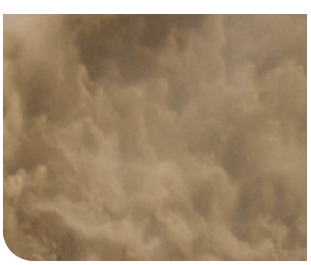
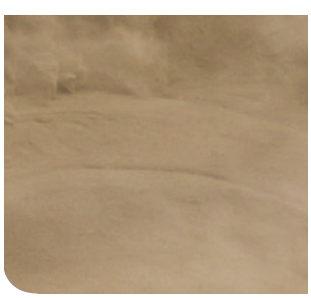
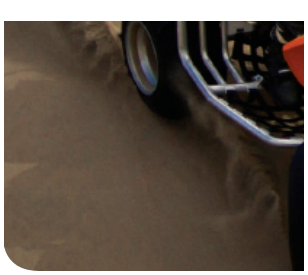
Shaft Seal Handbook







About ESP

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ESP offers a suite of products and services that are critical to global OEMs.

ESP has developed in-house engineering that helps design OEM components such as seals, metal castings and forgings, and also provides value-added assembly, inventory management programs and supply chain logistics. After working with customers on design, ESP then uses its qualified domestic and global factories to find the best cost manufacturer of the component. ESP can then provide any necessary subassembly or add the components to a highly automated inventory management program.

ESP continues to increase the value added to our customers' bottom line with successfully implemented engineering services, assembly services, assembly fixtures, kitting, global supplier qualification, vendor optimization and the technology to efficiently manage a process from sourcing to manufacturing plant delivery.

Worldwide Presence

ESP has a global strategy with physical locations in China, India and Taiwan. We made the decision that the best way to participate in globalization was to follow our customers around the globe.

Industries Served

- Ag & Construction Equipment
- Fluid Power & Handling
- Power Sport Vehicles
- Powertrain Sealing Systems
- Lawn & Garden Equipment

Product Line

Product Line

RADIAL SHAFT SEALS

- Oil Seals
- Grease Seals
- Axial Face Seals
- Valve Stem Seals
- V-Rings

O-RINGS

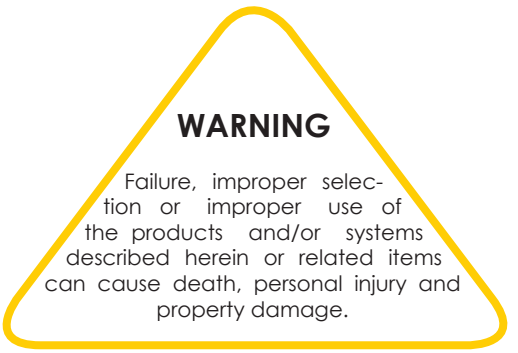
- O-ring Kits
- Extruded Cord
- Spliced O-Rings – precision vulcanized
- X-Rings
- Square Rings
- Backup Rings

FLUID POWER PRODUCTS

- U-Cups in all styles and materials
- O-ring Loaded piston/rod seals in various materials
- Wear Rings
- Rod Wipers, Metal Encased and various materials
- T-Seals
- Piston Seals

CUSTOM MOLDED RUBBER & INJECTION MOLDING – ANY SHAPE AND MATERIAL, RUBBER TO METAL, ETC.

FASTENER AND THREAD SEALS



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Please carefully evaluate your particular application. In any application for which there might be a risk of property damage or injury to persons, the final selection of a suitable product should be made by individuals possessing sufficient technical skills and competence. Only a trained professional should make the final product selection.

It is important that you analyze all aspects of your application and review the information concerning the product or system. Due to the variety of operating conditions and application for these products, the user through his or her own analysis and testing, is solely responsible for making the final product definition and assuring that all performance, safety and warning requirements of the application are met. The information in this document is subject to change by ESP International and its subsidiaries at any time without notice.

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THE EVOLUTION OF RADIAL SHAFT SEALS

For centuries engineers have been faced with the challenge of effectively sealing against dynamic surfaces. In the frontier era, as people began to migrate west across great distances, the need for a sealing system that could extend the life of wagon wheels became a necessity. The first known shaft seals were leather straps used to retain animal fat on the end of a wheel axle. This crude method of sealing often leaked and required routine maintenance.

The Industrial Revolution spawned the development of internal combustion engines, transmissions and gearboxes. All of these systems had challenging sealing requirements.

The seals of the industrial age were organic ropes or packings. These seals proved to be very effective until shaft speeds, temperatures and other parameters increased with the development of better transportation systems.

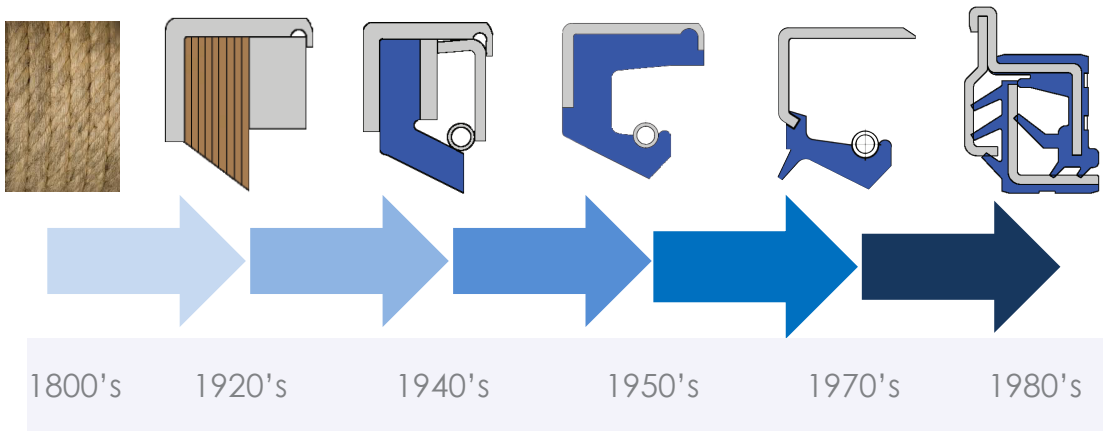
In the late 1920's, a self contained shaft seal was created from oil resistant leather assembled into a metal case. This was the first radial lip seal to be press fit into an outside diameter (OD) bore.

The most significant development in the evolution of the radial lip seal happened toward the end of World War II. A synthetic oil-resistant rubber, known as nitrile, replaced the leather element, forever changing seal design. Methods for bonding rubber to metal soon followed and, by the 1950's, direct bonded seals were readily available.

In the 1960's high temperature elastomers were developed including: silicone, polyacrylate and fluorocarbon. The increased price of these materials encouraged manufacturers to reduce material volume to stay cost effective. The resulting seal of the 1970's remains one of the most common designs today.

The 1980's brought an important change in radial lip seal design. The dynamic sealing surface was incorporated into the seal assembly. Doing this created a series of lips with horizontal as well as vertical contact points. This integral system was a technological advance that allowed manufacturers to take responsibility for the entire sealing system and not just the seal. This allowed them to provide a value added package, not just a commodity.

The future of radial shaft seals will be centered around the relationship between customer and manufacturer. The advancement of machinery design will depend on these relationships; the first to be successful will lead the next phase in seal evolution.



Radial Shaft Seal Evolution

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