



WAVE SPRING SEALS



Vulcan Wave Spring Type Seals



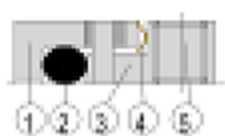
Introduction

The Vulcan Wave Spring Range of Bi-Directional mechanical seals offer proven design and wave spring technology, in a multitude of material combinations, with superior designs but at very competitive pricing.

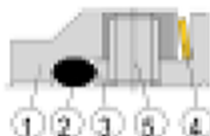
Applications

This range was specifically designed for rotary lobe pumps, whose principle application is normally for liquids of high viscosity. These are commonly found in the food, dairy, brewery and pharmaceutical industries. Their compact design makes these seals an excellent choice for confined stuffing boxes areas or even external mounted applications

Standard Components



Type
1688 Series

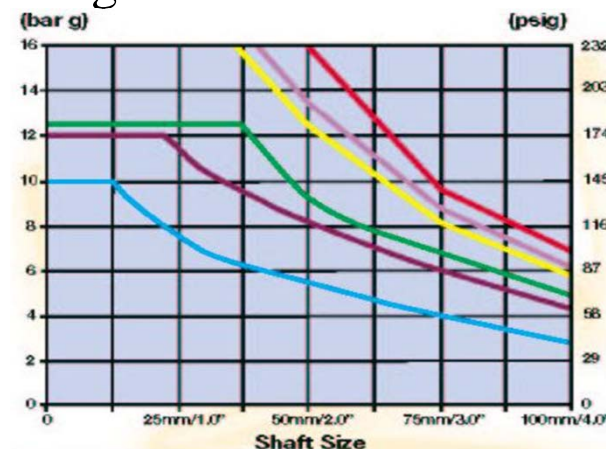


Type
1682 Series



Type
1677 Series

No	Description	No	Description
1	Face	4	Wave Spring
2	O- Ring	5	Grub Screw
3	Sleeve/Retainer	6	Backing Plate



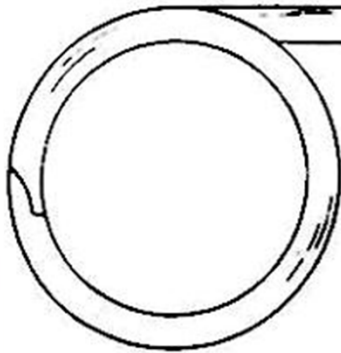
Vulcan Wave Spring
Type Seals PV Chart

Vulcan Wave Spring Type Seals



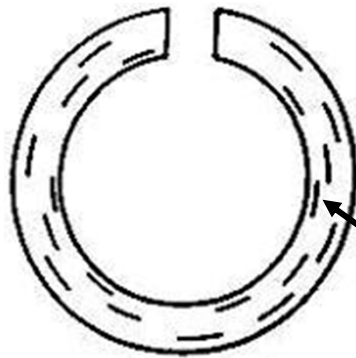
Vulcan Edge Wound Wave Spring vs. Die Stamped Washers

WAVE SPRING SEALS



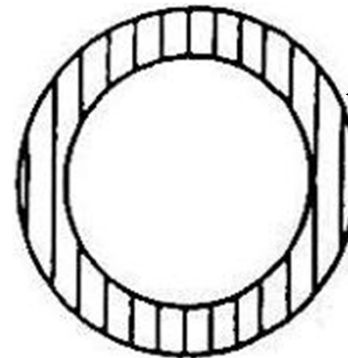
Vulcan wave springs are not manufactured by the more traditional die 'stamping' processes. Initially, spring temper round wire is cold rolled in stages, on all surfaces, to produce the desired rectangular section. The wire is then coiled on edge to form the required number of waves and number of turns to the correct finished diameter.

This 'circular grain' process produces wave springs with uniform grain microstructures and smooth exterior surfaces, free from pits, scratches, cracks and other imperfections.



Grain direction of finished spring

'Circular'



Grain "Breaks out" of spring at outer and inner edges

Die stamped springs have cross-grain microstructure which can cause 'breakout' at the outer edges which subsequently affects their load/deflection characteristics and fatigue (cycling) performance.

