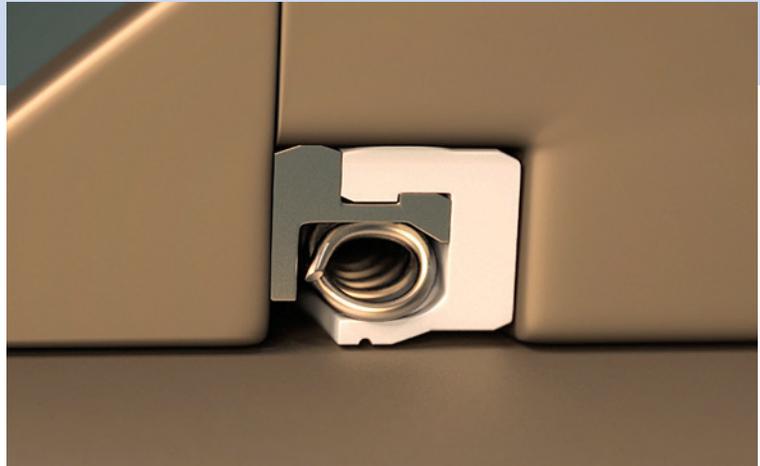




Sealing, Connecting, Conducting and EMI/RFI Shielding Solutions for Healthcare

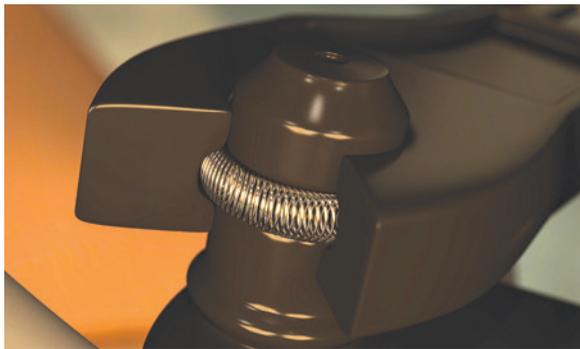
Advancing technology for worldwide industry

Bal Seal Engineering, Inc. is a global provider of custom-engineered sealing, connecting, conducting, and EMI/RFI shielding solutions. Our core technology, the Bal Spring[®], is a versatile component that functions independently or in combination with precision polymer sealing and metal retaining elements to enhance the performance and reliability of surgical instruments, orthopedic devices, drug infusion and diagnostic equipment.



More than just a problem-solver, we're your innovation partner. With over five decades of experience and a vast application knowledge base, we specialize in helping healthcare industry OEMs develop breakthroughs that set industry standards, push the technology envelope, and provide a competitive edge.

Whether you're addressing an existing challenge or still in the early stages of development, we can help. Our application and design engineers have the skills and expertise to collaborate and contribute during every step in the process, so that you can improve product performance and increase your speed to market.



Commitment to Quality

At Bal Seal Engineering, our goal is to be your #1 choice for sealing and connecting solutions for healthcare applications. We strive to accomplish this by integrating strict quality standards at every step, from design control to process control, supplier approval to final packaging. These efforts enable us to ensure compliance with the most demanding customer requirements, as well as our own high workmanship standards. We've maintained our ISO 9001 certification since 1999.

The Right Selection for You

We offer a broad range of solutions for the healthcare industry, and by guiding you through the assessment of design requirements—including material, configuration, spring load, etc.—our team of engineering professionals can help you determine which one is ideal for your unique challenge. Our early involvement in the design of the gland and hardware can ensure optimal performance to your criteria.

What We Offer

Knowledgeable, experienced people: A design engineering team with the industry's broadest application experience and the know-how to properly address all of your quality, packaging and technical performance requirements.

Custom solutions: Sealing, connecting, conducting, and EMI/RFI shielding components that are designed to meet the very unique demands of your application, providing safer, more reliable performance.

Superior customer service: A skilled team of customer representatives, serving as your personal connection to the products and services we offer, with the ability to accommodate your manufacturing processes and scheduling (i.e., Kanban, JIT, dock-to-stock, etc.)

