SMALLEY

THE ENGINEER'S CHOICE®



RING AND SPRING
CATALOG AND DESIGN GUIDE

SMALLEY®

THE ENGINEER'S CHOICE®

NO ORDINARY RING OR SPRING

As the inventor of the edgewound wave spring and with over 100 years of manufacturing excellence, Smalley is the Engineer's Choice® in providing wave springs and retaining rings for all of your application needs.



Quick Delivery

Large stock of over 10000 part numbers in 12 product types and 400 sizes.



U.S. Manufacturing with Global Support

Global network of offices, engineers, and distribution partners, no matter where you are.



Application Assistance & Expertise

Over 30 engineers ready to provide industry specialized application and product support.



Product Design Flexibility

Custom parts in over 40 material options made quickly and economically with no new tooling required.



Trusted & Proven Quality

Reliable and customer award winning inspection processes, backed by industry specific certifications.



Personalized Support

On-demand and responsive customer service customized to your needs.

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Wave Springs

Series	Spring Type	
SSB	Bearing Preload Single-Turn	15
	Bearing Cross Reference Chart	17
SSR	Imperial Overlap/Gap Single-Turn	19
SSR-N	Imperial Narrow Single-Turn	21
RW	Imperial Wavo (Round Wire) Single-Turn	22
NSSB	Nested Spirawave	23
NSSR	Imperial Nested Spirawave	24
CM	Crest-to-Crest without Shim Ends	25
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About Retaining Rings

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Internal Retaining Rings

Series	Rating, Ring Type	
VHM	Light Duty Single-Turn, Spirolox	63
VH	Imperial Light Duty Single-Turn, Spirolox	65
EH	Aerospace, Spirolox	67
DNH	DIN, Spirolox	69
WH	Imperial Medium Duty Two-Turn, Spirolox	71
WHW	Imperial WaveRing	74
WHT	Imperial Medium/Heavy Duty Two-Turn, Spirolox	75
WHM	Imperial Heavy Duty Two-Turn, Spirolox	77
HHM/HHMU	Hoopster	79
HH/HHU	Imperial Hoopster	81
FH	DIN, Constant Section	83
FHE	Heavy Duty Single-Turn, Constant Section	85
XAH	Imperial Constant Section	87
XDH	Imperial Constant Section	89

External Retaining Rings

Series	Rating, Ring Type	
VSM	Light Duty Single-Turn, Spirolox	91
VS	Imperial Light Duty Single-Turn, Spirolox	93
ES	Aerospace, Spirolox	95
DNS	DIN, Spirolox	97
WS	Imperial Medium Duty Two-Turn, Spirolox	99
WSW	Imperial WaveRing	102
WST	Imperial Medium/Heavy Duty Two-Turn, Spirolox	103
WSM	Imperial Heavy Duty Two-Turn, Spirolox	105
HSM	Hoopster	107
HS	Imperial Hoopster	109
FS	DIN, Constant Section	111
FSE	Imperial Heavy Duty Single-Turn, Constant Section	113
XAS	Imperial Constant Section	115
XDS	Imperial Constant Section	117

About Laminar Seal Rings

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Laminar Seal Rings

Series	Rating, Ring Type	
QH, QS	Light Duty Single-Turn	123
QHK, QSK	Medium Duty Single-Turn	123
QHD, QSD	Medium/Heavy Duty Two-Turn	124
QHKD, QSKD	Heavy Duty Two-Turn	124
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Springs



Crest-to-Crest®

Multi-turn wave springs coiled in series and designed to save space and weight for applications requiring low-to-medium forces.

smalley.com/crest-to-crest



Overlap-Type & Gap-Type Single-Turn

Single-turn wave springs specified for applications requiring short deflections and low-to-medium forces.

smalley.com/single-turn



Nested Spirawave®

Multi-turn wave springs coiled in parallel to produce high forces and short deflections.

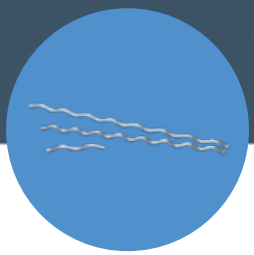
smalley.com/nested



Wavo®

Round wire wave springs produce high forces and operate in confined or tight radial spaces.

smalley.com/wavo



Linear

Continuous wave formed wire length with the same load/deflection characteristics as a traditional wave spring.

smalley.com/linear-springs



Rings



Spirolox®

Single-turn or multi-turn rings which are interchangeable with traditional retaining rings and available in many different configurations for light-to-heavy load requirements.

smalley.com/spirolox



Hoopster®

Single-turn rings that fit into a very shallow groove depth, optimal for thin-walled applications with low-to-medium load requirements.

smalley.com/hoopster



Constant Section

Single-turn rings with a square edge cross-section, ideal for heavy loads or impact loading applications.

smalley.com/constant-section-rings



WaveRing®

Multi-turn ring with an axial waveform, which operates as a retaining ring while also providing preload.

smalley.com/wavering



Laminar Seals

Labyrinth seals made of multiple rings in configurations dependent on the application, used to prevent contamination in harsh environments.

smalley.com/laminar

ENGINEERING



Ask Smalley

When you work with Smalley, you will find an experienced partner who is committed to providing you the exact part you need. We can guide you through the catalog to find a perfect standard part or help you with your custom design.

Our support goes further than just collaborating on your design; we will make sure our parts are working for you and your application from start to finish. Our engineers can guide you to helpful resources, provide samples, or assist you in selecting the right material for your application. We're just a phone call, email, live chat, virtual or in-person visit away from finding a solution to your design challenge.



Custom Products

At Smalley, we make custom products easy for you. Work with our innovative team of over 30 industry-specialized engineers to quickly create an economical custom solution in the material of your choice, all with no new tooling required. Prototype or production volume, our No-Tooling-Charges™ manufacturing process meets the design flexibility your application, budget, and timeline requires.

Please see page 1 for customizable options for wave springs, and page 45 for customizable options for retaining rings.

Popular custom configurations:



MANUFACTURING

Edgewinding Process

Edgewinding is a flexible and economical process that allows us to produce parts with No-Tooling-Costs™ and nearly no material waste. The process begins by feeding raw round wire through our rolling mills, and then coiling flat wire on edge to form the ring or spring.



Inventory and Delivery

To meet tight deadlines, we stock over 10000 standard parts, as well as raw materials ready to be processed to ensure that your rings and springs are delivered in a timely manner. We have stock in the US, France, and China for quick deliveries worldwide.



Edgewinding Benefits:

- Increased strength and stability compared to traditional stamped products
- Ability to customize with nearly no material waste
- Easily incorporate design changes throughout the process
- Quick and economical production

No-Tooling-Charges™

Because we coil our products instead of stamping them, no custom dies are required to create a custom ring or spring. Set-up procedures are simple and allow us to generate production-level prototypes for testing and make adjustments throughout production, allowing for an efficient process from design to final production.

