Company Overview

ROTOR CLIP®

Designed for Quality

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Rotor Clip - Designed for Quality

Made in the USA - Made in EU - Trusted Everywhere since 1957

Rotor Clip is the only manufacturer that produces a full line of inch, DIN, ANSI metric and JIS retaining rings to global standards, as well as a complete line of constant section rings, spiral retaining rings, wave springs, and self-compensating hose clamps. There are over 50 different styles and over 1000 part numbers to fit virtually every application. And if our stock items aren't the right fit, we are happy to work with our customers to create custom parts for a wide range of application needs.

Delivering quality products should always be a manufacturer's top priority, especially if the end product is in safety critical applications. Rotor Clip continues to support the ever-increasing quality demands for both retaining rings and wave springs that meet the performance goals of application reliability every day, supporting a diverse range of industries, including: automotive, aerospace, defense, energy, industrial, and medical device industries.

Many other manufacturers rely on third party companies for the tooling and processing of their product. However, this can lead to an inferior product because of lack of knowledge and extended lead times due the dependence on another company's capacity. Here at Rotor Clip we rely on our in-house quality and metrology labs in conjunction with our vertically integrated manufacturing process - ranging from wire rolling, to tool making, to heat treating, to finishing and packaging - allowing for tight process quality controls and process optimizations.

The results are quality products for our customers. Rotor Clip holds several quality awards from major global OEMs and is certified to IATF 16949, ISO 9001, ISO 14001, and AS9100. Naturally, this level of quality extends to Rotor Clip products sold by our RotorExpress® distribution partners.

Over 60 Years of Global Excellence

In 1957, Rotor Clip Company was founded by Robert Slass in Farmingdale, NY in a 2,000 square foot building.

Today, Robert's sons Jonathan and Craig own and operate the company headquartered in Somerset, NJ. The 238,000 square foot facility in Somerset is a world leader in the manufacture of tapered, constant section ring, spiral retaining rings, wave springs, and self-compensating hose clamps. These are all produced in a lean environment dedicated to eliminating waste and ensuring quality through IATF 16949, ISO 9001, ISO 14001, and AS9100 registration.

Rotor Clip is now a global entity with an additional manufacturing, warehouse, and distribution facility in the Czech Republic, a warehouse and distribution center in the United Kingdom, as well as additional field offices in Germany and China for local, hands-on sales, engineering support and customer service.

Distribution partnerships have been established throughout the world for quick and easy distribution of our products - as we know how crucial our parts may be for your production lines. Turn to page 40 to learn more about our RotorExpress partnerships.

Aerial view of Rotor Clip Company, Inc.
Somerset, NJ

Production Facilities

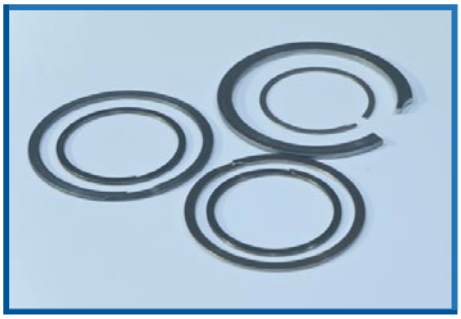
Tens of Thousands of Stock Items Available

TAPERED SECTION RETAINING RINGS
Axially Assembled:
- Axially installed into machined grooves in housings/bores (internal) or on shafts (external)
- Have lug holes for ease of installation and removal
- Make uniform contact when released in a groove
- Can accommodate higher thrust loadings

TAPERED SECTION RETAINING RINGS
Radially Assembled:
- Radially installed into machined grooves on shafts (external)
- Accommodate lower thrust loadings than axial retaining rings
- Do not have lug holes: Easy to install using retaining ring applicators
- Provide protruding "shoulders" for effective retention of assemblies
- Economical alternative to axially assembled external tapered section rings

TAPERED SECTION RETAINING RINGS
Self Locking:
- Can be installed on a shaft or in a housing/bore without a groove
- Save on machining time and costs since no groove is needed
- Can be used effectively and economically on small applications
- Accommodate low thrust loadings
- Difficult to remove once installed

CONSTANT SECTION RETAINING RINGS:
- Axially installed into machined grooves in housings/bores (internal) or on shafts (external)
- Offer more clearance that a tapered section ring
- Accommodate less force than a tapered section ring
- Uniform material width is elliptical when installed in a groove, making 3 point contact
- More difficult to install/remove
- Economical alternative to tapered section rings depending on the application



SPIRAL RETAINING RINGS:
- Axially installed into machined grooves in housings/bores (internal) or on shafts (external)
- Make 360° contact with a groove in a housing/bore or shaft
- Offer more clearance than a tapered section ring
- More difficult to install/remove

FLAT WIRE WAVE SPRINGS
- Single turn or multi-turn available
- Space saving in axial direction up to 50% of the operating height could be reduced
- Low load tolerance at specified work heights
- Unlimited range of forces could be created using the factors of wire size, wire form shape, number of turns, turn configuration, or number of waves.

Download Our Full Catalog

...And Custom Sizes and Parts on Request!

Quality Standards

Rotor Clip is certified and registered to **IATF 16949, ISO 9001, AS9100 & ISO 14001**. Under these guidelines, every department at Rotor Clip frequently conducts value stream meetings to evaluate operational goals in order to measure efficiency and effectiveness of our manufacturing processes.

This goal-driven philosophy results in cost reduction opportunities that are passed along to our customers. Rotor Clip takes quality to a new level by helping customers achieve more than acceptable quality standards.

IATF 16949

This certification guarantees that Rotor Clip has development a quality management system for continual improvement, defect prevention, and waste reduction in the automotive industry supply chain.

AS9100/ISO 9001

This certifies that Rotor Clip's products are developed and produced per aviation, space and defense industry requirements, including clauses on quality and safety

ISO 9001 - ANSI/ISO/ASQ Q9001

This certification guarantees quality management principles are implemented in Rotor Clip's manufacturing process, including Customer Focus, Leadership, Process Efficiencies, and Continual Improvement.

ISO 14001

This certification guarantees that Rotor Clip meets core Environmental Management standards reducing our environmental impacts and waste production. More information on our environmental commitments can be found on the following page.

Rotor Clip Quality Policy:

Considering the Context of the Organization and strategic guidance provided by management, The Company understands individual customer, statutory and regulatory requirements and ensures they are met through implementation of an integrated Management System.

The effectiveness of the Management System is continually improved using objectives, and our performance against them. Look for ways to improve and exceed customer expectations.

The Company plans, implements and controls the quality of the products with special characteristics to assure the delivery of fault-free products.

Environmental Commitment

"We will aggressively pursue pollution prevention and waste reduction; encourage reuse and recycling; conserve natural resources; proactively reduce injuries and illnesses related to environmental aspects and incorporate state-of-the-art EHS [Environmental, Health, and Safety] practices into our operations and throughout the life cycle of our products and services."

– Excerpt from Rotor Clip's Environmental Policy Manual

Solar-Powered – In 2018, we worked on our largest environmental investment yet. We constructed our solar field that has a 4 MW capacity, allowing us to be 75% operational on solar power.

In-House Water Treatment Facility – We've overhauled our in-house water treatment facility in late 2017, with larger processing capacity and the ability to achieve even tighter tolerances of water quality output, outpacing state and federal regulations.

Green Chemicals – We've introduced several environmentally friendly options, including the use of only water-based environmentally benign substances and giving our customers the option of trivalent over hexavalent chromium.

Commitment to Clean Air – We regulate emissions into the atmosphere from our furnaces and air conditioners through state-of-the-art air processing and filtration equipment.

Good Housekeeping – We keep our grounds clean and regularly clear any debris so that such items or chemicals will not find their way into nearby storm drains and water streams.

Energy Efficiencies – We are continually optimizing the production floor for ways to reduce various energy and natural resource demands, and have recently completed significant capital investments in furnace recuperators, to reduce our energy usage even further.

Internal Oil Recycling – We collect, filter, and reuse all of our oils and lubricants in order to reduce waste and slash consumption.

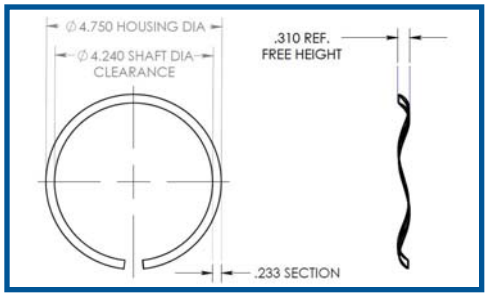
Facility-Wide Recycling Plan – Our Headquarters has set a standard of recycling at least 80% by volume all waste and outputs. This is done through training, accessibility of recycling facilities, tracking of all outputs, and continual optimization.

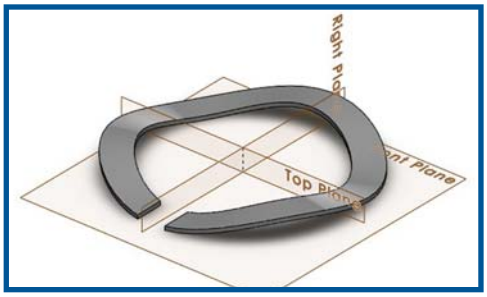
Standardized Environmental Policy – In order to meet customer standards, we comply with ISO 14001 which requires Rotor Clip to maintain a stringent environmental policy that must prevent pollution, continuously improve our Environmental Management System (EMS), avoid personal exposures and injuries from hazardous conditions and materials, minimize resource consumption, provide a commitment to comply with environmental legislation and regulations in our community, and encourage others to follow and practice good environmental practices.

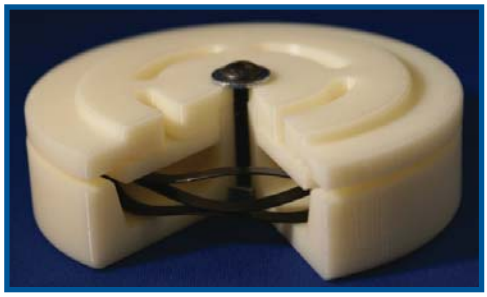
Our solar field is constructed to generate the capacity to power up to 75% of the Somerset, NJ headquarters' manufacturing energy needs.

Total Engineering Support

Rotor Clip offers choice, and provides solutions. We employ a large and dedicated Engineering team in order to partner with our customers to ensure that we understand your application requirements and constraints, as well as to make certain that Rotor Clip continues innovating.







Design Engineering Partnership: The parameters of an application should determine which retaining ring, wave spring or hose clamp is ideal to use, and this will vary from assembly to assembly. Selecting the correct type of fastener based on variables such as installation or removal requirements, anticipated thrust load, and end play take-up can ensure that your choice will perform reliably, while staying on-time and on budget.

Our team of technical engineers and designers will partner with you from Day One to ensure you are using the optimal parts, materials, and finishes to ensure you are maximizing outputs and efficiency, while maintaining your bottom line.

Open Door Policy: We can produce samples and prototypes to make sure that your application is running at 100% capacity and to the exact demands that you will require. And because our entire manufacturing process is conducted in-house, we are able to make any changes and incorporate any feedback instantaneously. Our production floor is always open for you to come and visit to inspect your part's manufacturing process and conditions to ensure we match your quality needs.

Speak to an engineer

In-House Testing and Metrology: We have a large on-site lab and testing facility dedicated to consistent product testing and ensuring constant quality on every part and product manufactured in our facilities. This means that our testing results and ultimately our product performance in the real world will always be reliable and consistent. Have a unique application requirement? We'd be happy to work with you, whether it means creating a 3D printed model of your application or testing our products in extreme conditions to make sure that you end up completely satisfied and with peace of mind.

Certifications and Proof: We have the ability to produce a number of various certificates and documents on demand for you, including:

- Certificates of Conformance
- Certificates of Origin
- DFARS Certificates
- Heat Treat Certificates
- PPAP Warrants and Levels 1-5
- RoHS and REACH Certificates

Customer Service, Stock and Supply: You will have a dedicated sales and customer service representative that will be with you to build a long lasting relationship. You can set up auto-shipments or our inventory system can remind you when it may be time to reorder your products.

Our Expertise: Customization

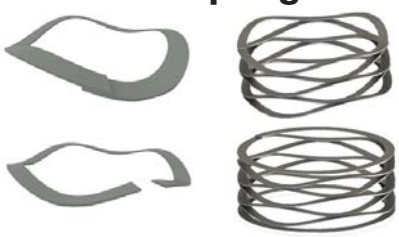
You may not need a lot of support if you are just ordering the standard part number with the same supplier over and over again, but what happens if you need help identifying the right retaining ring solution, have specific product certification demands, or require proper installation advice?

Here at Rotor Clip, you can be certain that you will always get the assistance and answers that you seek before, during, and after you purchase from us. We have a dedicated and highly trained team of professionals to help you get the answers you seek.

From pricing, lead times, logistics to part specs, application design assistance, and feasibility studies; our team has the answers.

We will be able to explain to you the suitability of one of our standard parts for your application or the characteristics of a custom designed part, if needed. We offer a wide range of custom retaining ring and wave spring options, and can work with you to determine prototyping and testing models to ensure we are developing a part to your exact requirements.

