TFC brings it together

E-BOOK

ASK THE EXPERT - RETAINING RING FAQ

Smalley engineers answer commonly asked retaining ring questions.

tfc.eu.com/retaining-rings

SMALLEY
THE ENGINEER'S CHOICE™

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OVERVIEW

Introduction & Benefits of Retaining Rings

Overview

A retaining ring is a type of industrial fastener that holds mating components and assemblies together. Used as an alternative to machining a shoulder, retaining rings eliminate complex machining processes, ultimately saving time, weight, and production cost for a more efficient production process.

Smalley retaining rings are a trusted solution because of their unique configuration, reliability, and convenience. From the watch dial on your wrist to a wind turbine, few applications are too small or too big for a retaining ring to secure.

From small to large diameters, light to heavy-duty loads, carbon steel to exotic materials, Smalley rings are versatile enough to be utilized in over 25,000 applications. We have five standard types of retaining rings, 30 configurations, and several thousand rings in stock.

Advantages of Using a Spirolox® Retaining Ring

1. No Ears to Interfere® with components

2. No lugs, ideal for tight radial applications

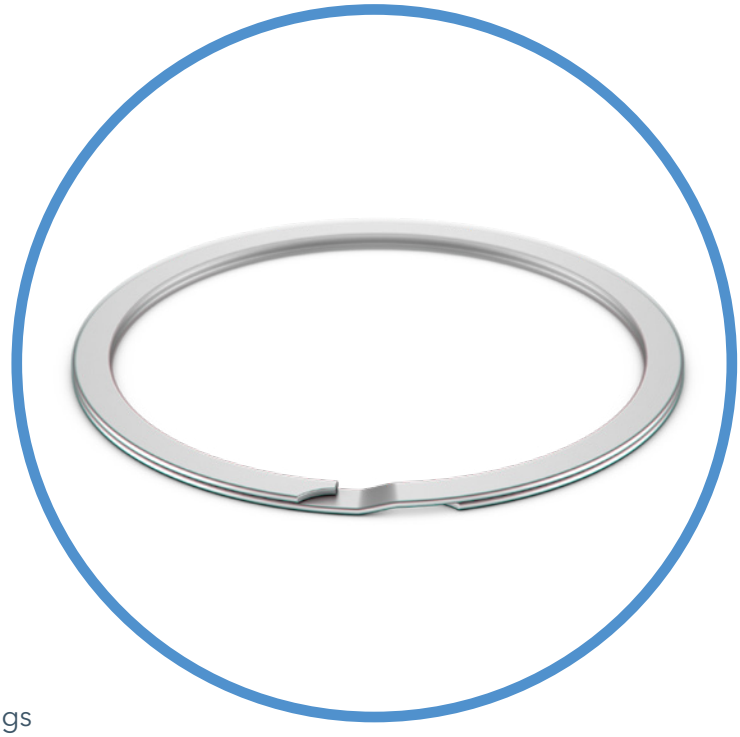
3. No gap, providing 360° retaining surface for even load distribution

4. Coiled, not stamped, reducing scrap costs and providing greater design flexibility

5. Improved aesthetic appearance, smoothly blending into your application

6. Safe and easy installation requiring no special tools

7. Groove interchangeable with stamped rings



Standard or Custom?

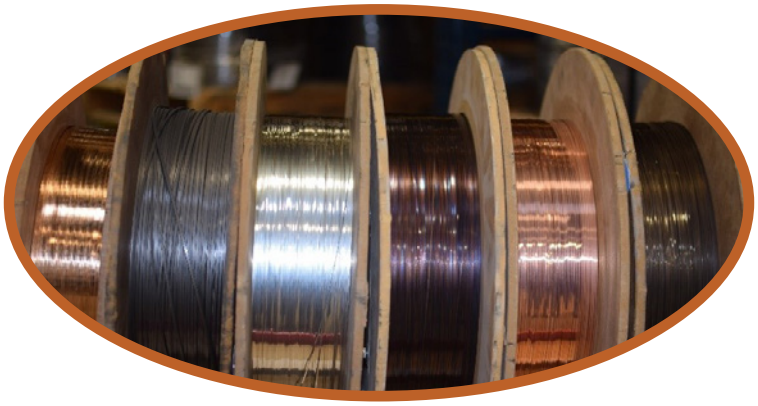
- Over 6,000 standard rings in carbon and stainless steel (.250 in. - 16 in., 6 mm - 400 mm diameters)
- No Tooling Charges™ on custom designs (.118 in. - 120 in., 3 mm - 3000 mm diameters)

DESIGN

Materials

What stock materials can I get a retaining ring in? What about a custom?

Standard Spirolox® retaining rings are available in Carbon Steel, 302 and 316 Stainless Steel, while Constant Section Ring (snap rings) and Hoopsters are available in Carbon Steel and 302 Stainless Steel. Retaining rings can be produced in a variety of custom materials to meet unique environmental conditions. Take a look at our Material Selection Guide, and consult with a Smalley engineer to find the appropriate material for your retaining ring.



My ring will be visible in my application and I'm concerned that the ring will stand out too much. Do you offer different finishes to help blend the ring into the application?

Besides providing a functional retaining surface, Spirolox rings are often preferred for their improved aesthetic appearance. In applications where the ring is visible, such as in the gauge pictured on the right, a Spirolox ring blends into the assembly since it has no protruding ears.

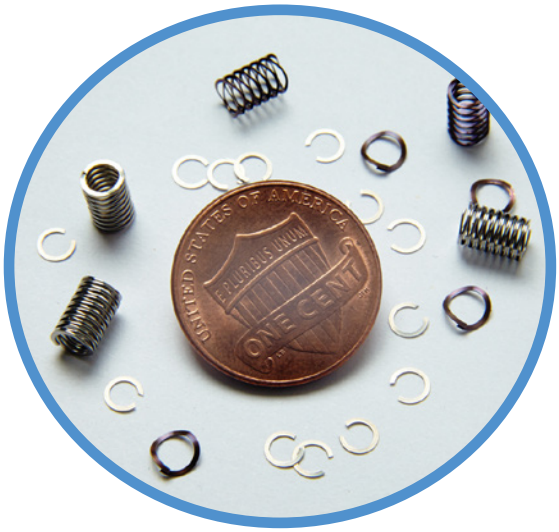
A number of coatings, finishes, and materials are available to meet aesthetic requirements. For example, black oxide provides a black flat finish often specified for cosmetic appearance. Passivation is an optional cleaning operation for stainless steel that provides a bright finish and increased corrosion resistance.

