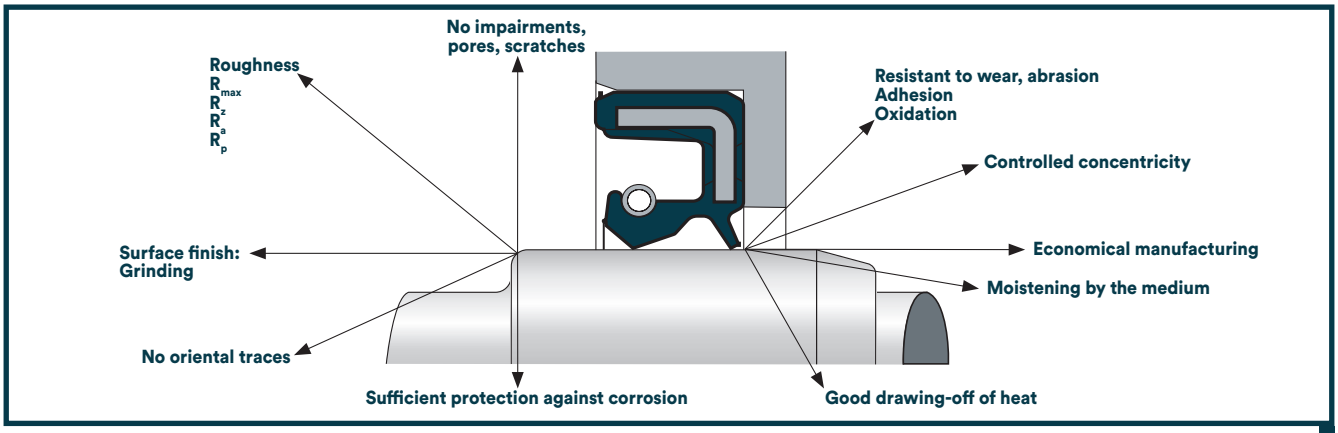
** Specific formulations for oil seals*
*** Thermoplastic*

# INSTALLATION REQUIREMENTS

An oil seal is defined by the working shaft dimensions and the housing where it will be confined. Both must meet a number of requirements.

## SHAFT DESIGN

One of the most influential factors in sealing is the surface finish of the shaft in the area of contact with the oil seal lip.




Key aspects for shaft structure. **Figure 30**

### SURFACE ROUGHNESS

In mechanics, roughness is the set of irregularities that a surface has. The greater or lesser surface roughness depends on its surface finish, which allows defining the microgeometry of the surface and validating it for use.

To measure the parts roughness, roughness meters are used that measure the depths and heights of the imperfections and undulations of a surface, no matter how polished it is.

Given a surface of length "l" with a certain profile, the roughness parameters to be measured are the following:

**Average roughness $R_a$ (ISO 4287, DIN 4768)**

$R_a$ corresponds to the arithmetic mean of the absolute values of the deviation of the profile in the base length "l".

**Maximum roughness $R_{máx}$ (DIN 4768)**

$R_{max}$ is the highest value from aisolated roughness "zi" in the base length "l".

**Average roughness $R_z$ DIN (DIN 4768)**

$R_z$ is the arithmetic mean of the 5 successive values of maximum roughness along the measurement length.

If the roughness is too low ($R_a$ < 0,2 µm), the lubricant film between the lip and the shaft is unstable and there may be a lack of lubricant in the sliding area.

The consequence is a greater heating of the contact point that will result in a hardening of the material, formation of cracks and even carbonization of the sealing edge, all of which cause premature failure of the oil seal.

If the roughness is excessive ($R_a$ > 0,8 µm), then the friction of the sealing lip increases and it wears out rapidly.

For a working pressure of less than 0,1 MPa (1 bar), the recommended roughness in the contact area of the shaft with the sealing lip is as follows

- 1,0 µm ≤ $R_z$ ≤ 5,0 µm
- 0,2 µm ≤ $R_a$ ≤ 0,8 µm
- $R_{max}$ ≤ 6,3 µm

In applications with a pressure higher than 0,1 MPa (1 bar) and PTFE sealing lips:

- 1,0 µm ≤ $R_z$ ≤ 3,0 µm
- 0,2 µm ≤ $R_a$ ≤ 0,8 µm
- $R_{max}$ ≤ 6,3 µm

## SURFACE QUALITY

It is absolutely necessary to do the final machining without orientation traces on the rolling tracks. The use of feed machining systems are only appropriate in special cases. It is recommended to use a grinding wheel with:

- A grain size “60” to “100” and a feed speed of approximately 0,25 m/min.
- With a depth of pass from 0,03 mm to 0,04 mm.
- Grinding wheel speed of 1.500 r.p.m.
- Revolutions of the rolling surface (turning backwards) from 80 r.p.m. to 100 r.p.m.

Scratches, bumps, rust or other superficial damage lead to a loss of sealing due to leaks at the rolling point of the radial oil seal.

For this reason, great care must be taken in protecting the shaft, from manufacturing to finished assembly, as well as providing protective covers for transport.

## TOLERANCES

Two types of tolerances are distinguished for the shaft, according to the ISO standard:

- Dimensional: h11
- Concentricity: IT8

## SHAFT SURFACE HARDNESS

The working track must always be treated to a minimum hardness of 45 HRC.

If the fluid is degraded and contains particles, if there is dirt in the working environment, or if the speed is greater than 12 m/s, then it is recommended that the minimum surface hardness of the shaft be 50 HRC, with a depth of the hardened area greater than 0,3 mm.

## SHAFT MATERIAL

Carbon steels which, in addition to withstanding the mechanical stresses of the application, can withstand a minimum surface hardness of 45 HRC are recommended. Spheroidal graphite cast irons and alloyed cast irons are also suitable. The condition for the use of the latter materials is a sound surface, free of cracks and voids and with a pore depth of less than 0,05 mm.

Coatings are suitable but pores deeper than 0,05 mm should be avoided. Hard chrome plating does not give good results because of uneven wear.

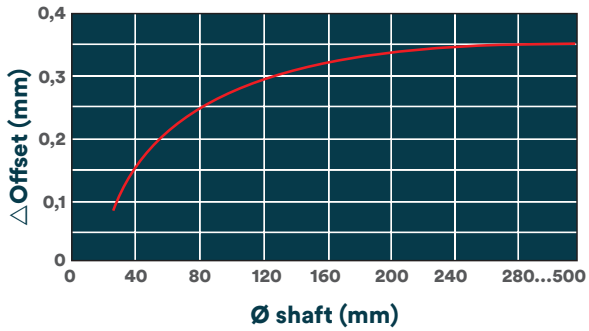
For low speed water sealing, stainless steels such as 1.4300 or 1.4112 can be used. Plastic materials are not suitable due to their low thermal conductivity which does not facilitate heat dissipation at the sealing edge.

Ceramic bushings used as rolling surfaces are very wear resistant and give good results in special cases.

## MISALIGNEMENT

Deviation of the offset or deviation of the static concentricity between the shaft and the bore (coaxiality), leads to an irregular distribution of the clamping force and to an unequal inclination of the lip on the perimeter of the shaft. A part of the sealing lip is exposed to greater stress, which causes a larger sliding surface and a loss of tightening on the opposite side, compromising the sealing of the oil seal.

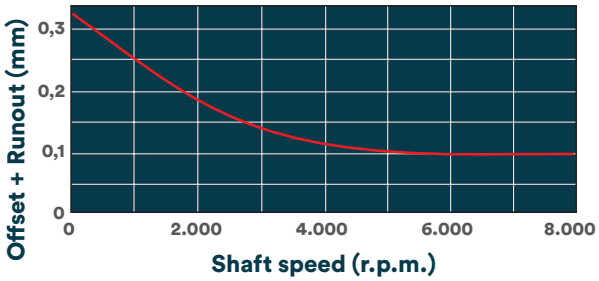
The allowable offset variation is shown in Graph 9.




Offset maximum variation depending on the shaft diameter. **Graph 9**

Dynamic eccentricity or runout deviation should be avoided as much as possible. At high speed, there is a risk that the lip cannot follow the shaft due to its inertia. The interference loss causes, from a certain value, leaks to occur.

For a given oil seal, the total deviation value of offset and runout must be less than 0,4 mm. However, there are oil seals designed for high eccentricities (> 1,0 mm).




Offset and runout deviation depending on shaft speed. **Gráfico 10**

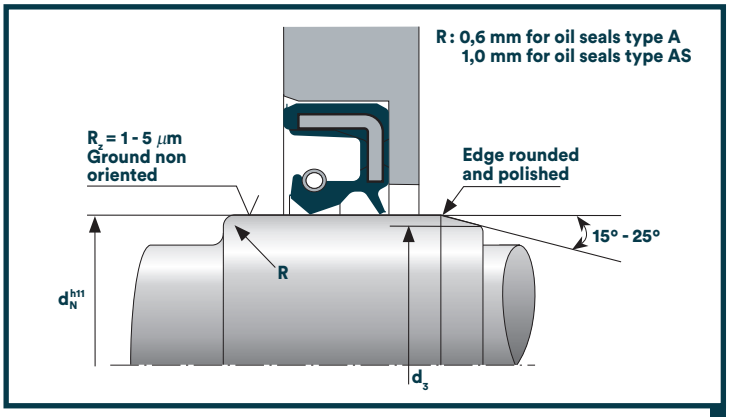
## AXIAL MOVEMENTS

An oil seal may absorb axial displacements added to the rotary movement, caused by thermal expansion, shaft vibrations, bearing axial clearance or forward movement in machine tools, without significantly diminishing its sealing capacity.

## SHAFT CHAMFERING

The chamfering of the shaft depends on the mounting direction of the seal with respect to the chamfer:

- If the shaft is inserted frontally into the oil seal through the dynamic sealing lip (lip with spring), then a chamfer with an angle of 15° to 25° must be made.
- If the shaft enters the oil seal from the rear of the oil seal, then a rounding of the chamfer area is enough.




Shaft key points. **Figure 31**

## HOUSING OR BORE DESIGN

Surface roughness.

Oil seals according to DIN 3761 types A and AS:

- 10,0 µm ≤ $R_z$ ≤ 25,0 µm
- 1,6 µm ≤ $R_a$ ≤ 6,3 µm
- $R_{max}$ < 25,0 µm

Oil seals according to DIN 3761 types B, BS, C and CS:

- 6,3 µm ≤ $R_z$ ≤ 16,0 µm
- 0,8 µm ≤ $R_a$ ≤ 3,2 µm
- $R_{max}$ ≤ 16,0 µm

### TOLERANCE

H8, in accordance with ISO standard.

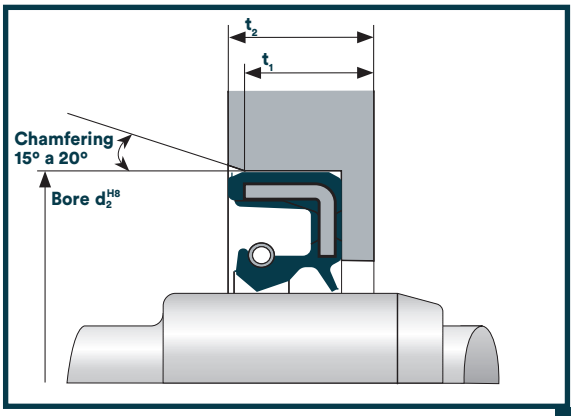
### THERMAL EXPANSION

The expansion of the housing, due to the heating that occurs in structures made of light metal or plastic material, causes the separation of the outer surface of the seal. In type B and C oil seals, this effect can cause some leakage.

Type A seals better assimilate the thermal expansion of the housing, given their pressure fit tolerances, as well as the higher coefficient of expansion of the elastomers and for this reason they are recommended for split housings.

### CHAMFERS

The seal housing must have an entry chamfer that facilitates its assembly. The angle of this chamfer will be approximately 20º and with a length in accordance with the proportion of the diameter of the seal to be installed, generally around 1 mm. The inner radii of the housing must not be greater than 1 mm.




Bore chamfer. **Figure 32**

### STIFFNESS

When inserting an oil seal in a thin-walled housing, in a relatively low resistance or elastic bore, there is a danger of damaging the housing or deforming it. In this case, the use of type A oil seals is recommended, applying an assembly tolerance of F8.

## ACCESSORIES

### SHAFT SLEEVES

A rotary machine may suffer episodes of vibrations and/or accentuate looseness of moving parts. Combined with the above, lubricant degradation can cause the gap between the lip and the shaft contact area to be reduced and lip wearing begins

When the sealing of the machine is compromised and it is decided to disassemble the oil seal, if it is observed that there is a groove on the shaft just where the lip of the oil seal has contacted and with a width of approximately 1 mm, then it is said that the shaft is damaged.

The worn area of a damaged shaft can be rebuilt, but it is expensive. However, a much more economical option is the use of bushings or sleeves to restore shafts scored by oil seals.

Speedi-Sleeve® sleeves are precision parts made of 300 series stainless steel with a hard chrome plated surface, a surface finish of 10 - 20 RMS and a surface hardness of 74 Rockwell on the 15N scale.

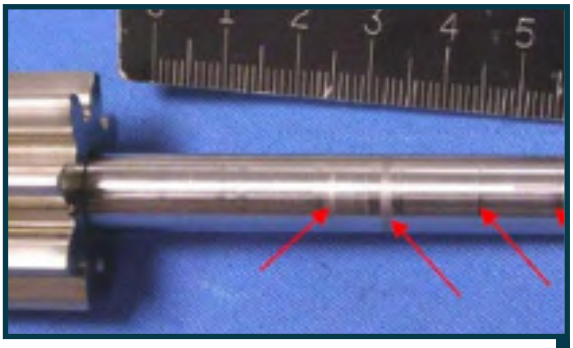
The thickness that is added to the diameter of the shaft is 0,6 mm, a measure that is perfectly absorbed by the oil seal membrane.

For the recovery of shafts in high load services, there is the Speedi-Sleeve® Gold version with a hardness of 80 – 85 HRC and which improves resistance to abrasion. The result is similar to that of a diamond surface.

The Speedi-Sleeve® part, once installed on the shaft, provides a sealing surface superior to most original shaft finishes and materials.

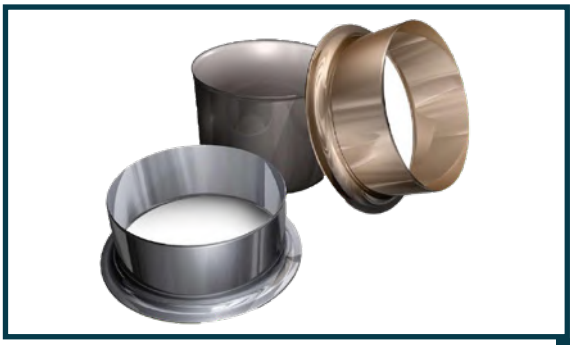
The Speedi-Sleeve® Gold sleeve was tested for abrasion resistance under severe working conditions, using fine and coarse sand at a temperature of 100 °C. The result obtained was the following:

- The oil seal, working on an unprotected shaft, start to leak at 450 hours.
- With shaft protected by Speedi-Sleeve® Gold, it started leaking at 2.500 hours.
- Speedi-Sleeve® Gold, in the salt spray test at 40 °C, passed the 600 hour test without traces of corrosion.

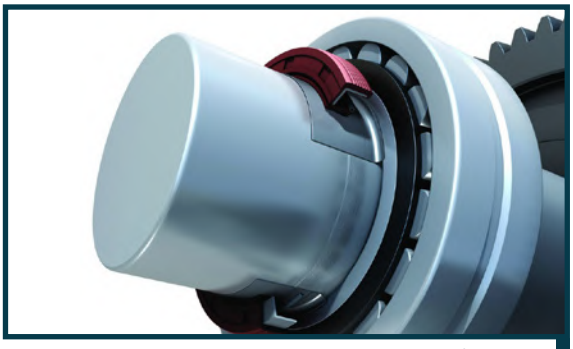


Shaft damaged at various points. **Figure 33**

Range of RMS values published by the American Foundry Society. **Figure 34**



Speedi-Sleeve® and Speedi-Sleeve® Gold sleeves. **Figure 35**

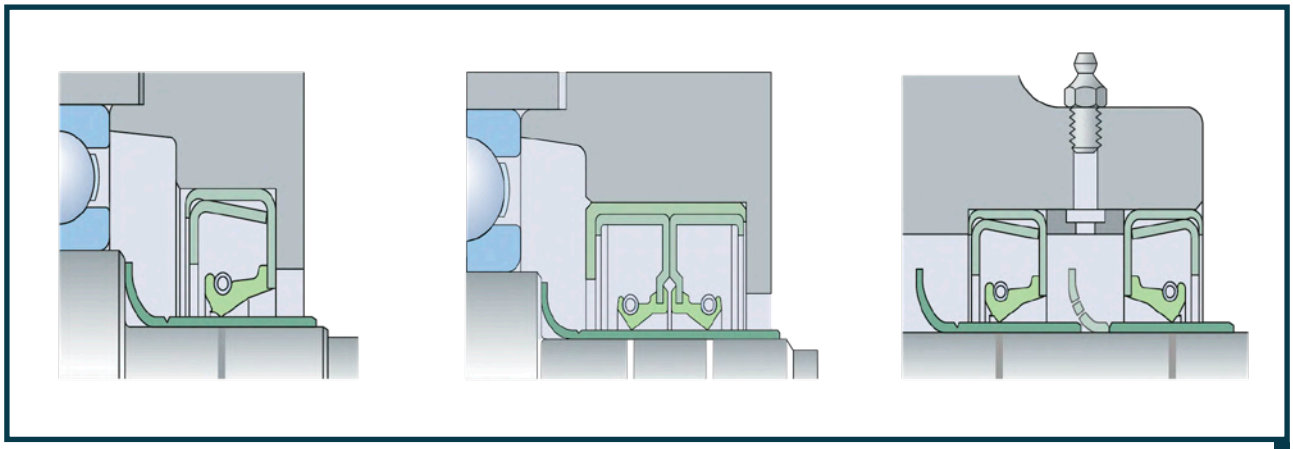


Speedi-Sleeve®. **Figura 36**

## INSTALLATION

Because the sleeve is thin-walled and has an interference fitting, any disturbance to the shaft surface can create a similar pattern on the sleeve surface and cause leakage.

It should never be heated before installation. Using heat will cause the sleeve to expand, but as it cools it may not shrink back to its original size, resulting in a loose fitting on the shaft.



Speedi-Sleeve® mounting. **Figure 37**

### Step 1

Clean the oil seal counterface surface on the shaft.

File down any burrs or rough spots and make sure that the Speedi-Sleeve® sleeve will not be installed over keyways, cross holes, splines or similar imperfections.

Otherwise will cause the sleeve to deform and make it difficult for it to follow its new contact surface during rotation.