OUR PRODUCTS

We offer a wide range of sealing, connecting, conducting and EMI/RFI shielding solutions that are easily customized to suit your specific requirements,

- Spring-energized PTFE seals
- Rotary lip seals
- Reciprocating seals
- Bal Spring® canted coil springs for mechanical connecting, electrical conducting, EMI shielding/grounding
- Bal Contact® electrical contacts

TYPICAL APPLICATIONS

- Catheters
- Centrifuges
- Dialysis equipment
- Endoscopes
- Hand pieces
- High speed motors
- Oxygen equipment
- Ophthalmic devices
- Orthopedic applications:
 - Instruments
 - Implantable retention devices
 - Implantable fixation systems
- Pumps
- Ultrasound equipment

Example 1. Surgical Bone Shaver



Operating Parameters

Pressure: Atmospheric to autoclaved 30 psi

Media: Bone, tissue, bearing grease, and sterilization fluids

Speed: 4 ft/min @ 60 Hz

Temperature: 70°F to 300°F (Autoclave)

Example 2. Carpometacarpal Joint Replacement Implant



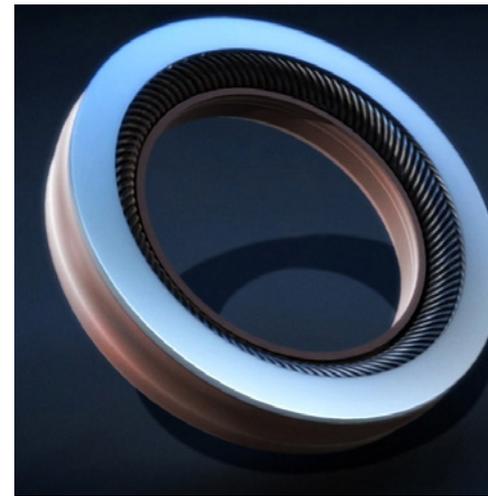
Operating Parameters

Diameter: 5-8mm

Degree of freedom (DOF): 90° on X and Y axes

Cycles: >1 million

Mating parts: Biocompatible materials (Housing = Titanium, Spring = Nickel Alloy, Insert/socket lining = UHMWPE)



Our core product, the Bal Spring® canted coil spring, was conceived in 1951 by Peter J. Balsells, an engineer and entrepreneur. Faced with a critical sealing challenge, Balsells applied education and inspiration to devise a new technology that combined the unique properties of polytetrafluoroethylene (PTFE) with a precision-engineered spring.

Balsells' invention, which satisfied the toughest application requirements, became known as the Bal Seal®. His energizer component, the Bal Spring canted coil spring, proved effective in mechanical connecting and EMI/RFI shielding/grounding applications, too.

Today, design engineers choose our Bal Seal spring-energized seals because they offer performance capabilities far beyond those of O-rings and other conventional elastomeric sealing components. Our seals are proven to provide longer service life, and they minimize the need for maintenance. Standard spring designs allow for a range of friction options in the seal cross-section.



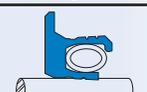
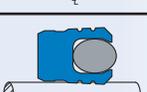
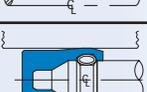
Bal Seal® spring-energized seals are made from specially-formulated polymers, such as virgin and blended PTFE, UHMWPE and PEEK. In addition, Bal Spring® canted coil spring energizer types can be paired with seal materials to meet exacting application requirements and provide longer service life.

Polymers for seal jackets

Ultimately, proper material selection is as critical to seal performance as the proper design. It is important to evaluate the materials for lifetime performance, cost, regulatory requirements and service environments. The table below contains information about some of our most popular sealing materials.

Material Callout	Description	Color	Temperature Range	Chemical Compatibility
T	Virgin PTFE Light duty service. Lowest friction. Low wear resistance. Low cost. FDA compliant.	White	-450° to 450°F (-268° to 232°C)	Excellent
TA	PTFE - Low Permeability Superior mechanical properties with good surface finishes, good sealing ability in gases and vacuum. FDA compliant.	White	-450° to 450°F (-268° to 232°C)	Excellent
GFP 55	Graphite Fiber Reinforced PTFE Moderate service conditions. Excellent performance in high temperature applications with moderate speed and pressure.	Black	-450° to 500°F (-268° to 260°C)	Very Good
UPC	UHMW Polyethylene High purity, high wear resistance in water and aqueous solutions. FDA compliant.	Translucent White	-450° to 180°F (-268° to 82°C)	Very Good
UP 30	Polyethylene Blend Suitable for very high pressure low speed reciprocating applications such as HPLC. FDA compatible.	Gold	-450° to 180°F (-268° to 82°C)	Very Good
SP 45	Polymer Filled PTFE General service conditions. Good wear resistance in liquid or dry environments. Low abrasion to dynamic mating surfaces. Suitable for high speed low pressure. FDA compatible.	Light Green	-450° to 475°F (-268° to 246°C)	Good
SP 50	Polymer Filled PTFE General service applications. Excellent wear resistance in gases, air and vacuum. Limited wear resistance in water. Low abrasion to dynamic surfaces. Suitable for high speed low pressure. FDA compatible.	Grayish Brown	-450° to 475°F (-268° to 246°C)	Good