QUALITY

Commitment to Quality

Our Total Quality Management Philosophy dictates our commitment to excellence and customer satisfaction. This philosophy has led to our numerous manufacturers' supplier quality awards. We have also established and continue to improve upon an in-house program that is built on the following principles:

- Total conformance to drawings, specifications, and customer requirements
- 100% on-time delivery
- Complete customer satisfaction



Quality Engineering Department

Our Quality Engineering Department is an essential part of the Smalley manufacturing process. This team's engineers work closely with our Inspection personnel to guarantee quality in our processes and products.

- In-house Statistical Quality Control (SQC) training programs
- Quick inspection processes within our manufacturing flow
- Processes with capability indexes (Cpk) exceeding 1,33

Environmental Regulatory Compliances

The raw materials and processes used to manufacture our standard products are in compliance with environmental regulations. We are committed to helping our customers choose products made from compliant materials that will limit their adverse effect on the environment. We offer materials that comply with:

- RoHS – Hazardous Substance Regulation
- REACH – Chemical Regulation

Defense Regulatory Compliances

Smalley sources and acquires materials from qualified suppliers that meet your Defense needs, and we are able to provide necessary material certifications. Contact us for more information.
We offer materials that comply with:

- DFARS – Defense Federal Acquisition Regulation

A Trusted Supplier

Smalley's dedication to excellence has earned the trust of manufacturers worldwide. We have received multiple awards for our service and quality from both GM and Caterpillar.



Quality Certifications

Smalley meets strict guidelines and requirements for aerospace, automotive, and medical industries to ensure that you get the highest quality parts. We hold the following certifications:

- ISO 9001 – Quality Management System
- ISO 14001 – Environmental Quality Management System
- ISO 13485 – Medical Quality Management System
- IATF 16949 – Automotive Quality Management System
- AS9100 – Aerospace Quality Management System



SUPPORT



Customer Service

Smalley's Customer Service department is ready to provide pricing, ordering, and delivery information.

For Customer Service inquires
+1 847.719.5920
info@smalley.com

Engineering

Smalley's Engineering department is ready to provide personalized application-support and expertise to determine the best solution for your needs.

For Engineering inquires
+1 847.719.5960
engineering@smalley.com

Quality

All Smalley products are manufactured and certified to the highest quality standards across all industries.

For Quality inquiries
+1 847.719.5950
info@smalley.com

Global Supply Chain

Our international network of offices, engineers, warehouses, and distributors allows us to provide real-time customer support and quick shipping options for businesses worldwide.

smalley.com/our-offices

Packaging

Smalley is committed to getting products to you in the manner you require. We offer standard and custom packaging solutions designed to fit your needs.

smalley.com/packaging

Ordering

Smalley is available to assist and guide you through the ordering process. You can find more information on page 150.

Talk to a representative
+1 847.719.5920
sales@smalley.com



Free Samples

We are happy to offer free samples of any of our standard rings or springs for you to try and test in your application.

smalley.com/samples

Quotes

Smalley responds quickly to all quote requests for standard and custom products.

sales@smalley.com
smalley.com/rfq

E-commerce

Easily purchase standard parts online using our web store. The web store offers product pricing, quick re-order from past online orders and a fast, secure check-out process.

Available to U.S. customers at this time.

smalley.com

CAD Models

Download CAD models of standard parts to application-specific requirements. Adjustments for material or spring height can be made to help you determine the best part for your needs. Custom CAD models available upon request.

smalley.com/CAD

Online Resource Library

Our digital library contains videos, e-books, white papers, and guides that cover everything from product design to installation and removal processes.

smalley.com/resource-center

Social Media

We update our blog and social media regularly so you are the first to hear about product launches, quality certifications, new applications, and advancements in ring and spring technology.

smalley.com/blog

INDUSTRIES



Aerospace

Smalley parts meet quality and performance standards to AS9100. Their compact design reduces assembly size and weight while maintaining precision.



Automotive

Smalley's IATF 16949 certified rings and springs have been specified for applications in cars and trucks from bumper-to-bumper. Our ability to produce durable, space-saving products quickly and economically has continuously earned us multiple GM Quality Awards.



Consumer

Our variety of sizes, configurations, and finishes allow us to serve the diverse requirements of the consumer industry with standard and custom parts that are both functional and durable. Our unique No Ears to Interfere® retaining ring feature allows for an aesthetically pleasing assembly when parts are visible.



Industrial

Our 10000 stock parts and No-Tooling-Charges™ on customs allows us to create products that meet exact application requirements for a vast range of demands.



Medical

Our products have been used in medical industry applications from imaging equipment to implantable devices. We can manufacture rings and springs in diameters as small as 4 mm (0,157"), with stainless steel and other medically approved materials readily available. Our products are certified to ISO 13485.



Off-Highway

Smalley offers products that are safe and reliable for an industry that often requires heavy-duty and/or large diameter parts for high impact loading or large machinery.



