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

Today, the company’s 238,000 square foot facility in Somerset, NJ is a global leader in the manufacture of tapered, constant section and spiral retaining rings meeting Inch, DIN, ANSI Metric and JIS standards. This includes the manual and automatic tools needed to install/remove every ring we sell.

Rotor Clip also manufactures wave spring rings as well as self-compensating hose clamps, all produced in a lean environment dedicated to eliminating waste and ensuring quality through ISO/TS 16949:2009 & ISO 9001:2008 registration.

But service is why customers rely on Rotor Clip for their domestic retaining ring needs. They know technical assistance is a phone call away and available during the critical phases of a new project. They also know a Rotor Clip engineer will come to their facility to work on a new design or help with installation issues. And they know that no other supplier in the world has the resources to match Rotor Clip’s level of commitment to its customers.
Rotor Clip Quality

Rotor Clip is certified and registered to ISO/TS 16949:2009 & ISO 9001:2008. Under these guidelines, departments conduct value stream meetings to evaluate goals and measure efficiency and effectiveness. This goal driven philosophy results in cost reduction opportunities that are passed along to our customers.

“We meet the customer’s standards for quality, not just quality standards.” - Craig Slass, Co-President/Owner, Rotor Clip.

Rotor Clip takes quality to a new level by helping customers achieve more than acceptable quality standards. We recently developed equipment to perform Non Destructive Testing (NDT) for a customer who wanted their retaining rings checked more stringently for temperature, porosity, and hardness.

Whatever the quality requirement, Rotor Clip will meet it as cost effectively as possible.

Checks were performed on parts with equipment designed according to customer quality requirements.

Value stream teams collect and analyze data to improve production in their respective areas.
Manufacturing

We Engineer It...

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

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 customers.

We Build & Tool It...

Nowhere in the industry is there a more sophisticated tool room for building high speed, progressive dies than at Rotor Clip Company. All personnel follow ISO/TS 16949:2009 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...

The floor of Rotor Clip’s press room pounds with the steady rhythm of the most modern presses in the industry, modified to conform to our requirements for speed and performance. Many of the 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.
Manufacturing

We Form & 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.

RoHS / DFARS Compliance...

Rotor Clip meets European Union Requirements for alternatives to hexavalent chrome coatings with zinc plus Trivalent 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 Specialty Metals,” which is part of the “Buy American” Act.

We Finish It...

We 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.

The standard finish for retaining rings is phosphate (PA) coating, available at NO EXTRA CHARGE. This affords the rings a basic shelf life protection. Phosphate and Oil (PD), a popular European coating, offers eight hours of salt spray protection and Heavy Phosphate and Oil (HPD), 72 salt spray hours.
Support

We Support The Product...

Rotor Clip supports its products with a full line of Retaining ring kits, pliers, applicators, dispensers... Everything you need to install/remove retaining rings or hose clamps is available to you from one source.

We Support The Customer...

We support our customers from the moment they contact us. Whether it’s placing an order, requesting design assistance for an assembly, addressing quality issues, or finding just the right part, Rotor Clip is there to help. The Customer Service, Technical Sales, Engineering and Quality Assurance Departments are staffed with knowledgeable people who are there to support you throughout our business relationship.

We Support The Environment...

It is the policy of the Rotor Clip Company to explore and establish all possible means to minimize and eventually eliminate all forms of pollution created by operations at our facilities. Our “Rotor Earth” initiative is our way of contributing to those customers who are involved in the manufacture and development of eco-friendly products. See www.rotorclip.com for more details.
In the past the management of Rotor Clip has demonstrated a commitment to environmentally responsible business practices by dedicating significant resources to correcting and/or eliminating sources of pollution. This has been and will continue to be the manner in which Rotor Clip conducts business. –Excerpt from ISO/TS16949 Document EX/WP294

Other Environmental Commitments...

In House Water Treatment facility — Years ago, we designed and built our own in house treatment facility to effectively remove metals present in the water as a by product of our processes.

Water based Lubricant — Several years ago we switched to this environmentally benign substance and eliminated the need to dispose of waste oil.

Commitment to Clean Air — We regulate emissions into the atmosphere from our furnaces and air conditioners.

Good Overall Housekeeping — We keep our grounds clean and clear of any debris so that such items do not find their way into nearby storm drains.

Car Pooling — Many of our employees travel to and from work together eliminating the need for single occupant cars, doing their part to reduce emissions and traffic during peak travel hours.

Hexavalent chromium replaced by Z3X (see RoHS Compliance, Page 5).

