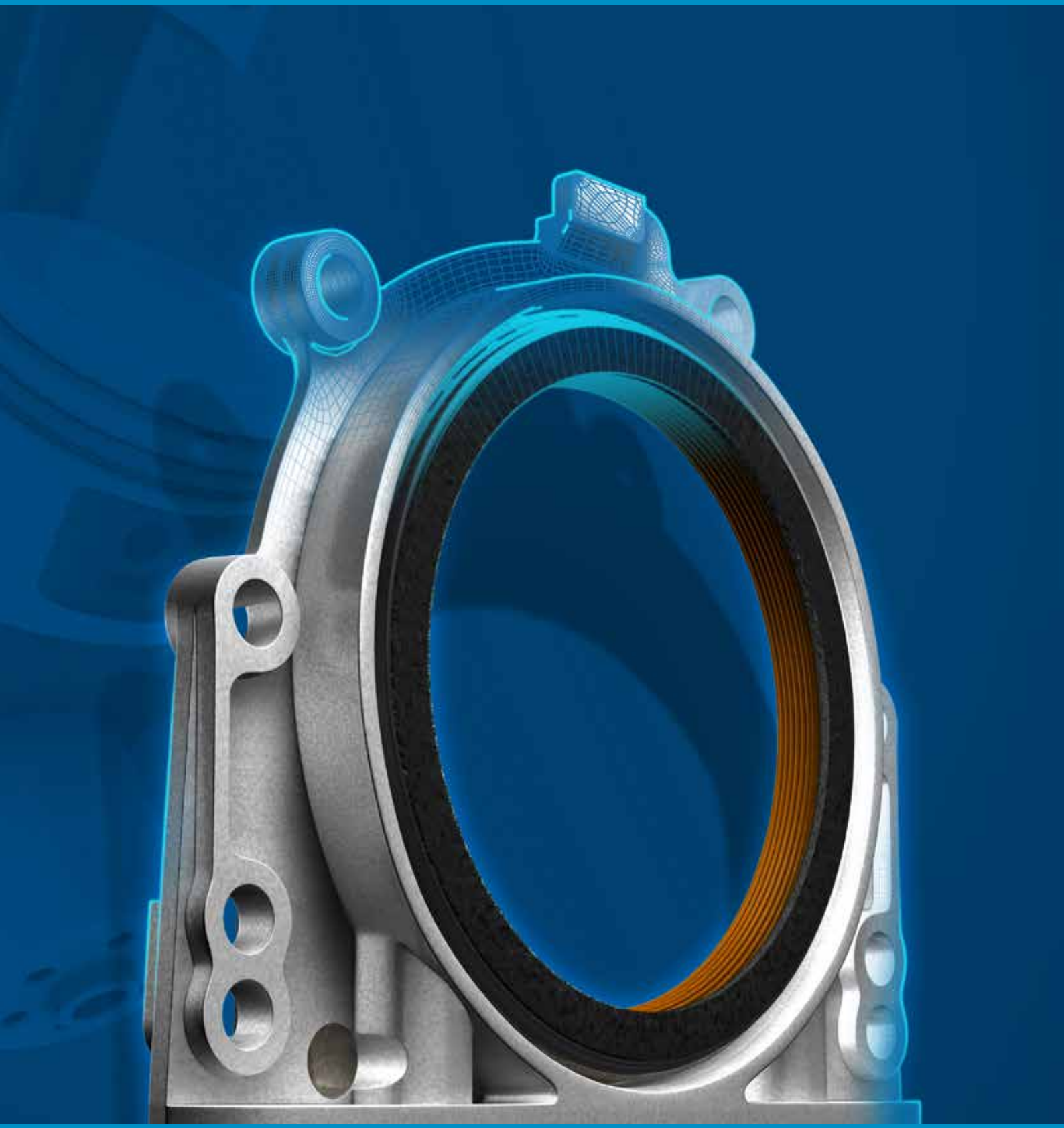


PTFE Oil Seals and Their Installation

Tips and Practical Information No. 4

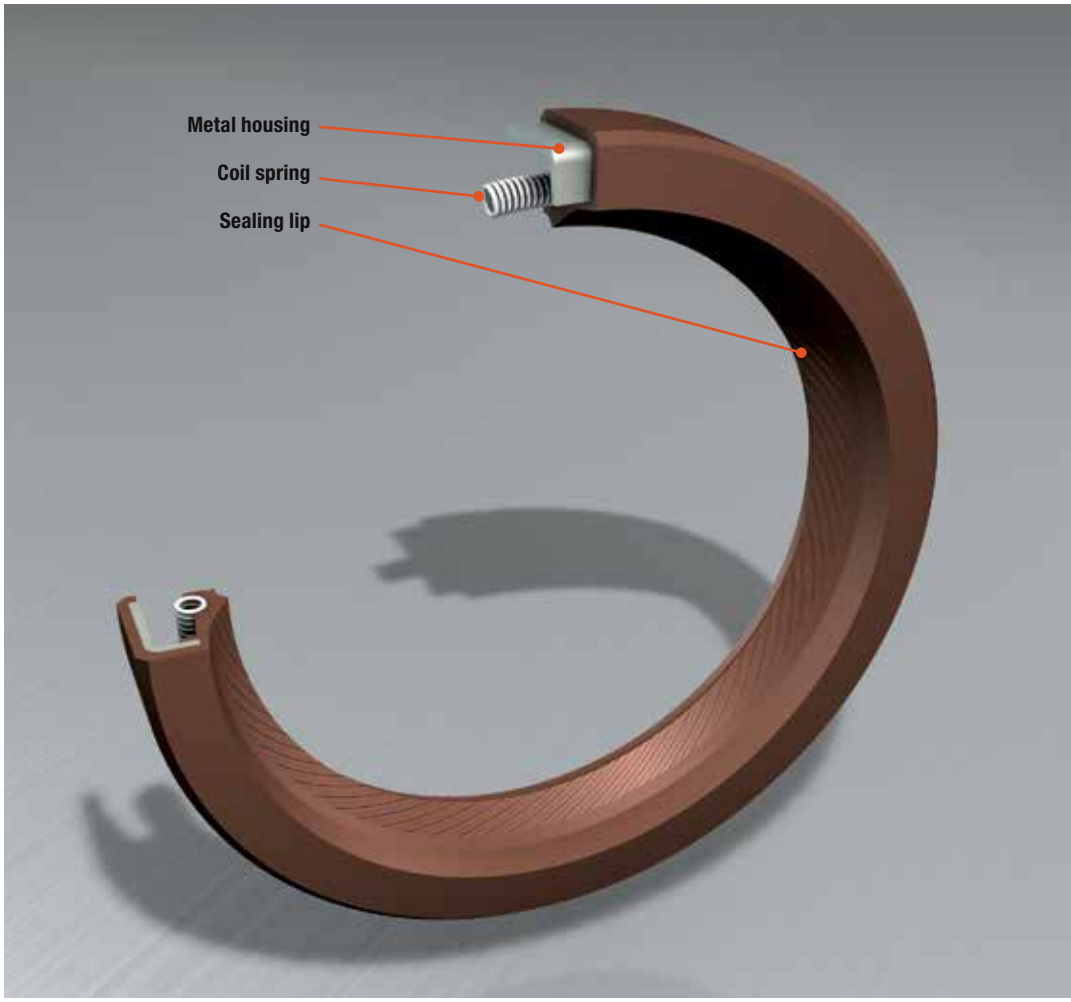
Dynamic Seals and Oil Seals

Dynamic Seals

The purpose of dynamic seals is to provide sealing between two moving machine components. The most important types are oil seals for use on rotating shafts, and valve stem seals for reducing the flow of oil through the cylinder head into the combustion chamber.

Oil Seals

The purpose of oil seals is to provide sealing between the rotating crankshaft and the outside. Classical oil seals consist of a metal housing that carries the dynamic sealing lip and also provides the static sealing function. The sealing lip of oil seals is usually manufactured of elastomer material, and is in contact with the surface of the rotating shaft. Hereby, the lip is pressed onto the shaft surface by means of a spring ring. As a result of the rotational movement, there is a sealing gap of approx. 1 µm at the lip edge. Oil can enter this gap, which serves to lubricate the sealing lip.



▲
Construction of a conventional oil seal with spring ring.

Dynamic seals may never be completely tight. A lasting sealing function can only be ensured if a defined amount of oil is able to exit for seal lubrication. Heat and attrition are generated by the parts moving against each other. The intentional oil leakage thus prevents seal wear and possible failure. In addition, the dynamic seal must provide a tight static seal between shaft and sealing lip when the shaft is stationary.

A Perfect Combination – Oil Seals and PTFE

New Demands On Oil Seals

Ongoing developments in engine design result in ever-higher demands on this type of seal. Higher engine speeds and oil temperatures, longer intervals between oil changes, and lubricants with
modern additives that react aggressively with the sealing materials require new and lasting solutions. The material for future oil seals is named polytetrafluoroethylene – or simply PTFE.