Customization Ranges for our line of products:

	Outer Diameter Size Range (mm)	Outer Diameter Size Range (inch)	Customization Options
Tapered Section Rings 	2-1000mm	.079-39.37”	• Load and Rotational Capacity • Tolerance • Thickness • Profile Modifcations • Materials and Finishes • Quality Assurances/Certifications
Constant Section Rings 	10-1000mm	.39-39.37”	• Load and Rotational Capacity • Tolerance • End Configurations • Radial Wall Thickness • Materials and Finishes • Quality Assurance/Certifications
Spiral Rings 	3-635mm	.188-25”	• Load and Rotational Capacity • Tolerance • Wire Thickness and Shape • Coiling Direction • Materials and Finishes • Quality Assurances/Certifications
Wave Springs 	3-635mm	.118-25”	• Spring Force and Work Height • Cycle Life • Nested Coiling • Shimmed or Flat End • Wire Thickness and Shape • Coiling Direction • Materials and Finishes • Quality Assurances/Certifications

Industries We Serve

Vertical Manufacturing

We Engineer It

It all begins with engineering, the skilled translation of your needs into accurate, concise language. Our engineers do more than execute drawings: They analyze engineering problems to find solutions and produce designs that stress efficiency and maximize yield of products.

Our engineers design the tooling for every part Rotor Clip produces. Their techniques ensure a steady flow of types and sizes of product to meet the demands of our customers.

We Build and Tool It

Nowhere in the industry is there a more sophisticated tool room for building high speed, progressive dies than at Rotor Clip. All personnel follow IATF 16949 guidelines for building new tools and repairing existing ones. An ample supply of spare parts assures maximum uptime. Prompt maintenance allows for long production runs.

We Stamp It

Our press room has some of the most modern presses in the industry, modified to conform to our requirements for speed and performance. Many of these presses stamp rings at the rate of up to 1,000 strokes per minute, while producing several rings with each stroke of the press.

We Manufacture Raw Material

Rotor Clip's factory boasts an in-house raw material production facility, which yields more than 4,500 tons of wire making per year. This enables quicker reaction time to material requirements of customers and allows for faster response in quality or material issues. And of course, lower production costs which are passed down to our customers.

We Form and Cut It

Rotor Clip produces larger retaining rings from wire to increase efficiency and reduce costs by eliminating waste. We are the leaders in this technology with modern wire-forming machinery engineered to meet our exacting standards of production. For prototype samples or small quantities of retaining rings where no tool exists, Rotor Clip can laser cut your requirements quickly and effectively.

We Heat Treat It

All Rotor Clip carbon steel retaining rings and hose clamps are heat treated using the austempering method. Parts are heated in one of six specially built in-house furnaces and special care is taken to feed rings into the furnace at the proper rate. A computer automatically regulates the number of parts moving through the furnace in a given time frame.

We Certify It

Rotor Clip meets European Union requirements for alternatives to hexavalent chrome coatings with Trivalent Zinc plus sealer (Z3X). This affords nearly comparable salt spray protection to the hexavalent-based coatings.

Rotor Clip military retaining rings made of specialty metals (stainless steel) comply with DFARS 252.225-7014 (Defense Federal Acquisition Regulation Supplement), "Preference for Domestic Speciality Metals" which is part of the "Buy American" Act. We offer Military and RoHS certification free of charge, so you can be sure our products meet your quality demands.

We Finish It

The standard finish for retaining rings is Phosphate (PA) coating or Phosphate and Oil (PD), depending on the part number. (PD offers eight hours of salt spray protection.) Both are available at NO EXTRA CHARGE. Our phosphate coating is top of line in the industry because we work directly with our Phosphate supplier to produce a reliable phosphate that produces an excellent crystal upon application. Heavy Phosphate and Oil (HPD), provides 72 hours of salt spray protection. We also still offer hexavalent chrome finishes including Zinc Dichromate (ZD), Zinc Dichromate with sealer (ZDL), Heavy Zinc Dichromate with sealer (HZDL), and Zinc Bright (ZF). All of our zinc coatings are applied using a mechanical plating process, which eliminates hydrogen embrittlement.

Choosing a Retaining Ring Solution

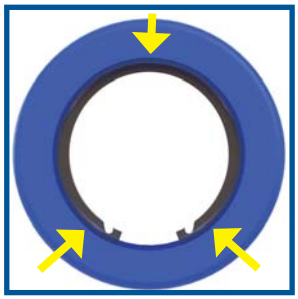
We offer Choice: We provide solutions. No one retaining ring style is "better" than another. Rather, the parameters of an application actually determine which retaining ring is best to use, and this can vary from assembly to assembly. Selecting the correct type of retaining ring based on variables such as installation/removal requirements, anticipated thrust load, and end play take-up can ensure the retaining ring you choose will perform reliably, while significantly reducing fastener costs.

There are three main types of retaining rings available to the designer: **tapered, constant section and spiral**. These are typically made from carbon steel, stainless steel or beryllium copper and feature a variety of finishes for corrosion protection. Below and in the following pages will help you understand what you need to take into consideration when choosing a ring.

TAPERED SECTION

Tapered section rings make uniform contact with the groove, with a gap between the lug.

See more on page 14-19



CONSTANT SECTION

Constant section rings are elliptical when installed in the groove, making only 3-point contact as illustrated.

See more on page 20-21

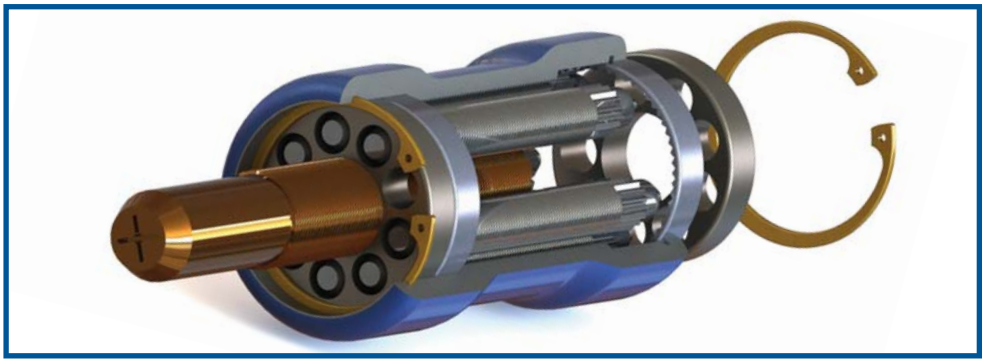
SPIRAL RINGS

Spiral rings make 360° contact with the groove in a housing/bore or a shaft.

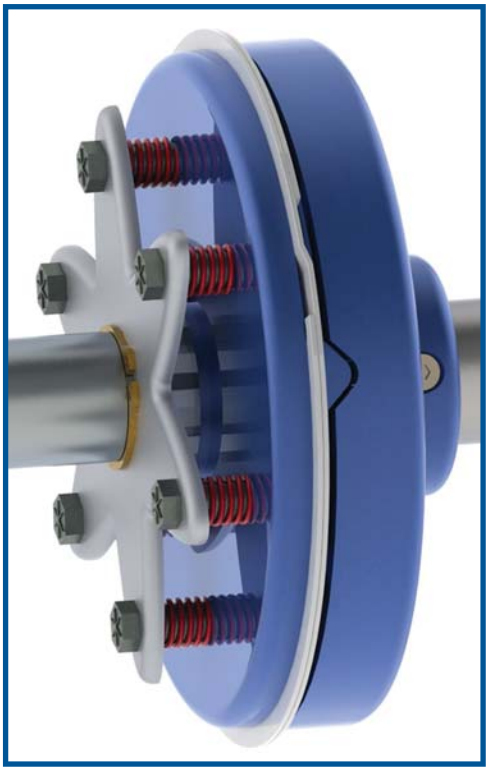
See more on page 28-30

Download the Whitepaper

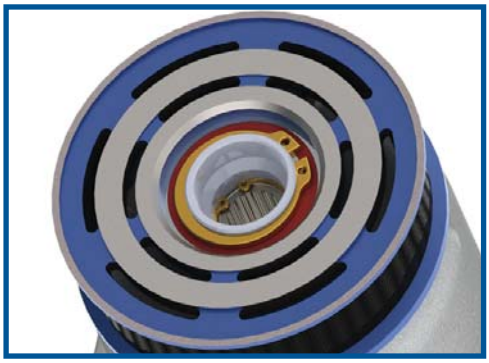
Retaining Ring Applications



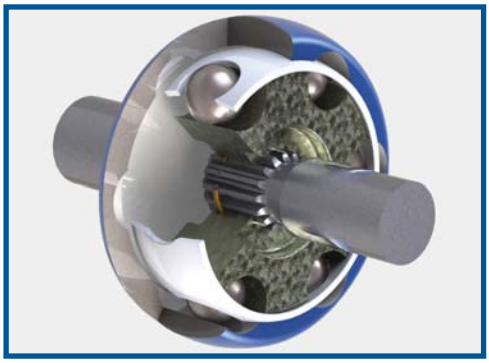
Linear Worm Drive Acutator



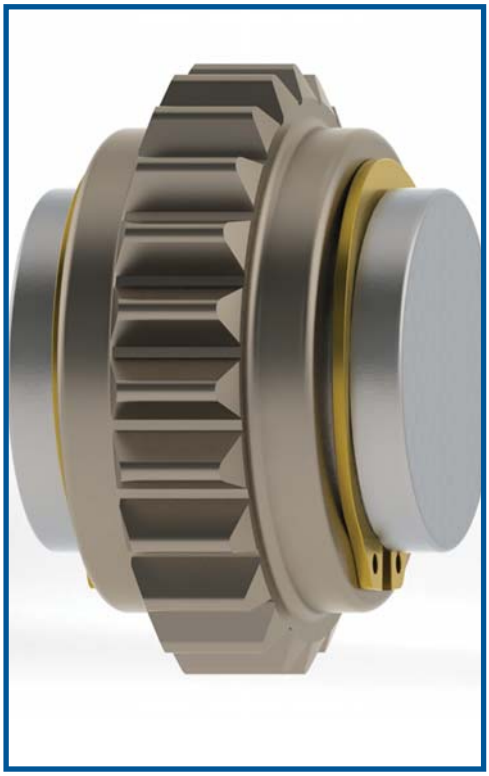
Magnetic Detection Slip Clutch



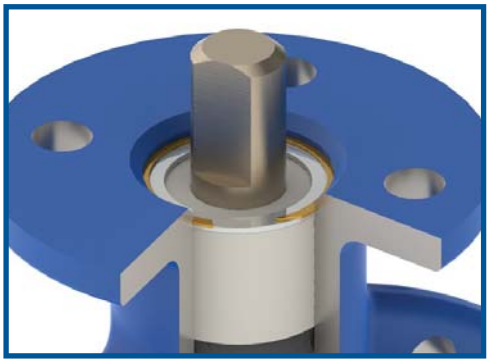
Automotive Pulley



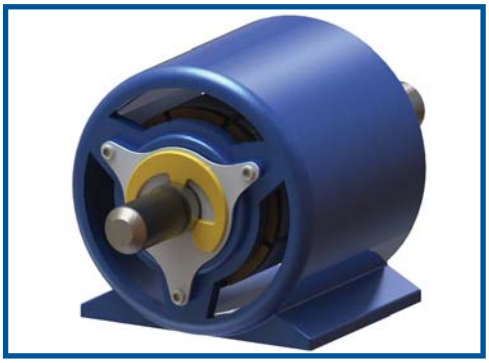
CV Joint Coupling



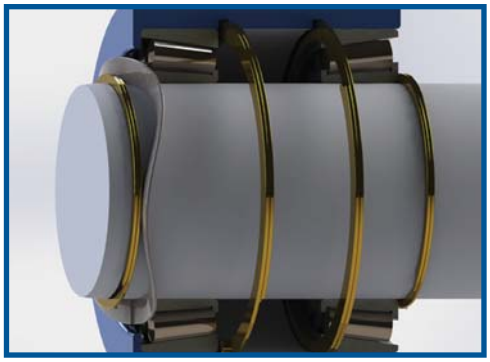
Gear End-Play Takeup



Butterfly Valve



Starter Motor



Bearing Retention

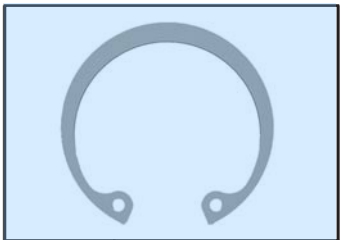
Rocker Arm

Inch Tapered Section Retaining Rings

Axially Assembled

Axial retaining rings are designed for axial installation into machined grooves. These rings are either internal for installation in housings and bores, or external for assembly on shafts. Once installed, they provide a protrusion or “shoulder” for retaining parts.

Axially Installed

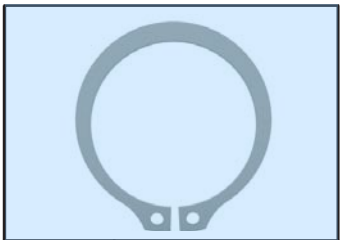


HO Internal Housing Ring

Once installed in the groove of a housing/bore, the portion of the ring protruding from the groove (shoulder) securely holds an assembly in place.

HOI Internal Housing Inverted Ring

Functions like a HO ring in a housing/bore, only the lugs are reversed, providing more clearance if needed in an application.



