

Chapter 1 Oil Seal Introduction



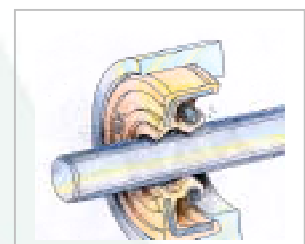
1.1 Introduction

Lip seal is one kind of contact type seals. During operation, lip seal is like other transmission elements (e.g. bearing or gear), which needs to establish a thin film to decrease wear and contact friction force between lip and shaft. So that the seal can maintain the sealing function and can have a longer life. In order to have a better understanding on oil seal, we will introduce some basic concepts and characteristics of lip seals below.

1.2 Seal introduction

The main function of a seal is to prevent the fluid (e.g. lubricant or air) to leak from shaft and housing. It can also prevent dust and mud to contaminate the housing. If dust and mud invade the housing, the life of transmission machinery will decrease greatly. The figure below is an illustration of a seal installed in one part of engine. In the early stage, the rotary shaft seal is made of leather. It is found that the rubber material properties for oil seal design is much better than leather. So that after the War , the seal made of rubber is widely used. In these two decades, automotive, aerospace, and other industries require the seals to resist higher temperature, pressure, and speed. This makes engineers have to do more research on material, structure, and function tests to improve the sealing function.

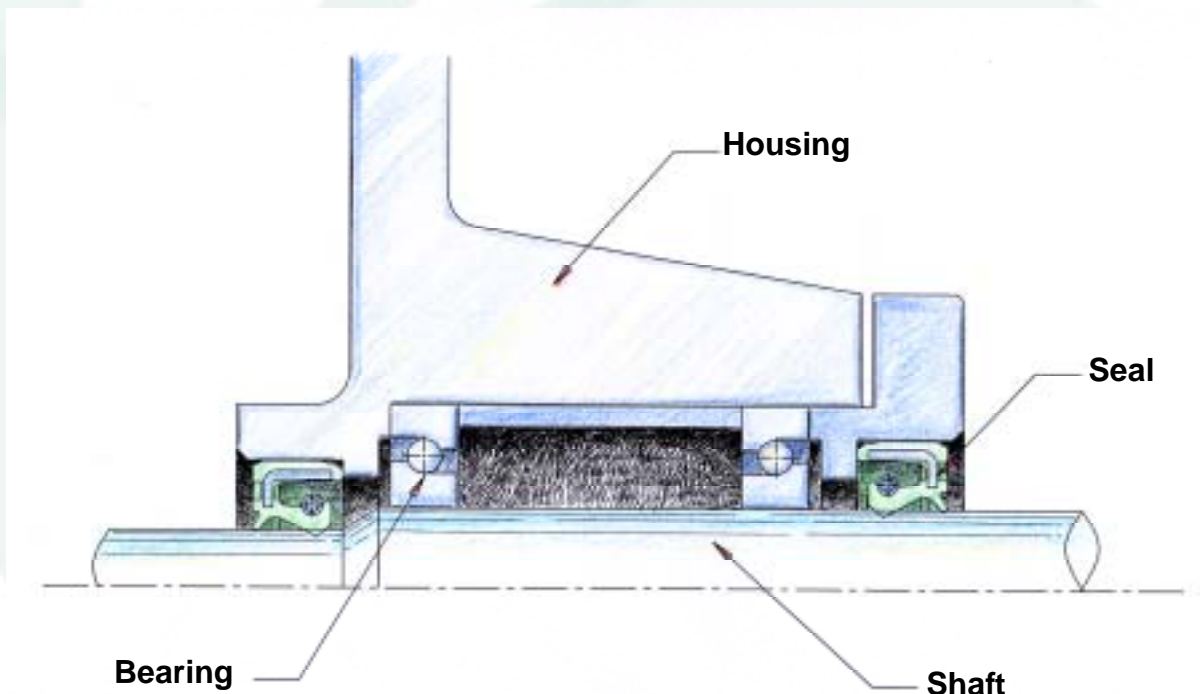
*Illustration of a seal installed in one part of an engine



1.3 Characteristics of rotary shaft lip seal

Characteristics of rotary shaft lip seal:

- (1) Prevent fluid leaking from shaft and housing, and prevent dust and mud to contaminate the housing.
- (2) Small torque, good sealing function.
- (3) Good resistance for high speed and high offset application.
- (4) Structure is simple and easy to take off from housing.
- (5) Good adaptation under many applications.



*Illustration of a seal installation

1.4 Applications

Seal is usually used in: tooling machine (e.g. lathe, planer, miller etc.), engineering machine (e.g. excavator, scraper, compacter etc.), transportation (e.g. car, motorcycle etc.), conveyance (e.g. crane etc.), chemical engineering (pump, compressor etc.), agriculture machine (cultivator, reaper etc.), others (tap, washing machine etc.). During machine operation, parts may contact directly. This will generate heat and parts would be worn. The lubricant is usually used to decrease wear and temperature. In order to prevent the lubricant from leaking that cause reducing machine life, oil seal is necessary in the transportation system.