Continuous promotion of our Rings On Wire packaging option to our customers, which cuts down on the use of plastics and adhesive tape.
**Rotor Clip: The Green Ring**

Simple concept. Using a retaining ring to fasten your assembly instead of a traditional fastener not only REDUCES YOUR COSTS, but also SAVES THE ENVIRONMENT. Fewer parts, less material mean cost savings for you and less waste for the planet. Consider the following:

**Machined Shoulder:** Machining this shoulder and screw threads onto a ½" cold-rolled steel shaft to accept a washer and nut retainer generated 0.021lbs. of waste (left). Machining two grooves to accept SH-50 (1/2 inch) retaining rings produced just 0.003lbs. of waste and use correspondingly less cutting fluid (right).

**Cover plate and screws:** The machine threads as well as the bolts and cover plate were replaced by a single groove and one Rotor Clip internal retaining ring (right).

**Cotter pin and washer:** Machine a groove on this shaft and retain it to the brace by installing an “E” retaining ring, eliminating the need to drill a hole through the shaft and retain it with a washer and cotter pin.

**Set Screw Collars:** Shaft collars are bulky and expensive; the set screw can also dig into the shaft when tightened. These collars can be replaced by machining a groove and using a retaining ring.

**Beveled Vs. Shims:** A VHO retaining ring replaces a bulky cover bolted to the main body of this E steering assembly. This allows the steering mechanism to be cut to almost the exact shape needed. Also, the beveled ring takes up end play and eliminates the need for shims.

**Lock Nut vs. Retaining Ring:** Rotary unions perform the critical sealing function between fixed plumbing and machinery that is constantly rotating. Integral to this function is the inner cartridge, containing the seal and bearing, which must be periodically replaced. A threaded lock nut previously held the assembly in place. Removal required a special wrench. The customer replaced the threads with a simple machined groove and an internal retaining ring replaced the lock nut.
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. The following are some points to take into consideration when choosing a ring.

1. **TAPERED SECTION**
   - Tapered section rings make uniform contact with the groove, with a gap between the lug.

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

3. **SPIRAL RINGS**
   - Spiral rings make 360° contact with the groove.
Ring Attributes
The Right Ring For Your Application

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/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 (externally)
• 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
The **TRU-WAVE™ Advantage**

Using wave springs can reduce traditional coil spring heights as much as 50% saving weight and costs as well as reducing overall assembly sizes.

## Wave Spring Types

### Gap Single Turn/Overlap Single Turn
*Standard Inch (SST) / Narrow Inch (NST) / Metric (MST)*
- 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.
- Ideal for:
  - Narrow radial wall dimensions
  - Light duty applications
  - Low clearance applications
  - Ball or roller bearing applications

### Multi-Turn Plain Ends/Multi-Turn Shim Ends
*Light (WSL-MWL) / Medium (WSM-MWM) / Heavy (WSR-MWR)*
- Decreasing spring rate is proportional to the number of turns: More turns equals less force.
- Used for low force applications with large deflections.
- Utilizes nearly 1/2 the space as helical compression springs while producing the same force.
- Ideal for:
  - Medium & heavy duty applications
  - High thrust load capacity
  - Light & medium bearing series: double row, tapered bearing depending on the spring version.

## Choosing a Wave Spring

5 critical factors when considering a wave spring:
- The constraints of the application: Pilot bore/shaft, ID/OD, etc.
- The load (force).
- The working height at which the load is applied.
- The material desired.
- Whether it’s dynamic or static.

## Wave Spring Terms

**Static:** A spring that holds a load at a given height for the life of the assembly; there is no cycling of the part.

**Dynamic:** A spring that is constantly moving up and down until the end of its life. It has two working heights and hence, two loads. Generally, the higher the cycle life the stronger the spring needs to be.

**Hysteresis:** The effect in springs where there is a higher response force during compression (loading) and a lower force during relaxation (unloading).

**Spring Heights:** *Free height*—The height of the wave spring when uncompressed; *Work height*—The height the spring is compressed to for delivering the desired force.

**Operates in Bore/Clears Shaft:**
- *Pilot Bore* - Designed to fit in a bore, and have excess clearance by the shaft;
- *Pilot Shaft* - Designed to fit over a shaft, and have excess clearance by the bore.

**Load:** The force the wave spring exerts when compressed. Load requirements can be stated three ways: A load requirement at a specific working height; the minimum load requirement at one working height, and a maximum load requirement at another working height; the specified spring rate between the minimum and maximum working heights.

