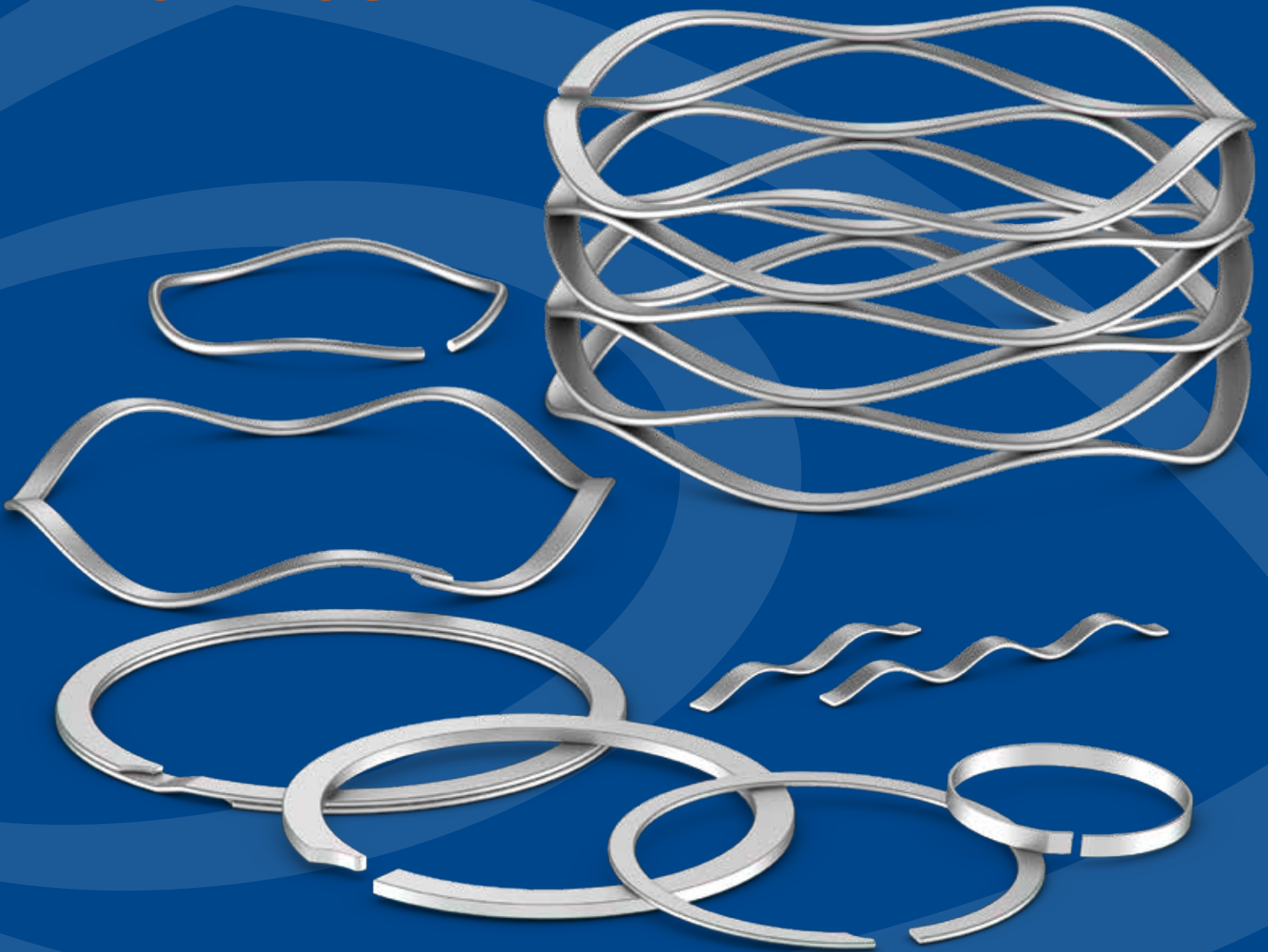


# ENGINEERING AND PARTS CATALOG

**READY TO SHIP**

OVER 10,000 STANDARDS  
CARBON AND STAINLESS STEEL

**CUSTOM ENGINEERED PRODUCTS**

.200" TO 120"  
5 MM TO 3,000 MM  
NO-TOOLING CHARGES™

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# READY TO TAKE YOUR DESIGN TO THE NEXT LEVEL?

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**Ask Smalley.** While we offer more than 10,000 standard stock products, there's no guarantee that one of these will exactly match your specific application. We get it. We're engineers, too. We're always ready to collaborate with you to design the unique wave spring, Spirolox Retaining Ring or constant section ring that meets your exact requirements.