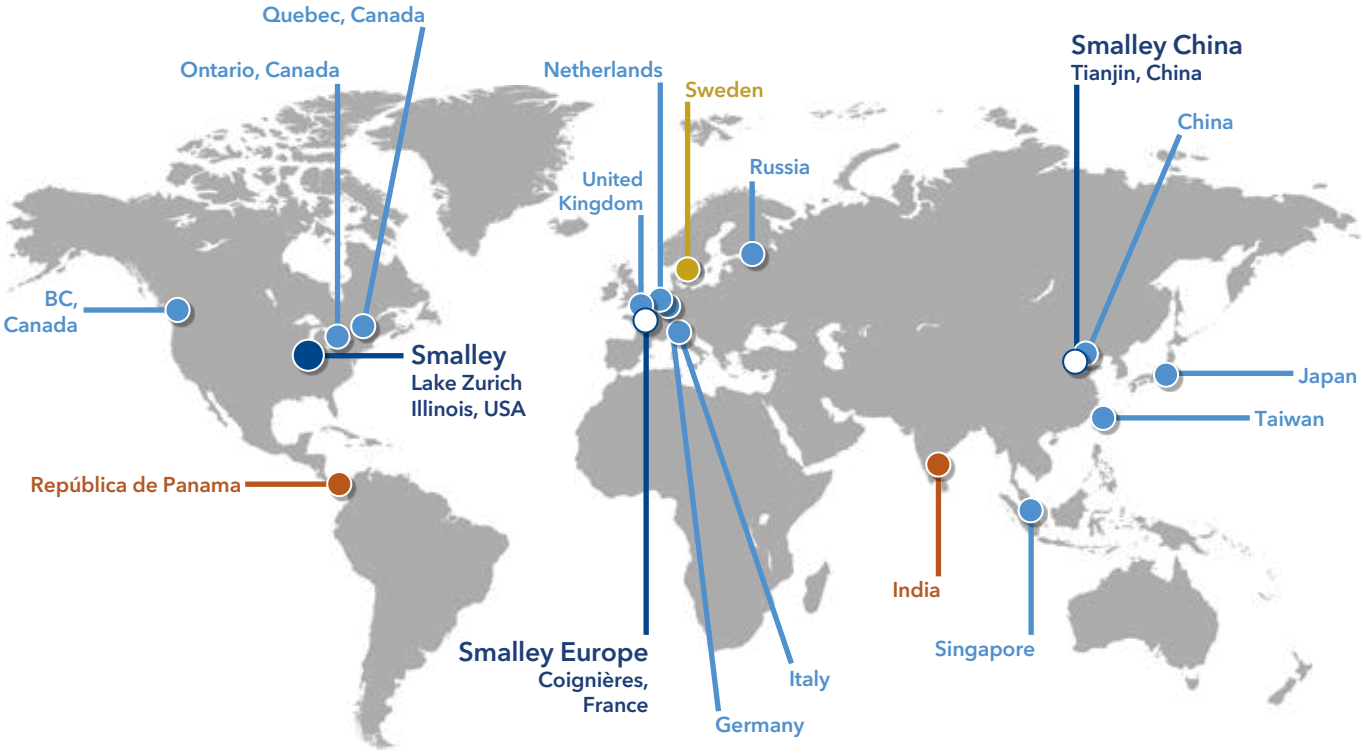
Oil and Gas

Smalley Engineers can design parts with NACE compliant materials. Select a standard material from stainless and carbon steel, or design your ring and spring to withstand the harshest of environments from over 40 material options, including Inconel®, Elgiloy®, and MP35N® stocked and available.



SMALLEY
THE ENGINEER'S CHOICE®

LOCATIONS



CORPORATE OFFICE & MANUFACTURING

Lake Zurich, Illinois, USA
+1 847.719.5900 • info@smalley.com

REGIONAL HEADQUARTERS & WAREHOUSE

Coignières, France
+33 182 886 913 • europe@smalley.com

Tianjin, China
+86 22 8895 6811 • china@smalley.com

DISTRIBUTION PARTNERS

Canada
China
France
Germany
Italy
Japan
Netherlands
Russia
Singapore
Taiwan
United Kingdom

ENGINEERING SALES OFFICE

Alingsås, Sweden
+46 322 611 770 • nordic@smalley.com

MANUFACTURERS' REPRESENTATIVES

Punta Paitilla, República de Panama
+507 6930 4744 • latinamerica@smalley.com

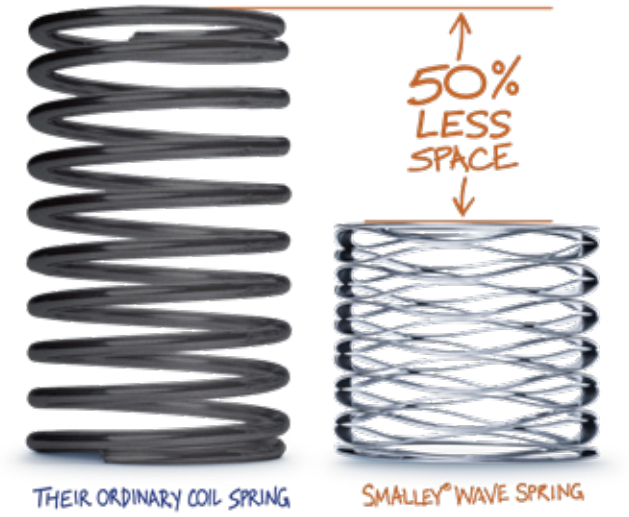
Tamil Nadu, India
+91 94443 76957 • india@smalley.com

CONNECT WITH US

Wave Spring Introduction

All Springs Are Not Equal®

Standard Smalley wave springs are available in a wide range of configurations in carbon and stainless steel from 5 to 400 mm (0,188 to 16"). Our wave springs can be found across nearly all industries because of their space and weight saving ability.



Standard Smalley wave springs include:

- Crest-to-Crest®
- Crest-to-Crest® with Shim Ends
- Overlap-Type Single-Turn
- Gap-Type Single-Turn
- Nested Spirawave®
- Wavo®
- Linear

Custom Wave Springs

If one of our standard springs does not fit your application, our engineers are here to help you design a wave spring that does. Application-specific features are customizable to ensure the desired spring size, force, and cycle life are met. It is often thought that designing a custom part is costly and time-consuming, but Smalley's No-Tooling-Charges™ manufacturing process makes custom parts a cost-effective solution. This process allows us to create and adjust your prototype quickly to meet your exact needs. At Smalley, customs are a practical and economical choice.

Customizable features include:

- Deburring
- Diameter (4 - 3000 mm; 0,157 - 120")
- End configurations
- Finishes, plating, coating
- Free height
- Markings
- Material
- Number of turns
- Number of waves
- Packaging/labeling
- Quality Assurance certifications
- Radial wall
- Shim ends
- Tolerances
- Wire thickness
- Work height

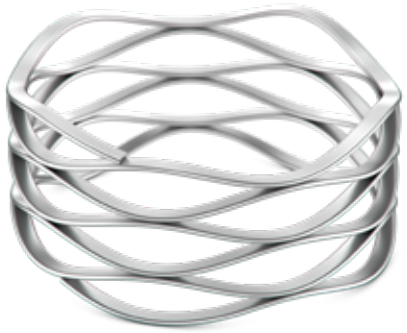
You can find more information about these terms in the glossary on page 151.

Wave Spring Types

Crest-to-Crest®

Crest-to-Crest Wave Springs are flat wire, multi-turn springs coiled in series. These wave springs provide a similar force with up to 50% less axial height compared to a traditional coil spring. Standard Crest-to-Crest springs are suitable for light-to-medium loads and medium travel, making them an ideal replacement for coil springs.

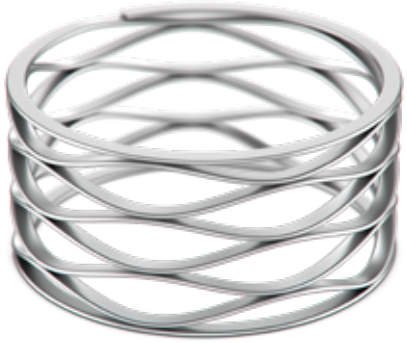
Series	Page	Material	Diameter
CM	25	Carbon Steel and 17-7 PH SS	5 - 60 mm
C	33	Carbon Steel and 17-7 PH SS	0,188 – 2"



Crest-to-Crest® with Shim Ends

Crest-to-Crest Wave Springs with shim ends provide a secure 360° contact surface for even load distribution. They are used in applications requiring a larger mating surface area for softer materials such as plastic or aluminum.

Series	Page	Material	Diameter
CMS	25	Carbon Steel and 17-7 PH SS	8 – 60 mm
CS	33	Carbon Steel and 17-7 PH SS	0,312 – 2"



Wave Spring Types

Overlap-Type Single-Turn

Overlap-Type Single-Turn Wave Springs are flat wire springs that have ends that sit with a slight overlap. Overlap-type springs are ideal for smaller diameters to lessen tangling during packaging and when over-compression is not a concern. They function best with light-to-medium loads and short deflections.