### Step 2

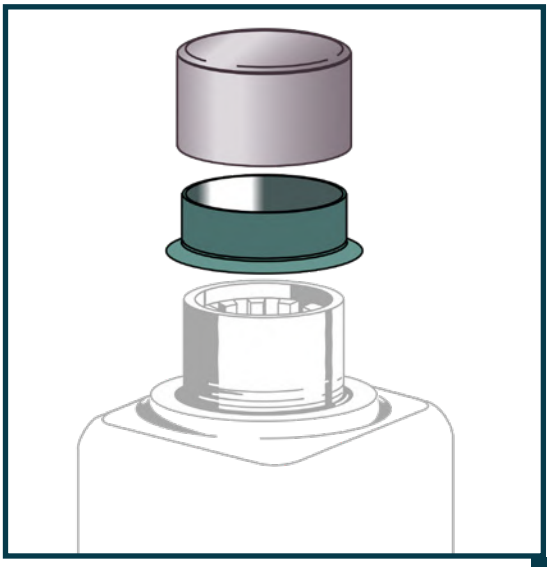
Measure the diameter on an unworn portion of the shaft where the sleeve will be positioned.

Measure in three positions and average the readings to make sure the shaft is within recommended specifications.

If the average diameter is within the range for a given Speedi-Sleeve® size, there is sufficient press fit built into the sleeve to prevent it from sliding or spinning without using an adhesive.

### Step 3

Determine where the sleeve must be positioned to cover the worn area. Measure to the exact point, or mark directly on the surface. The sleeve must be placed over the worn area, not just bottomed or left flush with the end of the shaft.



Installation tools. **Figure 38**

... GO ON

Shallow wear grooves do not require filling. Optionally, a light layer of a non-hardening sealant can be applied to the inside diameter surface of the sleeve.

Clean away sealant that migrates to the shaft or sleeve outside diameter surface.

### Step 4

If the shaft is deeply scored, fill the groove with a powdered metal epoxy-type filler. Install the sleeve before the filler hardens, enabling the sleeve to wipe off any excess filler.

Clean away any remaining filler from the sleeve outside diameter surface.

It should be repeated that heat should never be used to install SKF Speedi-Sleeve®.

### Step 5

If the flange should be removed after installation, cut it from the outside diameter into the radius in one location. The flange end of the sleeve goes on the shaft first. Then, place the installation tool over the sleeve (figure 38).

### Step 6

Gently tap the centre of the installation tool until the sleeve covers the worn shaft surface (figure 39).

If the installation tool is too short, a length of pipe or tubing with a squared-off, burr-free end can be used.

Be sure that the inside diameter of the pipe is the same as that of the installation tool. Use care not to scratch the precision ground sleeve's outside diameter.

SKF Speedi-Sleeve® should always be installed so that the outside edge of the sleeve is seated on the full shaft diameter. It must not rest in or outside the chamfer area since the sharp edge will likely cut the sealing lip during seal installation.

After the Speedi-Sleeve® sleeve is installed, check again for burrs that could damage the seal.

Lubricate the Speedi-Sleeve® sleeve with the system medium before installing the oil seal and proceed with the oil seal

Installation. **Figure 39**

## UNINSTALL

SKF Speedi-Sleeve® can be removed by applying heat to the sleeve with an electric heat blower, which will expand it enough to let it slide off the shaft without causing any damage to the shaft.

Alternatively, the sleeve can be removed in any of the following ways, always using care not to damage the shaft surface:

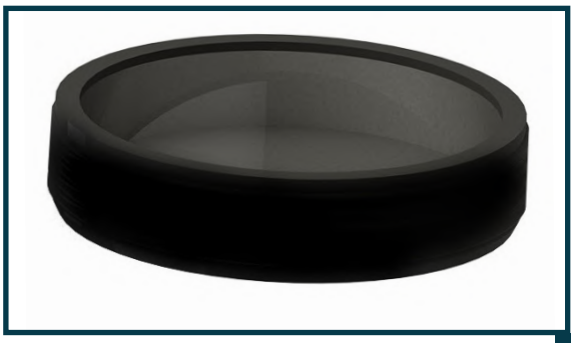
- By using a cold chisel to cut through the sleeve.
- By using a pair of wire cutters starting at or near the flange and applying a twisting motion.

Please note that SKF Speedi-Sleeve® cannot be reused.

## END CAPS

Another accessory that is used in gearboxes is the end cap. It is a plug for cylindrical holes, consisting of a blind metal casing coated with NBR.

It is a static sealing element, indicated for split or light metal housings with low viscosity fluids or gases. The working pressure must not exceed 0,05 MPa (0,5 bar). For higher pressures the additional installation of a circlip retaining ring is recommended. The working temperature is from -40 °C to +100 °C.



End cap. **Figure 40**

# OIL SEALS ASSEMBLY

A correct installation of the oil seal is essential to guarantee the tightness of the equipment. A large part of the failures in oil seals originate during their assembly, either due to incorrect positioning, due to having suffered damage due to the use of inappropriate tools or due to not following the assembly procedure correctly.

## PRELIMINARY CONSIDERATIONS

Before proceeding with the installation, it is advisable to examine the oil seal as well as the shaft and the housing to ensure that they are in the correct state of cleanliness and finish. Otherwise, the dirt present must be cleaned and the surface defects and edges that are necessary must be eliminated.

Both the lip of the oil seal and the rolling point where the sealing operation is to be carried out must be lubricated, to guarantee that during the first turns of operation there is no excessive damage due to friction.

Generally, the same lubricant to be sealed is used, or else, grease. Furthermore, if the seal has a dust lip, then the space between the two lips must also be greased to approximately 2/3 of its volume.

To facilitate assembly, it is also highly recommended to lubricate both the bore and the outside diameter of the oil seal.

Each point to be sealed generally requires only one oil seal. Its lip must be oriented towards the side of higher pressure.

On vertical or inclined shafts, and sealing points located below the lubricant level, it is recommended to mount 2 oil seals in series and oriented in the same direction. The space between the two should be used as a lubrication chamber. It is convenient to have the possibility of greasing from the outside.

The oil seal can only fulfill the mission of sealing and therefore, it is not suitable as a guide element for machinery parts. Therefore it should be installed as close as possible to the bearing.

If oil seals are used in standard versions, no pressure that exceeds the admissible one must be formed in the area, since this would reduce its useful life. Standard oil seals cannot be used for the transmission of axial forces.

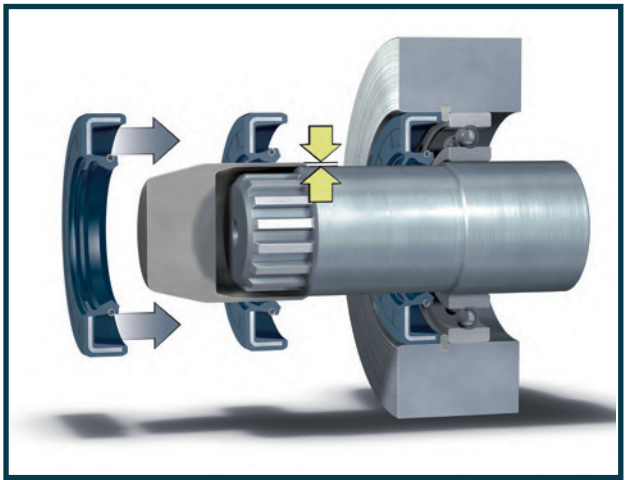
## OIL SEAL MOUNTING

Sometimes when mounting a oil seal, the user underestimates the effects of incorrect mounting. It is important to note that the assembly of said oil seal can determine its useful life.

Many claims and returns can be avoided by receiving proper assembly training or carrying out internal audits of the assembly and storage processes (see Training Courses on page 70).

To protect the sealing edge, during installation, all sharp edges, threads, keyways or any imperfection that could damage the oil seal will be covered.

If press-fitting partts are to slide over the rolling area, the diameter of the shaft must be reduced at this point by approximately 0,2 mm.



Oil seal mounting over a splined shaft. **Figure 41**

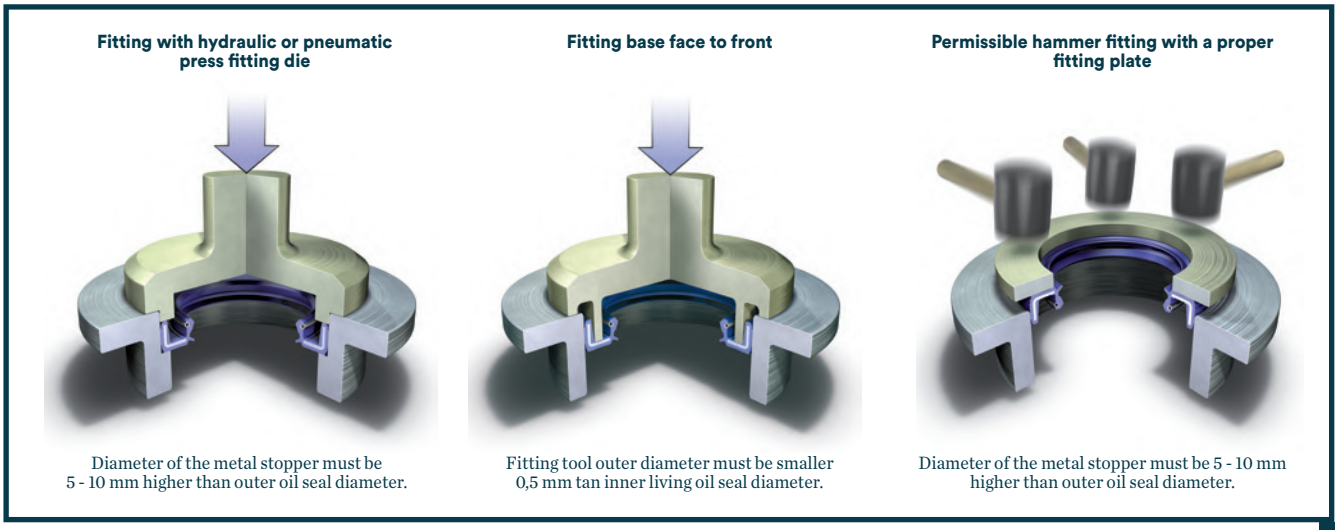
... OIL SEAL MOUNTING
... GO ON

Oil seals are designed so that the resulting diameter, smaller than the nominal, does not affect its sealing capacity.

The use of a mounting sleeve is essential if the oil seal is inserted with the sealing lip forwards and must pass over a stepped shaft, where chamfering is not possible. When sliding the oil seal along the shaft, special care must be taken to exert uniform pressure on the entire circumference of the oil seal, also trying to maintain a good perpendicularity with respect to the shaft.

It is highly recommended to use a mechanical or hydraulic device (with a suitable tool for each case) and maintain the tightening once the end of the course has been reached, to guarantee the correct seating of the seal.

Regarding the bore and shaft designs, it is important to ensure that the insertion chamfer (angle and length) is completely free of burrs in accordance with the instructions in section 6.1. **Shaft design** and section 6.2. **Bore design** (pages 25 - 28).




Various mounting options. **Figure 42**

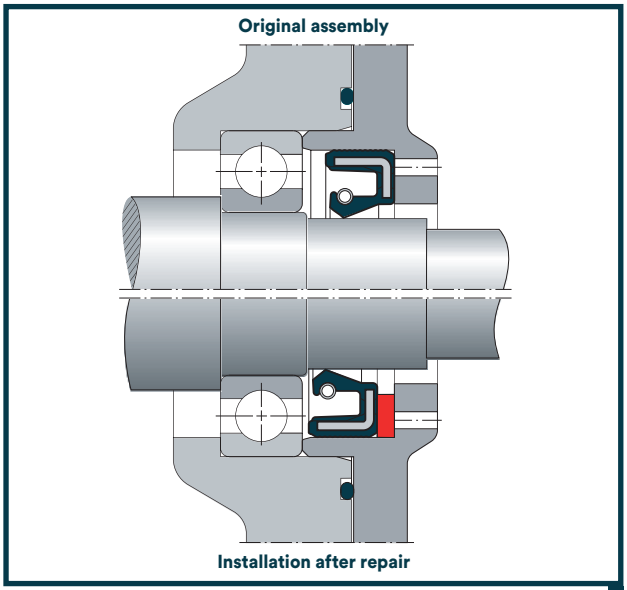
## OIL SEAL REPLACEMENT

Whenever a bearing unit is opened, it is advisable to replace the existing oil seals by new oil seals.

When assembling the new oil seal, its lip must be prevented from working on the same raceway as the oil seal to be replaced, since there may be wearing in that area that makes lubricant leaks possible. To do this, the shaft can be ground, sleeved or, if feasible, the oil seal can be moved to a different bore depth with a spacer ring.

The oil seal tightness on the bore side (unless it is clearly affected) is sufficient to not require more sealing parts, so the use of any sealing product in that area is not recommended.

Here are some examples.

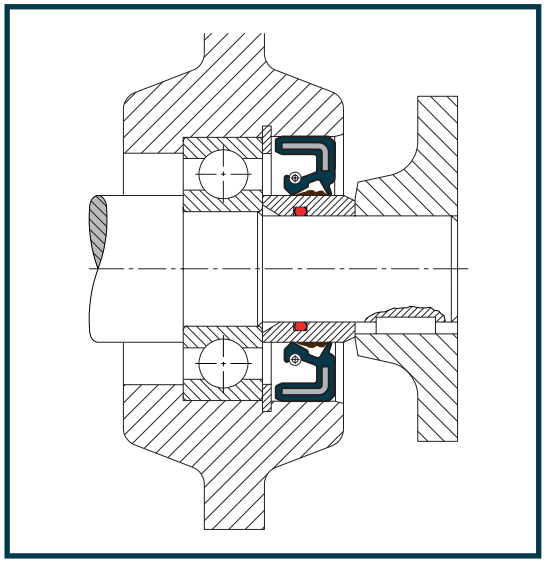



New oil seal assembly with spacer ring (red). **Figure 43**

## Example 1

Sealing design for low dirt ingress.

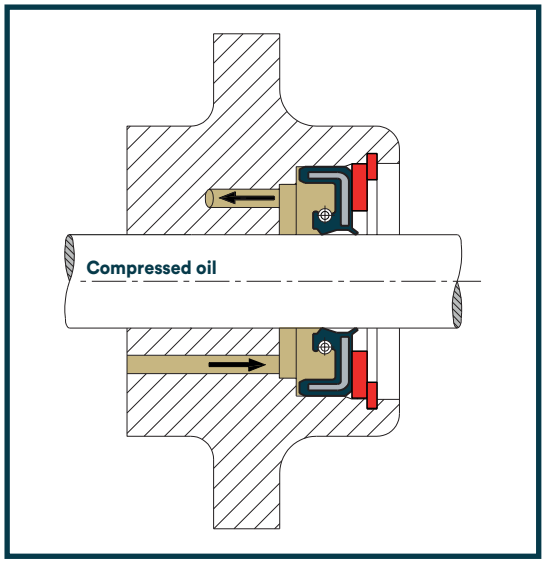
**Oil seal with dust lip.** Grease filled 2/3 of the volume between the lips. Interchangeable raceway and sealed on its inner diameter by an O-ring (Red).



## Example 2

Shaft output oil seal in a oil pump.

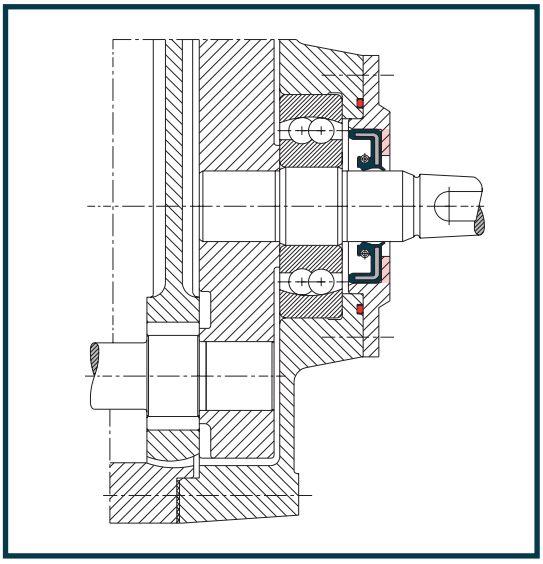
**Short lip oil seal with dust lip.** Grease filled 2/3 of the volume between the lips. Additional coverplates for the oil seal are required (Red).




## Example 3

2-cylinder engine crankshaft output oil seal.

**Pressurized oil seal with dust lip.** Grease filled 2/3 of the volume between the lips. A cover with O-ring (Red) is added.

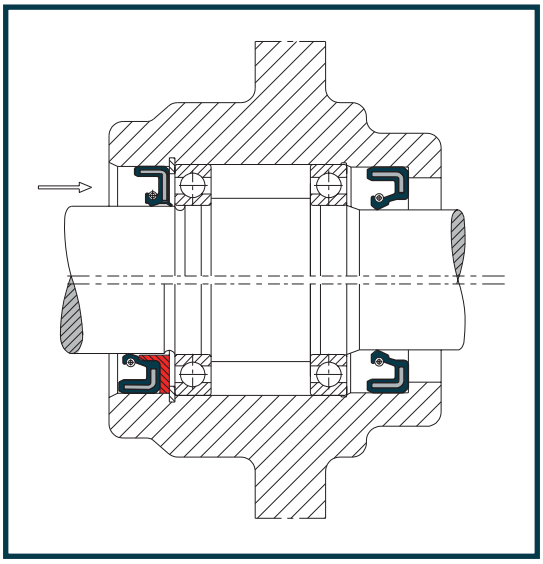


## Example 4

Low pressure oil sealing.

**Up.** Option 1: from left to right, short lip seal with reinforcement ring and standard oil seal.

**Below.** Option 2: from left to right, standard oil seals with back-up ring only in the left one (Red).



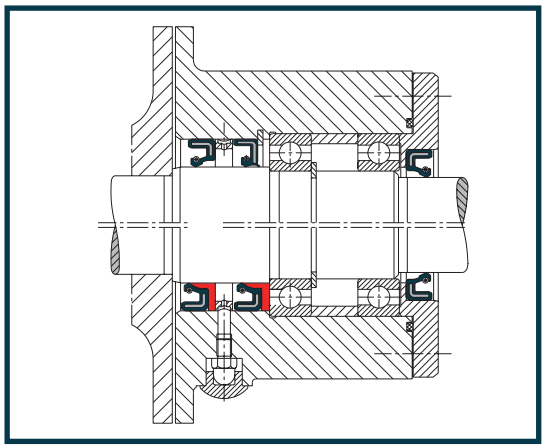
## Example 5

Middle pressure water sealing.

Under variable pressures, to avoid the suction of air in depression, the oil seal is assembled with the lips facing outwards.

**Up**. Option 1: from left to right, standard oil seal / short lip oil seal with dust lip / standard oil seal

**Below**. Option 2: from left to right, conventional seals in series with back-up rings (Red) forming a lubrication chamber.