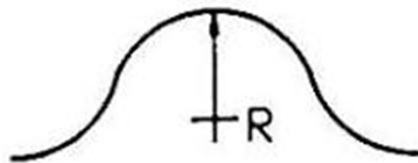
Vulcan Wave Spring Type Seals



Vulcan Edge Wound Wave Spring vs. Die Stamped Washers

The most significant advantage of the Vulcan manufacturing method is that there are no tooling charges, making it quicker and easier to produce prototypes and small volume batches. Modifications to the design can also be made immediately with minimal costs – unlike the stamped springs where tool modifications are lengthy and expensive.

Vulcan's precision manufacture also enables wave springs to be offered with a consistent and accurate spring rate from spring to spring. Stamped wave washers are inaccurate and typically non-repeatable, with variable spring rate from spring to spring. This has been shown in our recent load testing of wave spring samples.



The waveform produced by Vulcan edge coiling is sinusoidal with no abrupt straight edges, thus offering a larger and even contact surface.



Deburring or tumbling is not generally required since the springs are produced from round edge flat wire – ideal for restricted radial cavities.

Vulcan Wave Spring Type Seals



Vulcan Edge Wound Wave Spring vs. Die Stamped Washers



Stamped wave springs are commonly specified to free height tolerance alone, and are unable to offer any exact loading. Vulcan springs can be designed to satisfy a specific spring rate requirement. I.e. minimum and maximum loads between two pre determined work heights.



Unlike stamped springs that require heat treatment to obtain their spring properties, Vulcan springs require no heat treatment after forming, only stress relieving, consequently load predictability is more accurate.



The load tolerance for a stamped spring is commonly +/- 20-30%, whereas Vulcan springs offer a standard tolerance of +/- 10%.



Materials – in production stamped wave springs produce an extensive amount of scrap, whereas the Vulcan method produces very little. Stamping can also involve higher material costs for large diameter springs and exotic alloys.

Vulcan Wave Spring Type Seals



Vulcan Edge Wound Wave Spring vs. Die Stamped Washers

WAVE SPRING SEALS

The 'overlap' type wave spring permits radial expansion or growth in diameter within a bore, without the risk of binding or hang-up normally associated with stamped washers. The ends are free to move circumferentially as the spring outside diameter grows during compression.

e.g. The OD of an overlap spring would fit 0.020" loose per side in a bore. Its ID clears a shaft by 0.010" per side. As the spring is deflected, the OD and ID grow larger until the OD contacts the bore. Continued deflection causes the ends to slide over each other while the OD presses against the bore. If a stamped wave spring were in this situation, if deflected enough would guarantee buckling of the waves and spring failure.

In conclusion, wave springs produced by the edge winding process are characterised by smooth, exterior surfaces, free of pits, scratches, cracks and other minute imperfections. By contrast, subsequent manufacturing procedures for stamped wavy washers can lead to problems such as fatigue cracking and inaccurate and inconsistent loading between springs. All told, the metallurgy, the mechanical properties and the uniform dimensional stability of the Vulcan edge wound wave spring provide a component for precision quality applications.

Vulcan Wave Spring Type Seals



Standard Wave Spring Spring Types

Type 1688

The robust wave spring seal is ideally suited for standard, rotary lobe pump, stuffing boxes, of compact design. The seal is positively driven by grub screws and supplied from Vulcan with monolithic hard face materials as our standard.

Type 1688L

As above but supplied with a Type 24 DINL pinned stat, to suit DIN standard housing dimensions.

Type 1682

A wave spring seal to suit standard rotary lobe pumps. The Type 1682 is similar in design to the Type 1688 but is driven directly from the grub screws.

Type 1677

The Type 1677 is a positively, bi-direction driven wave spring seal, utilising crest to crest wave spring technology, offering excellent axial movement capabilities. The seal is radially compacted and designed to suit DIN 24960 (EN12756). The design of this seal head, enables easy replacement of a wide range of high quality materials and elastomers, supplied as standard.