Series	Page	Material	Diameter
SSB	15	Carbon Steel and 17-7 PH SS	9 – 95 mm
SSR	19	Carbon Steel and 17-7 PH SS	0,5 – 1,625"



Gap-Type Single-Turn

Gap-Type Single-Turn Wave Springs are flat wire springs that have ends that sit with a slight gap. Gap-type springs are ideal for situations in which the overlap would cause height or over-compression issues, especially while stacking. They function best with light-to-medium loads and short deflections.

Series	Page	Material	Diameter
SSB	15	Carbon Steel and 17-7 PH SS	100 - 580 mm
SSR	19	Carbon Steel and 17-7 PH SS	1,75 - 16"
SSR-N	20	Carbon Steel and 17-7 PH SS	3,25 – 7,75"



Wave Spring Types

Nested Spirawave®

Smalley's Nested Spirawave Wave Springs are multi-turn, flat wire wave springs coiled in parallel, available in two-turn or three-turn configurations. They can replace stacks of single-turn wave springs, which eliminates errors stacking individual springs and reduces assembly time. Nested wave springs are specified for applications requiring medium-to-high loads and short deflections.

Series	Page	Material	Diameter
NSSB	23	Carbon Steel and 17-7 PH SS	16 – 100 mm
NSSR	24	Carbon Steel and 17-7 PH SS	0,5 – 4"



Wavo®

Wavo Wave Springs are round-wire, single-turn springs which produce extremely high loads with an accurate, predictable spring rate. They are specified to reduce or eliminate vibration in preload, to compensate for looseness due to thermal expansion in assemblies, or perform in extremely tight radial spaces that demand very high force.

Series	Page	Material	Diameter
RW	22	Carbon Steel and 17-7 PH SS	0,5 – 6"



Wave Spring Types

Linear

Linear Springs are straight lengths of flat wire with an added wave-form. They are specified for applications requiring low-to-medium loads and deflections in a linear cavity, such as mechanical seals or rotary vane pumps.

Series	Page	Material	Length
LS	41	Carbon Steel and 17-7 PH SS	1,5 - 12"



Popular Custom Springs

In addition to customizing our stock spring types by changing diameter, turns, waves, or other characteristics, Smalley Engineers can help design the following alternative spring types:

Interlaced

Interlaced Springs are multiple Crest-to-Crest Wave Springs woven together in series. This increases the functional thickness of the turns in the spring to provide increased loading. Interlaced springs are a good alternative for applications in which a Crest-to-Crest Wave Spring cannot support required loads and a Nested Spirawave cannot produce the desired free height or deflection.



Marcel

Marcel Expanders are single-turn, flat wire wave springs coiled to provide radial forces. They are specified to self-center an assembly or to energize a seal when no pressure is available from another source within the application.



Pitched Coils

Pitched Coils are multi-turn flat wire coil springs, available with or without shims. They produce extremely low loads with extremely high travel.



Wave Spring Applications

Crest-to-Crest®



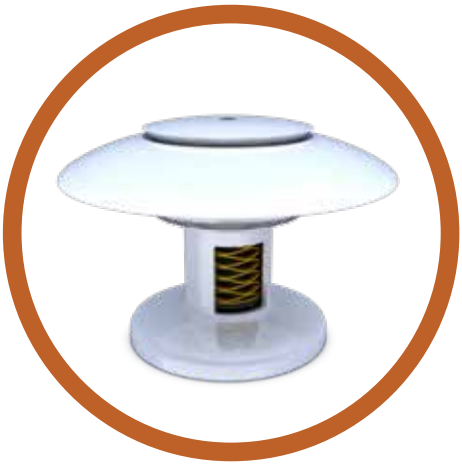
Pressure Relief Valve

Air pressure under the assembly causes the spring load to increase, forcing the plate away from the surface, providing pressure relief.



Flow Valve

As fluid pressure increases, the wave spring precisely controls the linear displacement of the piston, which positions the orifice for proper fluid flow.



Sprinkler Valve

The wave spring maintains constant pressure on the pop-up head so it remains closed. In operation, water pressure releases the head by overcoming the spring's force.



Oil Valve

The force provided by the wave spring precisely regulates the amount of oil that is released, providing accurate resistance in a small space, reducing valve size.

Wave Spring Applications

Crest-to-Crest®



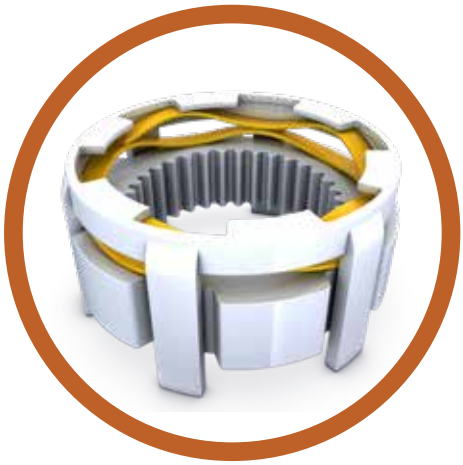
Ball Valve

The wave spring allows the seat to oscillate on the ball and keep a tight seal in the operating position. The smaller spring cavity reduces the weight and size of the valve.



Quick Disconnect

The sliding piece of the disconnect is held in its locked position against the retaining ring by the wave spring. The user slides the piece in the opposite direction to compress the spring, aligning the detent balls with a groove, and releases.



Floating Gear

The wave spring functions in a contained bracket, preloading a gear with a light load while allowing axial movement.



Water Valve

The wave spring prevents the valve handle from rotating by maintaining a constant load. As the handle rotates counter-clockwise, the spring's resistance increases, preventing rotation.

Wave Spring Applications

Crest-to-Crest®



Shoe

Wave springs positioned in the heel and ball of the sole are used to absorb shock when the foot hits the ground while walking or running.



Motherboard Heatsink Fan

Small diameter wave springs were designed to lighten the weight of the fan installed in an electronics application.



Push Button

Small diameter wave springs are used to minimize assembly size, allowing for a lighter weight assembly for compact wearable electronics.



Auto Mirror

The wave springs allows for the mirror to adjust while remaining lightweight and small to reduce assembly size.

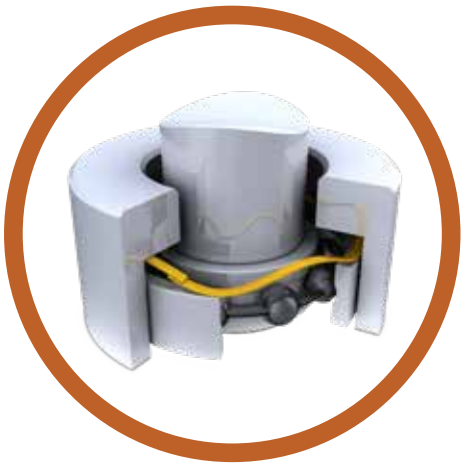
Wave Spring Applications

Overlap-Type Single-Turn



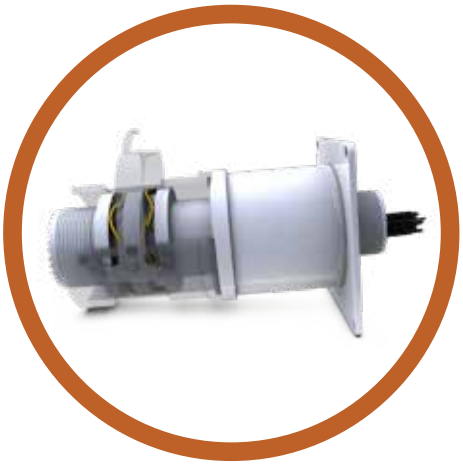
Slip Clutch

As torque is increased, the "V" detents ride up and out of the slots, depressing the wave spring and developing the slip mechanism. When torque is decreased, the wave spring forces the detents back into the slots to drive again.