DESIGN

Size

How small can a retaining ring be made and still function in my application?

If our smallest off-the-shelf .250 in. (6 mm) outer diameter is too large for your application, we can manufacture a custom retaining ring down to .118 in. (3 mm) outer diameter.



Please contact a Smalley engineer to discuss our small diameter capabilities.

Note: Rings with diameters of .375 in. and smaller can only be produced with a pi-cut end configuration

What is the biggest diameter you can design for a retaining ring?

Smalley can manufacture custom rings in diameters of up to about 120 in. (3 m).

Such large retaining rings require specific design criteria, so please contact a TFC Smalley engineer to discuss your large diameter requirements.

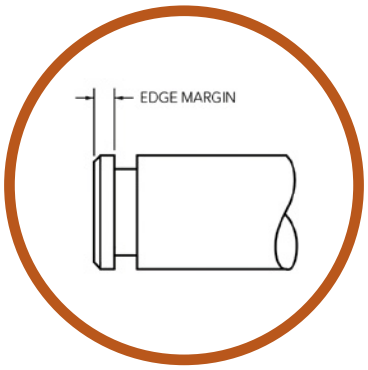
DESIGN

Groove Geometry

How much material is recommended between the end of my housing or shaft and the groove?

As a general rule, the distance from the end of the housing or shaft to the groove wall should be approximately three times the groove depth. However, each application may have more specific requirements that could allow for a shorter distance or require the groove to be located futher down the housing or shaft.

View detailed calculations for edge margin.



What is the ideal groove corner radius to balance retaining ring fit versus stress risers?

The recommended groove corner radius for a retaining ring with a diameter of 1 in. and under is .005 in. maximum. For a retaining ring with a diameter larger than 1 in., it is .010 in. maximum.

For any other groove radius, please consult TFC Smalley Engineering to determine its effectiveness.

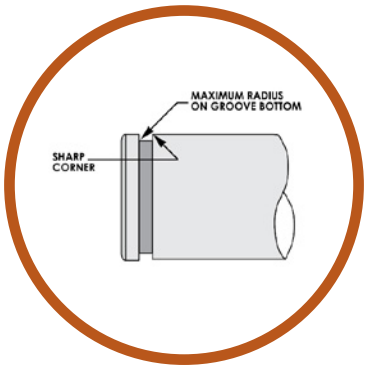


Table 1:

Diameter	Maximum Groove Radius
1 in. and under	.005 in.
Greater than 1 in.	.010 in.

I am dimensioning a groove and using the information from your catalog. For groove geometry, you give a maximum radius for the bottom of the groove. The outer corners just say "sharp corner". How sharp should the outer corners of the groove be?

The corners of the groove should be as sharp as the manufacturing capabilities allow for. The sharper corner allows for more contact with the ring and a rounded corner can contribute to a ring rolling out of the groove. If you have a concern that you might have too large of a radius or chamfer on the outside corners of your groove, contact TFC Smalley engineering dept to discuss your groove geometry.

DESIGN

Ring Failure

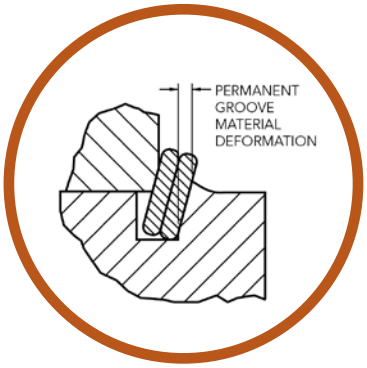
What are some reasons a retaining ring fails? If recommended groove dimensions are met, what are some factors that could lead to a possible failure?

While retaining ring failure can happen for many reasons, groove deformation is an often overlooked root cause. Groove deformation occurs when the bore or shaft's yield strength is less than the ring's yield strength. If the maximum allowable thrust load is exceeded, the ring can dish or compress the groove, causing deformation. The compromised groove wall allows for the ring to expand, twist, and ultimately work its way out of the groove.

It's important to consider what types of load (static, impact, or cyclic) will be seen and ensure that the recommended groove geometry guidelines are met to prevent failure. The groove form, including groove depth, chamfers, radii, and edge margin, all impact retention capacity. Thrust load capacity can be reduced if the recommended groove dimensions are not followed. Click to read a more in-depth explanation on preventing groove deformation.

Other factors that could lead to a possible failure include rotational velocity, operating temperature, and incompatible materials.

The rotational velocity of an application must be considered for shaft rings. Failure of the ring can occur when the centrifugal force is large enough to pull the ring from the groove, causing the ring to "open" or lose its cling. If the ring is exposed to an operating temperature that is greater than the recommended operating temperature for that material, the ring may deform. If an inappropriate ring material is chosen for the environment that it is exposed to, corrosion and failure may occur.



Can your rings be used in applications without a groove?

We do not offer stamped lock rings or other types of push-on washers. All Smalley retaining rings are designed to be used in a groove to support a load. Without a groove, rings will likely not have enough friction generated from cling to hold their position if a thrust load is applied.

DESIGN

Dimensions

How do Smalley engineers determine the size of retaining ring gaps? What happens if a retaining ring is compressed such that the free ends touch?

Retaining ring gaps are calculated based on the application dimensions, installation/removal methods, and our manufacturing capabilities. Smalley standard rings are designed such that the gap ends do not touch during installation. If the ring ends touch when compressed, it could jam and possibly deform or damage the ring and/or assembly. Consult TFC Smalley engineering to review your application and installation requirements.

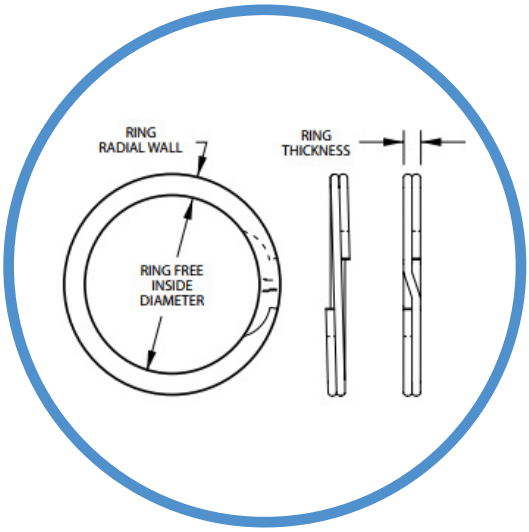
What is the upper limit for retaining ring thickness?