SH External Shaft Ring

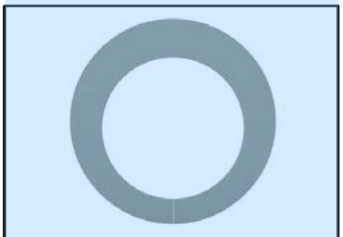
Once installed in the groove of a shaft, the portion of the ring protruding from the groove (shoulder) securely holds an assembly in place.

SHI External Shaft Inverted Ring

Functions like an SH ring on a shaft, only the lugs are “reversed,” providing more clearance if needed.

SHR External Shaft Reinforced Ring

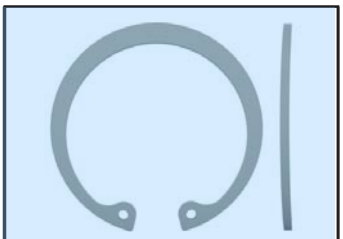
The SHR is an extra thick version of a regular SH retaining ring. As such, it is stronger and can withstand greater thrust loads than its standard counterpart.



SHM External Shaft Tamper-Proof Ring

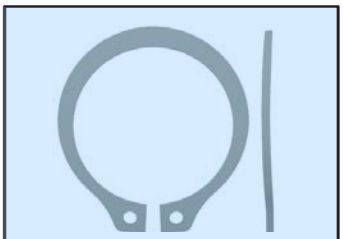
Tamper proof ring which does not have any lugs and can not be easily removed once installed.

RINGS FOR END-PLAY TAKEUP:



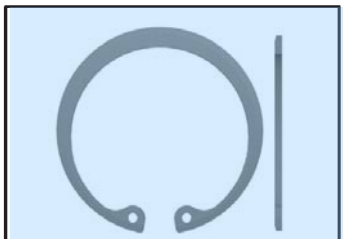
BHO Internal Bowed Housing Ring

Once snapped into the groove, bowed rings exert a force or preload on the retained parts, compensating for accumulated tolerances in a housing/bore.



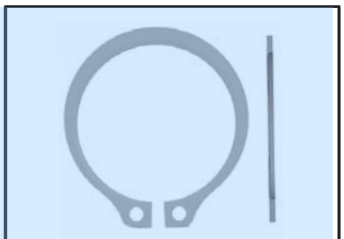
BSH External Bowed Shaft Ring

Once snapped into the groove, bowed rings exert a force or preload on the retained parts, compensating for accumulated tolerances on a shaft.



VHO Internal Beveled Housing Ring

These rings have a 15° angle on the outer edge, and when combined with a complementary groove angle, eliminate end-play by wedging between the groove and the retained part.



VSH External Beveled Shaft Ring

These rings have a 15° angle on the outer edge, and when combined with a complementary groove angle, eliminate end-play by wedging between the groove and the retained part.

Inch Tapered Section Retaining Rings

Radially Assembled

Radial retaining rings are radially installed into machined grooves on shafts. They don't have lugs or lug holes and do not extend as far around the circumference of the grooves as their axial counterparts. Consequently, they can accommodate applications with lower thrust loadings than those retained by axial retaining rings. They can be installed quickly using Rotor Clip applicators and dispensers.

E External E Ring

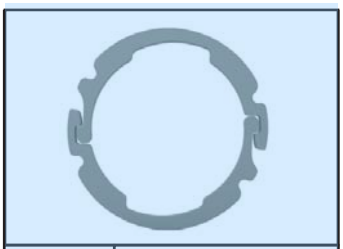
Three prongs make contact with the bottom of the groove and provide a shoulder for effective retention of assemblies.

RE External Reinforced E Ring

A reinforced version of the E ring, which will accommodate higher thrust loadings and RPM. RE rings function in the same groove as regular E rings.

C External Crescent Ring

Ideal for low clearance applications where radial installation is preferred.



LC External Interlocking Ring

The ends interlock into a groove on a shaft and, once assembled, are dynamically balanced. Effective in extremely high rotational speed applications.

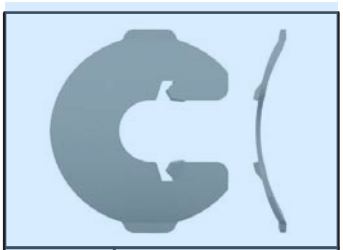
PO POL External Poodle Ring / Light Ring

Featuring wide ears (resembling those of a poodle dog) which offer extra retention surface against the retained parts. Also available in thinner sizes (POL).

RINGS FOR END-PLAY TAKEUP:

BE External Bowed E Ring

Once snapped into the groove, bowed rings exert a force or preload on the retained parts, compensating for accumulated tolerances on a shaft.



EL External Bowed Locking Ring

The bowed design eliminates end-play in an assembly, while featuring two prongs that extend from the inner circumference to the open end locking the ring firmly in place

Radially Installed

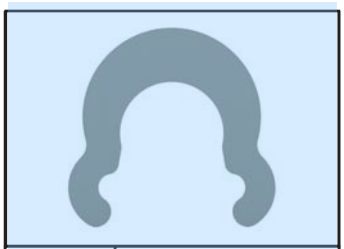
Inch Tapered Section Retaining Rings

Self-Locking

Self-locking retaining rings can be installed on a shaft or in a housing/bore without using a groove. They save machining time and overall costs since a groove is not needed for installation. They also come in small sizes (some fitting shafts as small as .058" in diameter) and can be used effectively and economically on small applications with very low thrust loadings.

SHF External Shaft Friction Ring

The design of the ring causes it to exert significant gripping power uniformly on the shaft (except where the gap occurs) without a groove.

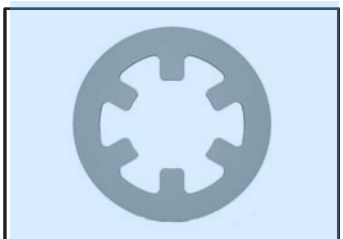


RG External Radial Grip Ring

This radially installed ring makes its own groove on a soft shaft, increasing its holding power significantly. Install directly against the face of the retained part, virtually eliminating end-play.

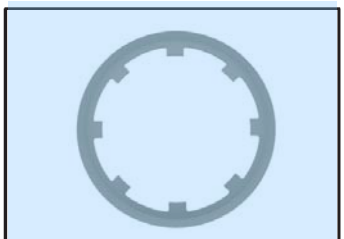
TI Internal Toothed Push-On Ring

This ring features a series of prongs protruding outward. The ends create interference with the housing when the ring is installed and a load introduced to the other side.



TY External Toothed Push-On Flat Ring

This ring features a flat outer rim with a series of prongs protruding into the center. The ends create interference with the shaft when the ring is installed and a load introduced to the other side.



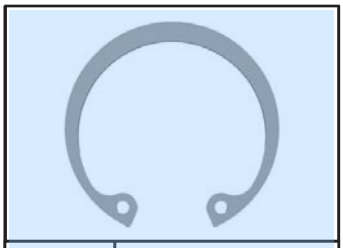
TX External Toothed Push-On Ring

Similar to the TY Toothed External Push On Ring, the outer rim of the TX is curved, affording greater thrust load capacity and easier assembly orientation.

DIN Tapered Section Retaining Rings

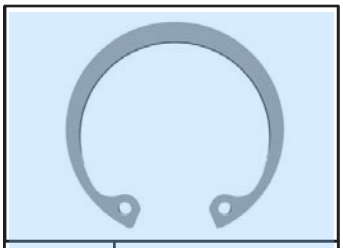
INTERNAL:

Axially Assembled



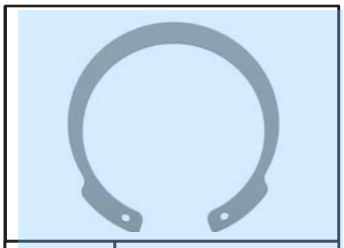
DHO Internal DIN Housing Ring

DIN 472
Once installed in the groove of a housing/bore, the portion of the ring protruding from the groove (shoulder) securely holds an assembly in place.



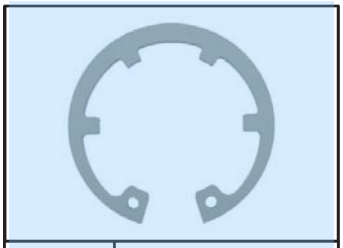
DHR Internal DIN Housing Reinforced Ring

DIN 472 Heavy Type
The DHR is an extra thick version of a regular DHO retaining ring. As such, it is stronger and can withstand greater thrust loads than its standard counterpart.



DHI Internal DIN Housing Inverted Ring

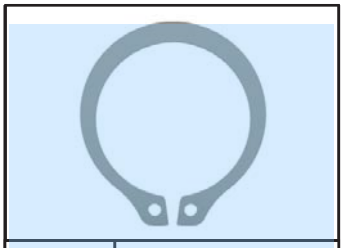
Functions like a DHO ring in a housing/bore, only the lugs are reversed, providing more clearance if needed in an application.



DHT Internal DIN Housing Teeth Ring

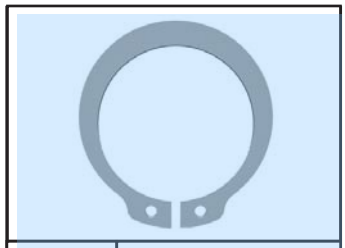
DIN 984
This ring features several teeth equally distributed along the inner circumference of the ring. Particularly effective in retaining applications with large radii or chamfers.

EXTERNAL:



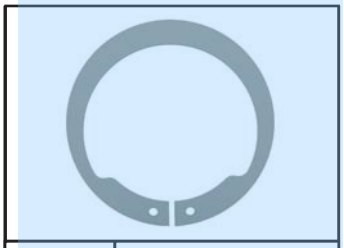
DSH External DIN Shaft Ring

DIN 471
Once installed in the groove of a shaft, the portion of the ring protruding from the groove (shoulder) securely holds an assembly in place.



DSR External DIN Shaft Reinforced Ring

DIN 471 Heavy Type
The DSR is an extra thick version of a regular DSH retaining ring. As such, it is stronger and can withstand greater thrust loads than its standard counterpart.



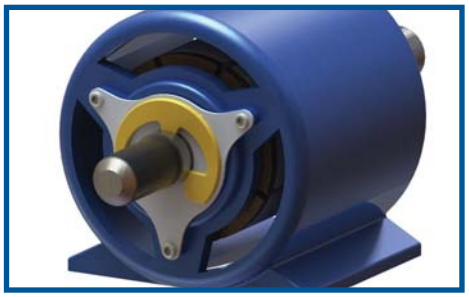
DSI External DIN Shaft Inverted Ring

Functions like an DSH ring on a shaft, only the lugs are "reversed," providing more clearance if needed.

DST External DIN Shaft Teeth Ring

DIN 983
This ring features several teeth equally distributed along the outer circumference of the ring. Particularly effective in retaining applications with large radii or chamfers.

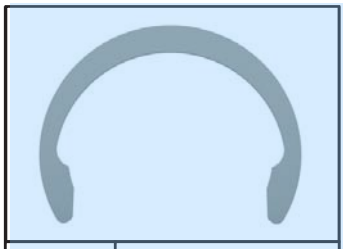
DIN Tapered Section Retaining Rings



Radially Assembled

DE External DIN E Ring

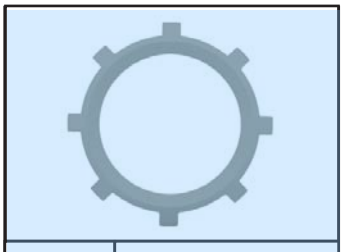
DIN 6799
Three prongs make contact with the bottom of the groove and provide a shoulder for effective retention of assemblies.



DC External DIN Crescent Ring

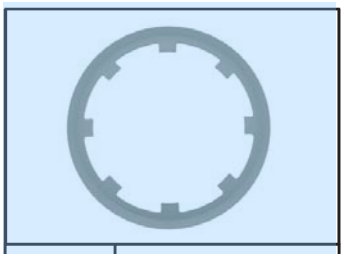
Ideal for low clearance applications where radial installation is preferred.

Self-Locking



DTI Internal DIN Toothed Push-On Ring

This ring features a series of prongs protruding outward. The ends create interference with the housing when the ring is installed and a load introduced to the other side.



DTX External DIN Toothed Push-On Ring

This ring features a series of prongs protruding into the center. The ends create interference with the shaft when the ring is installed and a load introduced to the other side.

DSF External DIN Self-Locking Friction Ring

The design of the ring causes it to exert significant gripping power uniformly on the shaft (except where the gap occurs).

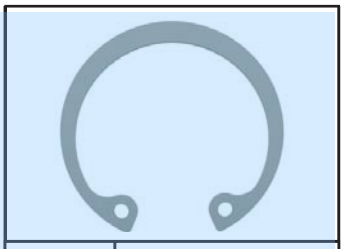
JIS "E" Retaining Ring
Radially Assembled

JE External JIS E Ring

JIS B 2805
Three prongs make contact with the bottom of the groove and provide a shoulder for effective retention of assemblies.