**Spring Rate:** The force per displacement (lbs./in. or Newton/mm). More accurate than stamped wave washers.

**Deflection:** How much the spring compresses.

**Diameter Expansion:** A wave spring tends to open outward during compression, which will increase the diameter.

**Fatigue:** All springs suffer fatigue, the weakening or failure of a material resulting from prolonged stress. This can be compensated for with optimal materials and sizing.
NOW YOU HAVE A CHOICE:
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 ISO/TS16949:2009. 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 contribute to your company’s profitability. Order self-compensating hose clamps from Rotor Clamp today. For more information visit www.rotorclamp.com.

### Hose Clamp Comparison

<table>
<thead>
<tr>
<th>Rotor Clamp</th>
<th>Competition Screw / Worm Type Hose Clamps</th>
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</thead>
<tbody>
<tr>
<td><strong>Rotor Clamp</strong> Self-Compensating Hose Clamps</td>
<td><em>Must be manually adjusted as temperature changes.</em></td>
</tr>
<tr>
<td>Expands / Contracts with hose in response to temperature shifts.</td>
<td><em>Screw mechanism maybe over/under tightened causing damage/leakage to the hose.</em></td>
</tr>
<tr>
<td><em>Cannot be over/under tightened.</em></td>
<td><em>Must be manually installed.</em></td>
</tr>
<tr>
<td><em>Can be installed automatically eliminating Carpal Tunnel Syndrome (CTS), a nerve disorder of the hand and wrist.</em></td>
<td><em>More time needed for assembly / disassembly due to screw adjustment.</em></td>
</tr>
<tr>
<td><em>Less time for assembly - resulting in lowered production costs.</em></td>
<td></td>
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</tbody>
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**Additional Models:**
- **HC** Single Wire Hose Clamp
- **DW** Double Wire Hose Clamp
- **CTB** Constant Tension Band Hose Clamp
- **CTL** Constant Tension Light Band Hose Clamp
- **CTO** Pre-Opened Pre-Positioned Band Clamp

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Rotor Clamp
Self-Compensating Hose Clamps
Tapered Section Rings, Constant Section Rings, Spiral Rings, Wave Springs and Hose Clamps from Rotor Clip are ideal when you need quality fasteners to reduce costs and maximize performance of your application.
Automotive Applications

Tapered Section Rings, Constant Section Rings, Spiral Rings, Wave Springs and Hose Clamps from Rotor Clip are ideal when you need quality fasteners to reduce costs and maximize performance of your application.
Wave Spring Applications

- Spring Cushioned Shoe
- Rolling Door
- Flash Light Application
- Sprinkler Device
- Inflator Application
- Night Vision Lens
- Centrifugal Pump
- Airbag Application
- Mechanical Seal
- Car Mirror
- Quick Connect
Hose Clamp Applications

Tapered Section Rings, Constant Section Rings, Spiral Rings, Wave Springs and Hose Clamps from Rotor Clip are ideal when you need quality fasteners to reduce costs and maximize performance of your application.
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.

**HO** - Internal Housing Ring.
Installed in the groove of a housing / bore.

**SH** - External Shaft Ring.
Installed in the groove of a shaft.

**HOI** - Internal Housing Inverted Ring.
Functions like a HO ring in a housing / bore, only the lugs are “reversed,” providing more clearance if needed.

**SHM** - External Shaft Tamper-Proof Ring.
Tamper proof ring which does not have any lugs and cannot be easily removed once installed.

**SHI** - External Shaft Inverted Ring.
Functions like an SH ring on a shaft, only the lugs are “reversed,” providing more clearance if needed.

**BHO** - Internal Bowed Housing Ring.
Compensating for accumulated tolerances is what a BHO retaining ring is designed to do in a housing/bore. Once snapped into the groove, bowed rings exert a force or “preload” on the retained parts for the range specified in the catalog.

**BSH** - External Bowed Shaft Ring.
Compensating for accumulated tolerances is what a BSH “bowed” retaining ring is designed to do on a shaft. Once snapped into the groove, bowed rings exert a force or a “preload” on the retained parts for the range specified in the catalog.

**VHO** - Internal Beveled Housing Ring.
These rings look exactly like their HO counterpart, only they have a 15 degree angle on the outer edge. This combines with a complementary groove angle to eliminate end-play by wedging itself between the groove and the retained part.

**VSH** - External Beveled Housing Ring.
These rings look exactly like their SH counterpart, only they have a 15 degree angle on the inner edge. This combines with a complementary groove angle to eliminate endplay by wedging itself between the groove and the retained part.
Products

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.
The RE retaining ring is 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 at retaining assemblies with extremely high rotational speeds.

**PO/POL** - External Poodle Ring / Poodle Light Ring.
Features wide “ears” (resembling those of a poodle dog, thus the name) which offer extra retention surface against the retained part. Also available in thinner sizes (POL).