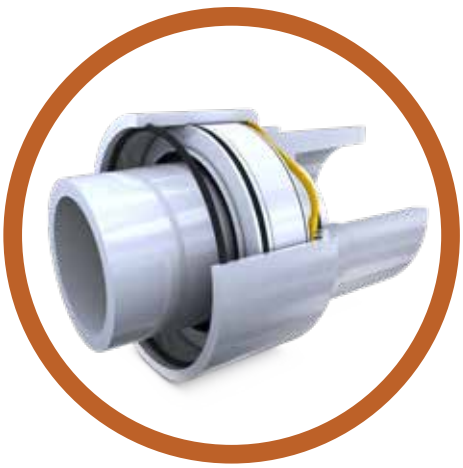
Bearing Preload

Properly loading a bearing with a wave spring extends the lifecycle by reducing vibration, which reduces operating temperature and minimizes wear.



Aerospace Electrical Connector

Two wave springs are compressed, exerting a constant force on the connector, providing continuous connection.



Rotary Union

The wave spring preloads a bearing, taking up play and reducing vibration and noise.

Wave Spring Applications

Gap-Type Single-Turn



Face Seal

The wave spring applies an exact force to precisely load the carbon face against a mating surface and properly seal fluids.

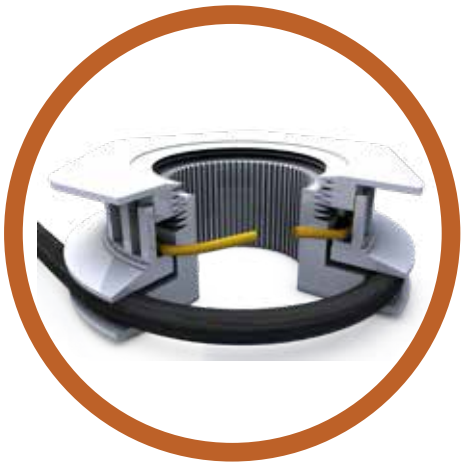


Multi-Tooth Cutter

The wave spring, custom designed with locating tabs, applies precise force to the two cutter halves, holding them together while allowing them to oscillate.

Wave Spring Applications

Wavo®



Clutch Drive

Compressing the Wavo Spring through sheave halves produces pressure on the round belt while the top threaded cap rotates to adjust compression.



Vibration Isolator

Wavo Springs are used to provide precise and predictable load and deflection curves in the isolator, dampening vibration from equipment operation.



Axial Piston Pump

A Wavo Spring can provide a high preload and large compressive force to tapered roller bearings.

Wave Spring Applications

Nested Spirawave®



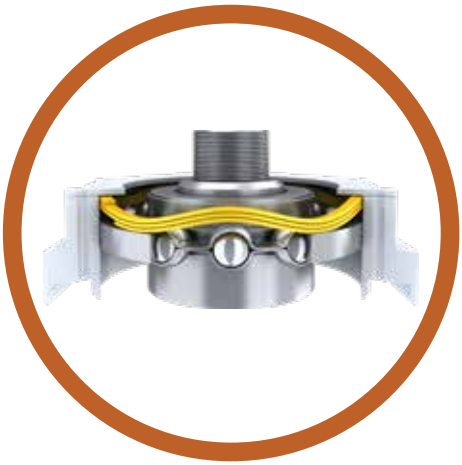
Low Voltage Connector

A bayonet connector couples as male and female components rotate, while the two-turn nested spring provides preload between two halves, developing a high load in a very tight radial and axial space.



Push Seal

A two-turn nested spring provides a higher force than a single-turn spring to maintain a proper seal. This exact pressure is essential to avoid excessive wear.



Bearing Preload

A three-turn nested spring can provide bearing preload for heavy duty applications with high preload requirements, prolonging bearing life.



Valve

A two-turn nested spring is used to provide a high spring force with a low profile for space savings.

Wave Spring Applications

Linear

Detent Preload

The springs are used to load pins positioned inside grooves so a rotating element can detent to specific positions. They exert a precise load to give the rotation a specific resistance.





Rotary Vane Pump

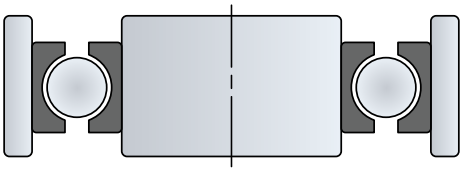
The springs energize the vanes against the bore for better sealing by loading the bottom of the vanes in the pump.

Wave Spring Application Spotlight

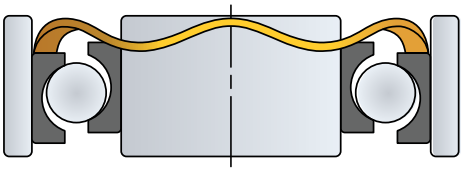
Single-Turn Bearing Preload

What is Bearing Preload?

There are two main methods to preload a bearing. The first is solid preload, which is achieved by holding inner and outer races in place with a locking mechanism. The more common, simpler, and less expensive method is spring preload, which is achieved by using a spring to apply a constant axial load on one side. A Smalley Single-Turn Wave Spring provides necessary preload force between the inner or outer races while also compensating for any tolerance stack-ups or thermal misalignments. Play is reduced both axially and radially, as depicted in the image below.



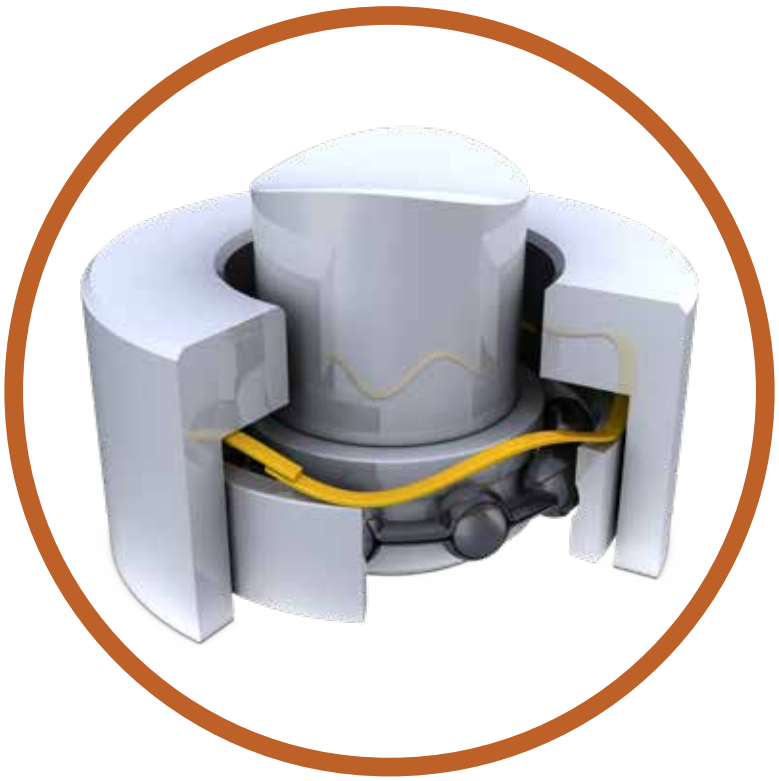
Bearing without a preload: Clearance between components can cause vibration and wear.