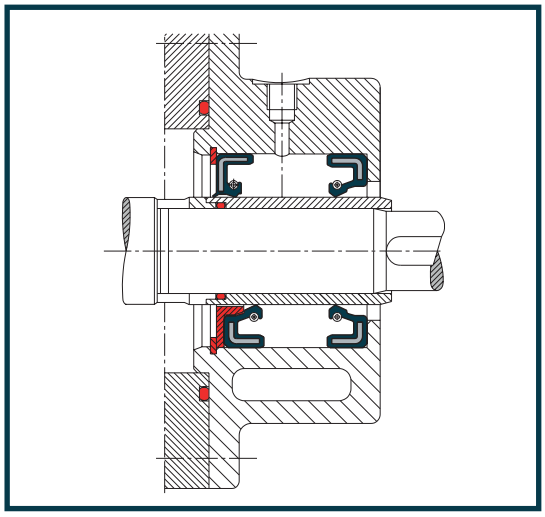
## Example 6

Vacuum sealing.

Oil Seals with lips opposite the vacuum side, forming a lubrication chamber.

**Above**: fastening cover for high pressure seal (Red).

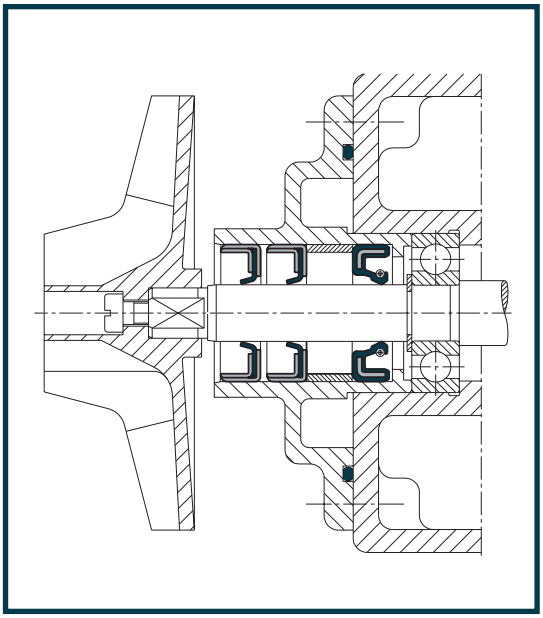
**Below**: fastening cover and additional back-up ring for standard oil seal (Red).



## Example 7

Process centrifugal pump.

Serial lip seals to seal fluid; space for possible drainage and standard oil seal for bearing lubricant.

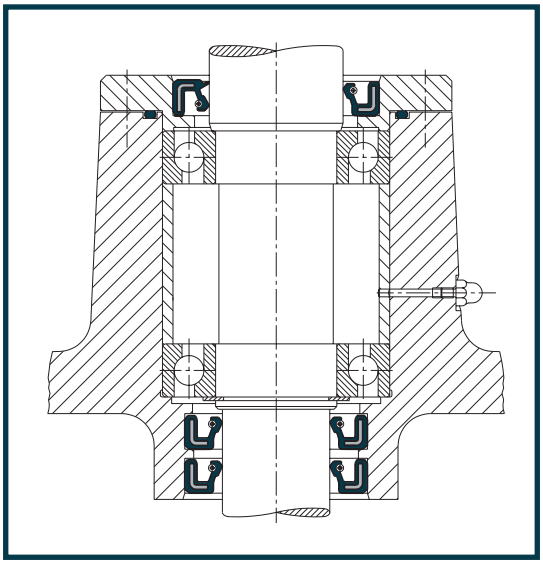


## Example 8

Vertical shaft sealing.

**Left half** oil lubrication.

**Right half** grease lubrication, the lip must face outwards, to avoid overpressure in the following greasing..



# RECEPTION AND STORAGE

## BASICS

Some of the issues listed below may seem trivial, but their effects cause real component failure. A minimum damage caused on the sealing edge can cause premature failure of the seal.

Therefore, it is very important to observe the following points:

**SUGGESTIONS**

- Pay attention to damaged packaging.
- Leave oil seals in packaging as much as possible until the fitting process.
- Protect oil seals from dust and dirt.
- Prevent oil seals from coming into contact with objects that have sharp edges such as metal chips, sharp edges on assembly tools, chamfers and housings.
- Safeguard oil seals in a sealed or covered state.
- Make sure that the amount of grease between the lip and the dust lip does not exceed 40 % of the volume (otherwise apparent leaks may occur).
- Grease oil seals carefully paying special attention to quantity, position and cleanliness.

## OIL SEALS STORAGE AND SERVICE LIFE

Oil seals should be stored under the following conditions:

### Environmental factors

**AMBIENT**

- Temperature between –10 ºC and +25 ºC.
- Relative humidity less than 65 %.
- Avoid direct light.
- Protection from solar radiation.
- Suitable packaging.
- The ozone level in the warehouse must not exceed the value according to current legislation

The oil seal shelf-life in accordance with ISO 2230:2002, depends on the compound:

### Storage

**STORAGE**

**a)** Oil seals made of **NBR** and **H-NBR**: up to 7 years.

**b)** Oil seals made of **FPM / FKM** and **VMQ**: up to 10 years..

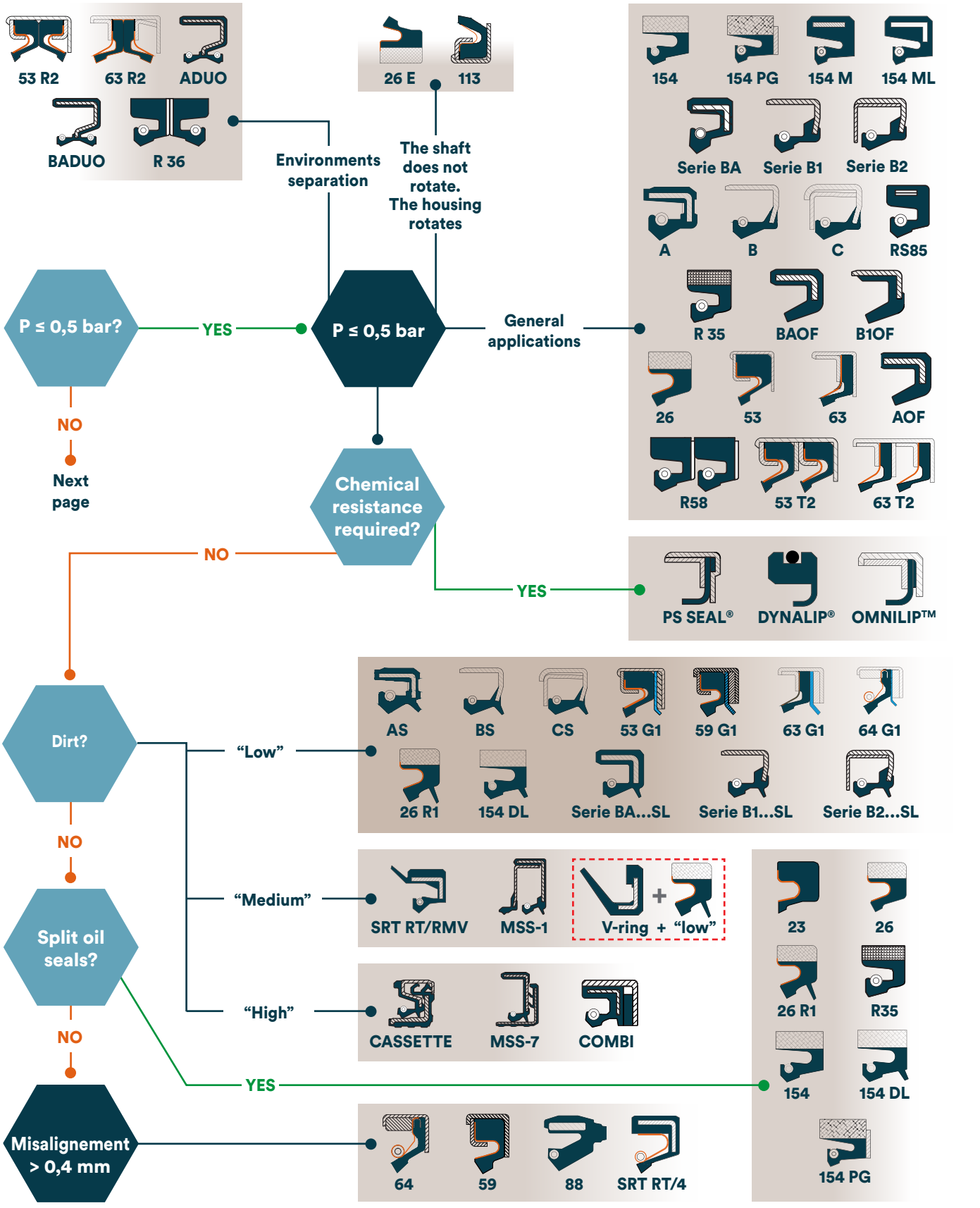
**c)** Oil seals made of **PTFE** and **rPTFE**: up to 20 years.

Following an appropriate control, the storage time can be extended up to a maximum of 3 years for the seals of category **a)** and 5 years for those of category **b)**.

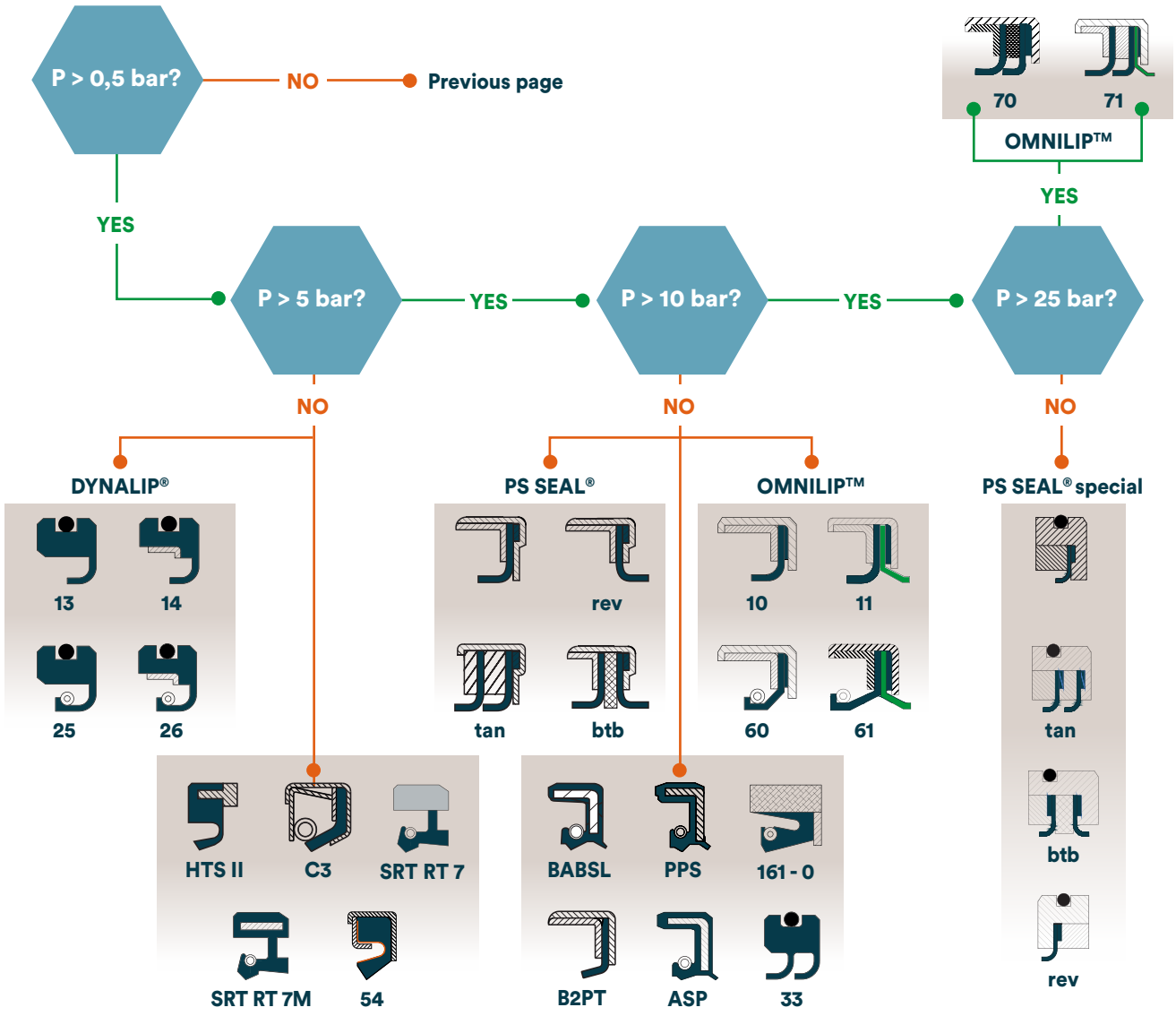
If the oil seal has a visible metal case, it must be protected with a film of lubricant that prevents atmospheric oxygen attack. Additionally, the assembly can be bagged and the bag sealed to avoid changes in ambient humidity.

*For further information, please see DIN 7716 storage standard.*

# OIL SEALS SELECTION GUIDE




*The oil seal maximum pressure can be reduced depending on the working speed. Please refer to its data sheet.*




## Oil seals datasheets index

# OIL SEAL PRODUCT DATASHEET

## BA, BAFUD, BAU, BAUX2


FREUDENBERG
INNOVATING TOGETHER

**Standard**

DIN 3760 type A

**Description**

Oil seal with right angle metal insert, elastomer coated and garter spring type.

**Materials**

**Lip:**
72 NBR 902
75 FPM 585
75 FPM 260466

**Metal insert:** DIN 1624 steel

**Garter spring:** DIN 17223 steel

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 45 - 60 HRC
Roughness: 0,2 µm ≤ Ra ≤ 0,8 µm

**Bore:**
Tolerance: ISO H8
Roughness: 10 µm ≤ Rz ≤ 25 µm

**Applications**

**Applications:**

Sealing of mineral oils, synthetic oils and greases.

P ≤ 0,5 bar

**NBR:** v ≤ 14 m/s
**FPM:** v ≤ 38 m/s

**NBR:** -40 ºC ≤ T ≤ +100 ºC
**FPM:** -25 ºC ≤ T ≤ +160 ºC

## BAFUDX7, BAUMX7


FREUDENBERG
INNOVATING TOGETHER

**Standard**

DIN 3760 type A

**Description**

Oil seal with right angle metal insert, elastomer coated and garter spring type. Grooved outer diameter.

**Materials**

**Lip:**
72 NBR 902
75 FPM 585
75 FPM 260466

**Metal insert:** DIN 1624 steel

**Garter spring:** DIN 17223 steel

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 45 - 60 HRC
Roughness: 0,2 µm ≤ Ra ≤ 0,8 µm

**Bore:**
Tolerance: ISO H8
Roughness: 10 µm ≤ Rz ≤ 25 µm

**Applications**

**Applications:**

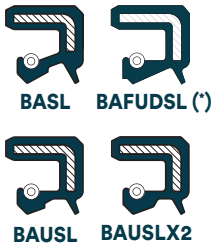
Sealing of mineral oils, synthetic oils and greases, where thermal expansion may be important.

P ≤ 0,5 bar

**NBR:** v ≤ 14 m/s
**FPM:** v ≤ 38 m/s

**NBR:** -40 ºC ≤ T ≤ +100 ºC
**FPM:** -25 ºC ≤ T ≤ +160 ºC

## BASL, BAFUDSL, BAUSL, BAUSLX2




FREUDENBERG
INNOVATING TOGETHER

**Standard**

DIN 3760 type AS

**Description**

Oil seal with right angle metal insert, elastomer coated, garter spring type and dust lip.

**Materials**

**Lip:**
72 NBR 902
75 FPM 585
75 FPM 260466

**Metal insert:** DIN 1624 steel

**Garter spring:** DIN 17223 steel

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 45 - 60 HRC
Roughness: 0,2 µm ≤ Ra ≤ 0,8 µm

**Bore:**
Tolerance: ISO H8
Roughness: 10 µm ≤ Rz ≤ 25 µm

**Applications**

**Applications:**

Sealing of mineral oils, synthetic oils and greases. "Low" dirt environments.

P ≤ 0,5 bar

v ≤ 8 m/s

**NBR:** -40 ºC ≤ T ≤ +100 ºC
**FPM:** -25 ºC ≤ T ≤ +160 ºC

P and T maximum values should not be combined simultaneously.
(*) the working pressure for the FUD type lip in all its variants is 0,02 MPa (0,2 bar).

## BAFUDSLX7, BAUMSLX7

BAFUDSLX7 (*)

BAUMSLX7

FREUDENBERG
INNOVATING TOGETHER

**Standard**

DIN 3760 type AS

**Materials**

**Lip:**
72 NBR 902
75 FPM 585
75 FPM 260466

**Metal insert:** DIN 1624 steel

**Garter spring:** DIN 17223 steel

**Description**

Sealing of mineral oils, synthetic oils and greases. “Low” dirt environments.

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 45 - 60 HRC
Roughness: 0,2 µm ≤ Ra ≤ 0,8 µm

**Bore:**
Tolerance: ISO H8
Roughness: 10 µm ≤ Rz ≤ 25 µm

**Applications**

**Applications:**

Sealing of mineral oils, synthetic oils and greases, where thermal expansion may be important. “Low” dirt environments.

P ≤ 0,5 bar

v ≤ 8 m/s

**NBR:** -40 °C ≤ T ≤ +100 °C
**FPM:** -25 °C ≤ T ≤ +160 °C

## BABSL

BABSL

FREUDENBERG
INNOVATING TOGETHER

**Standard**

DIN 3760 type AS

**Materials**

**Lip:**
72 NBR 902
75 FPM 595

**Metal insert:** DIN 1624 steel

**Garter spring:** DIN 17223 steel

**Description**

Short lip oil seal with right angle metal insert, elastomer coated, garter spring type and dust lip.

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 45 - 60 HRC
Roughness: 0,2 µm ≤ Ra ≤ 0,4 µm

**Bore:**
Tolerance: ISO H8
Roughness: 10 µm ≤ Rz ≤ 25 µm

**Applications**

**Applications:**

Sealing of mineral oils, synthetic oils and greases. “Low” dirt environments.

P ≤ 10 bar

v ≤ 10 m/s

**NBR:** -40 °C ≤ T ≤ +100 °C
**FPM:** -25 °C ≤ T ≤ +160 °C

## PPS

PPS

FREUDENBERG
INNOVATING TOGETHER

**Standard**

DIN 3760 type AS

**Materials**

**Lip:**
75 FPM 595

**Metal insert:** DIN 10027 steel

**Garter spring:** DIN 10270 steel

**Description**

Patented short lip oil seal with right angle metal insert, elastomer coated, garter spring type and dust lip.

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 45 - 60 HRC
Roughness: 0,2 µm ≤ Ra ≤ 0,4 µm

**Bore:**
Tolerance: ISO H8
Roughness: 10 µm ≤ Rz ≤ 25 µm

**Applications**

**Applications:**

Sealing of mineral oils, synthetic oils and greases. “Low” dirt environments.

P ≤ 10 bar

v ≤ 15 m/s

-25 °C ≤ T ≤ +160 °C

P and T maximum values should not be combined simultaneously.
(*) the working pressure for the FUD type lip in all its variants is 0,02 MPa (0,2 bar).