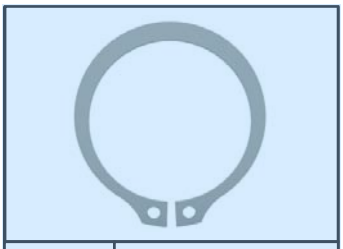
ANSI Metric Tapered Section Retaining Rings

Axially Assembled



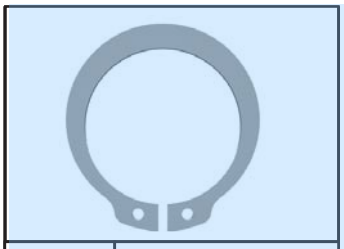
MHO Internal ANSI Metric Housing Ring

Once installed in the groove of a housing/bore, the portion of the ring protruding from the groove (shoulder) securely holds an assembly in place.



MSH External ANSI Metric Shaft Ring

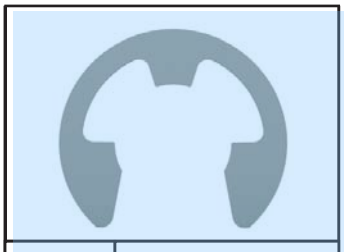
Once installed in the groove of a shaft, the portion of the ring protruding from the groove (shoulder) securely holds an assembly in place.



MSR External ANSI Reinforced Ring

The MSR is an extra thick version of a regular MSH retaining ring. As such, it is stronger and can withstand greater thrust loads than its standard counterpart.

Radially Assembled



ME External ANSI Metric E Ring

Three prongs make contact with the bottom of the groove and provide a shoulder for effective retention of assemblies.

MRE External ANSI Reinforced E Ring

A reinforced version of the E ring, which will accommodate higher thrust loadings and RPM. MRE rings function in the same groove as regular ME rings.

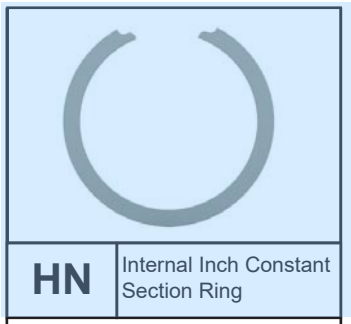
MC External ANSI Crescent Ring

Ideal for low clearance applications where radial installation is preferred.

Constant Section Retaining Rings - Inch

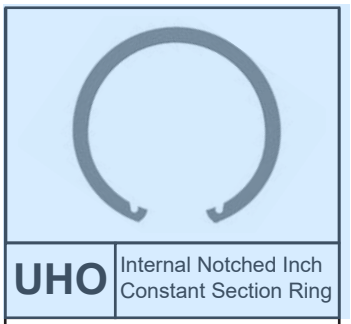
The constant section ring, also known as a snap ring, with its uniform material width is elliptical when installed in a groove, making 3-point contact with the groove as opposed to tapered section retaining rings which make circular contact.

Constant section rings offer more clearance, but generally accommodate less force than tapered rings. Carefully choosing the appropriate type of ring will maximize efficiencies and costs.



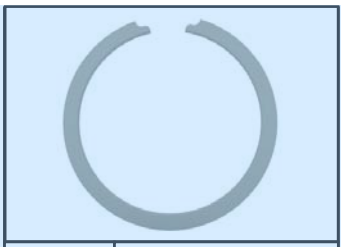
HN Internal Inch Constant Section Ring

Designed to retain needle bearings mounted in housings/bores.



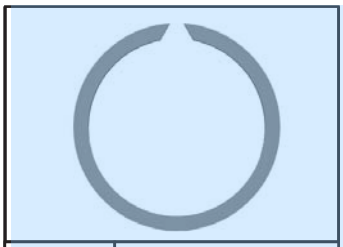
UHO Internal Notched Inch Constant Section Ring

Installed in the groove of a housing/bore, featuring notches for ease of installation/removal.



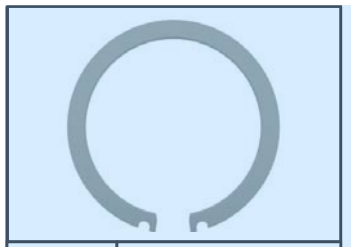
UHB Internal Inch Constant Section Ring

Installed in the groove of a housing/bore.



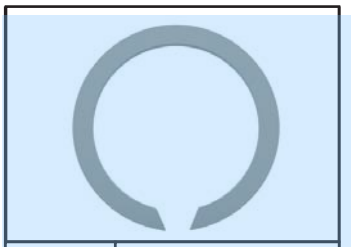
USC External Inch Constant Section Ring

Installed in the groove of a shaft.



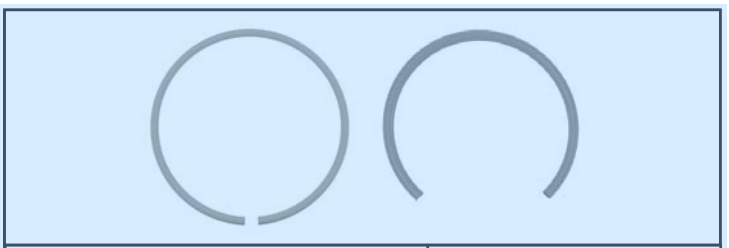
USH External Notched Inch Constant Section Ring

Installed in the groove of a shaft, featuring notches for ease of installation/removal.



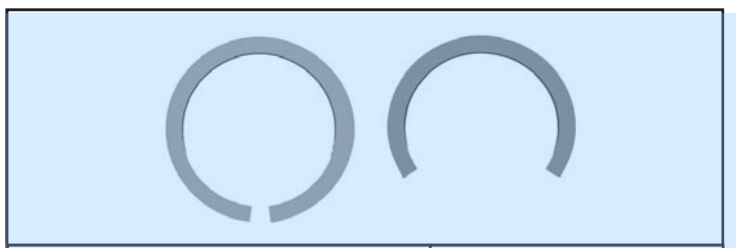
SNL External Inch Constant Section Ring

A light duty ring designed for needle bearing applications on shafts.



RLC/RLO, RHC/RHO External Inch Constant Section Ring-Round Section

Made from round-shaped wire, designed to be installed in the groove of a shaft.



SLC/SLO, SHC/SHO External Inch Constant Section Ring-Square Section

Made from square-shaped wire, designed to be installed in the groove of a shaft.

Constant Section Retaining Rings - Metric

HB- Internal Metric Constant Section Ring

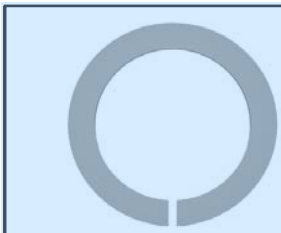
Designed to retain SAE standard metric bearings in a housing/bore.
Part Designations:
HBL = Light Bearing Number
HBM = Medium Bearing Number
HBH = Heavy Bearing Number

SR External Metric Constant Section Ring

Designed for grooves in outer tracks of ball or roller bearings on shafts.

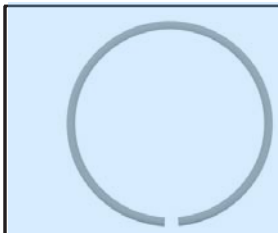
SB External Metric Constant Section Ring

Designed to retain SAE standard metric bearings on a shaft.



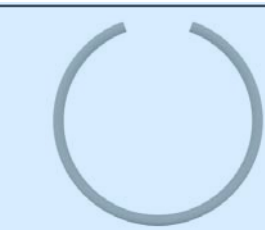
CBS External Metric Constant Section Ring

DIN 5417
Designed to retain metric bearings on a shaft.



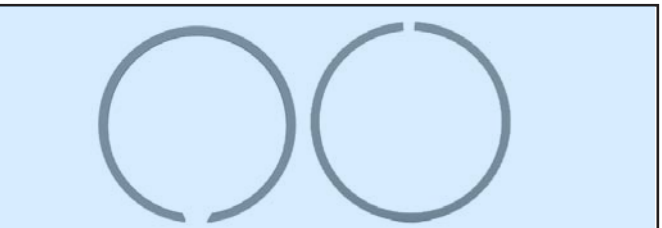
CRS External Metric Constant Section Ring Round Wire

DIN 7993 Type A
Made from round wire and installed in the groove of a shaft.



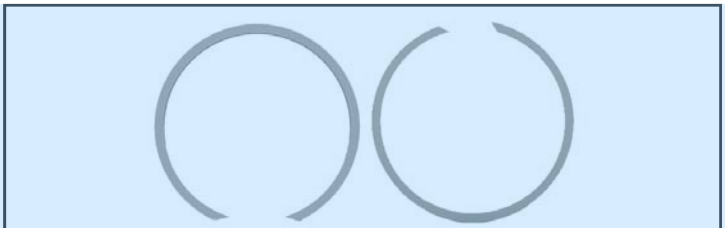
CRH Internal Metric Constant Section Ring Round Wire

DIN 7993 Type B
Made from round wire and installed in the groove of a housing/bore.



CFS External Metric Constant Section Ring Flat Wire

Made from flat wire and installed in the groove of a shaft.
Shaft Diameter of 38mm or less will have speared ends.
Shaft Diameter greater than 40mm will have straight ends.



CFH Internal Metric Constant Section Ring Flat Wire

Made from flat wire and installed in the groove of a housing/bore.
Housing Diameter of 24mm or less will have wide angled ends.
Housing Diameter greater than 24mm will have asymmetrical angled ends.

Tapered and Constant Section Ring Materials

Standard material for Rotor Clip retaining rings is carbon spring steel (SAE 1060-1090/UNS G10600-G10900.) Rings can also be produced in our standard stainless steel (PH 15-7 Mo/UNS S15700), with DIN 1.4122 as an option. Other materials available are our standard beryllium copper (Alloy #25/UNS C17200) and phosphor bronze (Alloy#5218/UNS C52180).

Rotor Clip can also produce rings one gauge thicker or thinner than standard sizes.

CARBON SPRING STEEL - (ST)

This steel is known for its high strength and reliability in retaining ring applications. Since carbon spring steel is subject to corrosion, Rotor Clip treats all such rings with a protective coating to ensure some corrosion resistance. For long-term corrosion protection, a zinc plating or non-metallic finish should be applied over the steel.

BERYLLIUM COPPER ALLOY #25 - (BC)

Applications that require conductivity are best served by this material. It is also characterized by excellent corrosion resistance and is particularly effective in sea air and seawater atmospheres.

PHOSPHOR BRONZE ALLOY #5218 - (PB)

The least expensive copper material Rotor Clip offers. This type exhibits higher strength compared to standard phosphor bronze materials with the same tin percentages. It is also characterized by very good stress relaxation characteristics.

Note: Rotor Clip can also supply phosphor bronze material to DIN standard 17 662, Material Number 2.1020. Contact Rotor Clip Technical Sales for more information.

STAINLESS STEEL

***PH 15-7 Mo* - (SS)**

This is an extra strength corrosion-resistant steel, capable of preventing atmospheric oxidation at temperatures up to 900° F. It also offers the following advantages:

1. Minimal distortion due to unique heat-treating process.
2. A minimum of 225,000 psi for high ultimate tensile strength.
3. High creep strength.

***DIN 1.4122* - (SG)**

A grade of stainless steel for retaining rings ordered in and for European countries.

SPECIAL MATERIAL GRADES

- AISI 302 Stainless (SJ)
- AISI 316 Stainless (SU)
- Inconel X-715 (IC)

Finishes

PHOSPHATE COATING (PA)
This standard finish offers extended shelf-life protection against rusting **AT NO ADDITIONAL CHARGE.**

PHOSPHATE AND OIL (PD)
This standard finish provides 8-hour salt spray protection **AT NO ADDITIONAL CHARGE.**

PHOSPHATE WITH SEALER (PAL)
A coating is added to the finish to control loose phosphate crystals on the surface of the part.

HEAVY PHOSPHATE AND OIL (HPD)
Features 72 salt spray hours and can replace costly stainless steel in some applications. (Contact Rotor Clip Technical Sales for more information).

ZINC PLATING (ZD)
This coating affords the metal excellent salt spray protection (96 hours). SAE 1060-1090 steel retaining rings are zinc plated using a mechanical plating process, which effectively eliminates hydrogen embrittlement.

ZINC BRIGHT (ZF)
Most of the dichromate is leeched out of this process, leaving a "bright" silver finish on the parts. ZF offers some corrosion protection (48 hours), but is widely used when the aesthetics of the part are a factor.

ZINC DICHROMATE w/SEALER (ZDL)
This improved finish offers corrosion protection of up to 240 hours of salt spray protection. (**Heavy Zinc Dichromate with Sealer (HZDL)** offers 480 hours of salt spray protection.) It is a low cost substitution for costly non-corrosive materials such as stainless steel in some applications. Call for additional information

TRIVALENT CHROMATE over ZINC (Z3X)
This coating meets global requirements for hexavalent-free coatings. **Z3X**, trivalent with a sealer, affords 240 salt spray hours of protection. RoHS & ELV compliant.

GALVANIC ZINC PLATING (GZN)
This plating has a thickness of 5-8 *µm* and blue chromate conversion coat. RoHS compliant. **GZY** is a yellow chromate conversion coat with the same thickness and contains hexavalent chromium. This plating is not RoHS compliant. Both provide 72 hours salt spray protection (red rust). Available for certain global markets only.

