



BELLOWS



STEIN SEAL



For over 50 years, Stein Seal Company has met the critical demands of applications for military and commercial aircraft engines, power generation equipment, pumps, compressors, centrifuges, and the military and commercial marine industry. As a leader in the custom design, testing and manufacture of seals and precision components, Stein Seal makes seal systems that are known for their outstanding performance in even the most difficult operating conditions.

Our bellows seals exemplify Stein Seal's inventive designs and technical expertise in manufacturing with their reliable, consistent performance. Generally mated with face seals to create a complete sealing system, bellows seals offer outstanding performance in gas or liquid applications characterized by toxic, corrosive, high temperature and high-pressure environ-

ments. Our bellows seals are highly sought after in the manufacture of compressors, industrial pumps, nuclear cooling pumps, centrifuges and expansion joints.

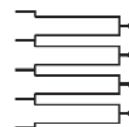
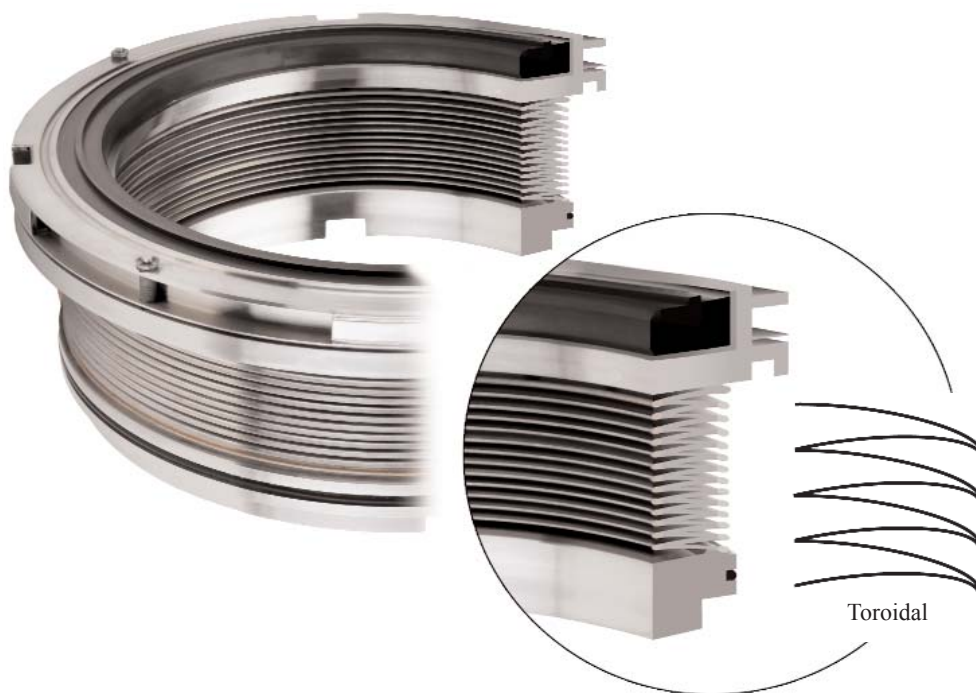
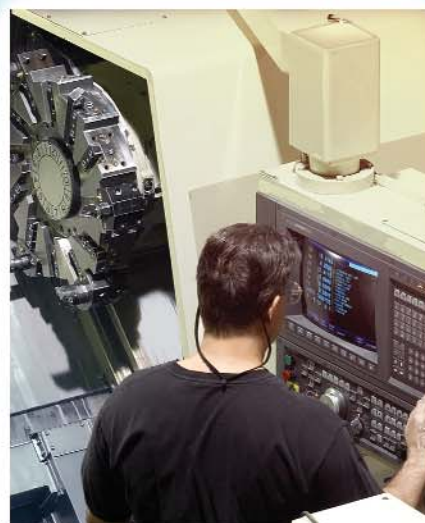
Specialty Designs, Precision Manufacturing

All our bellows seals are designed and manufactured at our facility to offer a truly perfect match for your applications. Not limited to only welded construction, our bellows designs can also be manufactured using a machine cut process or they can be hydroformed in a die.

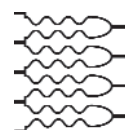
Within each construction choice there are different types of bellows to select including nested ripple, flat cantilevered, rippled cantilevered and toroidal. For example, a welded nested ripple bellows, with its thin convolutions, is most often used where there is a

low axial pressure and low spin rate. A welded toroidal configuration, using alternating thick and thin convolutions, offers high delta pressure capability.

Depending on the application requirements, Stein Seal will



Flat Cantilevered



Rippled Cantilevered



Nested Ripple

Types of Bellow Configurations



Toroidal

construct your bellows out of an appropriate material such as inconel, titanium or stainless steel. The choice of material is based on a wide variety and combination of factors such as a high resistance to corrosive environments, high temperatures, and pressure levels. Our expertise will help guide you to select the appropriate material for your application.