The limit on thickness is relative to the overall dimensions. Ring thickness can be customized to accommodate most applications by either varying material thickness and/or number of turns. A general Smalley guideline is a material thickness to radial wall ratio of 10:1. To determine the optimal ring thickness, we would like to understand the application. Smalley engineers are available to review your requirements.

How easily can you change the retaining ring wall size?

A custom ring can be easily tailored to your application if a larger radial wall is needed. This is because of our unique edgewinding process, which allows us to easily and economically modify ring properties without the need for additional tooling.

When changing the radial wall size, it is important to consider wire availability and the resulting installation stress of the ring. Typically, Smalley guidelines call for a radial wall to ring diameter ratio of 10:1. Rings with larger radial walls have higher installation stresses. If the installation stresses exceed the minimum tensile strength, permanent set may occur.



DESIGN

Assembly Considerations

I'm concerned about the ring scratching the assembly during installation.
Can Smalley manufacture different end configurations that would eliminate this from happening?

Smalley can manufacture rings with various end configurations to prevent scratching of the assembly during installation.

To name a few end types, radiused and deburred ends are two options that have worked for customers in the past. Radiused ends, pictured below, are rounded to prevents scratching, while deburring is a process that we use to smooth the sharp corners present on the gap ends of the ring.

I have a rotating assembly and am concerned about the ring coming off of my rotating shaft.
Can you advise me on this?

Any retaining ring operating on a rotating shaft is limited by centrifugal forces, including Smalley Retaining Rings. Failure happens when these centrifugal forces are great enough to expand and lift the retaining ring from the groove. With more and more applications requiring higher rotational capacities, Smalley has and continues to invest in ongoing research and development for this area.

For high RPM-based applications, please contact a TFC Smalley engineer to determine the maximum RPM of the ring you are using. A custom retaining ring, or possibly a self-locking ring, may be an option if your application requirements exceed the recommended rotational capacity of our standard ring.

DESIGN

Groove Interchangeability

Do Spirolox rings fit stamped ring grooves?

Yes, Spirolox rings are designed to fit into grooves for stamped or Truarc style snap rings without the downside of protruding "ears". Smalley has a published interchange listing to help you identify a Smalley ring replacement, or let us know the Truarc part number number you are using and we'll be happy to identify the appropriate ring for your application.

What is the difference between a Spirolox® retaining ring with an RR/RS part number and a Smalley WH/WS part number? Are they interchangeable?

RR/RS part numbers are interchangeable with WH/WS part numbers and have no dimensional differences between them. Reference our Interchange Table for a complete list of our interchangeable parts.

Table 2:

INTERCHANGE LISTING Smalley Spiral Retaining Rings

SMALLEY®	SPIROLOX SERIES	MILITARY MIL-DTL-27426	AERO-SPACE AS 3219	METRIC AERO-SPACE MA 4035	EUROPEAN SPECIFICATION DIN	WALDES TRUARC	EATON	INDUSTRIAL RETAINING RING	OTHER RINGS	ANDERTON
VH	UR	---	---	---	GROOVE INTERCHANGE ONLY Use a Smalley Retaining Ring to fit into the same groove of these stamped Retaining Rings (circlips).					
VS	US	---	---	---						
WH	RR	/3	AS 4299 AS 3217	---						
WS	RS	/1	AS 4299 AS 3218	---						
WHT	RRT	---	---	---	---	---	NAN	---	UHB	---
WST	RST	---	---	---	---	---	XAN	---	USC	---
WHM	RRN	/4	AS 4299 AS 3215	---	---	N5000 5008	IN	3000 4000	HO HOI UHO	N1300
WSM	RSN	/2	AS 4299 AS 3216	---	--	5100 5108	EN	3100 4100	SH SHI USH	N1400
DNH	---	---	---	---	DIN 472	---	---	---	DHO	D1300
DNS	---	---	---	---	DIN 471	---	---	---	DSH	D1400
EH	---	---	---	MA 4017	---	---	---	---	---	---
ES	---	---	---	MA 4016	---	---	---	---	---	---
FH	---	---	---	---	DIN 472	---	---	---	DHO	D1300
FS	---	---	---	---	DIN 471	---	---	---	DSH	D1400
XAH	---	---	---	---	---	---	NAN	---	UHB	---
XAS	---	---	---	---	---	---	XAN	---	USC	---
XDH	---	---	---	---	---	---	ND	---	HN	---
XDS	---	---	---	---	---	---	XD	---	SNL	---
XNH	---	---	---	---	---	---	IN	---	UHO	---
XNS	---	---	---	---	---	---	EN	---	USH	---

RETAINING RINGS VS. CIRCLIPS

Edgewinding Manufacturing Process

I read that Smalley coils its rings, and does not stamp them. What does this mean for me?

All Spirolox retaining rings are coiled using our unique edgewinding process. Edgewinding has been our trusted manufacturing process for over 50 years, providing precise yet flexible solutions to meet your retaining ring needs.

Round wire is first processed through our in-house rolling mill to a flat state. Then it is coiled on edge to form the ring. Edgewinding provides us the flexibility to have 6,000 standard parts broken up into 30 configurations.

Coiling our rings does not require dedicated punch and die tooling, which are necessary in traditional circlip manufacturing. This flexibility to modify part diameters without tooling replacement allows for improved confidence that our Smalley engineers can tailor a ring to meet even the most stringent application constraints.

What this means for you is quick, easy, and economical customization at any stage of the development process. If one of our standard rings does not meet your application requirements, a custom ring can be made with No-Tooling-Costs™.

Additionally, only the required flat wire material is coiled during edgewinding, which virtually eliminates material waste. When a stamped product is made, it is stamped from a piece of metal sheet, which in turn creates scrap from both inside and outside of the ring. In cases where a large diameter or an exotic material is required, the scrap cost increases drastically.