**BE** - External Bowed E Ring.
Compensating for accumulated tolerances is what a BE “Bowed” retaining ring is designed to do on a shaft. Once snapped into the groove, bowed rings exert a force or a “preload” on the retained parts.

**EL** - External Bowed Locking Ring.
In addition to the bowed design for eliminating “play” in an assembly, it also features two prongs, which extend from the inner circumference to the open end locking the ring firmly into place.

Rings For End-Play Takeup
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.**
Designed to function on soft shafts only, this ring makes indentations on either side of the groove once installed, significantly increasing its holding power. Install directly against the face of the retained part and virtually eliminate end play. Automate installation by using a Rotor Kick Jr. pneumatic installation tool.

**TX/TY - Toothed External "Push On" Rings.**
This ring features an 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. The outer rim of the TX is curved; the TY rim is flat. The TX affords greater thrust load capacity than the TY and is easier to orient for assembly.

**TI - Toothed Internal “Push On” Ring.**
The ends create interference with the housing when the ring is installed and a load introduced to the other side.
Products
DIN Metric Tapered Section Retaining Rings
Axially Assembled

**DHO DIN 472**  
Internal DIN Housing Ring.  
Installed in the groove of a housing / bore.

**DSH DIN 471**  
External DIN Shaft Ring.  
Installed in the groove of a shaft.

**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.

**DHT DIN 984**  
Internal DIN Housing Teeth Ring.  
Similar in design to the DHO internal ring, this features several “teeth” equally distributed along the circumference of the ring. Particularly effective in retaining applications with large radii or chamfers.

**DHR**  
Internal DIN Housing Reinforced Ring.  
A thicker version of the DHO featuring a larger radial width than this ring.

**DSR**  
External DIN Shaft Reinforced Ring.  
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 a DSH ring in a shaft, only the lugs are “reversed,” providing more clearance if needed.

**DST DIN 983**  
External Shaft Teeth Ring.  
Similar in design to the DSH external ring, this features several “teeth” equally distributed along the circumference of the ring. Particularly effective in retaining applications with large radii or chamfers.
**Products**

**DIN Metric Tapered Section Retaining Rings**

**Radially Assembled**

**DE DIN 6799**
External DIN E Ring.
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.

**DTX**
External DIN Self-Locking Ring.
This ring features an 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.

**DTI**
Internal DIN Self-Locking Ring.
The ends create interference with the housing 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 Rings - Radially Assembled**

**JE (JIS B 2805)**
External JIS E Ring.
Three prongs make contact with the bottom of the groove and provide a shoulder for effective retention of assemblies.
Products
ANSI Metric Tapered Section Retaining Rings
Axially Assembled

**MHO**
Internal ANSI Metric Housing Ring.
Installed in the groove of a housing/bore.

**MSH**
External ANSI Metric Shaft Ring.
Installed in the groove of a shaft.

**MSR**
External ANSI Metric Shaft 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.

ANSI Metric Tapered Section Retaining Rings
Radially Assembled

**ME**
External ANSI E Ring.
Three prongs make contact with the bottom of the groove and provide a shoulder for effective retention of assemblies.

**MC**
External ANSI Metric Crescent Ring.
Ideal for low clearance applications where radial installation is preferred.

**MRE**
External Reinforced ME Ring.
The MRE retaining ring is a reinforced version of the ME ring, which will accommodate higher thrust loadings and RPM. MRE rings function in the same groove as regular ME rings.
The constant section 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.

**USL**
External Inch Constant Section Ring.
Installed in the groove of a housing/bore.

**UHO**
Internal Notched Inch Constant Section Ring.
Installed in the groove of a housing/bore, featuring notches for ease of installation/removal.

**SNL**
External Inch Constant Section Ring.
A light duty ring designed for needle bearing applications on shafts.

**UHB**
Internal Inch Constant Section Ring.
Installed in the groove of a housing/bore.

**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.

**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.

**SHC / SHO**
External Inch Constant Section Ring - Square Section.
Made from square-shaped wire and installed in the groove of a shaft.

**RLO, RHC / RHO**
External Inch Constant Section Ring - Round Section.
Made from round-shaped wire and installed in the groove of a shaft.
**Products**

**Metric Constant Section Retaining Rings**

The constant section 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.

- **HBL, HBM, HBH**
  *Internal Metric Constant Section Ring.*
  Designed to retain SAE Standard metric bearings in a housing/bore.

- **CBS DIN 5417**
  *External Metric Constant Section Ring.*
  Designed to retain metric bearings on a shaft.