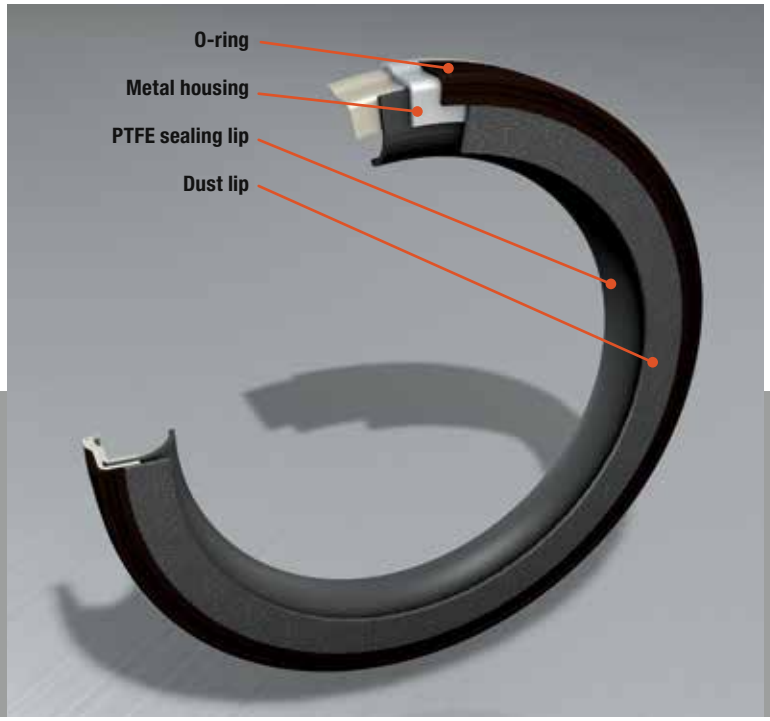
Trend-setting Advantages

Low friction and minimum power consumption are the decisive advantages offered by PTFE oil seals. These seals can be used without problems also with dry operation or insufficient lubrication. The material's excellent thermal properties, with an operating range of -130°C to +200°C, are unrivalled. Moreover, PTFE is featured by high chemical resistance and a low breakaway torque after standstill.

PTFE – Material With a Memory

When heated, PTFE attempts to return to its original form. In other words: The material «remembers» its original condition. This phenomenon is known as the plastic memory effect, and permits seals to be built without a pretensioning spring. During manufacture, the sealing lip is shaped as a flat ring, which is molded to the reinforcing ring. During assembly onto the shaft, the initially flat sealing lip expands and folds to match the shaft diameter. As soon as the sealing lip heats up during engine operation, it attempts to return to its original shape.

Polytetrafluoroethylene – PTFE for short – is a fully fluorinated polymer and belongs to the group of polyhalogenated olefins. This synthetic material is best known under the trade names Teflon and Gore-Tex. PTFE was discovered by chance in 1938 by the research chemist Roy Plunkett.



◀ *Construction of an oil seal with PTFE sealing lip.*

Design and Construction
The outer housing is made of stainless steel. An O-ring of fluoroelastomer ensures optimal static sealing. The internal diameter is perfectly concentric with the outer diameter. The actual sealing lip is made of highly wear-resistant and low-friction PTFE. An additional dust seal (rubber lip or felt strip) provides an effective barrier against contaminating particles.

Special Type With Integrated Oil Seal
Integrated oil seals reduce the manufacturing time of series production engines. As only one component needs to be installed, work on the assembly line as well as subsequent leakage is reduced by about one third. Similarly, significant time savings are achievable when replacing the radial crankshaft seals.

TIP FROM THE EXPERTS

For some engines the oil sump always needs to be detached and newly re-sealed whenever the integrated rotary shaft seals are replaced.

In order to install integrated radial oil seals with sensor technology both correctly and professionally, it is absolutely essential to use the right special tool for the replacement part.
In various OE repair manuals there are extensive disassembly and assembly instructions relating to this topic.
We do not recommend attempting to replace this component without these aids.