Edgewinding

Stamping

RETAINING RINGS VS. CIRCLIPS

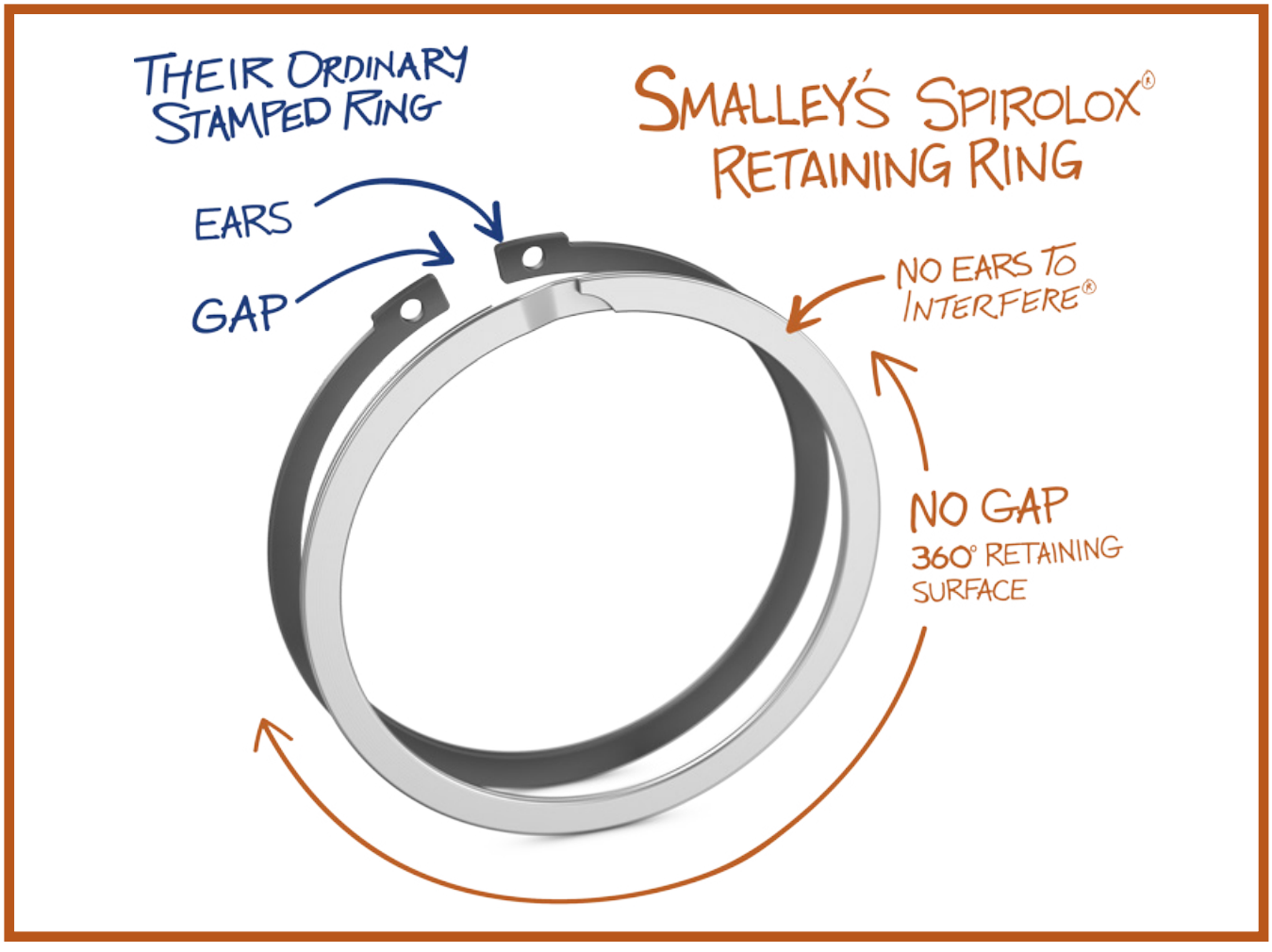
No Ears to Interfere®

I see that your retaining rings don't have traditional ears that I see on circlips- why is that?

Due to the edgewinding process, the Spirolox retaining ring's main advantage is in its unique configuration.

As you had mentioned, traditional circlips have "ears", also referred to as lugs. The ears take up additional radial space, which may cause an undesired interference with other components. Spirolox rings have No Ears to Interfere® by design, smoothly integrating into your assembly to retain mating components while maintaining a low radial profile.

Another advantage of no ears is that our rings have a uniform cross-section and no gap. Having a 360° retaining surface, Multiple-Turn Spirolox retaining rings provide even load distribution to securely hold mating components in place.



RETAINING RINGS VS. CIRCLIPS

No Special Tools for Installation and Removal

How do you install and remove Smalley retaining rings if they have no ears?

Our retaining rings have a removal notch, requiring no special tools to install or remove. For this reason, Spirolox retaining rings are safer and easier to install and remove in comparison to circlips.

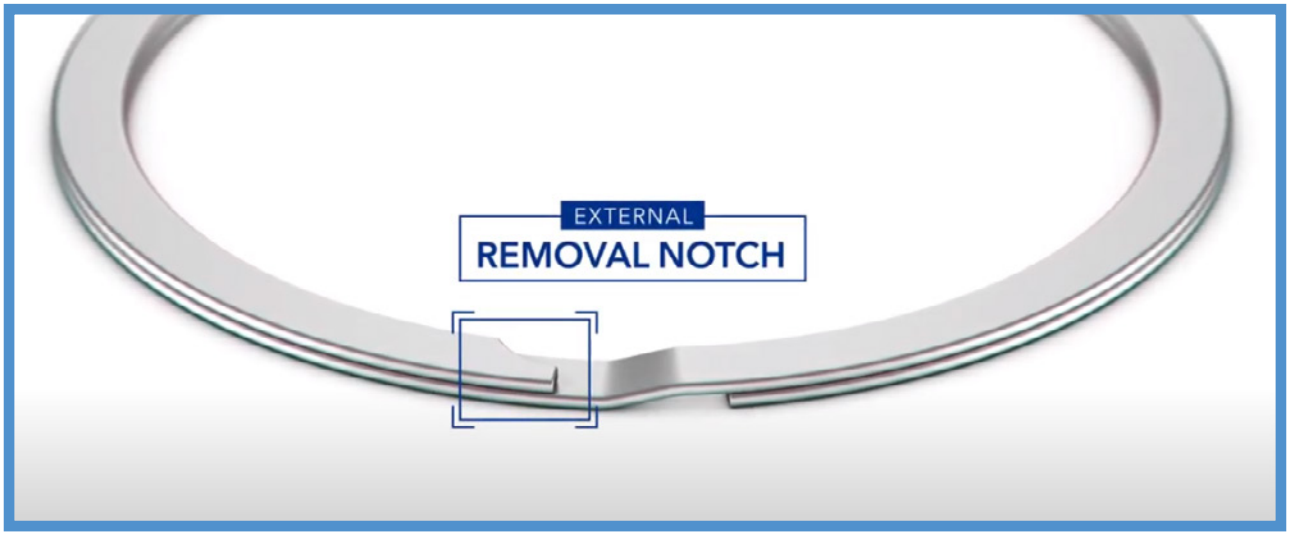
The typical installation process for circlips involves snap ring pliers. Snap ring pliers are inserted into the ears of the circlip, and the ring is then stretched over a shaft or compressed into a housing.