## B1FUD, B1U, B1

B1FUD (*)

B1U

B1

FREUDENBERG

**Standard**

DIN 3760 type B

**Materials**

**Lip:**
72 NBR 902
75 FPM 585

**Case:** DIN 1624 steel

**Garter spring:** DIN 17223 steel

**Description**

Oil seal with outer metal case and garter spring type.

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 45 - 60 HRC
Roughness: 0,2 µm ≤ Ra ≤ 0,8 µm

**Bore:**
Tolerance: ISO H8
Roughness: 6,3 µm ≤ Rz ≤ 16,0 µm

**Applications**

**Applications:**

Bores with thermal changes (contractions and expansions). Sealing of mineral oils, synthetic oils and greases.

P ≤ 0,5 bar

**NBR:** v ≤ 14 m/s
**FPM:** v ≤ 38 m/s

**NBR:** -40 ºC ≤ T ≤ +100 ºC
**FPM:** -25 ºC ≤ T ≤ +160 ºC

## B1FUDSL, B1USL, B1SL

B1FUDSL (*)

B1USL

B1SL

FREUDENBERG

**Standard**

DIN 3760 type BS

**Materials**

**Lip:**
72 NBR 902
75 FPM 585

**Case:** DIN 1624 steel

**Garter spring:** DIN 17223 steel

**Description**

Oil seal with outer metal case, garter spring type and dust lip.

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 45 - 60 HRC
Roughness: 0,2 µm ≤ Ra ≤ 0,8 µm

**Bore:**
Tolerance: ISO H8
Roughness: 6,3 µm ≤ Rz ≤ 16,0 µm

**Applications**

**Applications:**

Bores with thermal changes (contractions and expansions). Sealing of mineral oils, synthetic oils and greases. “Low” dirt environments.

P ≤ 0,5 bar

v ≤ 8 m/s

**NBR:** -40 ºC ≤ T ≤ +100 ºC
**FPM:** -25 ºC ≤ T ≤ +160 ºC

## B2FUD, B2U, B2

B2FUD (*)

B2U

B2

FREUDENBERG

**Standard**

DIN 3760 type C

**Materials**

**Lip:**
72 NBR 902
75 FPM 585

**Cases:** DIN 1624 steel

**Garter spring:** DIN 17223 steel

**Description**

Oil seal with reinforced outer metal case and garter spring type.

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 45 - 60 HRC
Roughness: 0,2 µm ≤ Ra ≤ 0,8 µm

**Bore:**
Tolerance: ISO H8
Roughness: 6,3 µm ≤ Rz ≤ 16,0 µm

**Applications**

**Applications:**
Bores the both with difficult assembly and thermal changes (contractions and expansions). Sealing of mineral oils, synthetic oils and greases.

P ≤ 0,5 bar

**NBR:** v ≤ 14 m/s
**FPM:** v ≤ 38 m/s

**NBR:** -40 ºC ≤ T ≤ +100 ºC
**FPM:** -25 ºC ≤ T ≤ +160 ºC

P and T maximum values should not be combined simultaneously.
(*) the working pressure for the FUD type lip in all its variants is 0,02 MPa (0,2 bar).

## B2FUDSL, B2USL, B2SL

B2FUDSL (*)

B2USL

B2SL

FREUDENBERG
INNOVATING TOGETHER

**Standard**

DIN 3760 type CS

**Description**

Oil seal with reinforced outer metal case, garter spring type and dust lip.

**Materials**

**Labio:**
72 NBR 902
75 FPM 585

**Case:** steel DIN 1624 steel

**Garter spring:** DIN 17223 steel

**Surface finishes**

**Eje:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 45 - 60 HRC
Roughness: 0,2 µm ≤ Ra ≤ 0,8 µm

**Bore:**
Tolerance: ISO H8
Roughness: 6,3 µm ≤ Rz ≤ 16,0 µm

**Applications**

**Applications:**

Bores the both with difficult assembly and thermal changes (contractions and expansions). Sealing of mineral oils, synthetic oils and greases. "Low" dirt environments.

P ≤ 0,5 bar

v ≤ 8 m/s

**NBR:** -40 ºC ≤ T ≤ +100 ºC
**FPM:** -25 ºC ≤ T ≤ +160 ºC

## BAOF, B1OF

BAOF

B1OF

FREUDENBERG
INNOVATING TOGETHER

**Description**

**BAOF**: oil seal with right angle metal insert, elastomer coated, and without garter spring.

**B1OF**: oil seal with outer metal case and without garter spring.

**Materials**

**Lip:**
72 NBR 902

**Metal insert:** DIN 1624 steel

**Case:** DIN 1624 steel

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 45 - 60 HRC
Roughness: 0,2 µm ≤ Ra ≤ 0,8 µm

**Bore:**
Tolerance: ISO H8
Roughness:
10 µm ≤ Rz ≤ 25 µm (**BAOF**)
6,3 µm ≤ Rz ≤ 16,0 µm (**B1OF**)

**Applications**

**Applications:**

Auxiliary component for grease sealing.

P ≤ 0,2 bar

v ≤ 6 m/s

-40 ºC ≤ T ≤ +100 ºC

## B2PT

B2PT

FREUDENBERG
INNOVATING TOGETHER

**Description**

Lip seal with double metal case that protects a spring-free sealing lip.

**Materials**

**Lip:**
PTFE
There are other PTFE formulations in accordance with FDA and EU Regulation nº 10/2011

**Case:** V4A stainless steel

**Surface finishes**

**Shaft:**
**Tolerance:** ISO h11
**Concentricity:** IT 8
**Hardness:** 45 - 60 HRC
**Roughness:** 0,2 µm ≤ Ra ≤ 0,4 µm

**Bore:**
**Tolerance:** ISO H8
**Roughness:** 6,3 µm ≤ Rz ≤ 16,0 µm

**Applications**

**Applications:**
Chemically aggressive fluids, with high viscosity as well as poor or no lubrication.

P ≤ 10 bar

v ≤ 30 m/s

-80 ºC ≤ T ≤ +200 ºC

- Process pumps.
- Agitators and mixers.
- Centrifuges.
- Grinding machine, rotary valves.
- ...

P and T maximum values should not be combined simultaneously.
(*) the working pressure for the FUD type lip in all its variants is 0,02 MPa (0,2 bar).

## CASSETTE

**CASSETTE**

**Description**

Simmerring® oil seal with labyrinth path and counter-surface integrated in the same part. Garter spring type.

**Materials**

**Lip:**
75 NBR 106200
75 FPM 595

**Metal insert:** DIN 1624 steel

**Garter spring:** DIN 17223 steel

**Surface finishes**

**Shaft:**
Tolerance: ISO h9
Concentricity: IT 8
Roughness: 10,0 µm ≤ Rz ≤ 16,0 µm

**Bore:**
Tolerance: ISO H8
Roughness: 10,0 µm ≤ Rz ≤ 16,0 µm

**Applications**

**Applications:**

Environments of “heavy” dirt such as that of agricultural machinery, construction equipment and industrial vehicles.

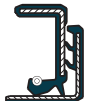
P ≤ 0,5 bar

**NBR:** v ≤ 4 m/s
**FPM:** v ≤ 6 m/s

**NBR:** -40 °C ≤ T ≤ +80 °C
**FPM:** -25 °C ≤ T ≤ +100 °C

FREUDENBERG
INNOVATING TOGETHER

## MSS-7



**MSS-7**

**Description**

Modular system made up of a **BA** oil seal and an auxiliary seal with 2 dust lips that act as a counter-surface. Klüber GHY 133N grease loading between the dust cover and the sealing lip.

**Materials**

**Lip and counter-surface:**
72 NBR 902

**Metal insert:** DIN 1624 steel

**Garter spring:** DIN 17223 steel

**Surface finishes**

**Shaft:**
Tolerance: ISO h8
Concentricity: IT 8
Roughness: 0,2 µm ≤ Ra ≤ 0,8 µm

**Bore:**
Tolerance: ISO H8
Roughness: 10,0 µm ≤ Rz ≤ 16,0 µm

**Applications**

**Applications:**

Environments of “heavy” dirt such as that of agricultural machinery, construction equipment and industrial vehicles.

P ≤ 0,5 bar

v ≤ 8 m/s

-40 °C ≤ T ≤ +100 °C

FREUDENBERG
INNOVATING TOGETHER

## MSS-1

**MSS-1**

**Description**

Modular system consisting of an oil seal with a dust lip and an internal auxiliary oil seal without garter spring. Klüber GHY 133N grease loading between the dust cover and the sealing lip.

**Materials**

**Lip:**
72 NBR 902
75 FPM 585

**Inner oil seal:** 75 FPM 585

**Metal insert:** DIN 1624 steel

**Garter spring:** DIN 17223 steel

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 45 - 60 HRC
Roughness: 0,2 µm ≤ Ra ≤ 0,8 µm

**Bore:**
Tolerance: ISO H8
Roughness: 10,0 µm ≤ Rz ≤ 25,0 µm

**Applications**

**Applications:**

Power transmissions and robotics in “moderate” dirty environments.

P ≤ 0,5 bar

v ≤ 6 m/s

**NBR:** -40 °C ≤ T ≤ +100 °C
**FPM:** -25 °C ≤ T ≤ +160 °C

FREUDENBERG
INNOVATING TOGETHER

P and T maximum values should not be combined simultaneously.

## COMBI

**COMBI**

**Description**

Simmerring® oil seal reinforced with a polyurethane ring that allows slight axial movements. Garter spring type.

**Materials**

**Lip:**
75 NBR 106200
75 FPM 595

**Reinforcing ring:** polyurethane (AU)

**Metal insert and case:** DIN 1624 steel

**Garter spring:** DIN 17223 steel

**Surface finishes**

**Shaft:**
Tolerance: ISO h9
Concentricity: IT 8
Hardness: 45 - 60 HRC
Roughness: 0,2 µm ≤ Ra ≤ 0,8 µm

**Bore:**
Tolerance: ISO H8
Roughness: 10,0 µm ≤ Rz ≤ 16,0 µm

**Applications**

**Applications:**

Bores with thermal changes (contractions and expansions) and environments of "heavy" dirt such as that of agricultural machinery, construction equipment and industrial vehicles.

P ≤ 0,5 bar

**NBR:** v ≤ 4 m/s
**FPM:** v ≤ 6 m/s

**NBR:** -40 ºC ≤ T ≤ +80 ºC
**FPM:** -25 ºC ≤ T ≤ +100 ºC

FREUDENBERG
INNOVATING TOGETHER

## BADUO

**BADUO**

**Description**

Simmerring® oil seal reinforced with an elastomer-coated metal insert, lips in a "back-to-back" configuration and garter springs type.

**Materials**

**Lip:**
72 NBR 102

**Metal insert:** DIN 1624 steel

**Garter spring:** DIN 17223 steel

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 45 - 60 HRC
Roughness: 0,2 µm ≤ Ra ≤ 0,8 µm

**Bore:**
Tolerance: ISO H8
Roughness: 10,0 µm ≤ Rz ≤ 25,0 µm

**Applications**

**Applications:**

Chambers separation with different pressures. Sealing of mineral oils, synthetic oils and greases.

P ≤ 0,5 bar

v ≤ 5 m/s

-40 ºC ≤ T ≤ +100 ºC

FREUDENBERG
INNOVATING TOGETHER

## RADIAMATIC® HTS II - 9535

**RADIAMATIC® HTS II - 9535**

**Description**

Lip seal with tightening ring. Good behavior in conditions of little or non lubrication.

**Materials**

**Lip:**
PTFE K212

Tightening ring in stainless steel.

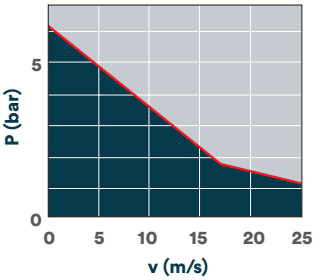
**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 45 - 65 HRC
Roughness: 0,1 µm ≤ Ra ≤ 0,2 µm
0,5 µm ≤ Rt ≤ 1,0 µm

**Bore:**
Tolerance: ISO H8
Rugosidad: Ra < 1,8 µm
Rt < 10,0 µm

**Applications**

**Applications:**
Blowers, gearboxes, compressors, process pumps, mixers, drive motors, tool-machinery… Service area under "P·v" curve.




-80 ºC ≤ T ≤ +200 ºC

FREUDENBERG
INNOVATING TOGETHER

P and T maximum values should not be combined simultaneously.

## MSC-01, MSC-02

MSC-01

MSC-02

FREUDENBERG

**Description**

Auxiliary sealing element known as “V-ring” with a front sealing lip protected by a metal housing.

**Materials**

**Lip:**
80 NBR 177458
80 FPM 177459

Chromium coated steel housing.

**Surface finishes**

**Shaft:**
Tolerance: ISO h9
Concentricity: IT 8
Hardness: -
Roughness: 1,0 µm ≤ Rz ≤ 5,0 µm
Rmáx ≤ 6,3 µm

**Applications**

**Applications:**

Auxiliary V-ring of a dust lip oil seal, for “moderate” dirt environments. Dust or splashing rejection.

v ≤ 6 /m/s

**NBR:** -40 ºC ≤ T ≤ +100 ºC
**FPM:** -25 ºC ≤ T ≤ +160 ºC

## RADIAMATIC® R35, RADIAMATIC® R36

RADIAMATIC® R35

RADIAMATIC ® R36

FREUDENBERG

**Description**

Endless or split oil seal (**R35**), with garter spring type and outer case impregnated with fiber reinforcement. Back to back configuration with radial groove for external lubrication (**R36**).

**Materials**

**Lip:**
80 NBR B241 / cotton
75 H-NBR U467 / aramide
80 FPM K670 / aramide

**Garter spring:** 1.4571 stainless steel

**Surface finishes**

**Shaft:**
Tolerance: ISO h9
Concentricity: IT 8
Hardness: 50 - 60 HRC
Roughness: Ra ≤ 0,6 µm
Rmáx ≤ 2,5 µm

**Bore:**
Tolerance: ISO H8
Roughness: Ra < 4,0 µm
Rmáx ≤ 15,0 µm

**Applications**

**Applications:**

Shipbuilding, rolling mills, wind turbines...

P ≤ 0,5 bar

**NBR:** v ≤ 20 m/s
**H-NBR:** v ≤ 25 m/s
**FPM:** v ≤ 25 m/s

**NBR:** -30 ºC ≤ T ≤ +100 ºC
**H-NBR:** -20 ºC ≤ T ≤ +140 ºC
**FPM:** -10 ºC ≤ T ≤ +180 ºC

## RADIAMATIC® RS85

RADIAMATIC®
RS85

FREUDENBERG

**Description**

Oil seal with metal insert, elastomer coated and garter spring type.

**Materials**

**Lip:**
80 NBR B241
75 H-NBR U467
80 FPM K670

**Garter spring:** 1.4571 stainless steel

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 45 - 60 HRC
Roughness: 0,2 µm ≤ Ra ≤ 0,8 µm

**Bore:**
Tolerance: ISO H8
Roughness: 10 µm ≤ Rz ≤ 25 µm

**Applications**

**Applications:**

Shipbuilding, rolling mills, wind turbines...

P ≤ 0,5 bar

**NBR:** v ≤ 20 m/s
**H-NBR:** v ≤ 25 m/s
**FPM:** v ≤ 25 m/s

**NBR:** -30 ºC ≤ T ≤ +100 ºC
**H-NBR:** -20 ºC ≤ T ≤ +140 ºC
**FPM:** -10 ºC ≤ T ≤ +180 ºC

P and T maximum values should not be combined simultaneously.

## RADIAMATIC® R58

RADIAMATIC® R58

FREUDENBERG
INNOVATING TOGETHER

**Description**

Oil seal in tandem configuration with garter springs type and outer case impregnated with fiber reinforcement. Radial groove for external lubrication (**R36**).

**Materials**

**Labio:**
80 NBR B241 / cotton

**Garter spring:** 1.4571 stainless steel

**Surface finishes**

**Shaft:**
Tolerance: ISO h9
Concentricity: IT 8
Hardness: 50 - 60 HRC
Roughness: Ra ≤ 0,6 µm
Rmáx ≤ 2,5 µm

**Bore:**
Tolerance: ISO H8
Rugosidad: Ra < 4,0 µm
Rmáx ≤ 15,0 µm

**Applications**

**Applications:**

Shipbuilding, rolling mills, wind turbines...

P ≤ 0,5 bar

v ≤ 15 m/s

-30 ºC ≤ T ≤ +100 ºC

## PS SEAL®, PS SEAL® rev, PS SEAL® tan, PS SEAL® btb

PS SEAL®
PS SEAL® rev
PS SEAL® tan
PS SEAL® btb

Garlock
SEALING TECHNOLOGIES

**Description**

Lip seal with internal and external metal casing that protect a spring-free sealing lip. Single lip, inverted lip, tandem double lip and back to back lip configurations.

**Materials**

**Lip:**
- Gylon® (restructured PTFE)
- Gylon® Black
- Gylon® Blue (FDA)
- Gylon® White (FDA)
- Gylon® Brown -White (FDA)

**Static seal:** Gylon® Blue; Gylon® White; FPM

**Case:** 1.4571 stainless steel

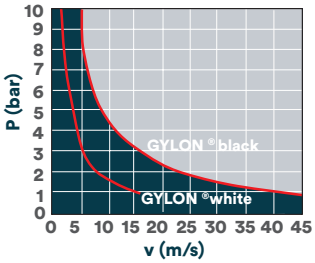
**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 50 HRC
Roughness: 0,1 µm ≤ Ra ≤ 0,4 µm

**Bore:**
Tolerance: ISO H8
Roughness: Ra ≤ 2,0 µm

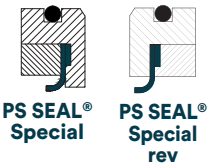
**Applications**

**Applications:**
Chemically aggressive fluids, with high viscosity as well as poor or no lubrication. Compatible with SIP / CIP processes, steam and vacuum. Service area under "P·v" curves.




-90 ºC ≤ T ≤ +260 ºC

## PS SEAL® Special, PS SEAL® Special rev, PS SEAL® Special tan, PS SEAL® Special btb



PS SEAL® Special
PS SEAL® Special rev
PS SEAL® Special tan
PS SEAL® Special btb

Garlock
SEALING TECHNOLOGIES

**Description**

Lip seal with reinforced casing for high pressure services. Single lip, inverted lip, tandem double lip and back to back lip configurations.

**Materials**

**Lip:**
- Gylon® (restructured PTFE)
- Gylon® Black
- Gylon® Blue (FDA)
- Gylon® White (FDA)
- Gylon® Brown -White (FDA)

**Static seal:** Gylon® Blue; Gylon® White; FPM

**Case:** 1.4571 stainless steel

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 50 HRC
Rugosidad: 0,1 µm ≤ Ra ≤ 0,4 µm

**Bore:**
Tolerance: ISO H7
Roughness: Ra ≤ 2,0 µm

**Applications**

**Applications:**
Blowers, gearboxes, compressors, process pumps, mixes, drive motors, tool-machinery… Compatible with SIP / CIP processes, steam and vacuum.

