



We make it **possible**

DYNAMIC SEALING



1 - GENERAL

1.1 - What is a seal ?

An element forms a sealing function when it prevents the passage of a fluid from a one enclosure to another. Such elements are called "Seals".

If the object is to prevent the flow of a fluid from an enclosure into a neighbouring enclosure **the seal is called a single seal**. If the seal must prevent the flow of another fluid which may be in the second enclosure into the first, **the seal is called a double seal**.

If the two mechanical parts between which the leakage is likely to occur are fixed with relation to each other, **the seal is called a static seal**. If one or both of these parts is moving relative to the other, **the seal is called a dynamic seal**.

In this document, we will only be dealing with **dynamic seals**.

In practice, we only meet two sorts of relative movement, which may or may not be combined:

- linear translation (such as the sliding of a piston in a cylinder);
- rotation (the relative rotation about a common axis of a shaft in a hub or a crank case).



1.2 - Types of seals

Many different methods have been or are still used for sealing such as :

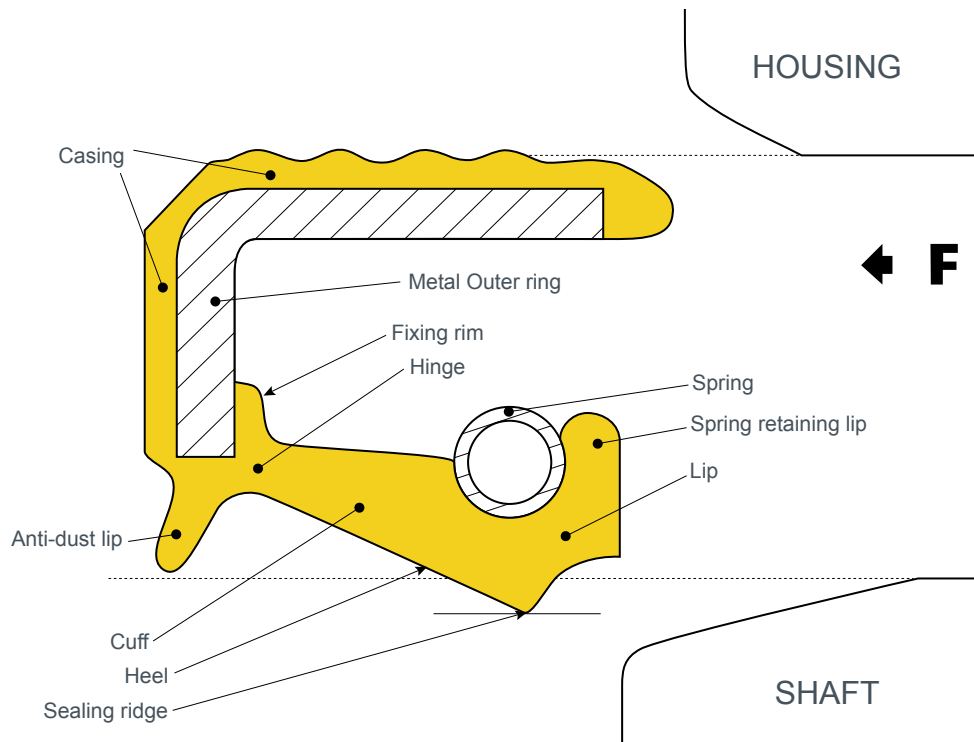
- labyrinth glands;
- stuffing-boxes;
- O-rings;
- lip seals;
- surface seals.

- **Labyrinth glands** are frictionless seals. They do not provide total sealing and do not seal if completely immersed in the fluid.
- **Stuffing-boxes** work by packing fibrous material which may or may not be braided tightly around a shaft by means of axial pressure applied by a screw cap or a flange tightened by a bolt. For many years, they have been the most common type of seals used. They produce a high frictional torque and absorb a relatively high amount of power. Although for many applications they have been replaced by lip seals or “surface” seals, they are still used a great deal, especially in the case of fluids under high pressure.
- **O-rings** are rings of synthetic elastomer of various cross-sections, most often circular (hence the name) but sometimes in the form of an X or a cross. They are most often used for static seals but can also be used in some cases as seals for rotating shafts, particularly at low speeds. They also give rise to a high frictional torque.
- **Lip seals for rotating shafts.** Lip seals first appeared about fifty years ago. They consisted of a leather cuff (which could be chromed) whose lip was kept in contact with the rotating shaft by an annular spring. In order to keep both the spring and the leather cuff in position, the parts were encased in a set of metallic collars and rings (normally at least three) which were crimped into each other. The external collar would usually be ground to size and “hard” mounted in a fixed hub. This type of seal was used a great deal, but its life was restricted as the leather wore out particularly in high temperatures. Nowadays, the leather has been replaced by synthetic elastomers which appeared on the market some forty years ago and gradually took over the role of the leather. The first of these elastomers to appear is today known as N.B.R. (Nitrile Butadiene Rubber) and was noted for its resistance to organic solvents, in particular liquid fuels and lubricating oils, even at high temperatures. The first seals manufactured had the same structure as the leather seal with its three crimped metal rings. The development of processes which ensure a very good bonding of N.B.R. to metal has enabled the structure of the seal to be simplified and has given it its present classic general shape. The discovery of new elastomers enables us to offer the user an increasingly varied range of seals, which are capable of solving increasingly difficult problems.



Segré's Plant (Maine-et-Loire) - ISO 9001

1.3 - Description of lip seals



In outline, a seal for a rotating shaft consists of three essential parts :

- the outer ring;
- the elastomer;
- the spring.

- **The Outer ring usually** consists of a metal ring in stamped steel with a right-angled cross-section.

- **The elastomer** is itself made up of 3 parts :

- the casing;
- the cuff;
- the lip.

- The casing (from the front surface to the back of the seal) is the part of the elastomer which is bonded to the Outer ring. It can cover it more or less entirely on the interior and/or the exterior.

- The cuff is cylindrical or slightly conical in shape and joins the Outer ring and the casing to the lip. It ensures a static seal and due to its elasticity - which is greater as it is longer - it allows slight movement of the lip due to movement of the shaft other than rotation.

- The lip is the element which ensures the dynamic seal by direct frictional contact with the shaft. It is made up of an annular beading including a double bevel forming a sharp ridge which is concentric with the perpendicular axis of the seal. The inclination of the surfaces of the bevel is designed to ensure the seal against leakage of a fluid situated on the side marked F.

- **The spring** is a spiral prestressed spring. It forms an annular ring. The join is usually effected by screwing into one end the conical spiral parts of the other end. The spring is fitted by light pressure into a groove in the beading of the lip.