If your specifications don't match a Smalley part number, contact a Smalley engineer today to design and prototype a part that fits your needs and gets you to your target application performance.

Shel  
Smalley Engineer

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Lake Zurich, IL 60047  
USA

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Gap-Type, No-Tooling-Costs, No-Tooling-Charges, Overlap-Type.

The following are registered trademarks of Smalley Steel Ring Company: All Springs Are Not Equal, Circular-Grain, Crest-to-Crest, Edgewound-Coiled, No Ears to Interfere, Quick Ship, Smalley, Spirawave, Spirolox, WaveRing, Wavo, Hoopster.

Smalley reserves the right to change dimensions.

# THE ENGINEER'S CHOICE™

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When engineers seek a higher level of precision and performance in retaining rings, wave springs or constant section rings, there's only one choice: **Smalley**.



From aerospace to automotive, medical, off-highway, oil & gas to industrial, Smalley has built a reputation for unsurpassed quality and an expert, collaborative engineering team. For more than 50 years, we have been the industry leader and technological pioneer—working alongside many of the world's most respected companies to give their products a true performance edge.

## What makes Smalley different?

**Our products**—Unlike rings and springs that are die-stamped through the metal grain, our proprietary edgewinding process results in a circumferential metal grain structure that gives Smalley rings and springs exceptional strength, dimensional stability and predictable performance characteristics. All of which result in higher quality for your application.

**Our engineers**—At Smalley, we believe that engineers should work with engineers. So we ensure that customers work directly with our experienced and talented team. This access to technical expertise and problem solving, prototyping and collaboration is

rare in the industry. But it allows you to take your designs further than you thought possible. And our No-Tooling Charges™ process means cost-effective prototyping for you.

**Our support**—Every Smalley ring and spring—whether it's a unique design or one of our 10,000 stock items—is backed by our legendary customer support. Our commitment to service combined with our near-perfect record of on-time delivery has earned us an approved supplier status with leading OEM manufacturers around the world.

We're always looking for ways to expand and improve our Customer Service and Engineering/Technical Assistance. And with regional offices in the Americas, Europe and Asia, Smalley provides total global supply chain solutions to meet your worldwide manufacturing requirements.

See for yourself what the Smalley team can bring to your critical design applications. We look forward to working with you.

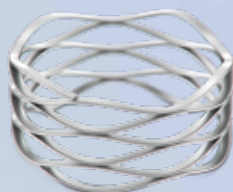
# PRECISION PRODUCTS FOR CRITICAL APPLICATIONS

All Smalley retaining rings, wave springs and constant section rings are manufactured with our unique edgewinding process. This eliminates any tooling charges, greatly increases design flexibility and reduces lead times as dies do not have to be produced.



## Retaining Rings

Unlike die-stamped circlips/retaining rings, Spirolox Retaining Rings are coiled to the exact diameter required. They have a uniform cross-section—or, to use our terminology, “No Ears to Interfere” within an assembly—and are free of burrs. Spirolox Retaining Rings meet military and aerospace specifications and are found in thousands of mechanical products around the world.



## Wave Springs

Wave springs are precise flat wire compression springs that fit into assemblies where space is at a premium. Since the overall lengths and operating heights of wave springs are lower than those of conventional round wire springs, they will often reduce the size of the spring cavity by as much as 50%. Of course, this will also reduce the weight and raw material cost of the assembly.



## Constant Section Rings

Constant section rings, or snap rings, are often specified for heavy duty or impact-loading applications. Produced by edgewinding, they are fixtures in the automotive and heavy equipment industries as their larger cross section produces strength and durability. In addition, a variety of Smalley end types are available for easy application in a wide range of applications.



Automation



Space Exploration



Medical



Energy



Consumer Products



Heavy Machinery



Aerospace



Automotive

# ENGINEERING AND DESIGN ASSISTANCE

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“Ask Smalley” is more than a tagline. For our engineering team, it’s a call to action. We are always ready to address your application requirements and work together to take your design to a higher level of performance.

## Tap Our Knowledge Early

Usually, the sooner we are able to review your requirements, the easier the solution will be. Getting Smalley engineers involved early in your design process usually produces the best results.

## Draw Upon Our Extensive Resources

Our engineering team has compiled a library of more than 25,000 applications while designing rings and springs in mechanical components and assemblies. In addition, we offer computer-aided spring-design alternatives to meet your specifications.