Type 1678

Designed as per the Type 1677 but with a stepped face, to provide a balanced seal for stepped shafts.



Type 1677 Description

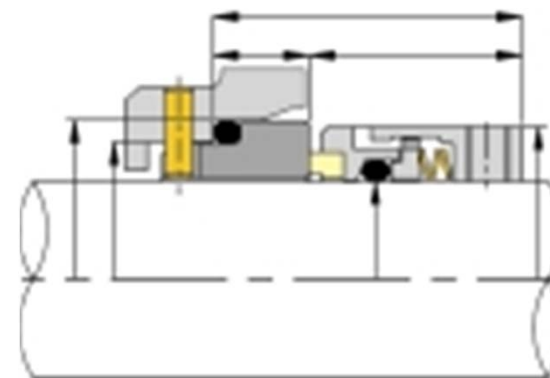
Wave-spring , 'O'-Ring mounted seal with shrink fitted face, commonly utilised in the European chemical process industries. Manufactured to suit DIN 24960 (EN12756) dimensions. Supplied with the Type 8 DIN Long seat as standard, but also available with other Vulcan seats, especially Type 8B, as Type 1677B.

Seal Compatibility

(European Based manufacturers)

Burgmann® Type M7N

Cross Sectional Line Drawing



Type 167X Superior Design

These seals utilise a double wave-spring . If the seal manufacturer's design solution is to use two wave-springs welded together, then this creates a weak spot, prone to both mechanical failure and corrosive attack. Vulcan Type 167X seals incorporate a one-piece designed, crest to crest wave spring, removing the possibility of corrosion to weld spots. This removes the most common seal failure mode on such seals. The seals contain an energised rotary 'O'-Ring, reducing shaft fretting and ensuring positive shaft sealing. Our design has a chamfer at the front wall of the 'O'-Ring groove and a dynamic ring backing plate constantly energising and pressing the 'O'-Ring forward and down onto the shaft. This overcomes 'O'-Ring hang-up on the shaft, the second common ultimate seal failure mode found on other manufacturer's designs.



Reliability

These are proven, very effective designs, highly utilised in many applications. They give extremely reliable performance based upon Vulcan's design improvements and the quality materials utilised.

Compact Seal

The uniform wave spring forces, provide excellent axial movement capabilities, compared to conventional mechanical seals. Use of a wave-spring allows the seal design to be very compact, giving an assured seal for short, confined glands.

VULCAN TYPE 1677



Type 1678 Description

Stepped shaft balanced seal, otherwise similar to our Type 1677. Both designs are energised by a special continuous wave spring with no weld spots, and are available in the same materials. Commonly fitted with a reduced shaft size Type 8 DIN Long seat

Seal Compatibility

(European Based manufacturers)

Burgmann® Type H7N

Type 167X Superior Design

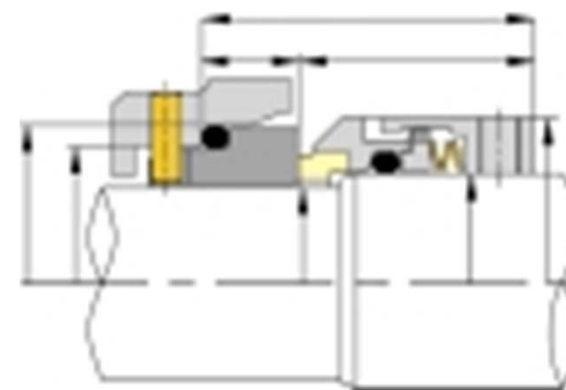
These seals utilise a double wave-spring . If the seal manufacturer's design solution is to use two wave-springs welded together, then this creates a weak spot, prone to both mechanical failure and corrosive attack. Vulcan Type 167X seals incorporate a one-piece designed, crest to crest wave spring, removing the possibility of corrosion to weld spots. This removes the most common seal failure mode on such seals. The seals contain an energised rotary 'O'-Ring, reducing shaft fretting and ensuring positive shaft sealing. Our design has a chamfer at the front wall of the 'O'-Ring groove and a dynamic ring backing plate constantly energising and pressing the 'O'-Ring forward and down onto the shaft. This overcomes 'O'-Ring hang-up on the shaft, the second common ultimate seal failure mode found on other manufacturer's designs.