BAL SEAL® SPRING-ENERGIZED RECIPROCATING SEALS

Profile	Series Callout	Features/Benefits	Minimum Size Availability	
			Cross Section	Inside Diameter
	13	<ul style="list-style-type: none"> • Long life • Excellent wiping • Low friction 	From 0.031" (.788 mm)	From 0.0625" (1.59 mm)
	KS13	<ul style="list-style-type: none"> • Self-retaining seal • Excellent sealing • Multiple autoclave reliability 	From 0.044" (1.12 mm)	From 0.125" (3.18 mm)
	R13	<ul style="list-style-type: none"> • Low friction • Flexible lip • Light duty 	From 0.031" (.79 mm)	From 0.0625" (1.59 mm)
	OR15	<ul style="list-style-type: none"> • Low friction • Flexible lip • Medium duty 	From 0.031" (.79 mm)	From 0.094" (2.39 mm)
	35	<ul style="list-style-type: none"> • Cover seal • Minimal dead volume • For very low pressures 	NA	Bore diameters from 0.156" (3.96 mm)

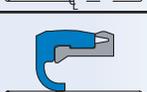
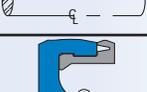
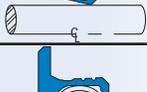
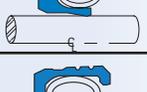
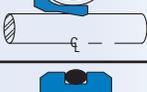
*O-Ring energized and silicone-filled spring cavities are also available.

These seals are designed primarily for reciprocating, slow rotary, and static service. Their Bal Spring® energizer element provides uniform loading in small diameters and cross-sections, and spring loads are interchangeable for optimal performance. The unique cant of the spring's coils provides a nearly constant load from a 10%-35% deflection, which translates to significantly improved service life over standard spring energizers.

Typical applications for these seal types include:

- Respirators
- Oxygen compressors
- Syringes
- Ultrasound equipment
- Dialysis machines
- Blood analysis equipment

BAL SEAL® SPRING-ENERGIZED ROTARY SEALS

Profile	Series Callout	Features/Benefits	Minimum Size Availability	
			Cross Section	Inside Diameter
	KS	<ul style="list-style-type: none"> • Med. speed, med. pressure • Long life • Excellent sealing • Multiple autoclave reliability 	From 0.044" (1.12 mm)	From 0.125" (3.18 mm)
	KP	<ul style="list-style-type: none"> • High speed, low pressure • To 5,000 ft/min (25.4 meters/sec) • Multiple autoclave reliability 	From 0.062" (1.57 mm)	From 0.125" (3.18 mm)
	KT	<ul style="list-style-type: none"> • High speed • Multiple autoclave reliability 	From 0.044" (1.12 mm)	From 0.125" (3.18 mm)
	RS3115	<ul style="list-style-type: none"> • Flanged seal • Better sealing • Low cost 	From 0.031" (.79 mm)	From 0.0625" (1.59 mm)
	S3115	<ul style="list-style-type: none"> • Better sealing • Low cost 	From 0.031" (.79 mm)	From 0.0625" (1.59 mm)
	P1	<ul style="list-style-type: none"> • High speed • Low cost 	From 0.062" (1.57 mm)	From 0.0625" (1.59 mm)
	PB1	<ul style="list-style-type: none"> • Very small profile • Lowest cost 	From 0.031" (.79 mm)	From 0.0625" (1.59 mm)

These seals offer unique advantages over conventional lip seals. Their metal locking ring component (integral to most profiles) makes them ideal for use in components and subcomponents that require autoclaving. The metal ring supports the seal jacket against the housing on the outer diameter for more effective sealing performance and better retention. It also helps dissipate heat, protecting the PTFE seal component from the potentially adverse effects of thermal variation. These seals are available in small diameters and cross-sections.