OIL OVER STEEL (OIL)
Used for Constant Section Rings, an oil finish is applied over carbon steel to offer an extended shelf-life protection against rusting. No salt spray protection.

Finish	Code	Description	Salt Spray Hours	Color
Phosphate	PA	Shelf-Life	None	Black
	PD	Phosphate and Oil	8 (Red Rust)	Black
	PAL	Phosphate with Sealer	None	Black
	HPD	Heavy Phosphate and Oil	72 (Red Rust)	Black
Hexavalent Chrome	ZF	Zinc Bright	48 (Red Rust)	Silver
	ZD	Zinc Dichromate	96 (Red Rust)	Yellow
	ZDL	Zinc Dichromate Sealer	240 (Red Rust)	Yellow
	HZDL	Heavy Zinc Dichromate Sealer	480 (Red Rust)	Yellow
Trivalent	Z3X	Trivalent Chromate Zinc plus Sealer	96/240*	N/A
Galvanic Zinc Plating	GZN	Galvanic Zinc - Blue Chromate	48/72*	Silver
	GZY	Galvanic Zinc - Yellow Chromate	48/72*	Yellow
Optional Color Coding Finishes	ZFF	Zinc Flash	None	Silver
	CF	Copper Flash	None	Copper
	OIL	Oil Over Steel - Shelf Life	None	Black

*White Corrosion / Red Corrosion

Packaging

Bulk
Rings are packaged in varying size boxes or bags depending upon the size of the part. Ideal for manual or pneumatic installation.

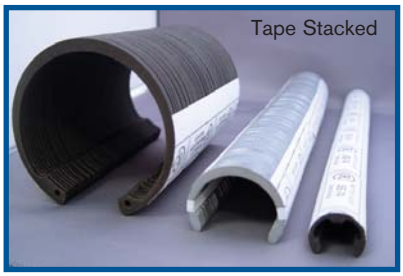
Rings On Wire (R0W)
Standard bulk packaging for certain rings. Eliminates mixed parts and reduces handling. All parts are packaged burr oriented and beveled parts are properly oriented on the stack. ROW also yields a flatter part.

Tape Stacked (S)
Rings are stacked on top of one another, using automated equipment and taped in position. The resulting cartridges can be used to feed automated assembly equipment for easier, more efficient installation of the rings.

Rod Stacked (W01)
Rings will be stacked and held in place with a flat metal rod. The resulting cartridge can be inserted into a ring dispenser which in conjunction with an applicator (see image on right) results in an easier and more efficient ring installation.

Shrink Wrapped (R01)
Rings are shrink wrapped instead of tape stacked which is particularly useful on Phosphate and Oil (PD) or other oiled parts in which tape will not stick.

Paper Wrapped (P01)
Rings are wrapped with paper, with similar benefits as Shrink Wrapping - effective on Phosphate and Oil parts.



How To Read Rotor Clip Part Numbers

RETAINING RINGS

HO-50ST PAS

Identifies the ring TYPE
Identifies the ring SIZE
Identifies the ring MATERIAL
Denotes the ring FINISH
Denotes PACKAGING

(Note: Bulk packaging has no code. Not all ring types can be stacked.)

Materials Codes:

ST	Carbon Steel
SS	Stainless Steel (PH15-7)
SG	Stainless Steel DIN 1.4122
BC	Beryllium Copper
PB	Phosphor Bronze

Packaging Codes:

No Code	Bulk
S	Tape Stacked
R01	Plastic Shrink Wrapped
W01	Rod Stacked
P01	Paper Stacked

Finishes Codes:

PA*	Phosphate
PD*	Phosphate & Oil
PAL*	Phosphate with Sealer
HPD*	Heavy Phosphate & Oil
ZD	Zinc Dichromate
ZDL	Zinc Dichromate with Sealer
ZF	Zinc Bright
Z3X*	Trivalent Chromate Zinc Plus Sealer
OIL*	Oil Over Steel (Constant Section Rings)
ZFF**	Zinc Flash
CF**	Copper Flash

* These finishes are RoHS compliant.
** For identification only. Does not provide corrosion protection.

Retaining Ring Pliers & Plier Kits

Standard Retaining Ring Pliers
Rotor Clip Standard Retaining Ring Pliers are made of high carbon, heat treated steel and produced to exacting QC specifications. They feature stop and return springs for problem-free installation and removal of retaining rings, and exclusive air-cushioned handles.

Ratchet Retaining Ring Pliers
Assemble large retaining rings up to 10" in diameter with ease and comfort. Spring loaded mechanisms compress or expand large rings through gradual "steps." Pliers lock at the desired size without continued pressure on the handles. (Note: Ratchet pliers do not include plier tips, which must be purchased separately.)

Convertible Retaining Ring Pliers
Convert quickly and easily from internal to external pliers and back again. This two-in-one capability is cost effective and ideal for handling a variety of applications with a minimum number of tools. Simply move the screw to the other hole and tighten with finger pressure to convert quickly to an internal / external plier.

Grip Ring Retaining Ring Pliers
Designed for SHF and DSF external (shaft) friction rings. Made from forged Chrome Vanadium steel with non-slip tips and non-slip, plastic coated handles.

Heavy-Duty Retaining Ring Pliers
Rotor Clip Heavy-Duty Retaining Ring Pliers are designed to perform with excessive use - lasts 10 times longer than standard retaining ring pliers. The pliers are made of forged Chrome Vanadium steel, and the handles have a non-slip plastic coating. They feature inserted tips of high density drawn spring wire and a precise, smooth operating screw joint. Large contact faces on the tips helps to eliminate distortion of the ring, and the slim head style allows for use in confined areas.

Retaining Ring Pliers Kits

Stock the tools you use most with any or all of these four retaining ring pliers kits. Rugged carrying cases provide portability and durability in a manufacturing environment. Tools are designed to fit a wide range of retaining ring sizes from 3/8" to 4", meeting most everyday MRO requirements.

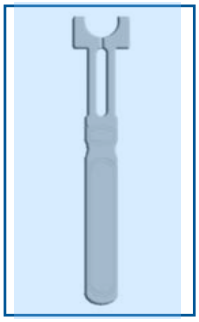
Replaceable Tip Pliers Kit (RPK#1)
Contains internal and external pliers in a reusable, clear plastic case. Features eight pair of replaceable tips that can be easily affixed to the end of the pliers to cover internal/ external retaining rings from 3/8" to 2"... Small enough to fit in your pocket!

Ratchet Pliers Kit (RPK#2)
Features two ratchet pliers for internal / external retaining rings. Handles larger retaining rings up to 4". Ratchet mechanism compresses (internal rings) and/or expands (external rings) through gradual steps, minimizing operator fatigue and effort.

Convertible Pliers Kit (RPK#3)
Contains 12 pliers which can be easily converted from internal to external and back again. Includes straight, 45° and 90° tip pliers that will fit retaining rings up to 2" in diameter. Does the work of 24 individual tools!

Mini Convertible Pliers Kit (RPK#6)
This abbreviated version of the RPK#3 features 6 pliers in straight and 90° configurations that will fit retaining rings up to 2" in diameter. Durable plastic case is easily stored in the tightest of spaces.

Retaining Ring Applicators and Dispensers



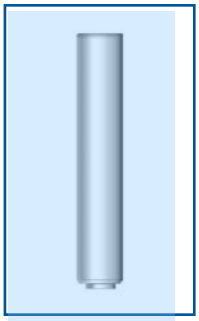
Applicators

Designed to install standard radial retaining rings on a shaft. Used with Rotor Clip dispensers, applicators enable operators to install rings quickly and correctly (rings will snap-in when seated in a groove.)

- For assembly of Rotor Clip C, E, BE, RE, PO/POL, E, DC, DE, ME, and JE inch, metric and JIS retaining rings.
- Heat treated for strength.
- Allows for installation without turning tool.

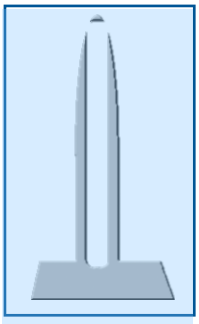
Heavy Duty Applicator Handles

Install large PO / POL retaining rings quickly and safely. Features an applicator blade affixed to a heavy-duty handle. Plastic grip enables you to hold tool steady as you strike the rear of the tool with a hammer or mallet to install the ring. Built-in shield at top prevents injury.



TX Applicator - “Easy Guide”

Designed to comfortably fit in the palm of your hand, the lightweight TX Easy Guide allows you to painlessly install Rotor Clip’s TX self-locking retaining rings. The nose is constructed from tool steel, a life extending material. Inside is a spring-loaded magnet, which holds the retaining ring in place during installation. The spring, along with the magnet, retracts into the handle while the tool forces the retaining ring over the shaft. Each ring is assigned its own Easy Guide, resulting in maximum tool performance.



Dispensers

For dispensing of radially installed C, E/SE, RE, PO/POL, DC, DE, ME, and JE retaining rings. Rotor Clip retaining ring dispensers feature a rail over which a stack of retaining rings can be slipped. Once in position, they can be dispensed one at a time using a retaining ring applicator for ease of installation.

Spring Rail (SD) dispensers are competitively priced and offer significant improvements (like more rail capacity and durable construction) on existing designs.

Heavy Duty (D) is a more permanent version which features replaceable parts and can be permanently affixed to a work station.

Rod Dispenser (RD) is designed specifically for metric (DIN 6799) DE rings that are packaged stacked on rods.

Features:

- Sturdy, Industrial-quality construction.
- Fast, easy loading.
- Longer rail for more capacity.
- Part & tool number stamped on dispenser for fast, easy identification of tool and corresponding ring.

Retaining Ring Kits

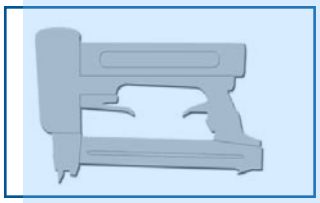
Rotor Pack (RPK#4)

Features 1,000 retaining rings in four durable, clear-plastic boxes with easy snap on/off lids in a convenient, portable carrying case. Includes internal ring sizes from 3/8" in diameter to 1-1/8" and external sizes from 1/4" to 1-1/8".

Rotor Pack Jr. (RPK#5)

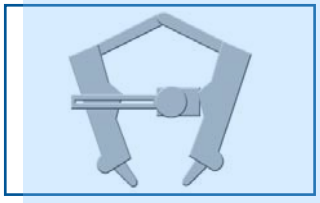
Rotor Pack Jr. (RPK#5) Contains over 1,500 "E" retaining rings in four durable, clear plastic boxes with easy snap on/off lids in a convenient, portable carrying case. Includes "E" rings accommodating shaft sizes from 1/16" in diameter to 1-3/16"

Automatic Retaining Ring Tools



"Rotor Kick Jr." (RKJ) Automated Assembly Tool

This ergonomic tool from Rotor Clip provides operator convenience and comfort along with efficient automated assembly. The tool is operated by air pressure for convenience and safety. Lightweight, portable and easy to use this hand tool features a patented feeder mechanism to ensure efficient, trouble-free operation.
(For use with RG-31 retaining rings only.)

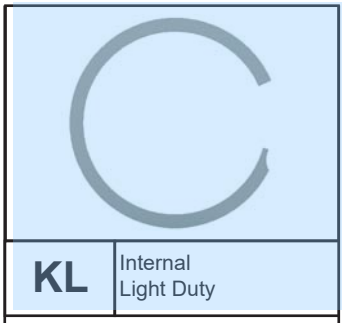


XXL Retaining Ring Tool

This tool is usable with internal and external retaining ring from a diameter of 15"-40" (400mm - 1000mm.) It securely opens, closes and holds rings due to a self-locking precision spindle action. Interchangeable paired tips cover different diameter ranges.

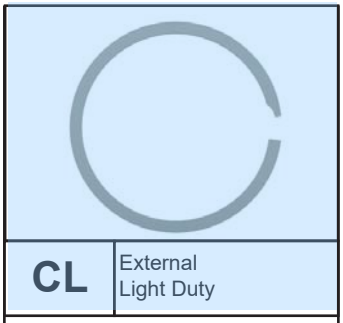
Spiral Retaining Rings - Inch

Spiral rings are axially installed into machined grooves in housings/bores (internal) or on shafts (external) to retain assemblies. They provide 360° contact with the groove and offer more clearance than a tapered section ring. They are ideal for applications with lower thrust loadings.



KL Internal Light Duty

These single-turn snap rings are ideal for light duty applications.

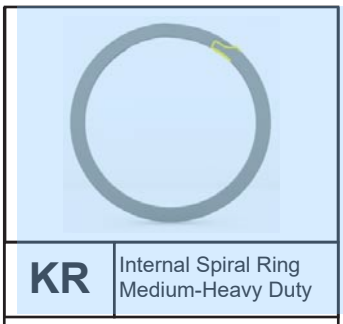


CL External Light Duty

These single-turn snap rings are ideal for light duty applications.

KM Internal Spiral Ring Medium Duty

These 2-turn rings provide 360° groove contact and are designed for applications with medium thrust loads.