- **SR**
  *External Metric Constant Section Ring.*
  Designed for grooves in outer tracks of ball or roller bearings on shafts.

- **CRS DIN 7993**
  *External Metric Constant Section Ring.*
  Round Wire.
  Made from round wire and installed in the groove of a shaft.

- **SB**
  *External Metric Constant Section Ring.*
  Designed to retain SAE Standard metric bearings on a shaft.

- **CRH DIN 7993**
  *Internal Metric Constant Section Ring.*
  Round Wire.
  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.

- **CFH**
  *Internal Metric Constant Section Ring - Flat Wire.*
  Made from flat wire and installed in the groove of a housing/bore.
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 retaining rings are ideal for light duty applications, or where axial positioning is the primary function.

**KM - Internal, Medium Duty.**
These rings offer the greatest economy in price and size. They are able to handle approximately twice the thrust capacity of the KL series, and to be produced to military specifications if needed.

**KR - Internal, Medium-Heavy Duty.**
With load bearing capacities closer to the Heavy-duty series, and almost universal groove dimensions, these rings offer greatest ease of assembly with greatest thrust capacity.

**KG - Internal, Heavy Duty.**
The greatest size range and thrust capacity make these rings the only choice for applications that require minimum deflection or thrust loads that demand a deep groove capacity.

**KLR - Internal, Heavy Duty Snap Ring.**
These single-turn snap rings are ideal for applications involving high thrust loads.

**CL - External, Light Duty.**
These single-turn retaining rings are ideal for light duty applications, or where axial positioning is the primary function.

**CM - External, Medium Duty.**
These rings offer the greatest economy in price and size. They are able to handle approximately twice the thrust capacity of the CL series, and to be produced to military specifications if needed.

**CR - External, Medium-Heavy Duty.**
Externally fitted to up to 10in. shaft diameter, these rings can handle all but the most rigorous applications.

**CG - External, Heavy Duty.**
The rigors of the toughest applications are easily handled by this external series. Its large size, and ease of application and removal, transfers into an assurance of quality for demanding uses.

**CLR - External, Heavy Duty Snap Ring.**
These single-turn snap rings are ideal for applications involving high thrust loads.
Products

Metric Spiral Retaining Rings

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.

**DKR DIN 472** - Internal, Heavy Duty, DIN.
An internal metric ring which meets DIN standards of performance and quality. Our metric rings come standard in 302 stainless steel.

**DKL** - Internal, Light Duty, Metric.
These single-turn retaining rings are ideal for light duty applications, or where axial positioning is the primary function.

**KLM** - Internal, Light Duty, Metric.
These single-turn retaining rings are ideal for light duty applications, or where axial positioning is the primary function.

**MKM** - Internal, Medium Duty, Metric.
These rings offer the greatest economy in price and size. They are able to handle approximately twice the thrust capacity of the MKL series.

**MKR** - Internal, Med.-Heavy Duty, Metric.
With load bearing capacities closer to the Heavy-duty series, and almost universal groove dimensions, these rings offer greatest ease of assembly with greatest thrust capacity.

**MKG** - Internal, Heavy Duty, Metric.
The greatest size range and thrust capacity make these rings the only choice for applications that require minimum deflection or thrust loads that demand a deep groove capacity.

**MKA** - Internal, Aerospace, Metric.
Dimensions conform to Metric Aerospace Specification MA 4017.

**DCR DIN 471** - External, Heavy Duty, DIN.
For applications where European DIN standards need to be met, these rings are designed to fit into the grooves established by DIN specifications.

**DCL** - External, Light Duty, Metric.
These single-turn retaining rings are ideal for light duty applications, or where axial positioning is the primary function.

**CLM** - External, Light Duty, Metric.
These single-turn retaining rings are ideal for light duty applications, or where axial positioning is the primary function.

**MCM** - External, Medium Duty, Metric.
These rings offer the greatest economy in price and size. They are able to handle approximately twice the thrust capacity of the MCL series.

**MCR** - External, Med.-Heavy Duty, Metric.
With load bearing capacities closer to the Heavy-duty series, and almost universal groove dimensions, these rings offer greatest ease of assembly with greatest thrust capacity.

**MCG** - External, Heavy Duty, Metric.
The rigors of the toughest applications are easily handled by this external series. Its large size, and ease of application and removal, transfers into an assurance of quality for demanding uses.

**MCA** - External Aerospace, Metric.
Dimensions conform to Metric Aerospace Specification MA 4017.
A wave spring is coiled flat wire with waves added to give it a spring effect. Wave springs are superior to coil springs in certain applications because they provide lower work heights with the same force.