Typical applications for these seal types include:

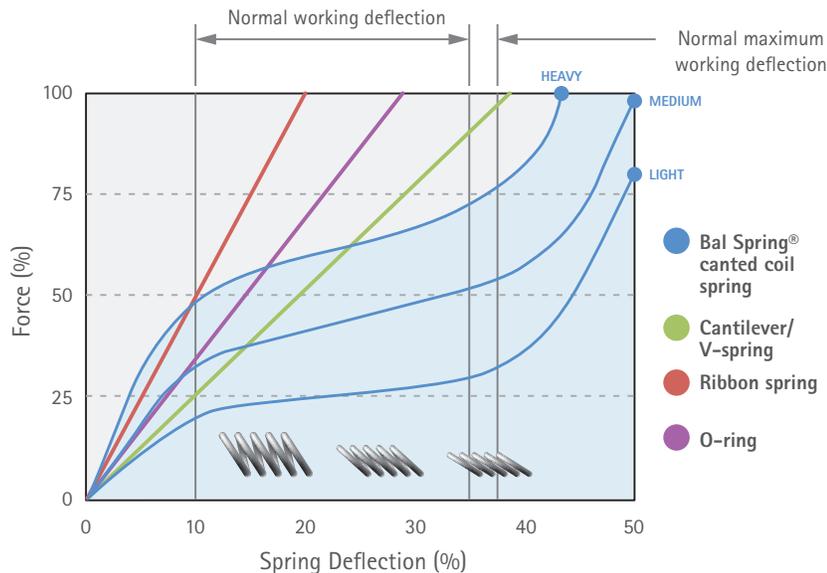
- High-speed and low-speed handpieces
- Bone drills, bone shavers
- Surgical saws
- Rotary catheters
- Small motors and pumps
- Centrifuges

BAL SPRING® CANTED COIL SPRING TECHNOLOGY

Unlike typical springs, the Bal Spring® canted coil spring maintains nearly constant force over a wide range of working deflections. This allows the spring to compensate for large tolerances between mating surfaces and wide temperature variations—without any significant change from its initial force. These springs can also be designed with a non-linear compression force.



Material Callout	Material Type	Ultimate Tensile Strength ksi (Mpa)	Features/Benefits
BSE3	Stainless Steel	230 to 322 (1,590 to 2,220)	<ul style="list-style-type: none"> • Good corrosion resistance • Bright finish
BSE19	Nickel Alloy	300 to 373 (2,070 to 2,570)	<ul style="list-style-type: none"> • Good corrosion and strength properties • Medical electronics applications
BSE23	Platinum Alloy	155 to 200 (1,070 to 1,380)	<ul style="list-style-type: none"> • Excellent corrosion resistance • Medical electronics applications
BSE27	Titanium Alloy	167 to 242 (1,150 to 1,670)	<ul style="list-style-type: none"> • High chemical resistance • Implantable-grade material



- Welded ring diameters are available in 0.035" (0.90 mm) and up
- Standard coil heights are available from 0.025" to 0.450" (0.64mm to 1.143mm)
- Spring lengths are available from 0.031 to 72" (0.79 to 1829 mm)
- A wide variety of standard and custom-designed springs are available to meet specific requirements
- Springs can be coated/plated to improve conductivity and resistance to abrasion and/or corrosion

A RANGE OF SOLUTIONS

Precision connecting

By combining groove and coil configurations, you can use our spring to design unique push-pull, snap-click or permanent mounting and breakaway devices. Insertion and disassembly forces can be precisely engineered to meet your application requirements. Examples of this application include interchangeable drill bits for surgical tools, alignment devices for hip replacement, and dental implant fixation.

Electrical conducting

Combine the mechanical properties of our spring with its inherent electrical conductivity, and you can simplify your device design by eliminating unnecessary components. Whether used as a stand-alone component or inserted into a metal housing, our spring provides exceptionally low electrical resistance and multi-point contact. Examples of this application include drug delivery systems and infusion pumps.