We also offer additional step-by-step resources. The “Custom Designs” section of this catalog will help you determine basic retaining ring and wave spring specifications. Our website offers interactive design guideline and options to help you get the most from your application.

## Put Us On Your Team

There are many more options we can review with you once your design criteria are established. For example, we can help you with the selection of a standard part from our vast inventory, or work together to modify a standard part to meet your unique needs.



## Customs

At Smalley, customs are standard. It’s easy to get a custom part from our engineers. In most cases we can manufacture a new ring or spring design in just two weeks or work with you to meet your delivery schedule. Fast, precise and economical—it’s how we produce rings and springs in short runs or high volumes, and from .200” to 120” in diameter. If you can’t find a standard part to meet your needs in this catalog, contact our engineering team for immediate assistance.

## CAD Downloads

Visit our website for CAD downloads in any native or neutral platform. It’s easy to search and select a standard part for a quick upload to your computer.

## Quality Policy

Smalley has established, and is continuously improving upon, a program that is designed to meet the following objectives:

- Total product conformance in terms of drawings, specifications and contractual requirements
- 100% on-time delivery performance
- Superior products with exceptional value
- Prompt, professional and courteous response in every facet of design, manufacturing, sales and customer service
- Continued development and use of the latest technology

# MEETING YOUR DEMANDS FOR PRECISION COMPONENTS

At Smalley, we have a single, overriding goal: To supply our customers with uncompromising quality and service. It begins with our raw material and extends through every aspect of our world-class manufacturing process.

## Raw Material

As demand for more raw material sizes continues to increase, Smalley has invested heavily in our flat wire rolling mill operation. In addition, we offer a vertical integration process that has evolved into the production of hundreds of material cross-sections in a wide variety of alloys.

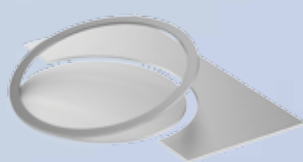
## Manufacturing

Edgewinding, also known as “The No-Tooling Cost Process,” is our precision forming operation that coils pre-tempered flat wire on edge to create a near-perfect circle, similar to the famous Slinky® coiled metal toy. Circular-Grain metallurgy gives our products key benefits including:

- Strength and stability that is far superior to conventional retaining rings and washers that are simply stamped through the metal grain
- The ability to coil to your exact specification in any diameter and with any number of turns (layers or coils), effectively eliminating material waste
- The flexibility to accommodate your design changes without the need for additional tooling and die modifications
- A quicker, more economical ability to produce your low-volume custom orders and working prototypes



Edgewinding Process



Conventional Stamping Process

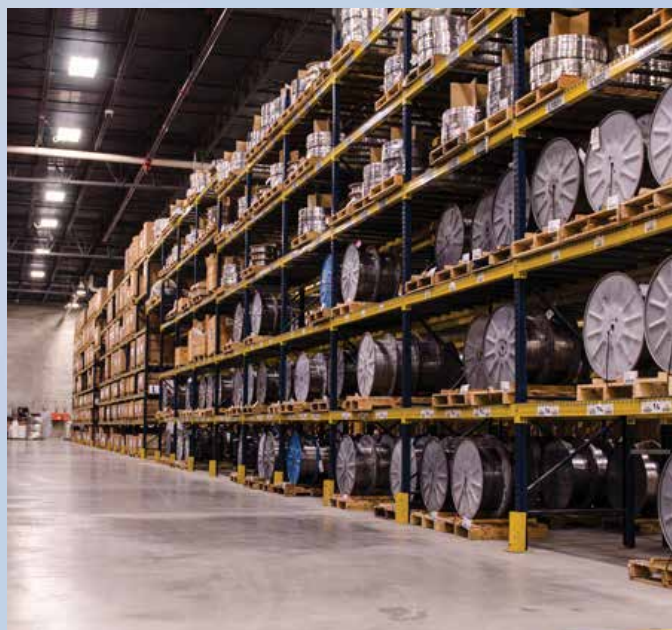
## Prototypes

Our engineers work closely with you to ensure you get the ideal prototype for your design: adjusting dimensions, changing the number of waves or turns, and trying different combinations of variables. Finally, we test for function, before production, so we know it's right.

From one to one thousand pieces, we can produce, test, modify and reproduce your design as often as necessary—all without special tooling costs.

## Warehousing

To meet our “just in time” (JIT) deliveries and any immediate requirement you may have, we maintain a substantial parts inventory of every cataloged/standard retaining ring and wave spring in both carbon and stainless steel.