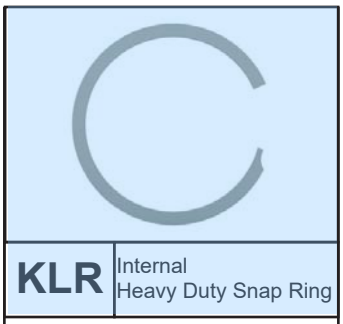


KR Internal Spiral Ring Medium-Heavy Duty

These 2-turn and multi-turn rings provide 360° groove contact and are designed for applications with medium-high thrust loads.

KG Internal Spiral Ring Heavy Duty

These 2-turn rings provide 360° groove contact and are ideal for applications with high thrust loads.



KLR Internal Heavy Duty Snap Ring

These single-turn snap rings are ideal for applications involving high thrust loads.

CM External Spiral Ring Medium Duty

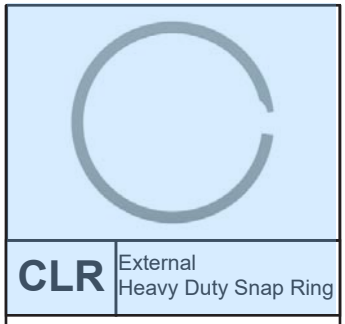
These 2-turn rings provide 360° groove contact and are designed for applications with medium thrust loads.

CR External Spiral Ring Medium-Heavy Duty

These 2-turn and multi-turn rings provide 360° groove contact and are designed for applications with medium-high thrust loads.

CG External Spiral Ring Heavy Duty

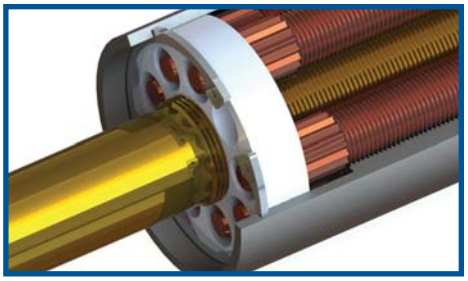
These 2-turn rings provide 360° groove contact and are ideal for applications with high thrust loads.

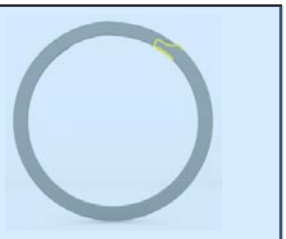


CLR External Heavy Duty Snap Ring

These single-turn snap rings are ideal for applications involving high thrust loads.

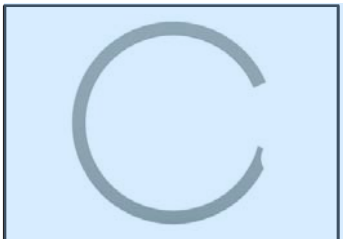
Spiral Retaining Rings - Metric, Internal





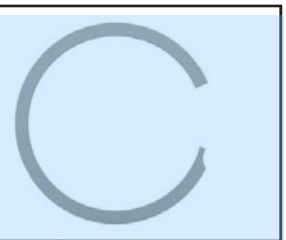
DKR Internal Spiral Ring Heavy Duty DIN

DIN 472 Groove
These 2-turn rings are ideal for applications with high thrust loads and are designed to fit into a groove established by DIN specifications.



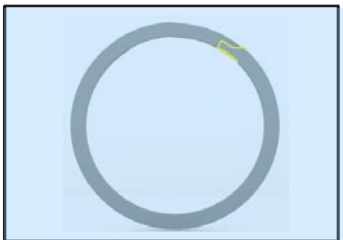
DKL Internal Heavy Duty DIN

DIN 472 Groove
These snap rings are ideal for applications with high thrust loads and are designed to fit into a groove established by DIN specifications.



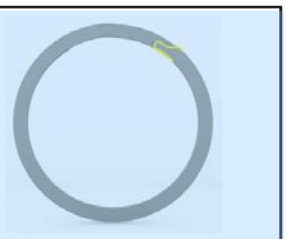
KLM Internal Light Duty Metric

These single-turn snap rings are ideal for light duty applications.



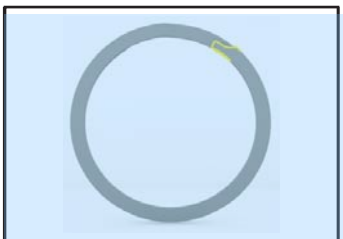
MKM Internal Spiral Ring Medium Duty Metric

These 2-turn rings provide 360° groove contact and are designed for applications with medium thrust loads.



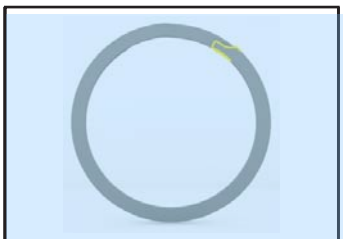
MKR Internal Spiral Ring Medium-Heavy Duty Metric

These 2-turn and multi-turn rings provide 360° groove contact and are designed for applications with medium-high thrust loads.



MKG Internal Spiral Ring Heavy Duty Metric

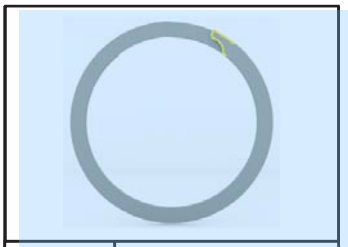
These 2-turn rings provide 360° groove contact and are ideal for applications with high thrust loads.



MKA Internal Spiral Ring Aerospace Metric

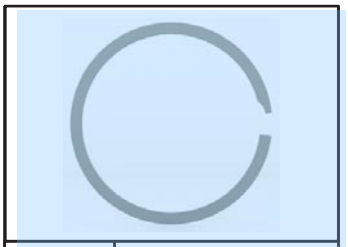
Dimensions Conform to Metric Aerospace Specification MA 4017.

Spiral Retaining Rings - Metric, External



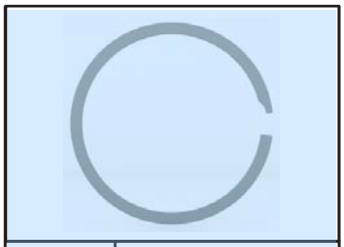
DCR External Spiral Ring Heavy Duty DIN

DIN 471 Groove
These 2-turn rings are ideal for applications with high thrust loads and are designed to fit into a groove established by DIN specifications.



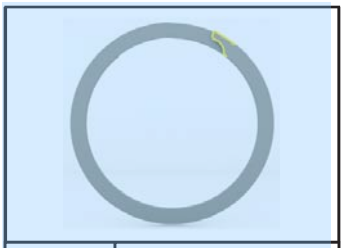
DCL External Heavy Duty DIN

DIN 471 Groove
These snap rings are ideal for applications with high thrust loads and are designed to fit into a groove established by DIN specifications.



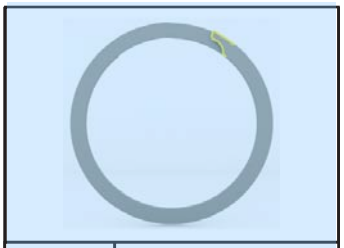
CLM External Light Duty Metric

These single-turn snap rings are ideal for light duty applications.



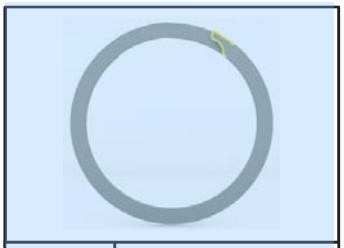
MCM External Spiral Ring Medium Duty Metric

These 2-turn rings provide 360° groove contact and are designed for applications with medium thrust loads.



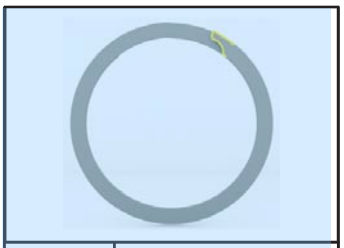
MCR External Spiral Ring Medium-Heavy Duty Metric

These 2-turn and multi-turn rings provide 360° groove contact and are designed for applications with medium-high thrust loads.



MCG External Spiral Ring Heavy Duty Metric

These 2-turn rings provide 360° groove contact and are ideal for applications with high thrust loads.



MCA External Spiral Ring Aerospace Metric

Dimensions Conform to Metric Aerospace Specification MA 4016.

Spiral Ring Materials & Finishes

MATERIALS:

CARBON SPRING STEEL (ST)
This steel is known for its high strength and reliability in spiral ring applications. Since carbon steel is subject to corrosion, Rotor Clip rings are oil dipped to ensure basic corrosion resistance.

STAINLESS STEEL - AISI 302 (SJ)
This general purpose stainless steel offers corrosion resistance and can be cold worked to high tensile strengths.

STAINLESS STEEL - AISI 316 (SU)
This type of stainless steel is heat resistant with superior corrosion resistance than other chromium nickel steels. It offers high creep strength at elevated temperatures and resistance to pitting.

STAINLESS STEEL - PH17-7 (SQ)
A high strength corrosion-resistant steel with good workability, easy hardening and excellent mechanical properties at elevated temperatures. Can be heat treated at relatively low temperatures for high strength properties.

BERYLLIUM COPPER (BC)
Applications that require conductivity are best served by this material. It is also characterized by excellent corrosion resistance and is particularly effective in sea air and seawater atmospheres

FINISHES:

OIL DIP (OIL)
This standard finish for carbon steel spiral retaining rings offers an extended shelf-life protection against rusting.

CADMIUM PLATING (CD)
This protective coating offers excellent corrosion protection, ductility, natural lubricity and solderability in specialized applications.

PASSIVATION (SPP)
The passivation process removes “free iron” contamination left behind on the surface of stainless steel due to the manufacturing process. Also, the passivation process facilitates the formation of a thin, transparent oxide film that protects the stainless steel from selective oxidation (corrosion).

Material	Material Thickness (in)	Minimum Tensile Strength (psi)	Shear Strength (psi)	Maximum Recommended Operating Temperature (°F)	Modulus of Elasticity (psi)
Carbon Steel Oil Tempered SAE 1070-1090	.006 - .014	269,000	153,000	250	30×10^6
	.0141 - .021	255,000	145,000		
	.0211 - .043	221,000	126,000		
	.0431 & larger	211,000	120,000		
Carbon Steel Hard Drawn SAE 1060-1075	.006 - .030	230,000	130,000		
	.0301 - .110	181,000	103,000		
	.1101 - .220	156,000	89,000		
AISI 302 AMS-5866	.002 - .022	210,000	119,000	400	28×10^6
	.0221 - .047	200,000	114,000		
	.0471 - .062	185,000	105,000		
	.0621 - .074	175,000	100,000		
	.0741 - .089	165,000	94,000		
	.0891 - .095	155,000	88,000		
AISI 316 ASTM A313	.002 - .023	195,000	111,000		
	.0231 - .048	190,000	108,000		
	.0481 - .061	175,000	99,000		
	.0611 & larger	170,000	97,000		
17-7 PH/C Condition CH900 AMS-5529		240,000[2]	137,000[2]	650	29.5×10^6
Beryllium Copper Temper TH02 ASTM B197		185,000[2]	128,000[2]	400	18.5×10^6

The TRUWAVE Advantage

Save Space with TRUWAVE Flat Wire Wave Springs

TruWave flat wire wave springs help to save up to 50% of axial space in your application when compared to conventional coil springs. The result is more compact applications in which unnecessary space and excess material of neighboring components can be reduced to a minimum. The flat wire reduces the solid height of the wave spring so that with the same amount of turns, the work height can be visibly reduced without compromising the load or spring deflection.

Another advantage is that one can increase the number of turns of the spring design in order to decrease the deflection per turn when the wave spring is compressed. Thus, the spring rate is reduced proportionally to the number of turns and a flat linear characteristic can be generated.