P ≤ 25 bar

v ≤ 45 m/s

-90 ºC ≤ T ≤ +260 ºC

P and T maximum values should not be combined simultaneously.

Mill-Right® N compound temperature range: from -40 °C to +93 °C
Mill-Right® ES compound temperature range: from -40 ºC to +150 ºC
Mill-Right® V compound temperature range: -30 ºC to +204 ºC (-30 ºC to +204 ºC)
Silicone (VMQ) compound temperature range: from -59 ºC to +177 ºC

## KLOZURE® 23

KLOZURE® 23

Garlock

**Description**

Split oil seal with double chamfered lip and finger spring type vulcanized in the elastomer itself. Independent action of each foil. Requires mounting cap. Available in meters.

**Materials**

**Lip:**
- Mill-Right® N (NBR base material)
- Mill-Right® ES (H-NBR base material)
- Mill-Right® V (FPM base material)
- VMQ

**Finger spring:** stainless steel

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 30 HRC
Roughness: 0,25 µm ≤ Ra ≤ 0,50 µm

**Bore:**
Tolerance: ISO H8
Roughness: Ra ≤ 2,5 µm

**Applications**

**Applications:**
Sealing of mineral oils, synthetic oils and greases, for rotary equipment with difficult access.

**Presión:** -

v ≤ 10,2 m/s

**Total eccentricity:**
0,25 mm @ 5,1 m/s
0,13 mm @ 10,2 m/s

**Temperatures:**
Mill-Right®: see footnote
VMQ: -60 ºC … +180 ºC

## KLOZURE® 26, KLOZURE® 26 R1

KLOZURE® 26

KLOZURE® 26 R1

Garlock

**Description**

Endless or split oil seal with double chamfered lip and finger spring type vulcanized in the elastomer itself. Split oil seal requires mounting cap. Dust lip (**26 R1**).

**Materials**

**Lip:**
- Mill-Right® N (NBR base material)
- Mill-Right® ES (H-NBR base material)
- Mill-Right® V (FPM base material)
- NBR
- H-NBR
- FPM

**Finger spring:** stainless steel

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Dureza: 30 HRC
Roughness: 0,25 µm ≤ Ra ≤ 0,50 µm

**Bore:**
Tolerance: ISO H8
Roughness: Ra ≤ 2,5 µm

**Applications**

**Applications:**
Sealing of mineral oils, synthetic oils and greases, in rolling mills, paper machines and other rotary equipment in general.

P ≤ 0,4 bar

v ≤ 25,4 m/s

**Total eccentricity:**
0,38 mm @ 5,1 m/s
0,25 mm @ 10,2 m/s
0,20 mm @ 25,4 m/s

**Temperatures:**
**Mill-Right®**: see footnote
**NBR:** -40 ºC … +100 ºC
**H-NBR:** -30 ºC … +150 ºC
**FPM:** -30 ºC … +205 ºC

## KLOZURE® 26 E

KLOZURE® 26 E

Garlock

**Description**

External radial sealing oil seal with double chamfered lip and finger spring type vulcanized in the elastomer itself. Independent action of each foil.

**Materials**

**Lip:**
- Mill-Right® N (NBR base material)
- Mill-Right® ES (H-NBR base material)
- Mill-Right® V (FPM base material)

**Finger spring:** stainless steel

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 30 HRC
Roughness: 0,25 µm ≤ Ra ≤ 0,50 µm

**Bore:**
Tolerance: ISO H8
Roughness: Ra ≤ 2,5 µm

**Applications**

**Applications:**
Sealing of mineral oils, synthetic oils and greases, in rotary equipment with external radial sealing.

P ≤ 0,4 bar

v ≤ 25,4 m/s

**Total eccentricity:**
0,38 mm @ 5,1 m/s
0,25 mm @ 10,2 m/s
0,20 mm @ 25,4 m/s

**Temperatures:**
See footnote

P and T maximum values should not be combined simultaneously.

Mill-Right® N compound temperature range: from -40 °C to +93 °C
Mill-Right® ES compound temperature range: from -40 ºC to +150 ºC
Mill-Right® V compound temperature range: -30 ºC to +204 ºC (-30 ºC to +204 ºC)
Silicone (VMQ) compound temperature range: from -59 ºC to +177 ºC

## KLOZURE® 53, KLOZURE® 63

KLOZURE® 53

KLOZURE® 63

Garlock

**Description**

Oil seals with reinforced outer metal case, double chamfered lip and finger spring type vulcanized in the elastomer itself. Independent action of each foil.

**Materials**

**Lip:**
- Mill-Right® N (NBR base material)
- Mill-Right® ES (H-NBR base material)
- Mill-Right® V (FPM base material)

**Case:** carbon steel
(availability in stainless steel)

**Finger spring:** stainless steel

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 30 HRC
Roughness: 0,25 µm ≤ Ra ≤ 0,50 µm

**Bore:**
Tolerance: ISO H8
Roughness: Ra ≤ 2,5 µm

**Applications**

**Applications:**

Bores the both with difficult assembly and thermal changes (contractions and expansions). Sealing of mineral oils, synthetic oils and greases.

P ≤ 0,5 bar

v ≤ 10,2 m/s

**Total eccentricity:**
0,38 mm @ 5,2 m/s
0,25 mm @ 10,2 m/s
0,13 mm @ 15,2 m/s

**Temperatures:**
**Mill-Right®:** see footnote
**VMQ:** -60 °C … +180 °C

## KLOZURE® 53 G1, KLOZURE® 63 G1

KLOZURE® 53 G1

KLOZURE® 63 G1

Garlock

**Description**

Oil seals with reinforced outer metal case, double chamfered lip and finger spring type vulcanized in the elastomer itself. Independent action of each foil. Dust lip.

**Materials**

**Lip:**
- Mill-Right® N (NBR base material)
- Mill-Right® ES ((H-NBR base material)
- Mill-Right® V (FPM base material)
- VMQ

**Dust lip:** Gylon® Blue

**Case:** carbon steel
(availability in stainless steel)

**Finger spring:** stainless steel

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 30 HRC
Roughness: 0,25 µm ≤ Ra ≤ 0,50 µm

**Bore:**
Tolerance: ISO H8
Roughness: Ra ≤ 2,5 µm

**Applications**

**Applications:**

Bores the both with difficult assembly and thermal changes (contractions and expansions). Sealing of mineral oils, synthetic oils and greases. “Low” dirt environments.

P ≤ 0,4 bar

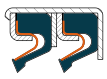
v ≤ 7,6 m/s

**Total eccentricity:**
0,25 mm @ 7,6 m/s

**Temperatures:**
**Mill-Right®:** see footnote
**VMQ:** -60 °C … +180 °C

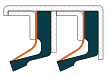
## KLOZURE® 53 R2, KLOZURE® 53 T2, KLOZURE® 63 R2, KLOZURE® 63 T2

KLOZURE® 53 R2



KLOZURE® 53 T2

KLOZURE® 63 R2



KLOZURE® 63 T2

Garlock

**Description**

Oil seals with reinforced outer metal case, double chamfered lip and finger spring type vulcanized in the elastomer itself. Independent action of each foil. Tandem double lip and back to back lip configurations.

**Materials**

**Lip:**
- Mill-Right® N (NBR base material)
- Mill-Right® ES (H-NBR base material)
- Mill-Right® V (FPM base material)
- VMQ

**Case:** carbon steel
(availability in stainless steel)

**Finger spring:** stainless steel

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 30 HRC
Roughness: 0,25 µm ≤ Ra ≤ 0,50 µm

**Bore:**
Tolerance: ISO H8
Roughness: Ra ≤ 2,5 µm

**Applications**

**Applications:**

Bores the both with difficult assembly and thermal changes (contractions and expansions). Sealing of mineral oils, synthetic oils and greases.

P ≤ 0,4 bar

v ≤ 5,1 m/s

**Total eccentricity:**
0,25 mm @ 2,5 m/s
0,13 mm @ 5,2 m/s

**Temperatures:**
**Mill-Right®:** see footnote
**VMQ:** -60 °C … +180 °C

P and T maximum values should not be combined simultaneously.
Mill-Right® N compound temperature range: from -40 °C to +93 °C
Mill-Right® ES compound temperature range: from -40 °C to +150 °C
Mill-Right® V compound temperature range: -30 °C to +204 °C (-30 °C to +204 °C)
Silicone (VMQ) compound temperature range: from -59 °C to +177 °C

## KLOZURE® 54

KLOZURE® 54

**Description**

Oil seal with reinforced outer metal case and finger spring type vulcanized in the elastomer itself. Independent action of each foil

**Materials**

**Lip:**
- Mill-Right® N (NBR base material)
- Mill-Right® ES (H-NBR base material)
- Mill-Right® V (FPM base material)
- VMQ

**Case:** carbon steel (availability in stainless steel)

**Finger spring:** stainless steel

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 30 HRC
Roughness: 0,25 µm ≤ Ra ≤ 0,50 µm

**Bore:**
Tolerancia: ISO H8
Roughness: Ra ≤ 2,5 µm

**Applications**

**Applications:**

Bores the both with difficult assembly and thermal changes (contractions and expansions). Sealing of mineral oils, synthetic oils and greases for spherical bearings.

P ≤ 3,4 bar

v ≤ 10,2 m/s

**Temperatures:**
Mill-Right®: see footnote
VMQ: -60 ºC … +180 ºC

## KLOZURE® 59

KLOZURE® 59

**Description**

Oil seal with reinforced outer metal case, double chamfered lip and finger spring type vulcanized in the elastomer itself. Independent action of each foil.

**Materials**

**Lip:**
- Mill-Right® N (NBR base material)
- Mill-Right® ES (H-NBR base material)
- Mill-Right® V (FPM base material)
- VMQ

**Case:** carbon steel (availability in stainless steel)

**Finger spring:** stainless steel

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 30 HRC
Roughness: 0,25 µm ≤ Ra ≤ 0,50 µm

**Bore:**
Tolerance: ISO H8
Roughness: Ra ≤ 2,5 µm

**Applications**

**Applications:**

Bores the both with difficult assembly and thermal changes (contractions and expansions). Sealing of mineral oils, synthetic oils and greases for rotary equipment with high misalignment.

P ≤ 0,5 bar

v ≤ 25,4 m/s

**Total eccentricity:**
2,36 mm @ 12,7 m/s
1,19 mm @ 25,4 m/s

**Temperatures:**
Mill-Right®: see footnote
VMQ: -60 ºC … +180 ºC

## KLOZURE® 59 G1

KLOZURE® 59 G1

**Description**

Oil seal with reinforced outer metal case, double chamfered lip and finger spring type vulcanized in the elastomer itself. Independent action of each foil. Dust lip.

**Materials**

**Lip:**
- Mill-Right® N (NBR base material)
- Mill-Right® ES (H-NBR base material)
- Mill-Right® V (FPM base material)
- VMQ

**Dust lip:** Gylon® Blue

**Case:** carbon steel (availability in stainless steel)

**Finger spring:** stainless steel

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 30 HRC
Roughness: 0,25 µm ≤ Ra ≤ 0,50 µm

**Bore:**
Tolerance: ISO H8
Roughness: Ra ≤ 2,5 µm

**Applications**

**Applications:**

Bores the both with difficult assembly and thermal changes (contractions and expansions). Sealing of mineral oils, synthetic oils and greases. "Low" dirt environments.

P ≤ 0,5 bar

v ≤ 12,7 m/s

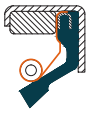
**Total eccentricity:**
0,25 mm @ 12,7 m/s

**NBR:** -40 ºC ≤ T ≤ +100 ºC
**H-NBR:** -30 ºC ≤ T ≤ +150 ºC
**FPM:** -30 ºC ≤ T ≤ +205 ºC

P and T maximum values should not be combined simultaneously.

Mill-Right® N compound temperature range: from -40 °C to +93 °C
Mill-Right® ES compound temperature range: from -40 ºC to +150 ºC
Mill-Right® V compound temperature range: -30 ºC to +204 ºC (-30 ºC to +204 ºC)
Silicone (VMQ) compound temperature range: from -59 ºC to +177 ºC

## KLOZURE® 64



KLOZURE® 64

**Description**

Oil seal with reinforced outer metal case, reinforcement metal ring and double chamfered lip with a garter spring integrated in a finger spring.

**Materials**

**Lip:**
- Mill-Right® N (NBR base material)
- Mill-Right® ES (H-NBR base material)
- Mill-Right® V (FPM base material)
- VMQ

**Case:** carbon steel (availability in stainless steel)

**Finger spring:** stainless steel

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 30 HRC
Roughness: 0,25 µm ≤ Ra ≤ 0,50 µm

**Bore:**
Tolerance: ISO H8
Roughness: Ra ≤ 2,5 µm

**Applications**

**Applications:**
Bores with thermal changes (contractions and expansions). Sealing of mineral oils, synthetic oils and greases for rotary equipment with high misalignment.

P ≤ 0,5 bar

v ≤ 35,6 m/s

**Total eccentricity:**
3,18 mm @ 25,4 m/s
2,36 mm @ 35,6 m/s

**Temperatures:**
**Mill-Right®:** see footnote
**VMQ:** -60 ºC … +180 ºC

## KLOZURE® 64 G1

KLOZURE® 64 G1

**Description**

Oil seal with reinforced outer metal case, reinforcement metal ring and double chamfered lip with a garter spring integrated in a finger spring. Dust lip.

**Materials**

**Lip:**
- Mill-Right® N (NBR base material)
- Mill-Right® ES (H-NBR base material)
- Mill-Right® V (FPM base material)
- VMQ

**Dust lip:** Gylon® Blue

**Case:** carbon steel (availability in stainless steel)

**Finger spring:** stainless steel

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 30 HRC
Roughness: 0,25 µm ≤ Ra ≤ 0,50 µm

**Bore:**
Tolerance: ISO H8
Roughness: Ra ≤ 2,5 µm

**Applications**

**Applications:**
Bores with thermal changes (contractions and expansions). Sealing of mineral oils, synthetic oils and greases. “Low” dirt environments.

P ≤ 0,5 bar

v ≤ 17,9 m/s

**Total eccentricity:**
0,25 mm @ 17,9 m/s

**Temperatures:**
**Mill-Right®:** see footnote
**VMQ:** -60 ºC … +180 ºC

## KLOZURE® 88

KLOZURE® 88

**Description**

Oil seal with metal insert, elastomer coated and garter spring type. Separation pin.

**Materials**

**Lip:**
- Mill-Right® N (NBR base material)
- Mill-Right® ES (H-NBR base material)
- Mill-Right® V (FPM base material)

**Metal insert:** carbon steel

**Garter spring:** stainless steel

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Dureza: 30 HRC
Roughness: 0,25 µm ≤ Ra ≤ 0,50 µm

**Bore:**
Tolerance: ISO H8
Roughness: Ra ≤ 2,5 µm

**Applications**

**Applications:**
Sealing of mineral oils, synthetic oils and greases for rotary equipment with high misalignment.

P ≤ 0,5bar

v ≤ 25,4 m/s

**Total eccentricity:**
2,54 mm @ 12,7 m/s
1,27 mm @ 25,4 m/s

**Temperatures:**
See footnote

P and T maximum values should not be combined simultaneously.
Mill-Right® N compound temperature range: from -40 °C to +93 °C
Mill-Right® ES compound temperature range: from -40 ºC to +150 ºC
Mill-Right® V compound temperature range: -30 ºC to +204 ºC (-30 ºC to +204 ºC)
Silicone (VMQ) compound temperature range: from -59 ºC to +177 ºC

## KLOZURE® 113

KLOZURE® 113

**Description**

External radial sealing oil seal with double chamfered lip and finger spring type vulcanized in the elastomer itself. In-dependent action of each foil.

**Materials**

**Lip:**
- Mill-Right® N (NBR base material)
- Mill-Right® ES (H-NBR base material)
- Mill-Right® V (FPM base material)

**Case:** carbon steel (availability in stainless steel)

**Finger spring:** stainless steel

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 30 HRC
Roughness: 0,25 µm ≤ Ra ≤ 0,50 µm

**Bore:**
Tolerance: ISO H8
Roughness: Ra ≤ 2,5 µm

**Applications**

**Applications:**

Bores with thermal changes (contractions and expansions). Sealing of mineral oils, synthetic oils and greases, in rotary equipment with external radial sealing.

P ≤ 0,4 bar

v ≤ 15,2 m/s

**Total eccentricity:**

0,50 mm @ 5,1 m/s
0,25 mm @ 10,2 m/s
0,13 mm @ 15,2 m/s

**Temperatures:**

See footnote

Garlock

## KLOZURE® 154, KLOZURE® 154 DL, KLOZURE® 154 PG

KLOZURE® 154

KLOZURE® 154 DL

KLOZURE® 154 PG

**Description**

Endless or split oil seals with reinforced heel, garter spring type and double chamfered lip. Dust lip optionally (**154 DL**) or radial and peripheral lubrication channels (**154 PG**).

**Materials**

**Lip:**
- NBR
- H-NBR
- FPM

**Garter spring:** stainless steel

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 30 HRC
Roughness: 0,25 µm ≤ Ra ≤ 0,50 µm

**Bore:**
Tolerance: ISO H8
Roughness: Ra ≤ 2,5 µm

**Applications**

**Applications:**

Sealing of mineral oils, synthetic oils and greases, in paper machines and other rotary equipment.

P ≤ 0,4 bar

v ≤ 15,2 m/s

**Total eccentricity:**

0,25 mm @ 15,2 m/s

**NBR:** -40 °C ≤ T ≤ +100 °C
**H-NBR:** -30 °C ≤ T ≤ +150 °C
**FPM:** -30 °C ≤ T ≤ +205 °C

Garlock

## KLOZURE® 154 M, KLOZURE® 154 ML

KLOZURE® 154 M

KLOZURE® 154 ML

**Description**

Oil seal with linear metal insert (**154 M**) or right angle metal insert (**154 ML**), elastomer coated, garter spring type and double chamfered lip.

**Materials**

**Lip:**
- NBR
- H-NBR
- FPM

**Garter spring:** stainless steel

**Surface finishes**

**Shaft:**
Tolerancia: ISO h11
Concentricity: IT 8
Hardness: 30 HRC
Roughness: 0,25 µm ≤ Ra ≤ 0,50 µm

**Bore:**
Tolerance: ISO H8
Roughness: Ra ≤ 2,5 µm

**Applications**

**Applications:**

Sealing of mineral oils, synthetic oils and greases, in rolling mills and other rotary equipment.