During installation and removal of a larger sized circlip, the risk of the ring flying off the pliers poses a safety hazard.

In contrast, Spirolox retaining rings can be installed by spiraling the ring into the groove by hand. This gives the operator more control of the ring, posing less of a safety risk.

Any flat-bladed tool such as a flathead screwdriver, or a staple remover can be used to spiral the ring up and out of the groove. Dental picks are another tool used for smaller retaining rings.

If you have a specific retaining ring in mind and are wondering what tool should be used, please contact Smalley Engineering.



INSTALLATION AND REMOVAL

How to Install and Remove Spirolox Retaining Rings

How do I install and remove a Spirolox Retaining Ring?

Smalley Retaining Rings are designed to be installed and removed by hand with no special tooling.

How to Install and Removal an Internal Retaining Ring

How to Install and Removal an External Retaining Ring

Semi-automated Assembly

Semi-automated assembly using a plunger and tapered plug or sleeve can also be achieved.
To learn more, view our Installation and Removal Guide, or contact a TFC Smalley engineer to discuss your installation and removal requirements.

INSTALLATION AND REMOVAL

Installation and Removal Tooling

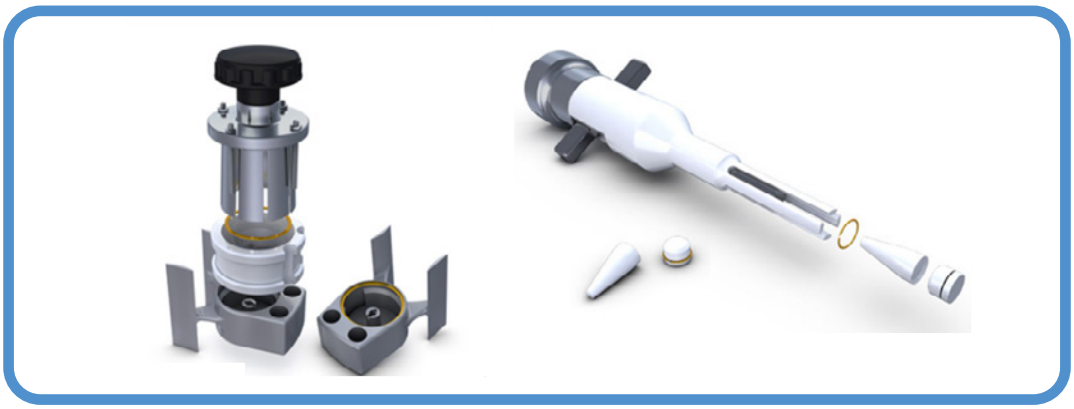
What tooling is available to aid in the installation of retaining rings?

Spirolox retaining rings are designed to be installed by hand, so no special tooling is required.

However, installation may not be so simple if you're using heavy-duty rings or have hard to reach grooves.

One solution is the combination of a plunger and either a tapered sleeve (for internal rings) or tapered plug (for external rings). These parts can be precisely manufactured to fit your application and smoothly integrated into a semi-automated assembly.

Smalley can recommend more tools and techniques to assist with rings that are more difficult to install. Take a look at our comprehensive Installation Tool Guide for more details.

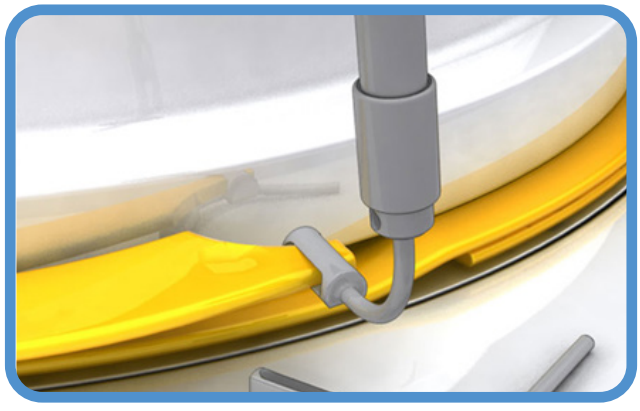


We know all applications may have unique requirements. If none of these solutions look like a good fit for you, contact TFC Smalley Engineering and we will help advise you on the right tool for the job.

We are using your part number WH-56-S02 and would like your recommendation for a removal tool that will not damage the retaining ring.

Smalley part number WH-56-S02 has a removal scallop on the end of the ring. To remove this ring, pry out the end using a small screwdriver, and then spiral the ring out by hand.

For larger size rings, Smalley also makes a removal tool, part number RT-108, that can be used to remove the rings. The end of the tool contains a slot to insert the tip of the removal notch. The ring can then be pulled out radially, then up for removal.



INSTALLATION AND REMOVAL

Installation Stress

I've had deformation issues in the past during installation of snap rings.
Is installation stress still a concern for Spirolox retaining rings?

Installation stress is a critical design parameter for any ring. As with any metal component, if the ring is stretched beyond the yield point of the material, it will plastically deform.

Deformation occurs when the installation stress exceeds the minimum tensile strength of the material. This varies whether the ring is an internal or external ring. For internal rings, 100% of the minimum tensile strength is allowed, while for external rings, only 80% of the minimum tensile is recommended.