Conventional Coil Spring Wave Spring

Space Savings
- Reduced work height
- Up to 50% of axial space savings compared to conventional coil springs

Flexible Flat Wire Production
- In-house flat wire production for various dimensions
- Special grades available

Short Delivery Times
- Standard springs in stock
- No delivery time for special tooling

Technical Support
- Computer aided spring calculations
- Installation solutions

Custom Spring Design
- No tooling costs
- Partnership with Rotor Clip's Technical Engineers

Spring Characteristics
- Precise specification of the spring load at individual work heights

Quality
- Certified to IATF 16949, AS9100, ISO 9001, and ISO 14001

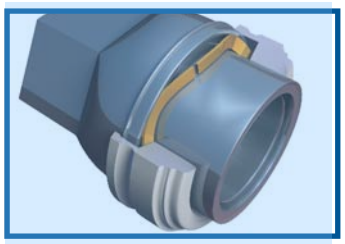
Gap Single Turn/Overlap Single Turn
SST, NST, MST Series (Page 34)

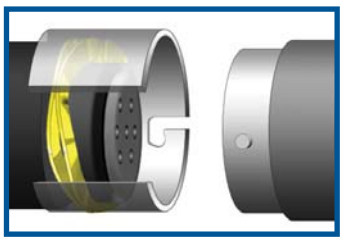
Multi-Turn Plain Ends / Shim Ends
WSL-MWL, WSM-MWM, WSR-MWR Series (Page 34)

NEW PRODUCT SPOTLIGHT:
Patented Surface-Friendly Flat End Wave Springs

- **Improves bearing and application life**
- **No debris, scratching, or excessive wear in application**
- **NEVER any tooling costs for custom parts**

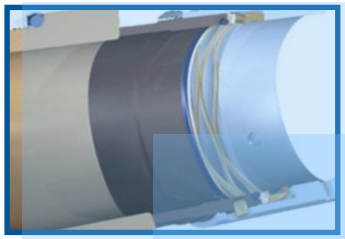
Wave Spring Applications


Quick Connector

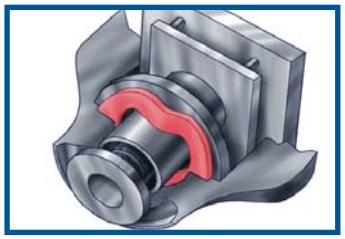

Bayonet Connector

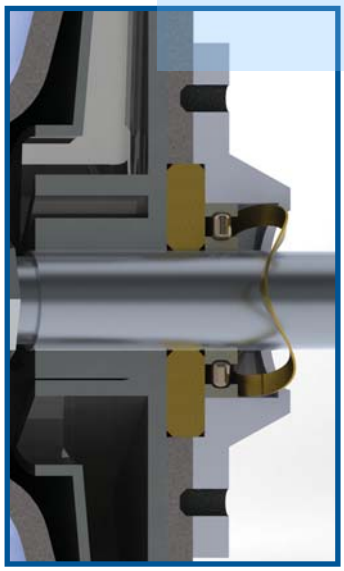

Fluid Power Quick Connect

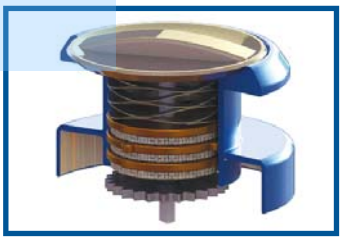

Lens

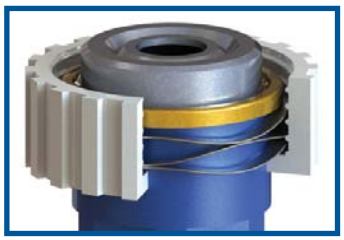

Mechanical Seal

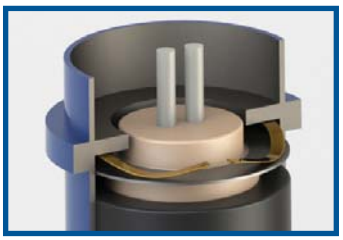

Car Mirror


Flash Light Application

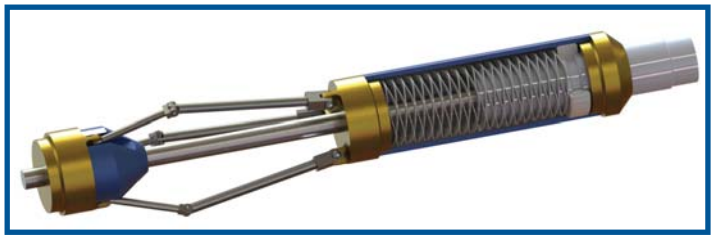

Intake Pump

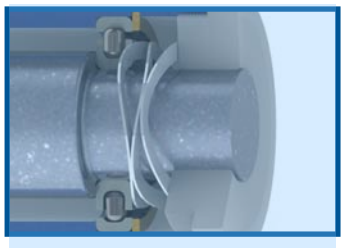

Fishing Reel

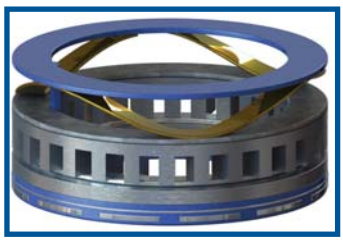

Fuel Filter


Sensor Preload

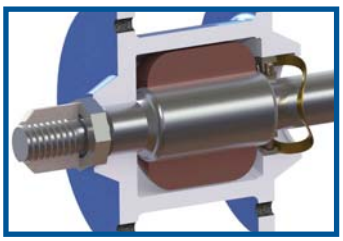

Plug-In Connector


Downhole Tool


Bearing Preload


Ultrasonic Motor

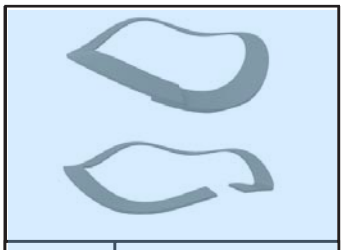

Clutch Application


Steering Motor Preload

TruWave® Wave Springs

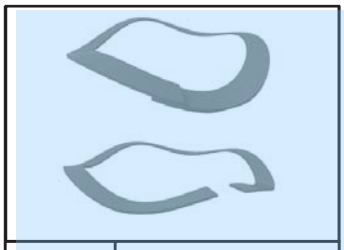
A wave spring is coiled flat wire with waves added to give it a spring effect.

Wave springs are preferred over traditional coil springs in many applications because they provide lower work heights with the same force.



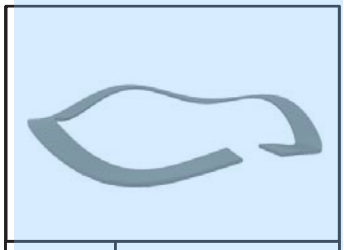
SST Single Turn Inch

Ideal for short deflection applications with low to medium forces. Offered in a number of waves and material thicknesses. Designed for a wide range of bore and rod diameters.



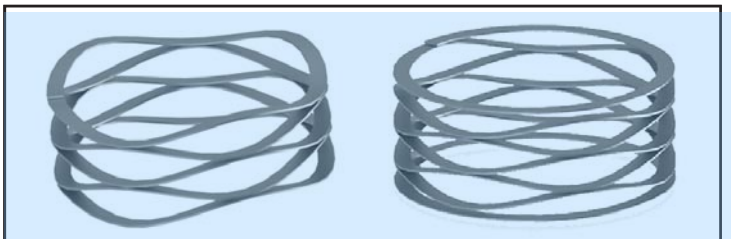
MST Single Turn Metric

Ideal for short deflection applications with low to medium forces. Offered in a number of waves and material thicknesses. Designed for a wide range of bore and rod diameters.



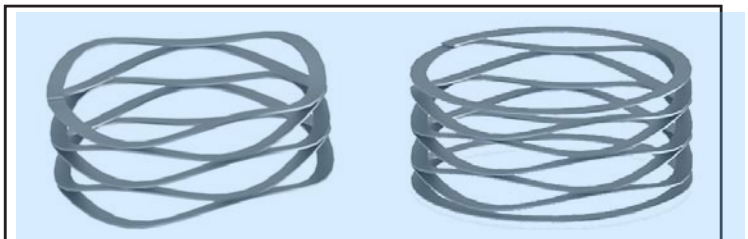
NST Single Turn Narrow, Inch

Ideal for short deflection applications where space is minimal.



WSL/WSM/WSR Multi-Turn Inch

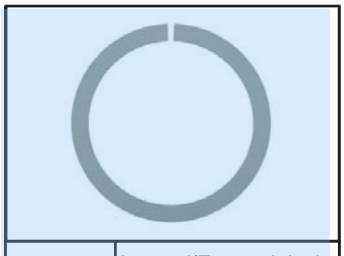
Used for low to medium force applications with greater travel compared to single-turn springs. Utilizes nearly half the space as helical compression spring while producing the same force.



MWL/MWM/MWR Multi-Turn Metric

Used for low to medium force applications with greater travel compared to single-turn springs. Utilizes nearly half the space as helical compression spring while producing the same force.

Shims



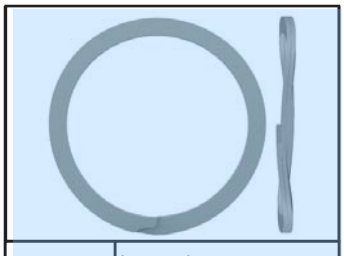
KMS Internal/External, Inch, Shim

Shims are typically used in order to support, adjust for better fit, or provide a level surface. Shims may also be used as spacers to fill gaps between parts subject to wear.

Shims are typically used in order to support, adjust for better fit, or provide a level surface.

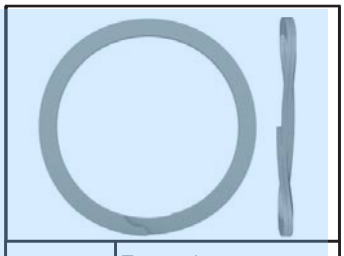
Shims may also be used as spacers to fill gaps between parts subject to wear.

TruWave® Spiral Retaining Rings



NKG Internal, Spiral, Inch

The waves in this spiral ring compensate for accumulated tolerances.



NCG External, Spiral, Inch

The waves in this spiral ring compensate for accumulated tolerances.

Wave Spring Materials and Finishes

SAE 1070-1090 Carbon Steel (ST)
- This prehardened material is the standard material for wave springs.
- Basic corrosion resistance.
- Less expensive option to Stainless Steel.

17-7 Stainless Steel (SQ)
- Used for high stress and fatigue applications.
- Can withstand much higher temperatures than SAE 1070-1090 and not lose its spring qualities.
- Higher corrosion resistance than SAE 1070-1090.

Special Material Grades
- AISI 302 Stainless (SJ) (DIN Material No.: 1.4319)
- AISI 316 Stainless (SU) (DIN Material No.: 1.4401)
- A286 (SY) (DIN Material No.: 1.4980)
- Inconel X-750 (IC) (DIN Material No.: 2.4669)
- Elgiloy (EG) (DIN Material No.: 2.4711)
- Hastelloy C276 (HE) (DIN Material No.: 2.4819)
- Beryllium-Copper (BC) (DIN Material No.: 2.1247)
- Phosphor-Bronze (PB)(DIN Material No.: 2.1030)

Finishes Available:
- Oiled (Standard Finish, Carbon Steel)
- Degreased and Ultrasonic-Cleaned (Stainless Steel)
- Passivation
- Electropolish

How To Read Rotor Clip Wave Spring Part Numbers

WAVE SPRINGS

WSL-50ST AF OIL

- WSL — Identifies the spring TYPE
- 50 — Identifies the spring SIZE
- ST — Identifies the spring MATERIAL
- AF — *Identifies the number of spring TURNS
- OIL — **Designates a FLAT SHIM END
- Identifies the spring FINISH

* Alphabetic designation for the number of turns according to catalog specifications. A, B, C, D...

** Designation to specify a Flat Shim End multi-turn wave spring. No code for a plain end multi-turn wave spring.

Material Codes:
ST* Carbon Steel
SQ* Stainless Steel (17-7 PH/C)
** Standards. See above for other special alloys available.*

Standard Finish Codes:
OIL* Oil Dipped
SPP Passivate
** Standards*

Rotor Clamp®
Self-Compensating Hose Clamps

Rotor Clamp provides a full line of 100% AMERICAN MADE, self-compensating hose clamps. Purchase clamps from a manufacturer known for its quality and reliability. Use our products with confidence since they are produced by Rotor Clip Company, Inc., a world class manufacturer of retaining rings and hose clamps.

Rotor Clamp is currently certified to IATF 16949, ISO 9001, ISO 14001 & AS9100. With continuous improvement as our theme, we move into the future ready to meet our customer's demand for quality innovation and process savings.

Easier to install and less expensive than the standard screw/worm type clamps, Rotor Clamp self-compensating hose clamps are extremely effective for low pressure applications.

Control your costs and order self-compensating hose clamps from Rotor Clamp today.

HC
Single Wire Hose Clamp

DW
Double Wire Hose Clamp

CTB
Constant Tension Band Hose Clamp

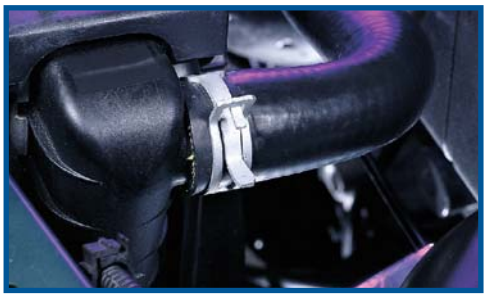
CTL
Constant Tension Light Band Hose Clamp

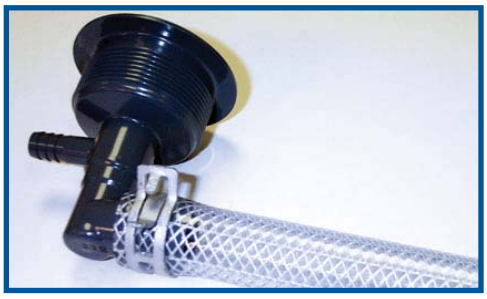
See the difference with our Self-Compensating Hose Clamps:

	ROTOR CLAMP Self-Compensating Hose Clamps 	Traditional Screw/Worm Hose Clamps 
Installation Ease	Automatic and manual installation options with our Pneumatic and Manual Tools	Must be installed manually - risk of Carpal Tunnel Syndrome is high due to repetitive installation
Installation Time	Less time for assembly - resulting in lower production costs	More time needed for assembly or disassembly due to screw adjustments
Installation Complexity	Cannot be over/under tightened due to the design of the clamp.	Screw mechanism may be over or under tightened causing damage or leakage to the hose
Temperature Adjustments	Expands or contracts with the hose in response to tempera-ture shifts	Must be manually adjusted as temperature changes
Uniform Hose Pressure	Even-pressure application to hose, especially great for low pressure areas	Screw clamps tend to pull from the screw side, stretching the hose
Cost	Simple design allow for lower manufacturing costs, passed down to our customers	Complex design and multiple parts mean higher manufacturing and final end costs

Hose Clamp Applications


Small Engine

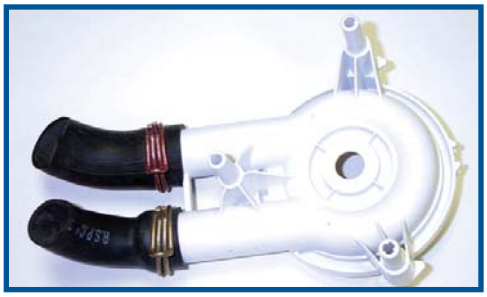

Automotive Cooling System


Spa Application


Small Engine


Fuel Line


Spa Application


Spa Application


Spa Application


Spa Application

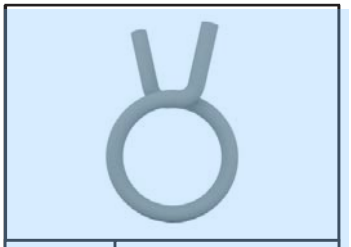

Appliance pump


Plastic Water Valve

Self-Compensating Hose Clamps

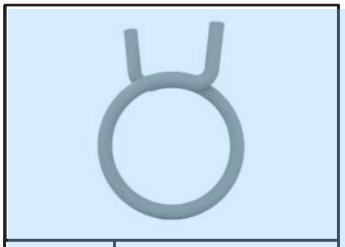
Rotor Clamp, Inc. produces a line of self-compensating hose clamps for low-pressure applications in single wire, double wire and constant tension band (CTB) configurations.