In operation, the bellows form a frictionless secondary seal when used with a primary seal to provide low wearing, high-temperature performance. Additionally it functions as the rotational lock and as the seal ring carrier to hold the primary seal against the shaft mating ring. The bellows also supplies axial springing to ensure that the sealing face stays in contact with its mating face during low or no pressure conditions. It can be used in static applications to compensate for misalignments during inprocess operation, in which case, the bellows can be supplied with customer defined end flanges for easy installation.

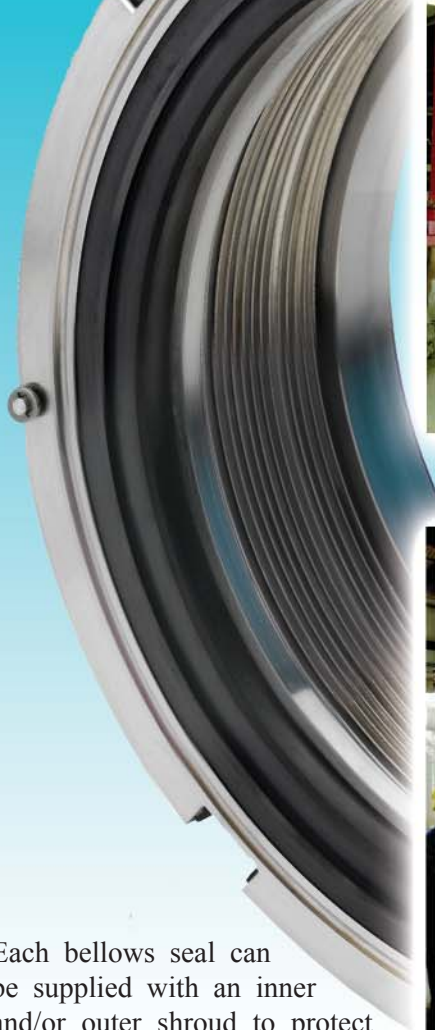
Innovative Features

Several significant design features make our bellows seals one of the most versatile and reliable devices on the market. Stein Seal can statically pressure balance each seal to ensure that each bellows will consistently meet operation and performance specifications. In addition, our bellows geometry allows for longer axial travel under low load compared to most other designs.

Each bellows seal can be supplied with an inner and/or outer shroud to protect the bellows, as well as rear and front fittings for a secure fit. Should minimizing vibration be important, a damper can also be added.

Stein Seal's bellows meet not only our own high quality requirements, but are rigorously tested to meet, and very often exceed, our customers' expectations. These seals:

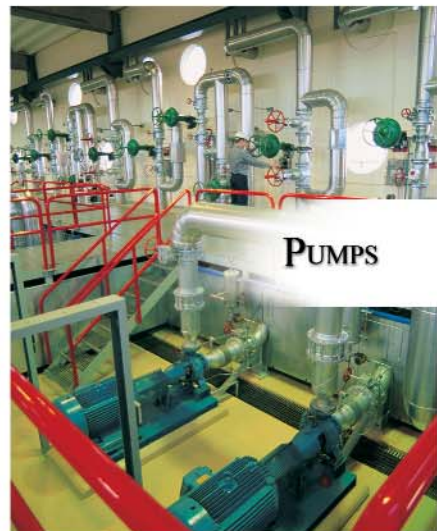
- Support shaft rotation speeds up to 152.4 meters/second (500 feet/second)
- Temperature ranges up to 427°C (800°F)
- Delta pressure ranges up to 1,517 KPa (220 psi)
- Are available in diameters up to 61 cm (24 inches)



COMPRESSORS



PROCESS EQUIPMENT



PUMPS



PROPULSION

Exceptional Performance in Any Environment

The variety of materials and the design options available in our bellows seals makes them suitable for a broad range of applications. In many process equipment applications using compressors and pumps, the bellows seal works with the face seal to prevent hazardous gases or other corrosive materials from escaping into the environment. By selecting the appropriate material for fabrication, we can ensure that the bellows seal will be completely inert to the chemical environment.

Some applications that rely on the high performance and reliability of a bellows seal include use in an aircraft turboprop engine. In this situation the bellows seal acts as control device in the event of a secondary seal failure. They are also found in the turbopumps of rocket propulsion systems, where they are part of the sealing system

that delivers fuel at very high rates. In nuclear coolant pumps, the bellows seal is used as the final closure seal in a multiple seal position system.

Custom Design to Custom Service

Stein Seal's commitment to reinvesting in our people, resources and capabilities allow us to deliver innovative, reliable, sealing systems. Solid, technical credentials and years of practical, real world experience in a broad range of applications characterize our design engineering talent. With proven manufacturing techniques, superior quality and testing processes, and a responsive customer support staff, the result is always a superior product. By maintaining a close partnership with our customers, Stein Seal Company continues to deliver superior value in products and services.

For more information on our bellows seals, our complete line of seal products and systems, or to discuss your application requirements with our experts, please contact Stein Seal Company.



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