◀
Integrated oil seal

Installation of PTFE Oil Seals

▶ *As opposed to the installation of conventional oil seals, certain particularities must be observed during the installation of oil seals with PTFE sealing lip.*

TIP FROM THE EXPERTS

1. *Only remove PTFE oil seals from their protective packaging immediately before installation, to protect them from dust and other contamination.*
2. *The sealing lip of PTFE oil seals is protected by a plastic sleeve, which can normally be used as an assembly aid. Therefore, the sleeve should remain in place until the seal has been installed.*
3. *If the seal is to be installed without the sleeve, use the special tool provided by the manufacturer.*
4. *Both the PTFE sealing lip and the shaft surface must be completely dry. Do not use any grease or oil.*
5. *The shaft may not exhibit any sharp-edged chamfers – if necessary, have the edges removed by an engine expert.*
6. *The shaft surface must be in a perfect condition – also here, possible damage must be repaired by an expert.*
7. *Position the assembly sleeve with the PTFE oil seal on the shaft.*
8. *Make sure that the sealing ring is aligned correctly – the sleeve must be located so that the seal can be pushed onto the shaft smoothly.*
9. *Push the sealing ring onto the shaft with an even motion.*
10. *When replacing, the PTFE lip of the new seal should not run in the same position as the old one.*
11. *You can now remove the assembly sleeve.*
12. *Do not start the engine sooner than four hours after installation – this permits the new sealing lip to adapt perfectly to the shaft.*

If these practical hints and the manufacturer's recommendations are observed, the PTFE oil seal will give reliable service.

Failure of PTFE Oil Seals

Damaged PTFE Sealing Lip
The most frequent cause for failure is damage to the PTFE sealing lip during assembly. If the seal is installed without the help of a sleeve or special tool, and is shifted or even turned inside out, reliable sealing will hardly be possible. Similarly, the use of oil or grease – as with classical oil sealing rings – will result in total failure of the PTFE oil seal immediately after installation.

You Can Trust the Dana Specialists
The advantages of PTFE technology set new standards in the development of oil seals. Modern engine concepts require solutions for dynamic seals, which are able to withstand the high loads lastingly. Thanks to outstanding properties, PTFE meets these demands – the best prerequisites for series use in modern engines.

▲ *Damaged PTFE sealing lip as the cause of failure.*

▲ *Greased PTFE sealing lip as the cause of failure.*

TIP FROM THE EXPERTS

If available, new oil seals with PTFE sealing lip can be used as replacements for conventional oil seals.

Dana offers a complete product range with the new generation of PTFE oil seals. Our latest Victor Reinz product catalogs provide a survey of the available PTFE oil seals.

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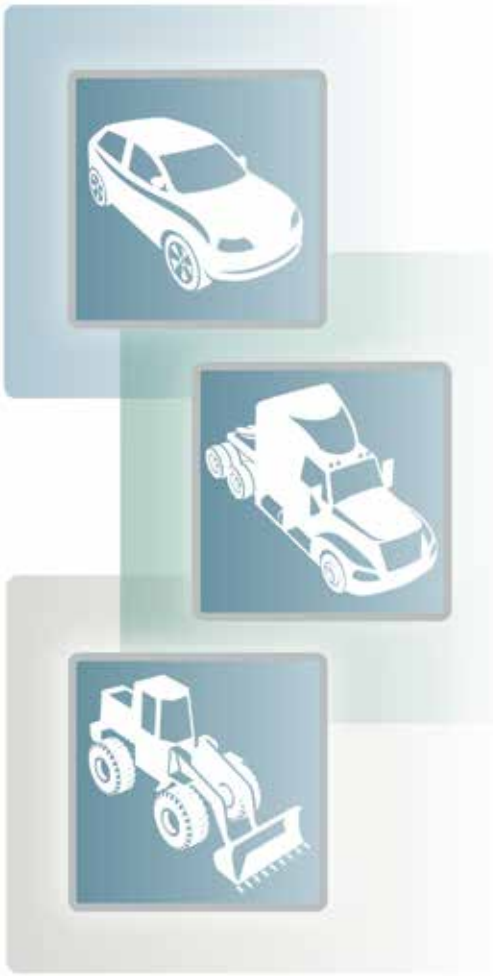

About Dana Holding Corporation

Dana is an integral partner for virtually every major vehicle and engine manufacturer worldwide. Dana is a leading supplier of drivetrain, sealing, and thermal technologies to the global automotive, commercial-vehicle, off-highway markets and for industrial applications. Founded in 1904, Dana employs thousands of people across five continents.

What Can Dana Do For You?

Dana provides high-quality product solutions. This lineup of technologies from one source is designed to offer flexibility to vehicle manufacturers around the world – whether in automotive centers or emerging markets – and ensures that customers get the latest state-of-the-art technologies, as well as products adjusted for specific local markets. With technology centers strategically located throughout the world, Dana engineers have the superior resources to develop, design, test, and manufacture to suit individual customer needs. This close collaboration allows Dana to create everything from advanced single components to fully integrated modular systems.

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