Rotary lip seals can be used in these areas:

1. Power system





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2. Agriculture, mining, and heavy industry



3. National defense industry



4. Chemical engineering, water, electric power industry



5. 3C industry



6. Formula One



1.5 Seal main parts

Sealing function of rotary shaft lip seal can be divided into static and dynamic sealing. The figure below is the illustration of seal basic parts. Interference between seal outer dimension and housing will generate “Press-fit” which can prevent fluid from leaking. This is so-called static sealing. After the seal is installed on the rotating shaft, the shaft and seal inner dimension will generate “Radial force” which can prevent fluid leaking. This is so-called dynamic sealing.

Seal is basically composed of three parts:

(1) Rubber:

Rubber is usually used to be the seal material.

Lip rubber will contact shaft and form pressure distribution on shaft. Different geometry seal design

will form different pressure distribution. The pressure distribution must be correct so that the seal can have

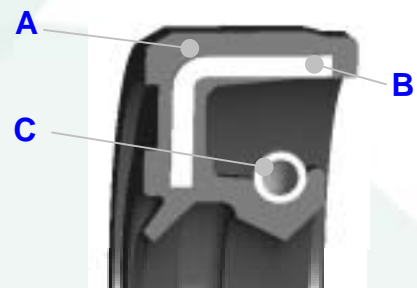
a good sealing function.

(2) Case:

The case can improve seal stiffness and sealing function. It also helps the seal to be installed correctly.

(3) Garter Spring:

It offers radial load for sealing lip, and it also can prolong the seal life. We have to consider shaft speed, shaft run-out and anticorrosive factors to select a proper garter spring.



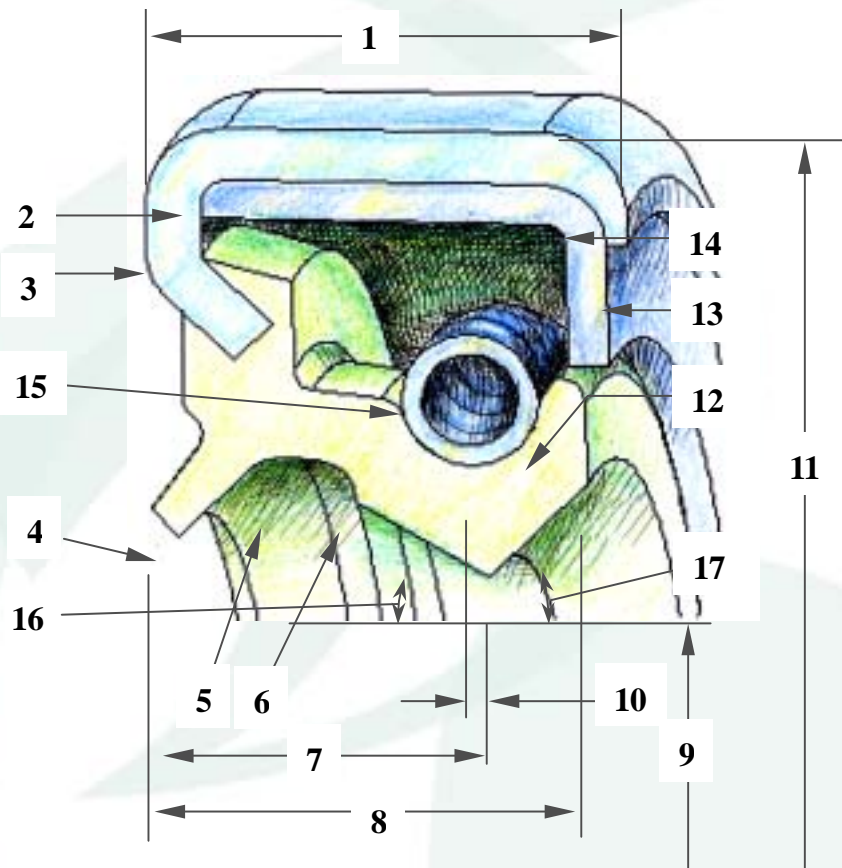


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1.6 Seal nomenclature



1. Seal Width
2. Outer Case
3. Outside Face
4. Dust Lip
5. Heel Section
6. Flex Section
7. Contact Line Height
8. Lip Height
9. Seal Inner Diameter

10. Spring Position
11. Seal Outer Diameter
12. Spring Groove
13. Inside Face
14. Inner Case
15. Garter Spring
16. Outside Lip Angle
17. Inside Lip Angle