Rotor Clamp



HC Single Wire Hose Clamp

Single wire clamps have the most effective holding force and clamping strength. The single wire concentrates the clamping force in one specific area around the hose.

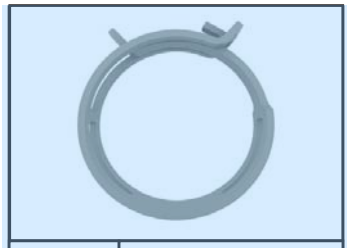


HW Slim Wire Hose Clamp

A slimmer version of the Single Wire Hose Clamp. The single wire concentrates the clamping force in one specific area around the hose. Can be installed with manual and pneumatic tools.

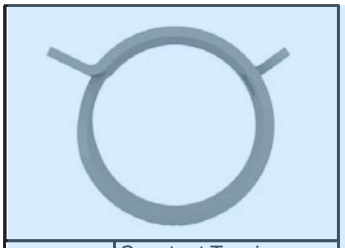
DW Double Wire Hose Clamp

Double wire clamps are used when a lower clamping force is sufficient and aesthetics are important. The double wound wire spreads out the clamping force around the hose, and is more cost effective than single wire clamps.



CTB Constant Tension Band Hose Clamp

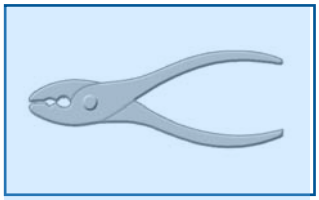
Constant Tension Band Clamps are used in applications where a lower clamping force than offered by single wire clamps is sufficient, but a higher clamping force than produced by double wire clamps is needed.



CTL Constant Tension Band Light Hose Clamp

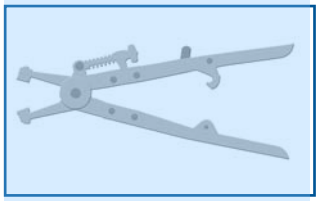
Constant Tension Band Clamps are used in applications where a lower clamping force than offered by single wire clamps is sufficient, but a higher clamping force than produced by double wire clamps is needed.

Manual Hose Clamp Tools



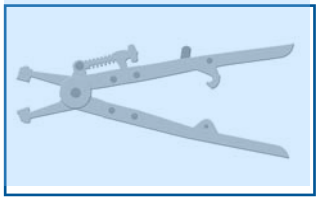
Single Wire Hose Clamp Pliers (KC-18)
Install Rotor Clamp single wire hose clamps (HC) quickly and easily using this simple hand tool.

One size fits all clamps.



Constant Tension Band (CTB) Hose Clamp Pliers (HCP-20)
Rugged and easy-to-use, this tool locks into place when clamp is fully compressed, relieving hand pressure when installing/removing. Tips can be adjusted to desired clamp opening to ensure fast, consistent installation or removal.

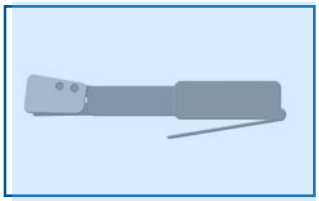
One size fits all clamps.



Heavy Duty Single Wire Hose Clamp Pliers (HAZ-2)
A heavy duty version of the Single Wire Plier Tool. Tips can be adjusted to desired clamp opening to ensure fast, consistent installation or removal.

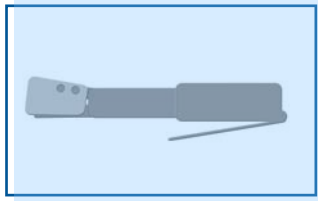
One size fits all clamps.

Pneumatic Hose Clamp Tools



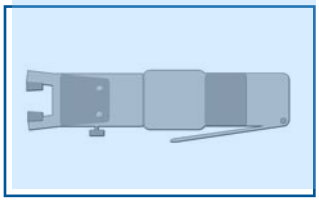
Single Wire Hose Clamp Pneumatic Tool (PWS)
Tangs of the clamp fit in the jaws and are compressed for installation and removal on the hose. Uses a compressed airline of 90psi. Activate by depressing a simple lever.

Use with HC/HW hose clamps.



Double Wire Hose Clamp Pneumatic Tool (PWD)
Tangs of the clamp fit in the jaws and are compressed for installation and removal on the hose. Uses a compressed airline of 90psi. Activate by depressing a simple lever.

Use with DW hose clamps.



Constant Tension Band Pneumatic Tool (PBC-1)
Tangs of the clamp fit in the jaws and are compressed for installation and removal on the hose. Uses a compressed airline of 90psi. Activated by depressing a simple lever. One size fits all.

Use with CTB hose clamps.

RotorExpress®

Customers have made it clear that they want quality products delivered on time, in the volumes they require. They also want their transactions to be seamless, with quotations and orders processed in a minimum amount of time. Rotor Clip has responded with its Rotor Express program.

Through a series of partnerships throughout the country, Rotor Clip can now provide customers with small package quantities of retaining rings that would otherwise be too costly to process from the company's facility. These partners keep product on the shelf at extremely competitive prices and can respond to customer requests for product the same day, in most cases. And they provide you with the same quality products you would get when dealing with Rotor Clip direct.

Benefits of the Rotor Express program include:

- Shipment of your order within 24 hours.
- Knowledgeable product service.
- Certification for any product provided by Rotor Clip through Rotor Express alliances.
- Full engineering support through Rotor Clip.
- Visa & MasterCard accepted.
- Available in the US, Mexico, Brazil, China, and Czech Republic

Military Retaining Rings

- DFARS Compliant
- Cage Code: 07382
- Made in USA
- Full Certs provided FREE of Charge
- Certificate of Quality FREE of Charge
- DFARS Certification FREE of Charge

Adherence to specified standards is a prerequisite to providing rings to government agencies and commercial suppliers of military equipment and parts. Rotor Clip can handle these orders and provide the necessary certification either to the MS or ASME standard. Customers will find excellent pricing on steel retaining rings, cadmium or zinc plated, or with a phosphate finish, as well as beryllium copper rings. Stainless steel rings are also available, passivated according to military requirements.

Rotor Clip military retaining rings made of specialty metals, like Stainless Steel and Beryllium Copper, comply with DFARS 252.225-7014 **(Defense Federal Acquisition Regulation Supplement)**, "Preference for Domestic Specialty Metals," which is part of the "Buy American" Act.

Rotor Clip's Online Services

Log on to rotorclip.com and get the information you need, whenever you want.

Access a variety of information and service that will help you get the most up-to-date information on our products, specfications, materials, certifications, applications and more.

Here's a sampling of what you'll find online:

ONLINE ORDERING
Customers now have the option of placing their orders online. You can also view your order status, submit, view and print completed quotes and view and print invoices… much faster than phoning or faxing in your request. Sign up today by calling 1-732-469-7333 or e-mail cs@rotorclip.com.

REQUEST FOR QUOTATIONS
Complete the online form and submit your quotation. Pricing will be sent to you via e-mail as soon as possible.

REQUEST FOR FREE SAMPLES
Get the retaining ring/hose clamp/wave spring samples you need for an application you are testing or for a customer you currently service.

ONLINE PART SEARCH
Find the right part, or a range of parts, to best suit your application by using our Part Search feature on rotorclip.com. Enter the diameter of your shaft, housing or hose (for clamps), and a list of parts that would fit your application appears. Click on any of these to get complete dimensions, recommended installation tool and an option to request samples or a quote from the same page. Customer and engineering drawings are also available for most rings.

ONLINE CATALOG SPECIFICATIONS
Get complete product catalog specifications for all of our retaining rings, wave springs, hose clamps and installation tools/kits. You can download the pages you need, or our entire product catalog in English, German, Spanish, Chinese and French versions.

Rotor Clip Trademarks

ROTOR CLIP®

Rotor Clamp®

SEGNOR®

WALDES TRUARC®

MADE IN AMERICA
MILITARY Express™
MILITARY RETAINING RINGS

TRUWAVE™

ROL-PAK®

ROTOR Express
24 Hour Retaining Ring Service

TRUARC™

IRR™

Full Catalog at a Glance

Axially Assembled, Inch Tapered Section Retaining Rings

Internal | External

HO | HOI | BHO | VHO | SH | SHI | SHR | SHM | BSH | VSH

Page 14

Radially Assembled, Inch Tapered Section Retaining Rings

External

E/SE/ YE/ZE | RE | BE | C | LC | PO/POL | EL

Page 15

Self-Locking, Inch Tapered Section Retaining Rings

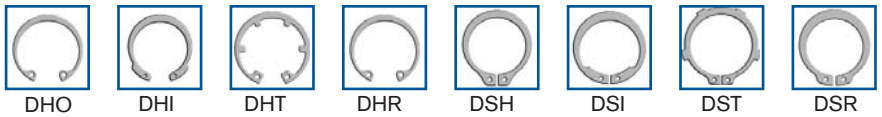
External | Internal

SHF | RG | TX | TY | TI

Page 16

Axially Assembled, Metric Tapered Section Retaining Rings

Internal | External



DHO DIN 472 | DHI | DHT DIN 984 | DHR DIN 472 Heavy Type | DSH DIN 471 | DSI | DST DIN 983 | DSR DIN 471 Heavy Type

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Radially Assembled, Metric Tapered Section Retaining Rings

External

DE DIN 6799 | DC

Page 18

Self-Locking, Metric Tapered Section Retaining Rings

External | Internal

DSF | DTX | DTI

Page 18

JIS "E" Retaining Rings

External

JE JIS B 2805

Page 18

Axially Assembled, ANSI Metric Tapered Section Retaining Rings

Internal | External

MHO | MSH | MSR

Page 19

Radially Assembled, ANSI Metric Tapered Section Retaining Rings

External

ME | MC | MRE

Page 19

Full Catalog at a Glance

Inch Constant Section Retaining Rings

Internal | External

HN | UHO | UHB | USC | USH | SNL | SLC/SLO SHC/SHO | RLC/RLO RHC/RHO

Page 20

Metric Constant Section Retaining Rings

Internal | External

HBL, HBM,HBH | CRH DIN 7993 | CFH | SR | SB | CFS | CBS DIN 5417 | CRS DIN 7993

Page 21

Inch Spiral Retaining Rings

Internal | External

KL | KM | KR | KG | KLR | CL | CM | CR | CG | CLR

Page 28

Metric Spiral Retaining Rings

Internal | External

DKR DIN 472 | DKL | KLM | MKM | MKR | MKG | MKA | DCR DIN 471 | DCL | CLM | MCM | MCR | MCG | MCA

Page 29-30

TruWave® Spiral Retaining Rings

Internal | External

NKG | NCG

Shims

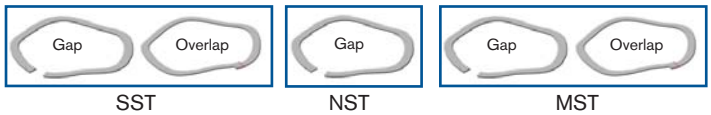
Internal/External

KMS

Page 34

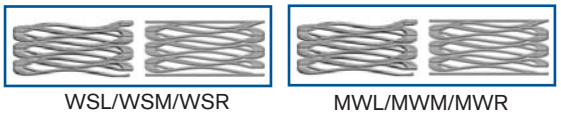
TruWave® Wave Springs

Single Turn



SST | NST | MST

Multi Turn



WSL/WSM/WSR | MWL/MWM/MWR

Page 34

Self-Compensating Hose Clamps

Wire Clamps | Band Clamps

HC | HW | DW | CTB | CTL

Page 38

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