P ≤ 0,5 bar

v ≤ 15,2 m/s

**Total eccentricity:**

0,13 mm @ 15,2 m/s

**NBR:** -40 °C ≤ T ≤ +100 °C
**H-NBR:** -30 °C ≤ T ≤ +150 °C
**FPM:** -30 °C ≤ T ≤ +205 °C

Garlock

P and T maximum values should not be combined simultaneously.
Mill-Right® N compound temperature range: from -40 °C to +93 °C
Mill-Right® ES compound temperature range: from -40 °C to +150 °C
Mill-Right® V compound temperature range: -30 °C to +204 °C (-30 °C to +204 °C)
Silicone (VMQ) compound temperature range: from -59 °C to +177 °C

## KLOZURE® 161-0

KLOZURE® 161-0

Garlock

**Description**

Oil seal with reinforced rubber heel, garter spring type and back-up ring.

**Materials**

**Lip:**
- NBR
- H-NBR
- FPM

**Back-up ring:** PTFE

**Garter spring:** stainless steel

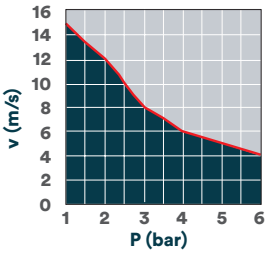
**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 30 HRC
Rugosidad: 0,25 µm ≤ Ra ≤ 0,50 µm

**Bore:**
Tolerance: ISO H8
Rugosidad: Ra ≤ 2,5 µm

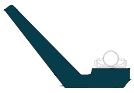
**Applications**

**Applications:**
Sealing of mineral oils, synthetic oils and greases, in rolling mills, paper machines and other rotary equipment. Service area under "P·v" curve.




**NBR:** -40 °C ≤ T ≤ +100 °C
**H-NBR:** -30 °C ≤ T ≤ +150 °C
**FPM:** -30 °C ≤ T ≤ +205 °C

## KLOZURE® 143, KLOZURE® 145



KLOZURE® 143

KLOZURE® 145

Garlock

**Description**

Auxiliary sealing element known as "V-ring" with a front sealing lip with garter spring type (**145**) or split design provided with a closing clamp (**143**).

**Materials**

**Lip:**
- NBR
- H-NBR
- FPM

**Garter spring:** stainless steel

**Closing clamp:** stainless steel

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 30 HRC
Roughness: 0,25 µm ≤ Ra ≤ 0,50 µm

**Bore:**
Tolerance: ISO H8
Roughness: Ra ≤ 2,5 µm

**Applications**

**Applications:**
Auxiliary V-ring of a dust lip oil seal, in "moderate" dirt environments. Dust or splash rejection.

**Pressure:** -

v ≤ 25,4 m/s

**NBR:** -40 °C ≤ T ≤ +100 °C
**H-NBR:** -30 °C ≤ T ≤ +150 °C
**FPM:** -30 °C ≤ T ≤ +205 °C

## OMNILIP™ 10, OMNILIP™ 11

OMNILIP™ 10

OMNILIP™ 11

SAINT-GOBAIN

**Description**

Lip seal with double metal case that protects a spring-free sealing lip. Dust lip option.

**Materials**

**Lip:**
- Fluoroloy® (filled PTFE)
- Fluoroloy® A12
- Fluoroloy® A15
- Fluoroloy® A16
- Fluoroloy® A46 (FDA)
- …

**Case:** AISI 316, AISI 316Ti, AISI 304, aluminium, steel …

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 50 HRC
Roughness: 0,2 µm ≤ Ra ≤ 0,6 µm

**Bore:**
Tolerance: ISO H8
Roughness: Ra ≤ 0,8 µm

**Applications**

**Applications:**
Rotary equipment with a maximum "P·v" factor of 2,60 bar·m/s (lubrication) or 1,30 bar·m/s (non lubricated).

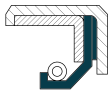
P ≤ 7 bar

v ≤ 25 m/s

-53 °C ≤ T ≤ +232 °C

P and T maximum values should not be combined simultaneously.

## OMNILIP™ 60, OMNILIP™ 61



OMNILIP™ 60

OMNILIP™ 61

SAINT-GOBAIN

**Description**

Lip seal with double metal case. A garter spring type corrects a higher eccentricity. Dust lip option.

**Materials**

**Lip:**
- Fluoroloy® (filled PTFE)
- Fluoroloy® A12
- Fluoroloy® A15
- Fluoroloy® A16
- Fluoroloy® A46 (FDA)
- …

**Case:** AISI 316, AISI 316Ti, AISI 304, aluminium, steel…

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 50 HRC
Roughness: 0,2 µm ≤ Ra ≤ 0,6 µm

**Bore:**
Tolerance: ISO H8
Roughness: Ra ≤ 0,8 µm

**Applications**

**Applications:**

Rotary equipment with a maximum "P·v" factor of 2,60 bar·m/s (lubrication) or 1,30 bar·m/s (non lubricated).

P ≤ 7 bar

v ≤ 10 m/s

-53 °C ≤ T ≤ +232 °C

## OMNILIP™ 70, OMNILIP™ 71

OMNILIP™ 70

OMNILIP™ 71

SAINT-GOBAIN

**Description**

Lip seal with double metal case that protects a double lip tandem configuration. Dust lip option.

**Materials**

**Lip:**
- Fluoroloy® (filled PTFE)
- Fluoroloy® A12
- Fluoroloy® A15
- Fluoroloy® A16
- Fluoroloy® A46 (FDA)
- …

**Case:** AISI 316, AISI 316Ti, AISI 304, aluminium, steel…

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricidad: IT 8
Hardness: 50 HRC
Roughness: 0,2 µm ≤ Ra ≤ 0,6 µm

**Bore:**
Tolerance: ISO H8
Roughness: Ra ≤ 0,8 µm

**Applications**

**Applications:**

Rotary equipment with a maximum "P·v" factor of 10,50 bar·m/s (lubrication) or 1,75 bar·m/s (non lubricated)..

P ≤ 35 bar

v ≤ 20 m/s

-53 °C ≤ T ≤ +232 °C

## DYNALIP® 13, DYNALIP® 14

DYNALIP® 13

DYNALIP® 14

SAINT-GOBAIN

**Description**

Lip seal with bore fixing O-ring. Reinforcement ring option.

**Materials**

**Lip:**
- Fluoroloy® (filled PTFE)
- Fluoroloy® A12
- Fluoroloy® A15
- Fluoroloy® A16
- Fluoroloy® A46 (FDA)
- …

**Case:** AISI 316, AISI 316Ti, AISI 304, aluminium, steel…

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 50 HRC
Roughness: 0,2 µm ≤ Ra ≤ 0,6 µm

**Bore:**
Tolerance: ISO H8
Roughness: Ra ≤ 0,8 µm

**Applications**

**Applications:**

Rotary equipment with a maximum "P·v" factor of 26 bar·m/s (lubrication) or 13 bar·m/s (non lubricated).

P ≤ 5,2 bar

v ≤ 25,4 m/s

-53 °C ≤ T ≤ +232 °C

P and T maximum values should not be combined simultaneously.

## DYNALIP® 25, DYNALIP® 26

DYNALIP® 25

DYNALIP® 26

SAINT-GOBAIN

**Description**

Lip seal with bore fixing O-ring.
A garter spring type corrects a higher eccentricity.
Reinforcement ring option.

**Materials**

**Lip:**

- Fluoroloy® (filled PTFE)
- Fluoroloy® A12
- Fluoroloy® A15
- Fluoroloy® A16
- Fluoroloy® A46 (FDA)
- …

**Case:** AISI 316, AISI 316Ti, AISI 304, aluminium, steel…

**Surface finishes**

**Shaft:**

Tolerance: ISO h11
Concentricity: IT 8
Hardness: 50 HRC
Roughness: 0,2 µm ≤ Ra ≤ 0,6 µm

**Bore:**

Tolerance: ISO H8
Roughness: Ra ≤ 0,8 µm

**Applications**

**Applications:**

Rotary equipment with a maximum "P·v" factor of 26 bar·m/s (lubrication) or 13 bar·m/s (non lubricated)..

P ≤ 5,2 bar

v ≤ 10 m/s

-53 °C ≤ T ≤ +232 °C

## DYNALIP® 33

DYNALIP® 33

SAINT-GOBAIN

**Description**

Double lip tandem lip seal with bore fixing O-ring.

**Materials**

**Lip:**

- Fluoroloy® (filled PTFE)
- Fluoroloy® A12
- Fluoroloy® A15
- Fluoroloy® A16
- Fluoroloy® A46 (FDA)
- …

**Case:** AISI 316, AISI 316Ti, AISI 304, aluminium, steel…

**Surface finishes**

**Shaft:**

Tolerance: ISO h11
Concentricity: IT 8
Hardness: 50 HRC
Roughness: 0,2 µm ≤ Ra ≤ 0,6 µm

**Bore:**

Tolerance: ISO H8
Roughness: Ra ≤ 0,8 µm

**Applications**

**Applications:**

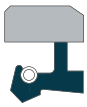
Rotary equipment with a maximum "P·v" factor of 70 bar·m/s (lubrication) or 17,7 bar·m/s (non lubricated).

P ≤ 8,6 bar

v ≤ 17,8 m/s

-53 °C ≤ T ≤ +232 °C

## SRT RT 7



SRT RT 7

**Description**

Oil seal with reinforced heel, garter spring type and double chamfered lip.

**Materials**

**Lip:**

- NBR
- H-NBR
- FPM
- VMQ

**Garter spring:** carbon steel; stainless steel AISI 302

**Surface finishes**

**Shaft:**

Tolerance: ISO h11
Concentricity: IT 8
Hardness: 40 HRC
Roughness: 0,2 µm ≤ Ra ≤ 0,6 µm

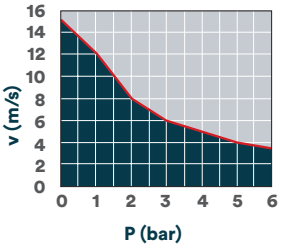
**Bore:**

Tolerance: ISO H10
Roughness: Ra ≤ 12,5 µm

**Applications**

**Applications:**

Sealing of mineral oils, synthetic oils and greases. Service area under "P·v" curve.




**NBR:** -30 °C ≤ T ≤ +100 °C
**H-NBR:** -40 °C ≤ T ≤ +150 °C
**FPM:** -20 °C ≤ T ≤ +200 °C
**VMQ:** -50 °C ≤ T ≤ +200 °C

P and T maximum values should not be combined simultaneously.

## SRT RT 7M

SRT RT 7M

**Description**

Oil seal with reinforcement metal insert, elastomer coated, garter spring type and double chamfered lip.

**Materials**

**Lip:**

- NBR
- H-NBR
- FPM
- VMQ

**Metal insert:** carbon steel

**Garter spring:** carbon steel; stainless steel AISI 302

**Surface finishes**

**Shaft:**

Tolerance: ISO h11
Concentricity: IT 8
Hardness: 40 HRC
Roughness: 0,2 µm ≤ Ra ≤ 0,6 µm

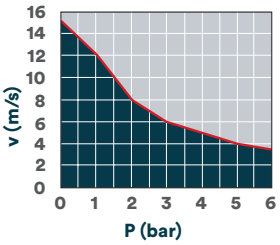
**Bore:**

Tolerance: ISO H8
Roughness: Ra ≤ 12,5 µm

**Applications**

**Applications:**

Sealing of mineral oils, synthetic oils and greases. Service area under "P·v" curve.




**NBR:** -30 °C ≤ T ≤ +100 °C
**H-NBR:** -40 °C ≤ T ≤ +150 °C
**FPM:** -20 °C ≤ T ≤ +200 °C
**VMQ:** -50 °C ≤ T ≤ +200 °C

## SRT RT / IVO

SRT RT / IVO

**Description**

Auxiliary sealing element known as "V-ring" with metal insert at right angle and frontal closing lip.

**Materials**

**Lip:**

- NBR
- H-NBR
- FPM
- VMQ

**Metal insert:** carbon steel

**Surface finishes**

**Shaft:**

Tolerance: ISO h8
Concentricity: IT 8
Hardness: 40-50 HRC
Roughness: 0,2 µm ≤ Ra ≤ 0,6 µm

**Bore:**

Tolerance: ISO H10
Roughness: Ra ≤ 12,5 µm

**Applications**

**Applications:**

Auxiliary V-ring of a dust lip oil seal, in "moderate" dirt environments. Rolling-mills.

**Presión:** -

v ≤ 60,0 m/s

**NBR:** -30 °C ≤ T ≤ +100 °C
**H-NBR:** -40 °C ≤ T ≤ +150 °C
**FPM:** -20 °C ≤ T ≤ +200 °C
**VMQ:** -50 °C ≤ T ≤ +200 °C

## SRT RT / 4

SRT RT / 4

**Description**

Oil seal with metal insert at right angle, reinforcing metal ring and double chamfered lip with a garter spring integrated into a finger spring.

**Materials**

**Lip:**

- NBR
- H-NBR
- FPM
- VMQ

**Metal insert:** carbon steel

**Springs:** stainless steel

**Surface finishes**

**Shaft:**

Tolerance: ISO h8
Concentricity: IT 8
Hardness: 40-50 HRC
Roughness: 0,2 µm ≤ Ra ≤ 0,6 µm

**Bore:**

Tolerance: ISO H10
Roughness: Ra ≤ 12,5 µm

**Applications**

**Applications:**

Sealing of mineral oils, synthetic oils and greases in rotary machinery with high misalignment.

P ≤ 0,5 bar

v ≤ 18 m/s

**Total eccentricity:**

2,0 mm @ 18 m/s

**NBR:** -30 °C ≤ T ≤ +100 °C
**H-NBR:** -40 °C ≤ T ≤ +150 °C
**FPM:** -20 °C ≤ T ≤ +200 °C
**VMQ:** -50 °C ≤ T ≤ +200 °C

P and T maximum values should not be combined simultaneously.

## SRT RT / RMV

SRT RT / RMV

**Description**

Oil seal with metal insert at right angle, double chamfered lip, garter spring type protected by the membrane and integrated V-ring lip on the front of the part.

**Materials**

**Lip:**
- NBR
- H-NBR
- FPM
- VMQ

**Metal insert:** carbon steel

**Garter spring:** stainless steel

**Surface finishes**

**Shaft:**
Tolerance: ISO h8
Concentricity: IT 8
Hardness: 40-50 HRC
Roughness: 0,2 µm ≤ Ra ≤ 0,6 µm

**Bore:**
Tolerance: ISO H10
Roughness: Ra ≤ 12,5 µm

**Applications**

**Applications:**

Sealing of mineral oils, synthetic oils and greases in “moderate” dirty environments. Dust or splash rejection.

P ≤ 0,5 bar

v ≤ 12 m/s

**NBR:** -30 °C ≤ T ≤ +100 °C
**H-NBR:** -40 °C ≤ T ≤ +150 °C
**FPM:** -20 °C ≤ T ≤ +200 °C
**VMQ:** -50 °C ≤ T ≤ +200 °C

## VA, VS, VE

VA

VS

VE

**Description**

Auxiliary sealing element known as “guttering”. Front closure between the lip and a surface perpendicular to the shaft.

**Materials**

**Lip:**
- CR
- NBR
- FPM

**Surface finishes**

**Shaft:**

**Friction surface roughness::**
- with lubrication: Ra ≤ 10 µm
- w/o lubrication: Ra ≤ 3 µm

**Applications**

**Applications:**

Auxiliary sealing of an oil seal with dust lip, in “moderate” dirt environments. Dust or splash rejection.

**Pressure:** -

**Peripheral speed (v):**
- if 6 m/s > v > 12 m/s, axial support is required.
- if 12 m/s > v > 18 m/s, a radial support is also necessary.
- if v > 18 m/s, there is no longer contact between the lip and the friction surface

**CR:** -40 °C ≤ T ≤ +90 °C
**NBR:** -30 °C ≤ T ≤ +100 °C
**FPM:** -20 °C ≤ T ≤ +180 °C

## A, AS, ASP

A

AS

AS

**Standard**

DIN 3760 type A, AS

**Materials**

**Lip:**
- NBR
- FPM
- VMQ

**Case:** DIN 1624 steel

**Garter spring:** DIN 17223 steel

**Description**

Oil seal with right angle metal insert, elastomer coated, garter spring type and optional dust lip.

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 45 - 60 HRC
Roughness: 0,2 µm ≤ Ra ≤ 0,8 µm

**Bore:**
Tolerance: ISO H8
Roughness: 10 µm ≤ Rz ≤ 25 µm

**Applications**

**Applications:**

Sealing of mineral oils, synthetic oils and greases. Dust lip for “low” dirt environments.

**Pressure:**
- **Oil seal types A, AS:** P ≤ 0,5 bar
- **Oil seal types ASP:** P ≤ 10,0 bar

**Peripheral speed:**
- Oil seal types AS, ASP v ≤ 8 m/s
- Oil seal type A**:**
  **NBR**: v ≤ 14 m/s
  **FPM:** v ≤ 38 m/s
  **VMQ:** v ≤ 38 m/s

**NBR:** -40 °C ≤ T ≤ +100 °C
**FPM:** -30 °C ≤ T ≤ +205 °C
**VMQ:** -60 °C ≤ T ≤ +180 °C

P and T maximum values should not be combined simultaneously.

## B, BS

B

BS

**Standard**

DIN 3760 type B, BS

**Description**

Oil seal with outer metal case, garter spring type and optional dust lip.

**Materials**

**Lip:**
- NBR
- FPM
- VMQ

**Case:** DIN 1624 steel

**Garter spring:** DIN 17223 steel

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 45 - 60 HRC
Roughness: 0,2 µm ≤ Ra ≤ 0,8 µm

**Bore:**
Tolerance: ISO H8
Roughness: 6,3 µm ≤ Rz ≤ 16,0 µm

**Applications**

**Applications:**
Bores with thermal changes (contractions and expansions). Sealing of mineral oils, synthetic oils and greases. Dust lip for “low” dirt environments.

P ≤ 0,5 bar

**Peripheral speed:**
- **Oil seal type BS:** v ≤ 8 m/s
- **Oil seal type B:**
  **NBR**: v ≤ 14 m/s
  **FPM:** v ≤ 38 m/s
  **VMQ:** v ≤ 38 m/s

**NBR:** -40 °C ≤ T ≤ +100 °C
**FPM:** -30 °C ≤ T ≤ +205 °C
**VMQ:** -60 °C ≤ T ≤ +180 °C

## C , CS

C

CS

**Standard**

DIN 3760 type C, CS

**Description**

Oil seal with reinforced outer metal case, garter spring type and optional dust lip.

**Materials**

**Lip:**
- NBR
- FPM
- VMQ

**Case:** DIN 1624 steel

**Garter spring:** DIN 17223 steel

**Surface finishes**

**Shaft:**
Tolerance: ISO h8
Concentricity: IT 8
Hardness: 45 - 60 HRC
Roughness: 0,2 µm ≤ Ra ≤ 0,8 µm

**Bore:**
Tolerance: ISO H8
Roughness: 6,3 µm ≤ Rz ≤ 16,0 µm

**Applications**

**Applications:**
Bores the both with difficult assembly and thermal changes (contractions and expansions). Sealing of mineral oils, synthetic oils and greases. Dust lip for “low” dirt environments.