Table 3:

Application	Percent of Minimum Tensile Strength
Shaft	80%
Housing	100%

Spirolox retaining rings could potentially be a good replacement for a snap ring if installation stress is a concern. Spirolox retaining rings may be easier to install in comparison to snap rings because they are "spiraled on", and not stretched over the entire shaft diameter with snap ring pliers. Because of the difference in installation methods, no unnecessary strain is put on the ring.

However, if the Spirolox retaining ring is stretched larger than what it was designed for, deformation may still occur. Our engineers are willing to work with you to determine if this could be an issue in your application. In cases where one of our standard rings does not fit your application requirements, our engineers can tailor a custom ring with No-Tooling-Costs™.

INSTALLATION AND REMOVAL

Expansion Limits

What are typical expansion limits for the installation of a two-turn spiral retaining ring over a tapered plug?

There are no "typical" expansion limits, because there are variables that affect the installation stress, as you can see in the formula below.

$$\text{External Ring Stress} = S_E = \frac{E\, b\, (D_S - D_I)}{(D_I + b)(D_S + b)}$$

$$\text{Internal Ring Stress} = S_C = \frac{E\, b\, (D_O - D_H)}{(D_O - b)(D_H - b)}$$

Nomenclature:

S_E = Stress due to expansion (psi)

S_C = Stress due to compression (psi)

E = Modulus of elasticity (psi)

b = Radial wall (in)

D_S = Shaft diameter (in)

D_H = Housing Diameter (in)

D_I = Free inside diameter, minimum (in)

D_O = Free outside diameter, maximum (in)

Ring material, wire cross-section, and ring diameter all impact the installation stress.

Our Retaining Ring Calculator can calculate the theoretical installation stress for you.

If the installation stress exceeds the minimum tensile strength, the ring may take a set and not properly cling to the groove. Please contact TFC Smalley Engineering to further discuss installation stresses.

INSTALLATION AND REMOVAL

Reusability

Can Smalley WHM series retaining rings be reused after they have been removed?

Smalley's Multiple-Turn Spirolox Retaining Rings are designed for high loads, yet are installed and removed easily because the ring thickness is distributed over multiple turns.

Depending on the installation method and installation stress, these rings can often be reused without any issues. If your application requires frequent installation and removal, it would be best to keep the installation stress low to minimize the need for replacement retaining rings.

Regardless, Spirolox Retaining Rings should always be carefully inspected prior to reinstallation. If the ring is damaged or deformed due to installation, usage, or removal, we recommend replacing it with a new one.

Please note that small rings without removal provisions are not reusable and will be destroyed during removal.

APPLICATIONS

Retaining Ring Selection Based on Type

What retaining ring should I choose based on my application?

We offer a variety of ring options, because we know every application is unique.

Assembly type, assembly size, thrust capacity, installation and removal methods, and environmental factors all play a role in determining which ring type will be selected.

With over 6,000 standard retaining rings broken down into 30 configurations, Smalley has plenty of ring types to suit anything from light to heavy-duty applications.

The table below is a general overview of the 5 main types of retaining rings we offer: Single-Turn Spirolox Retaining Rings, Multiple-Turn Spirolox Retaining Rings, Constant Section Rings, Hoopsters, and WaveRings.

Table 4:

Image					
Type	**Single-Turn Spirolox Retaining Ring**	**Multiple-Turn Spirolox Retaining Ring**	**Constant Section**	**Hoopster**	**WaveRing**
Description	Circular flat-wire ring with less than 1 revolution	Circular flat-wire ring with more than 1 revolution	Square edged ring with heavy cross-section	Thin walled ring for shallow grooves	Spiral retaining ring with an axial waveform
Force	Light-duty	Medium to heavy-duty	Medium to heavy-duty	Light-duty	Medium to heavy-duty
Can replace	E-clips	Snap ring/circlip	Eaton rings	Machined shoulder	Beveled/dished ring, ring & preload spring combination

For a more detailed explanation on selecting the right retaining ring for you application, download our Retaining Ring Selection Guide.

APPLICATIONS

Rotational-Dependent Applications

I have a high RPM application. Should I be concerned about my ring flying off?

Any retaining ring operating on a rotating shaft is limited by centrifugal forces, including Smalley Retaining Rings. Failure happens when these centrifugal forces are great enough to expand and lift the retaining ring from the groove. With more and more applications requiring higher rotational capacities, Smalley has and continues to invest in ongoing research and development for this area.

For high RPM-based applications, please contact a Smalley engineer to determine the maximum RPM of the ring you are using. A custom retaining ring, or possibly a self-locking ring, may be an option if your application requirements exceed the recommended rotational capacity of our standard ring.

What can Smalley do to improve performance in high RPM applications?

The rotational capacity is a function of several parameters, including thickness, radial wall, cling (interference fit of the ring in the groove), diameter, etc.

Quite often, the rotational capacity can be increased by increasing the radial wall dimension and/or the amount of cling in the groove.

If after investigating this, the rotational capacity is still not sufficient, then we can add a self-locking feature to the ring. The self-locking feature consists of a tab and a slot so that when the ring expands due to centrifugal force, it is restricted by the tab contacting the edge of the slot. For more information, visit our Rotational Capacity page and contact a Smalley engineer if RPM is critical in your application.