**TruWave™ Wave Springs**

- **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 diameter.

- **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 diameter.

- **NST** - Single Turn, Narrow, Inch. Ideal for short deflection applications where space is minimal.

- **WSL, WSM, WSR** - Multi Turn, Inch. Used for low force applications with large deflections: More turns equals less force. Utilizes nearly half the space as helical compression springs while producing the same force.

- **MWL, MWM, MWR** - Multi Turn, Metric. Used for low force applications with large deflections: More turns equals less force. Utilizes nearly half the space as helical compression springs while producing the same force.

**Shims**

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.

- **KMS** - Internal / External, Inch.
Products
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.

**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 where a lower clamping force than offered by single wire clamps 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 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 Light Band Clamp.**
These are cost effective alternatives to other types of band clamps, but do not compromise quality or reliability.

**CTO - Pre-Positioned, Pre-Opened Clamp**
This band clamp is held in the open position by compressing the tangs and allowing the stop to hook on to a complementary notch on the side on one of the tangs. Must be pre-glued to the hose.

**CTO PreOpen, PrePositioned Clamps**
This unique, patented version of a preopened clamp is held in the open position by compressing the tangs and allowing the stop to hook on to a complementary notch on the side on one of the tangs. The hook catches this “dimple” when the clamp is opened for a more secure hold. The clamp can then be glued in position on a hose.

For more information visit [www.rotorclamp.com](http://www.rotorclamp.com).

**CTO Clamp is only intended for rubber hose manufacturers who pre-glue clamps to hoses before supplying to the automotive industry.**
Products
Retaining Ring Tools

Rotor Clip supports its market with a full line of installation tools and systems including applicators, dispensers, pliers, pneumatic tools, and automated assembly equipment.

**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/removal of retaining rings and 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." Plier locks at the desired size without continued pressure on the handles. (Note: 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 - up to 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.

**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.
Products
Retaining Ring Tools

Rotor Clip supports its market with a full line of installation tools and systems including applicators, dispensers, pliers, pneumatic tools, and automated assembly equipment.

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 (ring “snaps” when properly seated in 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 / mallet to install the ring. Shield at top prevents injury.

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 your work station.

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.
Products
Retaining Ring Tools

Rotor Clip supports its market with a full line of installation tools and systems including applicators, dispensers, pliers, pneumatic tools, and automated assembly equipment.

Retaining Ring Pliers Kits
Stock the tools you use most with any or all of these four retaining ring plier kits. Rugged carrying cases provide portability and durability in a manufacturing environment. Tools are designed to fit a wide range of sizes from 3/8” to 4” retaining rings, 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.

V-Orbis™ Tool
This tool is specially made for easy removal of Rotor Clip’s line of Ventus™ Spiral Retaining Rings, which are designed to withstand the rigors and functional stresses of wind power applications. By machining a lug hole in the ring, the V-Orbis tool makes field installation and removal far easier than traditionally designed spiral rings. Visit www.rotorclip.com/windpower for more information, or e-mail tech@rotorclip.com for design considerations.
Products
Retaining Ring Tools

Rotor Clip supports its market with a full line of installation tools and systems including applicators, dispensers, pliers, pneumatic tools, and automated assembly equipment.

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”

Pneumatic Retaining Ring Tool
These pneumatic hand tools automate assembly using a compressed air line (85 psi). Saves time while eliminating injury. Pneumatic Retaining Ring Tools are designed to fit the following inch/metric retaining rings: HO, VHO, BHO, HOI, SH, VSH, BSH, SHI, SHR, DHO, DSH, DST, DHT. (NOTE: Power pack and tips must be purchased together for tool to operate.)

RotorMatics Automated Assembly Tool - “Rotor Kick Jr.” (RKJ)
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.
Rotor Clip supports its market with a full line of installation tools and systems including applicators, dispensers, pliers, pneumatic tools, and automated assembly equipment.

**Single Wire Hose Clamp Plier (KC-18)**
Install Rotor Clamp single wire hose clamps (HC) quickly and easily using this simple hand tool. ONE SIZE FITS ALL.

**Constant Tension Band (CTB) Hose Clamp Plier (HAZ-1)**
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.

**Heavy Duty Single Wire Hose Clamp Plier (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.

More Information Online at
www.rotorclamp.com
Products

Pneumatic Hose Clamp Tools

Rotor Clip supports its market with a full line of installation tools and systems including applicators, dispensers, pliers, pneumatic tools, and automated assembly equipment.