P ≤ 0,5 bar

**Peripheral speed:**
- **Oil seal type CS:** v ≤ 8 m/s
- **Oil seal type C**
  **NBR**: v ≤ 14 m/s
  **FPM:** v ≤ 38 m/s
  **VMQ:** v ≤ 38 m/s

**NBR:** -40 °C ≤ T ≤ +100 °C
**FPM:** -30 °C ≤ T ≤ +205 °C
**VMQ:** -60 °C ≤ T ≤ +180 °C

## AOF

AOF

**Description**

Oil seal with right angle metal insert, elastomer coated, and without spring.

**Materials**

**Lip:**
- NBR
- FPM

**Metal insert:** DIN 1624 steel

**Surface finishes**

**Shaft:**
Tolerance: ISO h11
Concentricity: IT 8
Hardness: 45-60 HRC
Roughness: 0,2 µm ≤ Ra ≤ 0,8 µm

**Bore:**
Tolerance: ISO H8
Roughness: 10 µm ≤ Rz ≤ 25 µm

**Applications**

**Applications:**
Auxiliary sealing component for grease.

P ≤ 0,2 bar

v ≤ 6 m/s

**NBR:** -40 °C ≤ T ≤ +100 °C
**FPM:** -30 °C ≤ T ≤ +205 °C

P and T maximum values should not be combined simultaneously.

## C3

C3

**Description**

Oil seal with double metallic casing, reinforcement ring and garter spring type.

**Materials**

**Lip:**

- NBR
- FPM
- VMQ

**Cases and reinforcing ring:** BS 1449 carbon steel

**Garter spring:** BS 5216 galvanized steel

**Surface finishes**

**Shaft:**

Tolerance: ISO h11
Concentricity: IT 8
Hardness: 45-60 HRC
Roughness: 0,2 µm ≤ Ra ≤ 0,4 µm

**Bore:**

Tolerance: ISO H8
Roughness: 0,8 µm ≤ Rz ≤ 3,2 µm

**Applications**

**Applications:**

Bores the both with difficult assembly and thermal changes (contractions and expansions). Sealing of mineral oils, synthetic oils and greases.

P ≤ 3 bar

v ≤ 15 m/s

**NBR:** -30 °C ≤ T ≤ +110 °C
**FPM:** -40 °C ≤ T ≤ +200 °C
**VMQ:** -70 °C ≤ T ≤ +200 °C

## ADUO

ADUO

**Description**

Oil seal reinforced with an elastomer-coated metal insert, lips in a “back-to-back” configuration and garter springs type.

**Materials**

**Lip:**

- NBR
- FPM

**Metal insert:** DIN 1624 steel

**Garter spring:** DIN 17223 steel

**Surface finishes**

**Shaft:**

Tolerance: ISO h11
Concentricity: IT 8
Hardness: 45-60 HRC
Roughness: 0,2 µm ≤ Ra ≤ 0,8 µm

**Bore:**

Tolerance: ISO H8
Roughness: 10,0 µm ≤ Rz ≤ 25,0 µm

**Applications**

**Applications:**

Chambers separation with different pressures. Sealing of mineral oils, synthetic oils and greases. .

P ≤ 0,5 bar

v ≤ 5 m/s

**NBR:** -40 °C ≤ T ≤ +100 °C
**FPM:** -30 °C ≤ T ≤ +205 °C

P and T maximum values should not be combined simultaneously.

# ISO TOLERANCES CHART

## Nominal size range: from 500 mm up to 3.150 mm

| Nominal size range (mm) | OUTSIDE dimensions (Shafts) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | d10 | e8 | e9 | f8 | f9 | g6 | g7 | h6 | h7 | h8 | h9 | h10 | h11 | h12 | h13 | h14 | h15 | h16 |
| > 500 - 630 | -260 | -145 | -145 | -76 | -76 | -22 | -22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | -540 | -255 | -320 | -186 | -251 | -66 | -92 | -44 | -70 | -110 | -175 | -280 | -440 | -700 | -1100 | -1750 | -2800 | -4400 |
| > 630 - 800 | -290 | -160 | -160 | -80 | -80 | -24 | -24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | -610 | -285 | -360 | -205 | -280 | -74 | -104 | -50 | -80 | -125 | -200 | -320 | -500 | -800 | -1250 | -2000 | -3200 | -5000 |
| > 800 - 1000 | -320 | -170 | -170 | -86 | -86 | -26 | -26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | -680 | -310 | -400 | -226 | -316 | -82 | -116 | -56 | -90 | -140 | -230 | -360 | -560 | -900 | -1400 | -2300 | -3600 | -5600 |
| > 1000 - 1250 | -350 | -195 | -195 | -98 | -98 | -28 | -28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | -770 | -360 | -455 | -263 | -358 | -94 | -133 | -66 | -105 | -165 | -260 | -420 | -660 | -1050 | -1650 | -2600 | -4200 | -6600 |
| > 1250 - 1600 | -390 | -220 | -220 | -110 | -11 | -30 | -30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | -890 | -415 | -530 | -305 | -420 | -108 | -155 | -78 | -125 | -195 | -310 | -500 | -780 | -1250 | -1950 | -3100 | -5000 | -7800 |
| > 1600 - 2000 | -430 | -240 | -240 | -120 | -120 | -32 | -32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | -1030 | -470 | -610 | -350 | -490 | -124 | -182 | -92 | -150 | -230 | -370 | -600 | -920 | -1500 | -2300 | -3700 | -6000 | -9200 |
| > 2000 - 2500 | -480 | -260 | -260 | -130 | -130 | -34 | -34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | -1180 | -540 | -700 | -410 | -570 | -144 | -209 | -110 | -175 | -280 | -440 | -700 | -1100 | -1750 | -2800 | -4400 | -7000 | -11000 |
| > 2500 - 3150 | -520 | -290 | -290 | -145 | -145 | -38 | -38 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | -1380 | -620 | -830 | -475 | -685 | -173 | -248 | -135 | -210 | -330 | -540 | -860 | -1350 | -2100 | -3300 | -5400 | -8600 | -13500 |

| Nominal size range (mm) | INTERNAL dimensions (Bores) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | D10 | E8 | E9 | F8 | F9 | G6 | G7 | H6 | H7 | H8 | H9 | H10 | H11 | H12 | H13 | H14 | H15 | H16 |
| > 500 - 630 | +540 | +255 | +320 | +186 | +251 | +66 | +92 | +44 | +70 | +110 | +175 | +280 | +440 | +700 | +1100 | +1750 | +2800 | +4400 |
| | +260 | +145 | +145 | +76 | +76 | +22 | +22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| > 630 - 800 | +610 | +285 | +360 | +205 | +280 | +74 | +104 | +50 | +80 | +125 | +200 | +320 | +500 | +800 | +1250 | +2000 | +3200 | +5000 |
| | +290 | +160 | +160 | +80 | +80 | +24 | +24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| > 800 - 1000 | +680 | +310 | +400 | +226 | +316 | +82 | +116 | +56 | +90 | +140 | +230 | +360 | +560 | +900 | +1400 | +2300 | +3600 | +5600 |
| | +320 | +170 | +170 | +86 | +86 | +26 | +26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| > 1000 - 1250 | +770 | +360 | +455 | +263 | +358 | +94 | +133 | +66 | +105 | +165 | +260 | +420 | +660 | +1050 | +1650 | +2600 | +4200 | +6600 |
| | +350 | +195 | +195 | +98 | +98 | +28 | +28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| > 1250 - 1600 | +890 | +415 | +530 | +305 | +420 | +108 | +155 | +78 | +125 | +195 | +310 | +500 | +780 | +1250 | +1950 | +3100 | +5000 | +7000 |
| | +390 | +220 | +220 | +110 | +110 | +30 | +30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| > 1600 - 2000 | +1030 | +470 | +610 | +350 | +490 | +124 | +182 | +92 | +150 | +230 | +370 | +600 | +920 | +1500 | +2300 | +3700 | +6000 | +9200 |
| | +430 | +240 | +240 | +120 | +120 | +32 | +32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| > 2000 - 2500 | +1180 | +540 | +700 | +410 | +570 | +144 | +209 | +110 | +175 | +180 | +440 | +700 | +1100 | +1750 | +2800 | +4400 | +7000 | +1100 |
| | +480 | +260 | +260 | +130 | +130 | +34 | +34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| > 2500 - 3150 | +1380 | +620 | +830 | +475 | +685 | +173 | +248 | +135 | +210 | +330 | +540 | +860 | +1350 | +2100 | +3300 | +5400 | +8600 | +13500 |
| | +520 | +290 | +290 | +145 | +145 | +38 | +38 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**Tolerances in µm = (1 / 1000 mm)**

# ISO tolerances chart

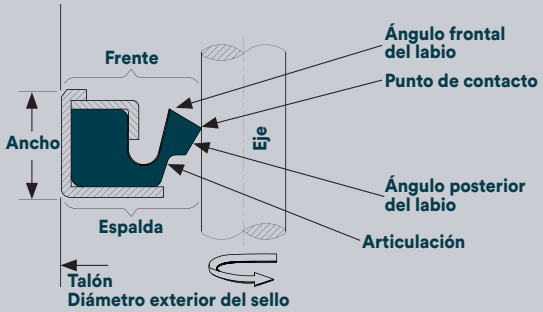
## Nominal sizes up to 500 mm

| Nominal size range (mm) | OUTSIDE dimensions (Shafts) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | z6 | u6 | u8 | s6 | r6 | p6 | n6 | k6 | j6 | h6 | h8 | h9 | h11 | g6 | f7 |
| > 1,6 - 3 | +35 | +25 | +36 | +22 | +19 | +16 | +13 | +6 | +4 | 0 | 0 | 0 | 0 | -2 | -6 |
| | +28 | +18 | +22 | +15 | +12 | +9 | +6 | 0 | -2 | -7 | -14 | -25 | -60 | -8 | -16 |
| > 3 - 6 | +43 | +31 | +46 | +27 | +23 | +20 | +16 | +9 | +6 | 0 | 0 | 0 | 0 | -4 | -10 |
| | +35 | +23 | +28 | +19 | +15 | +12 | +8 | +1 | -2 | -8 | -18 | -30 | -75 | -12 | -22 |
| > 6 - 10 | +51 | +37 | +56 | +32 | +28 | +24 | +19 | +10 | +7 | +0 | 0 | 0 | 0 | -5 | -13 |
| | +42 | +28 | +34 | +23 | +19 | +15 | +10 | +1 | -2 | -9 | -22 | -36 | -90 | -14 | -28 |
| > 10 - 14 | +61 | | +67 | | | | | | | | | | | | |
| | +50 | +44 | +40 | +39 | +34 | +29 | +23 | +12 | +8 | 0 | 0 | 0 | 0 | -6 | -16 |
| > 14 - 18 | +71 | +33 | +72 | +28 | +23 | +18 | +12 | +1 | -3 | -11 | -27 | -43 | -110 | -17 | -34 |
| | +60 | | +45 | | | | | | | | | | | | |
| > 18 - 24 | +86 | +54 | +87 | | | | | | | | | | | | |
| | +73 | +41 | +54 | +48 | +41 | +35 | +28 | +15 | +9 | 0 | 0 | 0 | 0 | -7 | -20 |
| > 24 - 30 | +101 | +61 | +81 | +35 | +28 | +22 | +15 | +2 | -4 | -13 | -33 | -52 | -130 | -20 | -41 |
| | +88 | +48 | +48 | | | | | | | | | | | | |
| > 30 - 40 | +128 | +76 | +99 | | | | | | | | | | | | |
| | +112 | +60 | +60 | +59 | +50 | +42 | +33 | +18 | +11 | 0 | 0 | 0 | 0 | -9 | -25 |
| > 40 - 50 | | +86 | +109 | +43 | +34 | +26 | +17 | +2 | -5 | -16 | -39 | -62 | -160 | -25 | -50 |
| | | +70 | +70 | | | | | | | | | | | | |
| > 50 - 65 | | +106 | +133 | +72 | +60 | | | | | | | | | | |
| | | +87 | +87 | +53 | +41 | +51 | +39 | +21 | +12 | 0 | 0 | 0 | 0 | -10 | -30 |
| > 65 - 80 | | +121 | +148 | +78 | +62 | +32 | +20 | +2 | -7 | -19 | -46 | -74 | -190 | -29 | -60 |
| | | +102 | +102 | +59 | +43 | | | | | | | | | | |
| > 80 - 100 | | +146 | +178 | +93 | +73 | | | | | | | | | | |
| | | +124 | +124 | +71 | +51 | +59 | +45 | +25 | +13 | 0 | 0 | 0 | 0 | -12 | -36 |
| > 100 - 120 | | +166 | +198 | +101 | +76 | +37 | +23 | +3 | -9 | -22 | -54 | -87 | -220 | -34 | -71 |
| | | +144 | +144 | +79 | +54 | | | | | | | | | | |
| > 120 - 140 | | +195 | +233 | +117 | +88 | | | | | | | | | | |
| | | +170 | +170 | +92 | +63 | | | | | | | | | | |
| > 140 - 160 | | +215 | +253 | +125 | +90 | +68 | +52 | +28 | +14 | 0 | 0 | 0 | 0 | -14 | -43 |
| | | +190 | +190 | +100 | +65 | +43 | +27 | +3 | -11 | -25 | -63 | -100 | -250 | -39 | -83 |
| > 160 - 180 | | +235 | +273 | +133 | +93 | | | | | | | | | | |
| | | +210 | +210 | +108 | +68 | | | | | | | | | | |
| > 180 - 200 | | +265 | +308 | +151 | +106 | | | | | | | | | | |
| | | +236 | +236 | +122 | +77 | | | | | | | | | | |
| > 200 - 225 | | +287 | +330 | +159 | +109 | +79 | +60 | +33 | +16 | 0 | 0 | 0 | 0 | -15 | -50 |
| | | +258 | +258 | +130 | +80 | +50 | +31 | +4 | -13 | -29 | -72 | -115 | -290 | -44 | -96 |
| > 225 - 250 | | +313 | +356 | +169 | +113 | | | | | | | | | | |
| | | +284 | +284 | +140 | +84 | | | | | | | | | | |
| > 250 - 280 | | +347 | +396 | +190 | +126 | | | | | | | | | | |
| | | +315 | +315 | +158 | +94 | +88 | +66 | +36 | +16 | 0 | 0 | 0 | 0 | -17 | -56 |
| > 280 - 315 | | +382 | +431 | +202 | +130 | +56 | +34 | +4 | -16 | -32 | -81 | -130 | -320 | -49 | -108 |
| | | +350 | +350 | +170 | +98 | | | | | | | | | | |
| > 315 - 355 | | +426 | +479 | +226 | +144 | | | | | | | | | | |
| | | +390 | +390 | +190 | +108 | +98 | +73 | +40 | +18 | 0 | 0 | 0 | 0 | -18 | -62 |
| > 355 - 400 | | +471 | +524 | +244 | +150 | +62 | +37 | +4 | -18 | -36 | -89 | -140 | -360 | -54 | -119 |
| | | +435 | +435 | +208 | +114 | | | | | | | | | | |
| > 400 - 450 | | +530 | +587 | +272 | +166 | | | | | | | | | | |
| | | +490 | +490 | +232 | +126 | +108 | +80 | +45 | +20 | 0 | 0 | 0 | 0 | -20 | -68 |
| > 450 - 500 | | +580 | +637 | +292 | +172 | +68 | +40 | +5 | -20 | -40 | -97 | -155 | -400 | -60 | -131 |
| | | +540 | +540 | +252 | +132 | | | | | | | | | | |

**Tolerances in µm = (1 / 1000 mm)**

| OUTSIDE dimensions | | | | | INTERNAL dimensions (Bores) | | | | | | | | | Nominal size range (mm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| f8 | e8 | e9 | d9 | d10 | H7 | H8 | H9 | H10 | H11 | F8 | E9 | D10 | D11 | C11 | |
| -6 | -14 | -14 | -20 | -20 | +9 | +14 | +25 | +40 | +60 | +20 | +39 | +60 | +80 | +120 | > 1,6 - 3 |
| -20 | -28 | -39 | -45 | -60 | 0 | 0 | 0 | 0 | 0 | +6 | +14 | +20 | +20 | +60 | |
| -10 | -20 | -20 | -30 | -30 | +12 | +18 | +30 | +48 | +75 | +28 | +50 | +78 | +105 | +145 | > 3 - 6 |
| -28 | -38 | -50 | -60 | -78 | 0 | 0 | 0 | 0 | 0 | +10 | +20 | +30 | +30 | +70 | |
| -13 | -25 | -25 | -40 | -40 | +15 | +22 | +36 | +58 | +90 | +35 | +61 | +98 | +130 | +170 | > 6 - 10 |
| -35 | -47 | -61 | -76 | -98 | 0 | 0 | 0 | 0 | 0 | +13 | +25 | +40 | +40 | +80 | |
| -16 | -32 | -32 | -50 | -50 | +18 | +27 | +43 | +70 | +110 | +43 | +75 | +120 | +160 | +205 | > 10 - 14 |
| -43 | -59 | -75 | -93 | -120 | 0 | 0 | 0 | 0 | 0 | +16 | +32 | +50 | +50 | +95 | > 14 - 18 |
| -20 | -40 | -40 | -65 | -65 | +21 | +33 | +52 | +84 | +130 | +53 | +92 | +149 | +195 | +240 | > 18 - 24 |
| -53 | -73 | -92 | -117 | -149 | 0 | 0 | 0 | 0 | 0 | +20 | +40 | +65 | +65 | +100 | > 24 - 30 |
| -25 | -50 | -50 | -80 | -80 | +25 | +39 | +62 | +100 | +160 | +64 | +112 | +180 | +240 | +280<br>+120 | > 30 - 40 |
| -64 | -89 | -112 | -142 | -180 | 0 | 0 | 0 | 0 | 0 | +25 | +50 | +80 | +80 | +290<br>+130 | > 40 - 50 |
| -30 | -60 | -60 | -100 | -100 | +30 | +46 | +74 | +120 | +190 | +76 | +134 | +220 | +290 | +330<br>+140 | > 50 - 65 |
| -76 | -106 | -134 | -174 | -220 | 0 | 0 | 0 | 0 | 0 | +30 | +60 | +100 | +100 | +340<br>+150 | > 65 - 80 |
| -36 | -72 | -72 | -120 | -120 | +35 | +54 | +87 | +140 | +220 | +90 | +159 | +260 | +340 | +390<br>+170 | > 80 - 100 |
| -90 | -126 | -159 | -207 | -260 | 0 | 0 | 0 | 0 | 0 | +36 | +72 | +120 | +120 | +400<br>+180 | > 100 - 120 |
| -43 | -85 | -85 | -145 | -145 | +40 | +63 | +100 | +160 | +250 | +106 | +185 | +305 | +395 | +450<br>+200 | > 120 - 140 |
| -106 | -148 | -185 | -245 | -305 | 0 | 0 | 0 | 0 | 0 | +43 | +85 | +145 | +145 | +460<br>+210 | > 140 - 160 |
| -50 | -100 | -100 | -170 | -170 | +46 | +72 | +115 | +185 | +290 | +122 | +215 | +335 | +460 | +480<br>+230 | > 160 - 180 |
| -122 | -172 | -215 | -285 | -355 | 0 | 0 | 0 | 0 | 0 | +50 | +100 | +170 | +170 | +530<br>+240 | > 180 - 200 |
| -56 | -110 | -110 | -190 | -190 | +52 | +81 | +130 | +210 | +320 | +137 | +240 | +400 | +510 | +550<br>+260 | > 200 - 225 |
| -137 | -191 | -240 | -320 | -400 | 0 | 0 | 0 | 0 | 0 | +56 | +110 | +190 | +190 | +570<br>+280 | > 225 - 250 |
| -62 | -125 | -125 | -210 | -210 | +57 | +89 | +140 | +230 | +360 | +151 | +265 | +440 | +570 | +620<br>+300 | > 250 - 280 |
| -151 | -214 | -265 | -350 | -440 | 0 | 0 | 0 | 0 | 0 | +62 | +125 | +210 | +210 | +650<br>+330 | > 280 - 315 |
| -68 | -135 | -135 | -230 | -230 | +63 | +97 | +155 | +250 | +400 | +165 | +290 | +480 | +630 | +720<br>+360 | > 315 - 355 |
| -165 | -232 | -290 | -385 | -480 | 0 | 0 | 0 | 0 | 0 | +68 | +135 | +230 | +230 | +760<br>+400 | > 355 - 400 |
| | | | | | | | | | | | | | | +840<br>+440 | > 400 - 450 |
| | | | | | | | | | | | | | | +880<br>+480 | > 450 - 500 |

# GLOSARIO / GLOSSARY




**ACABADO SUPERFICIAL:**
término que describe la calidad, apariencia y/o las características superficiales de un eje resultante de operaciones de pulido, tostación, rebaje etc… para mayor información, véase SAE J488a (Junio, 1963).