Reliability

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Cross Sectional Line Drawing



Compact Seal

The uniform wave spring forces, provide excellent axial movement capabilities, compared to conventional mechanical seals. Use of a wave-spring allows the seal design to be very compact, giving an assured seal for short, confined glands.

VULCAN TYPE 1678



Type 1682 Description

Rotary based, bi-directional, wave-spring seal to suit standard rotary lobe SSP® pumps. The Type 1682 is driven directly from the grub-screws. Most commonly found in the food, brewing and dairy industries.

Seal Compatibility

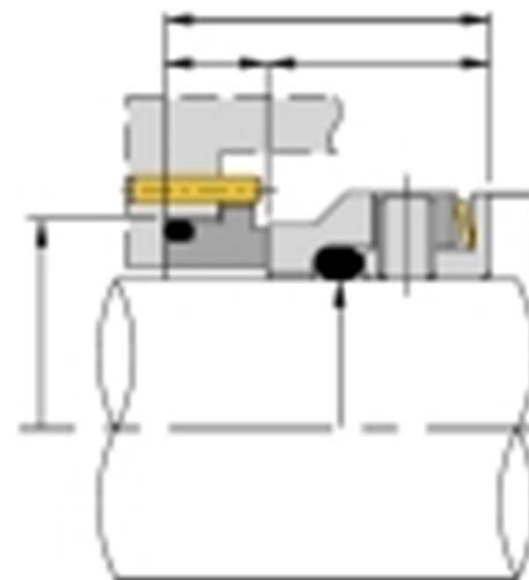
(European Based manufacturers)

John Crane® Type 87

Type 168X Superior Design

Types 1688, 1688L and 1682 are supplied with monolithic rotary heads, in both standard and hard face alternatives, to improve the seal operating performance in viscous fluids. This is achieved by eliminating the possibility of spinning and damage common to inserted face designs. Competitors inserted T.C/Sic seal face rings are prone to spinning, particularly in the viscous or coagulating fluids, which are common to rotary lobe pump applications. Common, popular sizes of Type 168x seals are fitted with our special, split Sinusoidal Wave-Springs. These split wave-springs offer a more consistent and accurate spring rate than traditional wave-springs.

The Sinusoidal waves offer a larger and more even contact and the split over-lap minimises the working stresses which frequently result in fracture, buckling or hang-up with a stamped, non-split, wave-spring.



Cross Sectional Line Drawing

Reliability

These are proven, very effective designs, highly utilised in many applications. They give extremely reliable performance based upon Vulcan's design improvements and the quality materials utilised.

Compact Seal

The uniform wave spring forces, provide excellent axial movement capabilities, compared to conventional mechanical seals. Use of a wave-spring allows the seal design to be very compact, giving an assured seal for short, confined glands.

VULCAN TYPE 1682



Type 1688 Description

Wave spring mechanical seal with thin cross section and short working length. Most commonly used on rotary lobe pumps, found extensively in the food, process, dairy and brewery industries. Popular, common sizes are fitted with Vulcan's Sinusoidal Split Wave-Springs.