**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.

**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.

**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.

**Rotor Clamp Pneumatic Pre-Opened Release Tool (PRT)**
The PRT is an innovative application system for pre-opened hose clamps (CTO). It guarantees the perpendicular placement of the clamp to the hose and mating tube. It eliminates clamps placed at an angle which can possibly lead to leaks and loosening of the hose. Clamps cannot be closed until the tool is properly in place. The PRT verifies that the clamp has been cycled by sending a confirmation to an electronic work station. The tool is ergonomic and can fit into limited space requirements due to its unique design and adapts easily to standard assembly line air supply systems.

For Ease of Hose Clamp Installation and Removal.
Materials, Finishes & Packaging

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 420 type cold rolled stainless steel (UNS S42000) and DIN 1.4122 as options. Other materials available are our standard beryllium copper (Alloy #25/UNS C17200) and phosphor bronze (Alloy#5218/UNS C52180).

Please note that the availability of rings in the stainless steel and copper materials is subject to prior inquiry and acceptance of a formal quotation.

Rotor Clip can also produce rings one gauge thicker or thinner than standard sizes. Again, such orders are subject to prior inquiry and acceptance of a formal quotation.

Characteristics of each material follow:

**CARBON SPRING STEEL -** Rotor Clip Code 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 -** Rotor Clip Code 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 -** Rotor Clip Code 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 -** Rotor Clip Code 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.
  Note: We reserve the right to substitute PH 17-7 (Rotor Clip Code SS) stainless steel material for PH 15-7 Mo on larger rings.

- **TYPE 420 -** Rotor Clip Code SC
  A less expensive alternative to PH 15-7. Since general corrosion resistance for this material is less than PH-15-7, use of this material depends upon the application. Contact Technical Sales for assistance.

- **DIN 1.4122 -** Rotor Clip Code SG
  A grade of stainless steel for retaining rings ordered in / for European countries.
PHOSPHATE COATING (PA) - This standard finish offers extended shelf-life protection against rusting AT NO ADDITIONAL CHARGE.

PHOSPHATE AND OIL (PD) - This finish provides 8-hour salt spray protection.

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) and is particularly effective for applications exposed to seawater. 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 leached 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.

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.

<table>
<thead>
<tr>
<th>Finish</th>
<th>Code</th>
<th>Description</th>
<th>Salt Spray Hours</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phosphate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PA</td>
<td>Shelf-Life</td>
<td></td>
<td>-</td>
<td>Black</td>
</tr>
<tr>
<td>PD</td>
<td>Phosphate and Oil</td>
<td>8 (Red Rust)</td>
<td>Black</td>
<td></td>
</tr>
<tr>
<td>PAL</td>
<td>Phosphate with Sealer</td>
<td>-</td>
<td>Black</td>
<td></td>
</tr>
<tr>
<td>HPD</td>
<td>Heavy Phosphate and Oil</td>
<td>72 (Red Rust)</td>
<td>Black</td>
<td></td>
</tr>
<tr>
<td>Hexavalent Chrome</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZF</td>
<td>Zinc Bright</td>
<td></td>
<td>48 (Red Rust)</td>
<td>Silver</td>
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<td>ZD</td>
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<td>96 (Red Rust)</td>
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<td>ZDL</td>
<td>Zinc Dichromate Sealer</td>
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<td>HZDL</td>
<td>Heavy Zinc Dichromate Sealer</td>
<td>480 (Red Rust)</td>
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<td>Trivalent</td>
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<tr>
<td>Z3X</td>
<td>Trivalent Chromate Zinc plus Sealer</td>
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<td>Optional Color Coding Finishes</td>
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<tr>
<td>ZFF</td>
<td>Zinc Flash</td>
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<tr>
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<td>Copper Flash</td>
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<tr>
<td>OIL</td>
<td>Oil Over Steel - Shelf Life</td>
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<td>Black</td>
<td></td>
</tr>
</tbody>
</table>

*White Corrosion / Red Corrosion

NOTE: Electroplating can not be successfully done with steel retaining rings due to the problems encountered with hydrogen embrittlement.
Materials, Finishes & Packaging

Spiral Ring Materials & Finishes

Materials:

CARBON SPRING STEEL
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 some corrosion resistance.

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

STAINLESS STEEL - AISI 316
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
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
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
This standard finish for carbon steel spiral retaining rings offers an extended shelf-life protection against rusting.

BLACK OXIDE
This flat, black finish is used more for when aesthetics of the part are a factor with minimal corrosion protection.

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

PASSIVATION
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).

ZINC PHOSPHATE
This coating affords carbon steel excellent salt spray protection and corrosion resistance.