**ALOJAMIENTO:**
superficie cilíndrica de la máquina que se acopla al diámetro exterior de la cajera del retén (estanqueidad radial) o bien, a un labio externo (estanqueidad axial).

**ALOJAMIENTO DEL MUELLE:**
ranura mecanizada en la parte interior del labio, de sección circular que sirve para alojar y proteger el muelle helicoidal.

**ALTURA DE LA LÍNEA DE CONTACTO:**
distancia axial entre el frente de retén y el punto de contacto.

**ANCHO DE CONTACTO:**
área que reacciona dinámicamente en la dirección axial.

**ÁNGULO FRONTAL DEL LABIO:**
ángulo del labio con el eje y visto desde la parte delantera del retén.

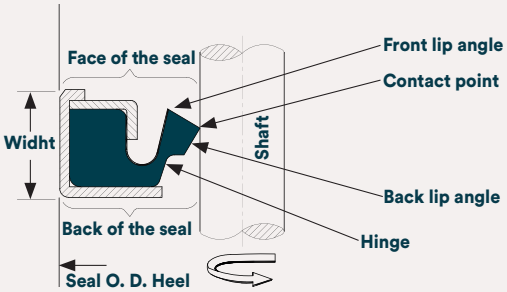
**ÁNGULO POSTERIOR DEL LABIO:**
ángulo del labio con el eje y visto desde la espalda del retén.

**ÁRBOL:**
elemento que se emplea para la transmisión de movimiento giratorio en las máquinas y que está sometido, en la mayor parte de los casos, a esfuerzos de flexión y torsión.

**ARTICULACIÓN:**
punto donde el labio se doblega sobre el conjunto del retén.

**CAJERA DEL LABIO:**
componente rígido al cual está unido el elemento de elastómero.

**CAJERA EXTERIOR:**
elemento rígido del conjunto del retén que alberga todos los componentes del conjunto del sello.




***SURFACE FINISH:***
*a term used to describe the quality, appearance, and / or characteristics of the shaft surface resulting from operations such as grinding, polishing, burnishing, etc. For further information, see SAE J488a (June, 1963).*

***HOUSING BORE:***
*a cylindrical surface which mates with the outside diameter of the seal outer case (standard lip seal) or the external contact lip (external lip seal).*

***SPRING GROOVE:***
*a depression formed in the head section of the seal. It is generally semicircular in form and serves to accommodate and locate the garter spring.*

***CONTACT LINE HEIGHT:***
*the axial distance from the seal face to the contact point.*

***CONTACT WIDTH:***
*the amount of area that is reacting dynamically in the axial direction.*

***FACE LIP ANGLE:***
*the angle seen from the face of the seal coincident of the seal interface.*

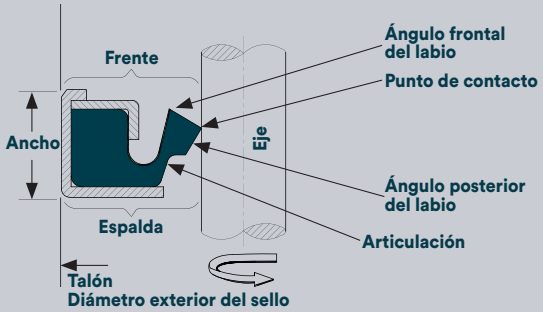
**BACK LIP ANGLE:**
*the angle seen from the back of the seal coincident of the seal interface.*

***DRIVE SHAFT:***
*element used for the transmission of rotary motion in the machines, and is subjected in most cases to bending and twisting efforts.*

***HINGE:***
*the point at which the seal lip pivots about the seal assembly.*

***SEAL CASE:***
*a rigid member to which the elastomeric element is attached.*

***OUTER CASE:***
*the rigid structure of the lip-seal assembly which houses all components of the seal assembly.*




**CAJERA INTERIOR:**
componente rígido, en forma de copa, del conjunto del retén utilizado como elemento de refuerzo, escudo, retenedor del muelle y dispositivo de sujeción de labios.

**CARGA DEL LABIO:**
es la fuerza radial que ejerce la geometría del labio así como cualquier otra carga del muelle. La carga del labio se expresa como fuerza por unidad de circunferencia del eje.

**CASQUILLO DE DESGASTE:**
manguito metálico de sacrificio que evita que se pueda rayar la superficie de contacto del eje con el labio del retén.

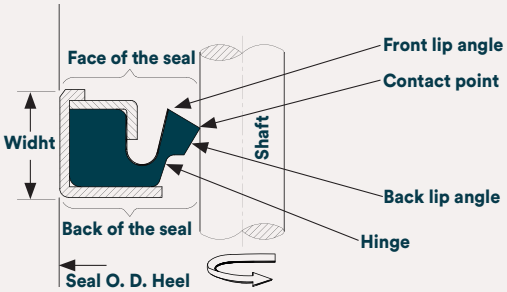
**CONJUNTO DEL RETÉN:**
componentes del retén, que incluye la(s) superfície(s) de sellado, disposiciones para la carga inicial y un mecanismo de cierre secundario que acomoda el movimiento radial necesario para su instalación y funcionamiento.

**DIÁMETRO DEL LABIO:**
es el diámetro interior del labio de sellado más pequeño y medido con el muelle instalado.

**DIÁMETRO EXTERIOR DEL RETÉN:**
diámetro del conjunto que encaja en el alojamiento mecanizado en la máquina.

**EJE:**
elemento constructivo destinado a guiar el movimiento de rotación en una pieza o conjunto de piezas, como una rueda o un engranaje. Hay casos que el eje no gira y un sistema de rodamientos o de bujes insertados en el centro de la pieza permiten que ésta gire alrededor del eje. En otros casos, la rueda gira solidariamente al eje y el sistema de guiado se encuentra en la superficie que soporta el eje.

**ELASTÓMERO:**
producto natural o sintético que puede vulcanizarse y estirarse (como mínimo) al doble de su longitud original a temperatura ambiente y recuperar su longitud al cesar el estiramiento.




***INNER CASE:***
*a rigid, cup shaped component of a seal assembly used as one or more of the following: reinforcing member, shield, spring retainer, and lip-clamping device.*

***LIP LOAD:***
*the radial force exerted by the seal lip geometry as well as any spring loading. Lip load is expressed as force per unit of shaft circumference.*

***WEAR SLEEVE:***
*a replaceable metal sleeve generally used in assemblies to eliminate expensive shaft replacement due to grooving from contamination at the seal-shaft interface.*

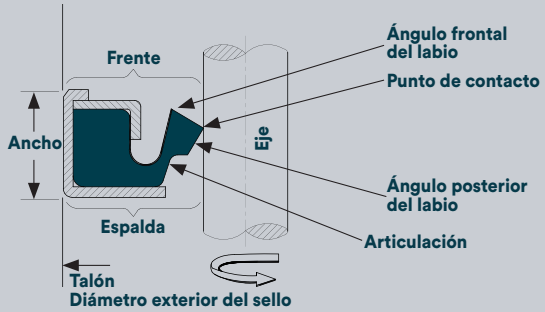
***ASSEMBLED SEAL:***
*a group of parts, which includes sealing surface(s), provisions for initial loading, and a secondary sealing mechanism that accommodates the radial movement necessary for installation and operation.*

***LIP DIAMETER:***
*the most inner diameter of the seal lip, measured with the spring installed.*

***SEAL OUTER DIAMETER (O.D.):***
*the external diameter of a lip seal assembly, which interfaces with the housing bore diameter.*

***AXLE:***
*is a central shaft for a rotating wheel or gear. On wheeled vehicles, the axle may be fixed to the wheels, rotating with them, or fixed to the vehicle, with the wheels rotating around the axle. In the former case, bearings or bushings are provided at the mounting points where the axle is supported. In the latter case, a bearing or bushing sits inside a central hole in the wheel to allow the wheel or gear to rotate around the axle. Sometimes, especially on bicycles, the latter type axle is referred to as a spindle.*

***ELASTOMER:***
*synthetic and natural products able to be vulcanized and capable of being elongated at least double their original length at room temperature but return to their approximate length when released.*




**EXCENTRICIDAD DINÁMICA:**
es la desviación existente entre los centros del retén y del eje, cuando éste describe un movimiento orbital.

**EXCENTRICIDAD ESTÁTICA:**
desplazamiento del eje de simetría del eje respecto al centro de rotación del retén.

**HINCHAMIENTO:**
aumento de volumen del elastómero por absorción del fluido con el que está en contacto.

**HOLGURA AXIAL:**
separación existente entre el talón del retén y el labio de sellado.

**HOLGURA DINÁMICA:**
movimiento axial permisible, referido generalmente al eje donde contacta el labio del retén.

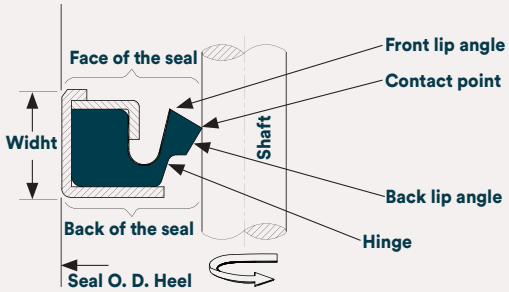
**LABIO PRINCIPAL:**
elemento elastomérico de sellado que roza contra la superficie del eje. Está orientado hacia el lado de mayor presión para evitar la fuga de lubricante o el ingreso de contaminantes exteriores.

**LADO PRODUCTO:**
típicamente, referido al frente del retén, cuando el objetivo es la retención del lubricante, pero puede tratarse de su espalda cuando se quiera evitar el ingreso de contaminantes.

**LÍNEA DE RETENCIÓN DEL MUELLE:**
porción del labio que restringe el movimiento axial del resorte de extensión desde una posición predeterminada.

**LUBRICACIÓN DEFICIENTE:**
falta de lubricante en la zona de contacto del labio con el eje y que puede provocar un desgaste prematuro.

**MUELLE HELICOIDAL:**
o muelle de gusanillo que se une sobre sí mismo para formar un anillo. El muelle aporta la tensión necesaria al conjunto para mantener la fuerza radial de sellado entre el labio y el eje o la cajera.




***DYNAMIC RUNOUT:***
*is defined as the amount by which the shaft (at the sealing surface) does not rotate around the true center.*

***SHAFT ECCENTRICITY / OFFSET:***
*the radial distance which the geometric centerline of the shaft is displaced from the axis of shaft rotation.*

***VOLUME SWELL:***
*increase in physical size caused by the absorption of the fluid the elastomer is immersed in.*

***AXIAL CLEARANCE:***
*the gap between the element heel and seal lip.*

***END PLAY:***
*a measure of axial movement encountered or allowed, usually in reference to the shaft on which the seal lip contacts.*

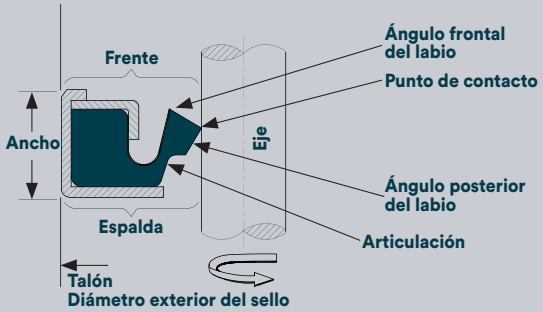
***PRIMARY LIP:***
*the elastomeric sealing element which typically rides against the rotating surface facing in toward the lubricant for lubricant inclusion or out away from the lubricant for contamination exclusion.*

***FLUID SIDE:***
*typically, referred to the face of the seal when the primary sealing objective is to retain lubricant, but can be the back of the seal when the primary sealing objective is to exclude contamination.*

***SPRING RETAINING LIP:***
*the portion of the primary lip that restricts the axial movement of the extension spring from a predetermined position.*

***LUBRICANT STARVATION:***
*lack of proper lubrication at the seal interface which may cause premature wear.*

***GARTER SPRING:***
*a helically coiled wire with its ends connected to form a ring. Close wound can be used in tension or open wound used in compression for maintaining a radial sealing force between the element of a radial lip seal and a shaft or bore.*




**MUELLE LAMINAR:**
muelle que se vulcaniza en el reverso del labio del retén y que distribuye la carga uniformemente, con acción independiente de cada una de las láminas que constituyen el muelle.

**PUNTO DE CONTACTO:**
zona de contacto donde el elemento de sellado reacciona dinámicamente con el eje o la cajera.

**RECTIFICADO:**
textura de la superficie del eje o de su casquillo, conseguida al situar una muela perpendicular al eje sin que haya movimiento axial.

**RUGOSIDAD:**
irregularidades en la superficie del eje resultante del proceso de fabricación. Para mayor información, véase SAE J488a (Junio, 1963).

**SELLO DE LABIO RADIAL:**
elemento de elastómero que evita la fuga radial de lubricante en condiciones estáticas y dinámicas, gracias al diseño de su geometría y carga.

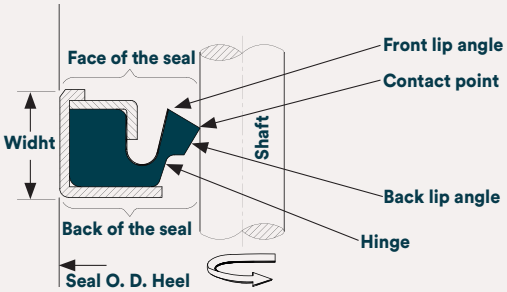
**SELLO UNIDIRECCIONAL:**
sello diseñado para el servicio en ejes que giren en una sola dirección.

**STICK - SLIP:**
fenómeno relacionado con la fricción donde el labio tiende a adherirse y girar momentáneamente con la superficie del eje hasta que sus características elásticas superen la fuerza de adhesión, haciendo que el labio de sellado pierda el contacto con la superficie del eje y que fugue el lubricante. Este ciclo se repite continuamente y se asocia normalmente al trabajo en seco, a condiciones de lubricación deficiente y a velocidades bajas.

**TALÓN DEL RETÉN:**
porción de la cajera del labio, tangente a la parte posterior del sello.

**TASA DE FUGA:**
cantidad por minuto de lubricante que fuga por el retén.

**TRAZAS DE MECANIZADO:**
ranuras helicoidales en la superficie de un eje, causadas por el movimiento axial relativo de la muela de rectificado respecto a su superficie.




***FINGER SPRING:***
*laminar spring that vulcanizes in the back of the lip of the seal and distributes the load evenly, with independent action of each of the sheets that constitute the spring.*

***CONTACT POINT:***
*the interface where the sealing element reacts dynamically with the shaft or bore housing.*

***PLUNGE GROUND:***
*the surface texture of a shaft or wear sleeve produced by introducing a grinding wheel perpendicular to the rotating shaft without axial motion.*

***ROUGHNESS:***
*irregularities in shaft surface texture which result from the production process. For further information, please see SAE J448a [June, 1963].)*

***RADIAL LIP SEAL:***
*an assembly containing an elastomeric element which prevents leakage in dynamic and static applications through means of geometry and loading.*

***UNIDIRECTIONAL SEAL:***
*a seal designed for applications having a single direction of shaft rotation.*

***SLIP-STICK:***
*a friction related phenomena in which the sealing element tends to adhere and rotate with the shaft surface momentarily until the elastic characteristics of the sealing element overcome the adhesive force, causing the seal lip to lose contact with the rotating surface long enough to allow leakage. This cycle repeats itself continuously and is normally associated with non-lubricated and boundary-lubricated conditions.*

***HEEL:***
*the portion of a lip seal case located tangent to the back of the seal.*

***WEEPAGE:***
*a minute amount of liquid leakage by the seal.*

***SHAFT LEAD:***
*helical grooves on a shaft surface caused by relative axial movement of the grinding wheel to shaft.*

# TRAINING SERVICES


**Training and knowledge of our products is an essential element in our organisation:** we train our own teams by means of an expert group of engineers. At the same time, we collaborate with universities and professional schools in the dissemination of knowledge of sealing systems and their correct use. And we also offer this service to our customers.

Below we detail some examples of available training courses, although in general, the training content is developed in collaboration with the Client to adapt it to real needs:

| Curso | Descripción | Duración |
|---|---|---|
| UP1-CG | **General sealing concepts** | 2H |
| UP1-EE | **Static Sealing**<br>Complete course | 8H |
| UP1-JT | **Static Sealing**<br>O-rings, x-ring seals, cord rings, back-up rings | 4H |
| UP1-JB | **Static Sealing**<br>Gaskets for flanges | 4H |
| UP1-ER | **Dynamic Sealing**<br>Complete course | 6H |
| UP1-RT | **Radial dynamic Sealing**<br>Shaft seals | 4H |
| UP1-VR | **Radial dynamic Sealing**<br>Other elements for rotary shafts (V-rings, labyrinths, shaft sleeves) | 2H |
| UP1-EA | **Axial dynamic Sealing**<br>Complete course | 6H |
| UP1-JH | **Axial dynamic Sealing**<br>Seals for hydraulic cylinders | 4H |
| UP1-JN | **Axial dynamic Sealing.**<br>Seals for pneumatic cylinders | 2H |
| UP1-AV | **Vibration isolation**<br>Complete course | 4H |

# NOTES

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