# DEDICATED TO UNSURPASSED SERVICE AND SUPPORT

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Smalley is dedicated to providing the most positive, efficient and economical service possible, each and every day. We continually train our staff on every important aspect of keeping you productive. In addition, we can split shipments to suit your JIT delivery requirements, and we offer lower prices for your annual higher-volume orders. Contact us for complete details and ideas on how you can purchase economically.

## General Sales Information

### Description

The product descriptions in this catalog are intended to provide practical information for application selection. Since it is not possible to include complete detail on all parts, please contact Smalley for any information not included here that may be critical for your application.

### Quotations

We will provide written or verbal quotations as requested. Requests can be submitted at [smalley.com/rfq](http://smalley.com/rfq), [orders@smalley.com](mailto:orders@smalley.com) or phone

### Returns

Parts not stocked that must be specially manufactured are not returnable except by special arrangement and will be subject to cancellation charges. Stocked parts may be returned for credit at a standard restocking charge (subject to condition). All returns of stocked parts must be made within 30 days from date of receipt of material.

### Delivery

Parts carried in stock normally will be shipped within 48 hours after receipt of an order. Special parts are normally delivered in three weeks (if no special processes are required) or as previously arranged.

### Certifications

Standard Certification of Conformance will be supplied at no charge. Material and other Certifications for plating, load, etc. will be furnished as quoted.

### Transportation

As specified by the customer. In the absence of instructions, the shipping method will be selected by Smalley. Insurance will be provided only at the customer's request.

### Terms

1/10/Net 30 on open accounts. For consideration of an open account, customers are requested to supply banking information and at least three commercial credit references. Visit [www.smalley.com](http://www.smalley.com) for Terms and Conditions that apply.

### F.O.B.

Factory, Lake Zurich, Illinois, USA

### Packaging

Rings and springs 1 5/16" in diameter and under are bulk packaged. Rings and springs 1 3/8" and over in diameter are generally tube (coin) packaged in lengths 10 to 18 inches.





# QUALITY ASSURANCE

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Smalley's Total Quality Management philosophy dictates our commitment to quality and customer satisfaction. While this commitment has earned us official certification (ISO 9001, ISO/TS 16949, AS 9100 and ISO 14001), quality assurance and customer satisfaction mean much more at Smalley. They are tradition; the very foundation upon which we have built our company. From the beginning, we have never lost sight of our goal: To supply customers with uncompromising quality and service.

Our entire manufacturing team is committed to a quality policy built around:

- Conformance to specifications with controlled lot variation about the target
- Statistical quality control
- Defect prevention
- Annual improvement in process and product

Every Smalley employee works toward excellence, individually and cooperatively, to provide superior products and services.

## Approved Supplier Status

A history of quality and strict compliance with military and aerospace standards has earned Smalley an approved supplier status with many leading OEMs worldwide. In accordance with the requirements of ISO 9001, ISO/TS 16949, AS 9100 and ISO 14001, we have established and continuously improve upon our quality systems. Use of the latest technology, including statistical tools, has helped us achieve and maintain the world-class quality associated with Smalley for more than 50 years.

Smalley uses statistical quality control tools to assure the capability and stability of our coiling process:

- First, we identify common dimensions to monitor and special causes of variation in the product
- Then, we collect and analyze data on these critical dimensions, performing disciplined sampling and taking measurements during in-line and final inspection—and yet again during pre-shipment inspection

## Robust Quality Training

In addition to quality testing, Smalley makes formal SQC in-house training programs mandatory for many employees involved in manufacturing. This training has noticeably developed quality awareness and responsibility at all levels, giving employees a clear understanding of what is expected, a means of regulating their processes and checking their output, and statistical tools to ensure optimal machines performance.

In fact, our machine capability studies help us identify sources of variation before they become a problem. We analyze the capabilities of all production machinery in primary and secondary operations, heat treating and finishing. We also follow our own meticulous procedures to determine the reproducibility and repeatability of our gauging systems.

## Confidence Delivered Daily

Based on our careful quality documentation, many Smalley customers have found that they can reduce or even eliminate their incoming inspections of our product. Many have also revised their dual sourcing policy and confidently rely on our team as their single source for Spirolox Retaining Rings, wave springs, constant section rings, linear springs and other wire forms.

Defect prevention, or near-zero defects, is a key goal at Smalley. We use the latest automated inspection techniques to monitor production. As a result, we are constantly studying the causes of variation, improving upon and developing processes with capability indexes (Cpk) exceeding 1.33.

Talk to a Smalley engineer today and you'll see why quality assurance is more than a department. It's a way of life.