<table>
<thead>
<tr>
<th>Material</th>
<th>Material Thickness (in)</th>
<th>Minimum Tensile Strength (psi)</th>
<th>Shear Strength (psi)</th>
<th>Maximum Recommended Operating Temperature °F</th>
<th>Modulus of Elasticity (psi)</th>
</tr>
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<tbody>
<tr>
<td>CARBON STEEL</td>
<td>0.05 - 0.14</td>
<td>265,000</td>
<td>155,000</td>
<td>250</td>
<td>30 x 10^6</td>
</tr>
<tr>
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<td>0.081 - 0.67</td>
<td>255,000</td>
<td>145,000</td>
<td>250</td>
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<td>0.0211 - 0.633</td>
<td>221,000</td>
<td>125,000</td>
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<tr>
<td></td>
<td>0.031 &amp; Longer</td>
<td>215,000</td>
<td>120,000</td>
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<td>0.091 - 0.10</td>
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<td>0.0471 - 0.653</td>
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<td>0.0811 - 0.665</td>
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<td>0.0631 - 0.661</td>
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<td></td>
<td>0.0811 &amp; Longer</td>
<td>176,000</td>
<td>97,000</td>
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<tr>
<td>17-7 PHC</td>
<td>CONDITION C9000</td>
<td>240,000°F</td>
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<td>AMS3525</td>
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<tr>
<td>BERYLLIUM COPPER</td>
<td>TEMPER TH92</td>
<td>185,000°F</td>
<td>123,000°F</td>
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<td>18.5 x 10^6</td>
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<td>ASTM B197</td>
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</tbody>
</table>
**Materials, Finishes & Packaging**

**Wave Spring Materials**

**SAE 1070-1090 Carbon Steel**
- This prehardened material is the standard material for wave springs.
- Less expensive option to Stainless Steel.

**17-7 Stainless Steel**
- 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.

**Packaging**

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

**Ring On Wire (ROW)** - 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.

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

**Shrink Wrapped** - 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.
How To read Rotor Clip Part Numbers

HO-50ST PA S

- Identifies the **TYPE** of ring
- Identifies the **SIZE** of the ring
- Identifies the **MATERIAL**
- Denotes the **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, PH-17-7)
- SC  Stainless Steel 420
- SG  Stainless Steel DIN 1.4122
- BC  Beryllium Copper
- PB  Phosphor Bronze

**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.
Services
www.rotorclip.com

Log on to rotorclip.com (retaining rings) or rotorclamp.com (selfcompensating hose clamps) and get the information you need now from our multinational sites including the U.S., U.K., and Germany. Access a variety of information and services that will streamline your dealings with Rotor Clip/Rotor Clamp. And if you register your account, all forms for sample requests, quotation requests and general inquiries will be automatically filled out with your company info when you visit these services.

Here's a sampling of what you'll find at rotorclip.com:

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REQUEST FOR QUOTATIONS
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REQUEST FOR FREE SAMPLES
Get the retaining ring/hose clamp samples you need for an application you are testing or for a customer you currently service. Click on “Request Samples” and complete the form. Your order will be picked and shipped to you within 24 working hours of receipt of your request.

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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 page(s) you need or our entire product catalog in English, German, Spanish and French versions.
RotorExpress & Military Retaining Rings

Through a series of partnerships throughout the country (part of our Rotor Express program), 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.

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.

**Inch Constant Section Retaining Rings**

**Internal**
- HN
- UHO
- UHB
- USC
- USH
- SNL
- SLC/SLO
- SHC/SHO
- RLC/RLO
- RHC/RHO

**External**

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**Metric Constant Section Retaining Rings**

**Internal**
- HBL
- CRH
- CFH
- SR
- SB
- CFS
- CBS
- CRS

**External**

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**Inch Spiral Retaining Rings**

**Internal**
- KL
- KM
- KR
- KG
- KLR
- CL
- CM
- CR
- CG
- CLR

**External**

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**Metric Spiral Retaining Rings**

**Internal**
- DKR
- DKL
- KLM
- MKM
- MKR
- MKG
- MKA

**External**
- DCR
- DCL
- CLM
- MCM
- MCR
- MCG
- MCA

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**TruWave™ Spiral Retaining Rings**

**Internal**
- NKG

**External**
- NCG

**Shims**
- KMS

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**TruWave™ Wave Springs**

**Single Turn**
- SST
- NST
- MST

**Multi Turn**
- WSL/WSM/WSR
- MWL/MWM/MWR

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**Self-Compensating Hose Clamps**

**Wire Clamps**
- HC
- HW
- DW
- CTB
- CTL
- CTO

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**Band Clamps**

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**Tools**

**Manual / Pneumatic**

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