Bearing with a preload: The ball complement and bearing races mate reliably reducing or eliminating vibration and wear.

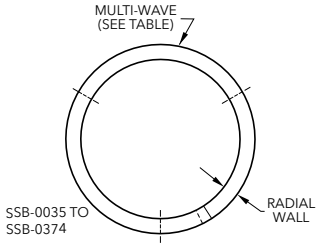
Controlling play is necessary to maintain bearing functionality and longevity. Preloading a bearing provides constant contact between the bearing type (ball, needle, etc.) and bearing races. The sustained load provided by the spring controls axial and radial play, reducing bearing damage, wear, noise, and vibration.

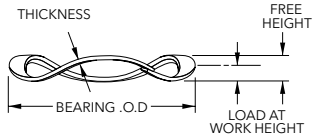
The overall goal of preloading is to prolong bearing life, and therefore, your application product life. Using a Single-Turn Wave Spring for preload is critical for high-precision or high-speed applications, as it essentially eliminates the need for holding tighter tolerances and helps withstand high operating speeds.

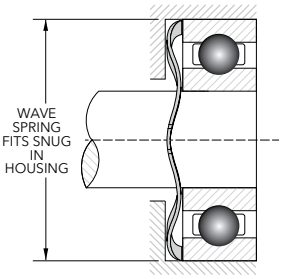


SSB Series
Bearing Preload Springs



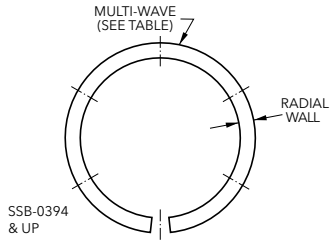


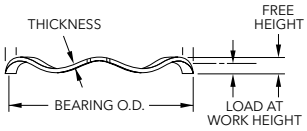




Gap-Type Wave Spring shown in a housing.







Product Dimensions: All dimensions in millimeters unless otherwise specified.

Smalley Part Number		Bearing O.D.[1] (mm)	Clears Shaft Diameter (mm)	Load (N)	Work Height (mm)	Free Height[2] (mm)	Number of Waves	Number of Turns	Thickness (mm)	Radial Wall (mm)	Spring Rate[3] (N/mm)
Carbon Steel	Add Suffix 17-7 SS										
Single-Turn Overlap-Type Springs											
SSB-0035	**-S17**	9,00	6,86	25,8	1,00	1,50	3	1	0,20	0,81	52
SSB-0039	**-S17**	10,00	7,49	27,6	1,00	1,57	3	1	0,20	1,02	48
SSB-0043	**-S17**	11,00	8,46	29,4	1,00	1,83	3	1	0,20	1,02	35
SSB-0047	**-S17**	12,00	9,17	33,4	1,00	1,57	3	1	0,25	1,17	59
SSB-0051	**-S17**	13,00	9,53	37,8	1,00	1,57	3	1	0,25	1,47	66
SSB-0063	**-S17**	16,00	11,28	44,5	1,57	2,29	3	1	0,25	1,98	65
SSB-0075	**-S17**	19,00	14,28	53,4	1,57	3,05	3	1	0,25	1,98	35
SSB-0087	**-S17**	22,00	16,46	62,3	1,57	3,05	3	1	0,30	2,39	48
SSB-0095	**-S17**	24,00	18,46	66,7	1,57	3,56	3	1	0,30	2,39	35
SSB-0102	**-S17**	26,00	18,22	71,2	1,98	2,54	3	1	0,41	3,38	111
SSB-0110	**-S17**	28,00	20,22	75,6	1,98	2,79	3	1	0,41	3,38	85
SSB-0118	**-S17**	30,00	22,22	84,5	1,98	3,30	3	1	0,41	3,38	66
SSB-0126	**-S17**	32,00	24,22	89,0	1,98	3,81	3	1	0,41	3,38	52
SSB-0138	**-S17**	35,00	27,22	97,9	1,98	4,57	3	1	0,41	3,38	38
SSB-0146	**-S17**	37,00	28,72	102,3	1,98	3,81	3	1	0,46	3,63	58
SSB-0158	**-S17**	40,00	31,72	111,2	1,98	5,08	3	1	0,46	3,63	37
SSB-0165	**-S17**	42,00	33,72	115,7	1,98	3,05	4	1	0,46	3,63	99
SSB-0185	**-S17**	47,00	38,72	129,0	1,98	3,81	4	1	0,46	3,63	68
SSB-0205	**-S17**	52,00	43,11	142,4	2,36	3,56	4	1	0,61	3,76	121
SSB-0217	**-S17**	55,00	46,11	151,3	2,36	3,81	4	1	0,61	3,76	100
SSB-0244	**-S17**	62,00	51,69	169,1	2,36	4,32	4	1	0,61	4,52	85
SSB-0268	**-S17**	68,00	57,17	186,9	2,77	4,32	4	1	0,76	4,78	131
SSB-0276	**-S17**	70,00	59,17	191,3	2,77	4,32	4	1	0,76	4,78	119
SSB-0284	**-S17**	72,00	61,17	195,8	2,77	4,57	4	1	0,76	4,78	108
SSB-0295	**-S17**	75,00	64,17	204,7	2,77	5,08	4	1	0,76	4,78	94
SSB-0315	**-S17**	80,00	68,66	218,0	2,77	5,59	4	1	0,76	4,78	76
SSB-0335	**-S17**	85,00	71,38	231,4	2,77	5,59	4	1	0,76	5,92	83
SSB-0354	**-S17**	90,00	76,38	249,2	2,77	6,35	4	1	0,76	5,92	68
SSB-0374	**-S17**	95,00	81,38	262,5	2,77	7,37	4	1	0,76	5,92	57
Single-Turn Gap-Type Springs											
SSB-0394	**-S17**	100,00	86,38	275,9	2,77	4,57	5	1	0,76	5,92	157
SSB-0413	**-S17**	105,00	91,38	289,2	2,77	5,08	5	1	0,76	5,92	134
SSB-0433	**-S17**	110,00	96,38	302,6	2,77	5,33	5	1	0,76	5,92	115
SSB-0453	**-S17**	115,00	101,38	315,9	3,18	6,35	5	1	0,76	5,92	99
SSB-0472	**-S17**	120,00	106,38	329,3	3,18	7,11	5	1	0,76	5,92	86
SSB-0492	**-S17**	125,00	111,38	342,6	3,18	7,62	5	1	0,76	5,92	76
SSB-0512	**-S17**	130,00	116,38	356,0	3,18	8,64	5	1	0,76	5,92	67
SSB-0532	**-S17**	135,00	121,38	369,3	3,18	9,40	5	1	0,76	5,92	59
SSB-0551	**-S17**	140,00	126,38	382,7	3,18	6,86	6	1	0,76	5,92	108

[1] Wave Spring fits snug in housing.
[2] Reference dimension.
[3] Theoretical dimension.