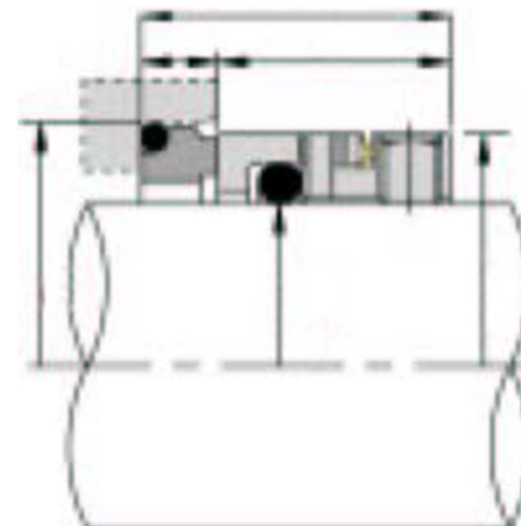
Seal Compatibility

(European Based manufacturers)
John Crane® Type 80 with
DF Seat

Cross Sectional Line Drawing

Type 168X Superior Design

Types 1688, 1688L and 1682 are supplied with monolithic rotary heads, in both standard and hard face alternatives, to improve the seal operating performance in viscous fluids. This is achieved by eliminating the possibility of spinning and damage common to inserted face designs. Competitors inserted T.C/Sic seal face rings are prone to spinning, particularly in the viscous or coagulating fluids, which are common to rotary lobe pump applications. Common, popular sizes of Type 168x seals are fitted with our special, split Sinusoidal Wave-Springs. These split wave-springs offer a more consistent and accurate spring rate than traditional wave-springs. The Sinusoidal waves offer a larger and more even contact and the split over-lap minimises the working stresses which frequently result in fracture, buckling or hang-up with a stamped, non-split, wave-spring.



Reliability

These are proven, very effective designs, highly utilised in many applications. They give extremely reliable performance based upon Vulcan's design improvements and the quality materials utilised.

Compact Seal

The uniform wave spring forces, provide excellent axial movement capabilities, compared to conventional mechanical seals. Use of a wave-spring allows the seal design to be very compact, giving an assured seal for short, confined glands.

VULCAN TYPE 1688



Type 1688L Description

Wave spring mechanical seal with thin cross section and short working length. Most commonly used on rotary lobe pumps, found extensively in the food, process, dairy and brewery industries. Popular, common sizes are fitted with Vulcan's Sinusoidal Split Wave-Springs.

Seal Compatibility

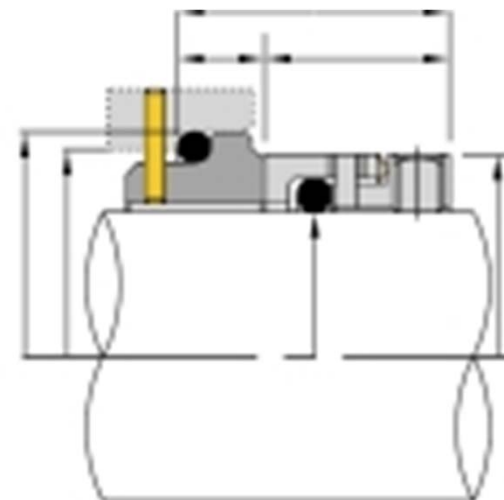
(European Based manufacturers)
John Crane® Type 80 with BP Seat

Type 168X Superior Design

Types 1688, 1688L and 1682 are supplied with monolithic rotary heads, in both standard and hard face alternatives, to improve the seal operating performance in viscous fluids. This is achieved by eliminating the possibility of spinning and damage common to inserted face designs. Competitors inserted T.C/Sic seal face rings are prone to spinning, particularly in the viscous or coagulating fluids, which are common to rotary lobe pump applications. Common, popular sizes of Type 168x seals are fitted with our special, split Sinusoidal Wave-Springs. These split wave-springs offer a more consistent and accurate spring rate than traditional wave-springs. The Sinusoidal waves offer a larger and more even contact and the split over-lap minimises the working stresses which frequently result in fracture, buckling or hang-up with a stamped, non-split, wave-spring.



Cross Sectional Line Drawing



Reliability

These are proven, very effective designs, highly utilised in many applications. They give extremely reliable performance based upon Vulcan's design improvements and the quality materials utilised.

Compact Seal

The uniform wave spring forces, provide excellent axial movement capabilities, compared to conventional mechanical seals. Use of a wave-spring allows the seal design to be very compact, giving an assured seal for short, confined glands.

VULCAN TYPE 1688L