APPLICATIONS

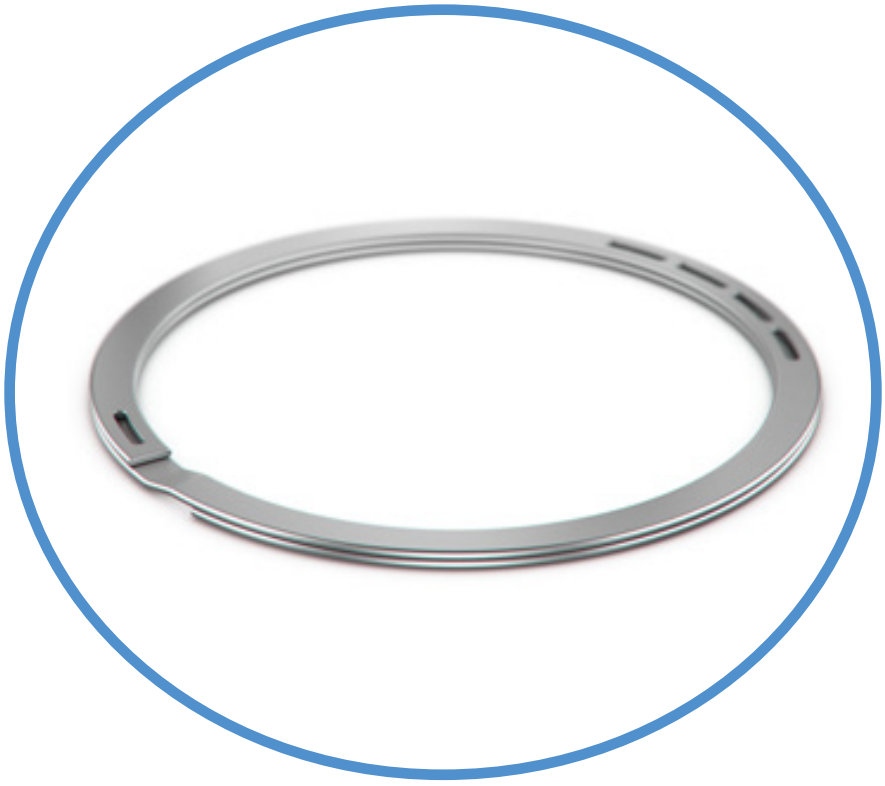
Balance-Critical Applications

The balance of the ring is a concern in my application. Do you offer rings that address residual imbalance?

To address residual imbalance, we offer a balanced ring design. Smalley's balance feature statically balances the retaining ring.

A series of slots, opposite of the gap end, are placed such that the ring's center of gravity is statically balanced along its axis of rotation. This characteristic is very useful when the balance of the assembly, such as a rotor, is critical.

Please contact Smalley Engineering to determine if a balanced ring is right for your application.



APPLICATIONS

Laminar Seal Rings

Can a Spirolox retaining ring function as a seal in my application?

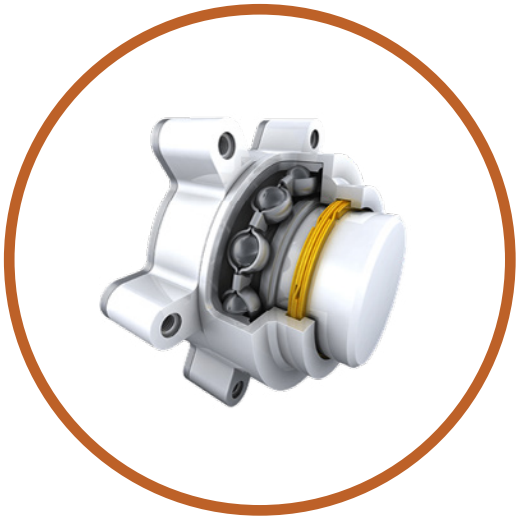
Spirolox retaining rings are not designed to be used as a seal. Smalley's Laminar Seal Rings, however, are designed to seal out contaminants, such as particles and debris.

Laminar Seal Rings consist of multiple, metal rings in a groove, oriented in a specific configuration to create a difficult path for contaminants to get through, known as a labyrinth. Because Laminar Seal Rings are made of metal, they are able to withstand high temperatures and corrosive environments.

A stronger "seal" can be created using different standard configurations we offer. Refer to our Laminar Seal Rings section for a complete list of Laminar Seal Ring configurations.

I'm working on a turbomachinery application and I am considering a Laminar Seal Ring to seal the shaft from debris. Will this work?

Smalley's Laminar Seal Rings are designed to seal out contaminants, such as small particles and debris in lubricants.



Oil and grease, for example, will be able to pass through the labyrinth, while small particles and debris will be blocked from passage, effectively sealing the assembly from contaminants.

Please note that Laminar Seal Rings are not designed to hold pressure across the seal.

Please contact Smalley Engineering to discuss your application in more detail.

APPLICATIONS

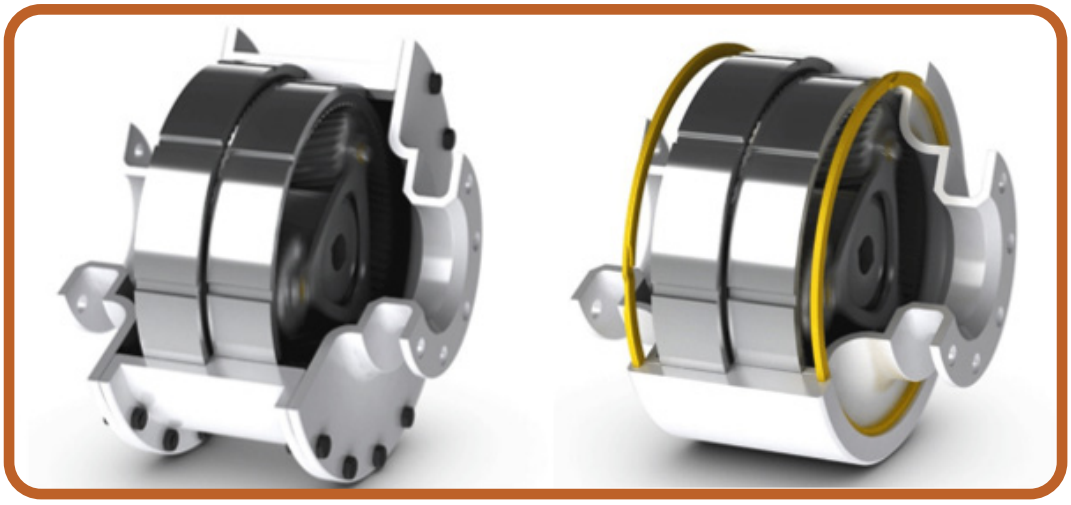
Bolt Replacement

Can I use a Spirolox retaining ring to replace bolts?

Bolts are a common fastener used to connect two or more components in an assembly. Although bolts can be used as an inexpensive method of assembly, Smalley Spirolox® Retaining Rings can be used as an alternative in some instances to reduce assembly time, weight, and machining costs. As an added benefit, Spirolox retaining rings provide a more aesthetically pleasing assembly.

Two dozen bolts were replaced with just two Spirolox Retaining Rings in the featured gear assembly application below. The gearbox design was slightly modified to add a groove for the retaining ring to operate in. The WHT series 3-turn ring specified for this application is capable of handling medium to heavy loads. Once installed, the ring retains the two components of the gear assembly together.