SSB Series

Bearing Preload Springs Continued

Smalley Part Number		Bearing O.D.[1] (mm)	Clears Shaft Diameter (mm)	Load (N)	Work Height (mm)	Free Height[2] (mm)	Number of Waves	Number of Turns	Thickness (mm)	Radial Wall (mm)	Spring Rate[3] (N/mm)
Carbon Steel	Add Suffix 17-7 SS										
Single-Turn Gap-Type Springs											
SSB-0571	**-S17**	145,00	131,38	396,0	3,18	7,37	6	1	0,76	5,92	97
SSB-0591	**-S17**	150,00	136,38	404,9	3,18	7,87	6	1	0,76	5,92	87
SSB-0630	**-S17**	160,00	146,38	440,5	3,18	9,40	6	1	0,76	5,92	71
SSB-0650	**-S17**	165,00	151,38	453,9	3,18	10,41	6	1	0,76	5,92	64
SSB-0669	**-S17**	170,00	156,38	467,2	3,18	11,18	6	1	0,76	5,92	58
SSB-0689	**-S17**	175,00	154,16	480,6	3,96	8,13	6	1	0,81	9,53	116
SSB-0709	**-S17**	180,00	159,16	493,9	3,96	8,64	6	1	0,81	9,53	105
SSB-0728	**-S17**	185,00	164,16	507,3	3,96	9,14	6	1	0,81	9,53	97
SSB-0748	**-S17**	190,00	169,16	520,6	3,96	9,91	6	1	0,81	9,53	88
SSB-0787	**-S17**	200,00	179,16	547,3	3,96	7,11	7	1	0,81	9,53	174
SSB-0807	**-S17**	205,00	184,16	560,7	3,96	7,37	7	1	0,81	9,53	161
SSB-0827	**-S17**	210,00	189,16	578,5	3,96	7,87	7	1	0,81	9,53	149
SSB-0847	**-S17**	215,00	194,16	591,8	3,96	8,38	7	1	0,81	9,53	138
SSB-0866	**-S17**	220,00	199,16	605,2	3,96	8,64	7	1	0,81	9,53	128
SSB-0886	**-S17**	225,00	204,16	618,5	3,96	7,11	8	1	0,81	9,53	203
SSB-0906	**-S17**	230,00	209,16	631,9	3,96	6,10	9	1	0,81	9,53	303
SSB-0925	**-S17**	235,00	214,16	645,2	3,96	6,35	9	1	0,81	9,53	283
SSB-0945	**-S17**	240,00	219,16	658,6	3,96	6,35	9	1	0,81	9,53	265
SSB-0984	**-S17**	250,00	229,16	685,3	3,96	6,86	9	1	0,81	9,53	232
SSB-1024	**-S17**	260,00	239,16	712,0	3,96	7,37	9	1	0,81	9,53	205
SSB-1043	**-S17**	265,00	244,16	725,3	3,96	7,62	9	1	0,81	9,53	193
SSB-1063	**-S17**	270,00	249,16	743,1	3,96	8,13	9	1	0,81	9,53	182
SSB-1102	**-S17**	280,00	259,16	769,8	3,96	8,64	9	1	0,81	9,53	162
SSB-1142	**-S17**	290,00	269,16	796,5	3,96	9,40	9	1	0,81	9,53	144
SSB-1181	**-S17**	300,00	279,16	823,2	3,96	10,41	9	1	0,81	9,53	129
SSB-1221	**-S17**	310,00	289,16	849,9	3,96	7,11	9	1	1,07	9,53	264
SSB-1260	**-S17**	320,00	299,16	876,6	3,96	7,62	9	1	1,07	9,53	239
SSB-1339	**-S17**	340,00	319,16	934,5	3,96	8,64	9	1	1,07	9,53	198
SSB-1378	**-S17**	350,00	329,16	961,1	3,96	9,40	9	1	1,07	9,53	180
SSB-1417	**-S17**	360,00	339,16	987,9	3,96	7,62	10	1	1,07	9,53	271
SSB-1457	**-S17**	370,00	349,16	1014,6	3,96	8,13	10	1	1,07	9,53	249
SSB-1496	**-S17**	380,00	359,16	1041,3	3,96	8,64	10	1	1,07	9,53	229
SSB-1535	**-S17**	390,00	369,16	1072,4	3,96	9,14	10	1	1,07	9,53	211
SSB-1575	**-S17**	400,00	379,16	1099,1	3,96	9,65	10	1	1,07	9,53	196
SSB-1614	**-S17**	410,00	382,82	1125,8	3,96	8,38	10	1	1,07	12,70	251
SSB-1654	**-S17**	420,00	392,82	1152,5	3,96	8,89	10	1	1,07	12,70	233
SSB-1693	**-S17**	430,00	402,82	1179,2	3,96	7,62	11	1	1,07	12,70	317
SSB-1732	**-S17**	440,00	412,82	1205,9	3,96	8,13	11	1	1,07	12,70	295
SSB-1811	**-S17**	460,00	432,82	1263,7	3,96	8,89	11	1	1,07	12,70	256
SSB-1890	**-S17**	480,00	452,82	1317,1	3,96	8,13	12	1	1,07	12,70	318
SSB-1969	**-S17**	500,00	472,82	1370,5	3,96	8,89	12	1	1,07	12,70	280
SSB-2126	**-S17**	540,00	512,82	1481,8	3,96	8,89	13	1	1,07	12,70	303
SSB-2284	**-S17**	580,00	552,82	1593,0	3,96	8,89	14	1	1,07	12,70	327

[1] Wave Spring fits snug in housing.
[2] Reference dimension.
[3] Theoretical dimension.