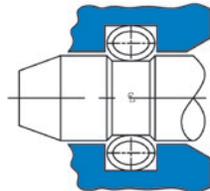
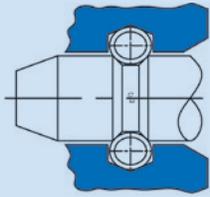
EMI Shielding/grounding

Supplied in welded form or in lengths, the Bal Spring® can be used to protect sensitive electronics from the harmful effects of electromagnetic interference, or EMI. The spring's conductivity, combined with its ability to compensate for surface irregularities, makes it ideal for use in ultrasound and MRI equipment, monitoring devices and computer workstations.

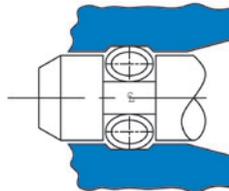
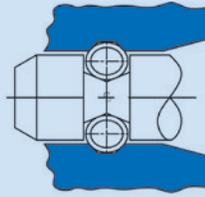
For information about our connecting and conducting solutions for active implantable devices, including the Bal Conn® electrical contact and the SYGNUS® Implantable Contact System, ask your Bal Seal representative, or call us at 800.366.1006

LATCHING DESIGNS

Housing Mounted



Piston Mounted

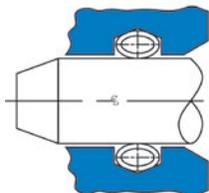
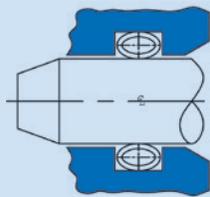


Features/Benefits

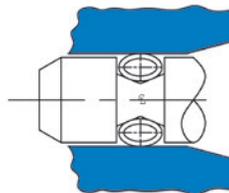
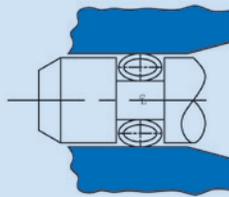
- Latching design with V-bottom groove reduces axial displacement and minimizes variations in conductivity
 - Used for latching applications where a specific latch/unlatch force ratio is required
 - Can be engineered to meet desired insertion and latch/unlatch force
 - Connect/disconnect force ratios range from 1:1 to 1:10
-
- Latching design with flat-bottom groove
 - Used for latching applications where a specific latch/unlatch force is required
 - Can be engineered to meet desired insertion and latch/unlatch force
 - Connect/disconnect force ratios range from 1:1 to 1:3

HOLDING DESIGNS

Housing Mounted



Piston Mounted



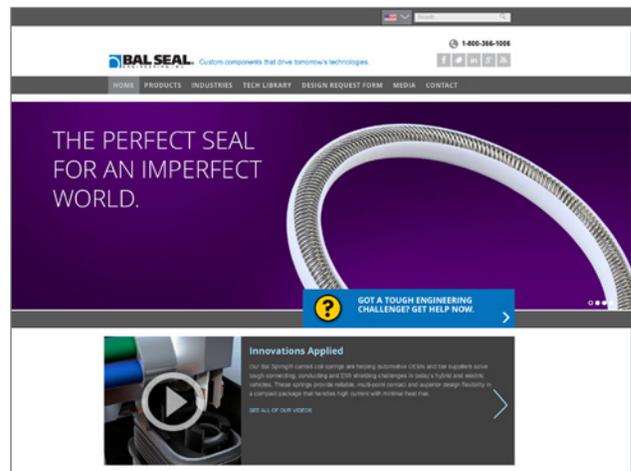
Features/Benefits

- Typical holding design with flat-bottom groove
 - Used for holding, aligning, and electrical contact applications
 - Can be engineered to meet desired insertion and sliding force
-
- Holding design with V-bottom groove firmly secures spring, minimizing variations in conductivity
 - Used for holding, aligning, and electrical contact applications
 - Can be engineered to meet desired insertion and sliding force

Other spring and groove configurations are available. Please consult Bal Seal Engineering for more information.

ADDITIONAL RESOURCES

For more than 60 years, we've been helping OEMs solve the toughest engineering challenges. Take advantage of our experience by checking out some of the resources we've made available at www.balseal.com. Our website features general product information, application videos and a comprehensive library with detailed technical reports, material bulletins, and design manuals.





www.balseal.com

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Bal Seal Engineering is certified to **ISO 9001**