The redesigned assembly eliminated all bolts and nuts, which simplified the installation process. Unlike bolts, where each has to be screwed into the assembly, Spirolox retaining ring can be manually wound into the groove with no special tools. This is especially important in applications requiring larger diameter rings; traditional snap rings pose a safety risk during installation as they can fly off of the pliers and cause damage or injury.



APPLICATIONS

Automotive

Can a Spirolox retaining ring be used in a gearbox or transmission applications?

Spirolox retaining rings are the main retention method within assemblies to retain high speed rotating gears and bearings. These components are obviously critical to the function of the gearbox or transmission.

With the technological advances of electric cars, the electric motors used to power the wheels are subjects to rapid acceleration, vibration, and, of course, high RPMs. Such applications can often exceed the rotational capacity for many retaining rings, and if a ring slips out of place, the entire assembly can fail, causing serious damage. Smalley has and continues to invest in ongoing research and development for this area.

Any retaining ring operating on a rotating shaft is limited by centrifugal forces, including Smalley retaining rings. Failure happens when these centrifugal forces are great enough to expand and lift the retaining ring from the groove.

A custom retaining ring, or possibly a self-locking ring, may be an option if your application requirements exceed the recommended rotational capacity of our standard ring.

The self-locking feature consists of a tab and a slot that interlock to prevent the ring from expanding. The tab lines up with a slot on the mating turn such that when the ring is installed into the groove, the tab seats inside the slot.

This feature allows the ring to function properly at speeds far exceeding the rotational capacity of a standard retaining ring. The self-locking feature makes it possible for the ring to operate at high speeds, withstand vibration, function under rapid acceleration and absorb a degree of impact loading.

If rotational capacity is critical in your application, please contact Smalley Design or Application Engineer.

APPLICATIONS

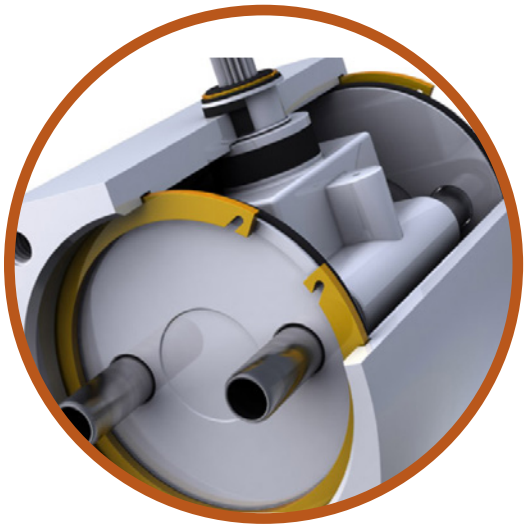
The Louvre

Smalley has supplied and specified parts for tens of thousands of applications. One of the most exciting has been the Louvre Pyramid. Designed by I.M. Pei to welcome visitors to the prestigious museum in Paris, France, the pyramid is built of glass panes held together by a supporting frame consisting of stainless steel rods. These rods are connected at strategically placed junctures, and each juncture consists of a knuckle and 16 of our two-turn Spirolox rings. The custom design was produced in stainless steel so protect the structure against corrosion. Our rings were not only specified because of their superior durability, but also because they maintained the aesthetic beauty of the structure.

APPLICATIONS

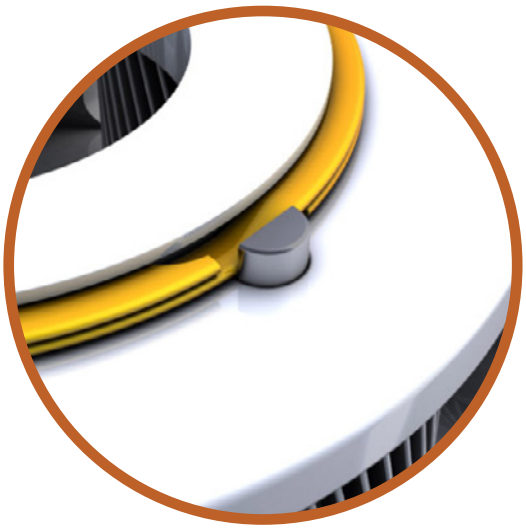
Industry Examples

What kind of unique applications are retaining rings used in?



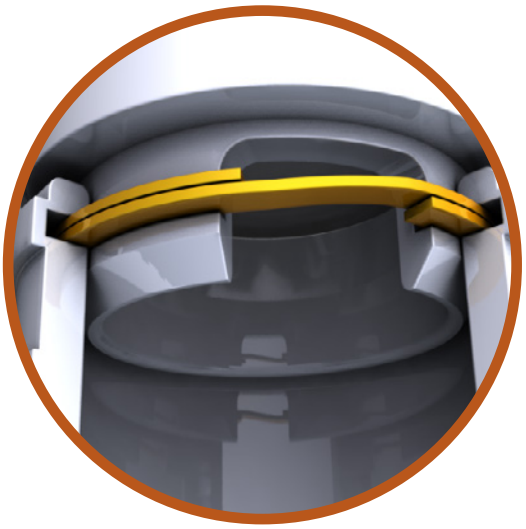
Actuator Valve

A heavy-duty constant section ring was installed to absorb the occasional shock loading of the pistons. The rings feature special ends allowing for easy installation and removal using compatible tools and have a profile designed for high thrust capacity.



Gear Assembly

An external, 2-turn, retaining ring prevents the pinion shafts from rotating with the gears. The Spirolox Retaining Ring snaps securely on the groove while maintaining room to be installed.



Hose Connector

A 2-turn retaining ring is located in a shallow internal groove to secure two rotating parts. Due to the limited area for the ring, Smalley opted to square the edges of the ring creating a more efficient use of area. The two units are able to rotate about the retaining ring independently of one another.

For a more application examples, visit our Applications page.

Ask TFC about Smalley.

For over 50 years, Smalley has been the world leader in the manufacturing and development of precision retaining rings and wave springs.

TFC is the exclusive distributor of Smalley products in the United Kingdom. Working with a wide range of industry including oil & gas, automotive, EV, electronics, medical,and industrial.

While all Smalley manufacturing is in their U.S. based 300,000 ft2 facility, TFC UK regional network of offices and technical design engineers allows you to quickly receive parts and support.

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enquiries@tfc.eu.com