SSB Series
Cross Reference Guide for Bearing Preload

Smalley Part Number		Bearing O.D.[1] (mm)	Bearing Part Numbers						
Carbon Steel	Add Suffix 17-7 SS		Extra Small	Extremely Light	Extra Light	Narrow	Light	Medium	Heavy
Single-Turn Overlap-Type Springs									
SSB-0035	**-S17**	9,00	603, 684	–	–	–	–	–	–
SSB-0039	**-S17**	10,00	623	–	–	–	–	–	–
SSB-0043	**-S17**	11,00	694, 685	–	–	–	–	–	–
SSB-0047	**-S17**	12,00	604	–	–	–	–	–	–
SSB-0051	**-S17**	13,00	633,624,695,686	–	–	–	–	–	–
SSB-0063	**-S17**	16,00	625, 634, 688	–	–	–	–	–	–
SSB-0075	**-S17**	19,00	607,626,635,698	–	–	–	–	–	–
SSB-0087	**-S17**	22,00	608, 627, 636	6900	–	–	–	–	–
SSB-0095	**-S17**	24,00	609, 628	6901	–	–	–	–	–
SSB-0102	**-S17**	26,00	637, 629	–	6000	–	–	–	–
SSB-0110	**-S17**	28,00	638	6902	6001	–	–	–	–
SSB-0118	**-S17**	30,00	639	6903	–	–	6200	–	–
SSB-0126	**-S17**	32,00	–	–	6002	16002	6201	–	–
SSB-0138	**-S17**	35,00	–	–	6003	16003	6202	6300	–
SSB-0146	**-S17**	37,00	–	6904	–	–	–	6301	–
SSB-0158	**-S17**	40,00	–	–	–	–	6203	–	–
SSB-0165	**-S17**	42,00	–	6905	6004	16004	–	6302	–
SSB-0185	**-S17**	47,00	–	6906	6005	16005	6204	6303	–
SSB-0205	**-S17**	52,00	–	–	–	–	6205	6304	–
SSB-0217	**-S17**	55,00	–	6907	6006	16006	–	–	–
SSB-0244	**-S17**	62,00	–	6908	6007	16007	6206	6305	6403
SSB-0268	**-S17**	68,00	–	6909	6008	16008	–	–	–
SSB-0276	**-S17**	70,00	–	–	–	–	–	–	–
SSB-0284	**-S17**	72,00	–	6910	–	–	6207	6306	6404
SSB-0295	**-S17**	75,00	–	–	6009	16009	–	–	–
SSB-0315	**-S17**	80,00	–	6911	6010	16010	6208	6307	6405
SSB-0335	**-S17**	85,00	–	6912	–	–	6209	–	–
SSB-0354	**-S17**	90,00	–	6913	6011	16011	6210	6308	6406
SSB-0374	**-S17**	95,00	–	–	6012	16012	–	–	–

[1] Wave Spring fits snug in housing.

SSB Series

Cross Reference Guide for Bearing Preload Continued

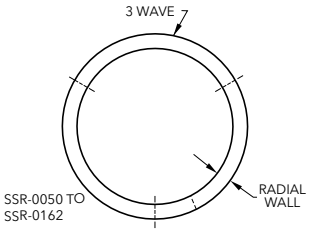
Smalley Part Number		Bearing O.D.[1] (mm)	Bearing Part Numbers						
Carbon Steel	Add Suffix 17-7 SS		Extra Small	Extremely Light	Extra Light	Narrow	Light	Medium	Heavy
Single-Turn Gap-Type Springs									
SSB-0394	**-S17**	100,00	–	6914	6013	16013	6211	6309	6407
SSB-0413	**-S17**	105,00	–	6915	–	–	–	–	–
SSB-0433	**-S17**	110,00	–	6916	6014	16014	6212	6310	6408
SSB-0453	**-S17**	115,00	–	–	6015	16015	–	–	–
SSB-0472	**-S17**	120,00	–	6917	–	–	6213	6311	6409
SSB-0492	**-S17**	125,00	–	6918	6016	16016	6214	–	–
SSB-0512	**-S17**	130,00	–	6919	6017	16017	6215	6312	6410
SSB-0532	**-S17**	135,00	–	–	–	–	–	–	–
SSB-0551	**-S17**	140,00	–	6920	6018	16018	6216	6313	6411
SSB-0571	**-S17**	145,00	–	6921	6019	16019	–	–	–
SSB-0591	**-S17**	150,00	–	6922	6020	16020	6217	6314	6412
SSB-0630	**-S17**	160,00	–	–	6021	16021	6218	6315	6413
SSB-0650	**-S17**	165,00	–	6924	–	–	–	–	–
SSB-0669	**-S17**	170,00	–	–	6022	16022	6219	6316	–
SSB-0689	**-S17**	175,00	–	–	–	–	–	–	–
SSB-0709	**-S17**	180,00	–	6926	6024	16024	6220	6317	6414
SSB-0728	**-S17**	185,00	–	–	–	–	–	–	–
SSB-0748	**-S17**	190,00	–	6928	–	–	6221	6318	6415
SSB-0787	**-S17**	200,00	–	–	6026	16026	6222	6319	6416
SSB-0807	**-S17**	205,00	–	–	–	–	–	–	–
SSB-0827	**-S17**	210,00	–	6930	6028	16028	–	–	6417
SSB-0847	**-S17**	215,00	–	–	–	–	6224	6320	–
SSB-0866	**-S17**	220,00	–	6932	–	–	–	–	–
SSB-0886	**-S17**	225,00	–	–	6030	16030	–	6321	6418
SSB-0906	**-S17**	230,00	–	6934	–	–	6226	–	–
SSB-0925	**-S17**	235,00	–	–	–	–	–	–	–
SSB-0945	**-S17**	240,00	–	–	6032	16032	–	6322	6419
SSB-0984	**-S17**	250,00	–	6936	–	–	6228	–	6420
SSB-1024	**-S17**	260,00	–	6938	6034	16034	–	6324	6421
SSB-1043	**-S17**	265,00	–	–	–	–	–	–	–
SSB-1063	**-S17**	270,00	–	–	–	–	6230	–	–
SSB-1102	**-S17**	280,00	–	6940	6036	16036	–	6326	6422
SSB-1142	**-S17**	290,00	–	–	6038	16038	6232	–	–
SSB-1181	**-S17**	300,00	–	–	–	–	–	6328	–
SSB-1221	**-S17**	310,00	–	–	6040	16040	6234	–	–
SSB-1260	**-S17**	320,00	–	–	–	–	6236	6330	–
SSB-1339	**-S17**	340,00	–	–	6044	16044	6238	6332	–
SSB-1378	**-S17**	350,00	–	–	–	–	–	–	–
SSB-1417	**-S17**	360,00	–	–	6048	16048	6240	6334	–
SSB-1457	**-S17**	370,00	–	–	–	–	–	–	–
SSB-1496	**-S17**	380,00	–	–	–	–	–	6336	–
SSB-1535	**-S17**	390,00	–	–	–	–	–	–	–
SSB-1575	**-S17**	400,00	–	–	6052	16052	6244	6338	–
SSB-1614	**-S17**	410,00	–	–	–	–	–	–	–
SSB-1654	**-S17**	420,00	–	–	6056	16056	–	6340	–
SSB-1693	**-S17**	430,00	–	–	–	–	–	–	–
SSB-1732	**-S17**	440,00	–	–	–	–	6248	6342	–
SSB-1811	**-S17**	460,00	–	–	6060	–	–	6344	–
SSB-1890	**-S17**	480,00	–	–	6064	16064	6252	–	–
SSB-1969	**-S17**	500,00	–	–	–	–	6256	6348	–
SSB-2126	**-S17**	540,00	–	–	–	–	6260	6352	–
SSB-2284	**-S17**	580,00	–	–	–	–	6264	6356	–

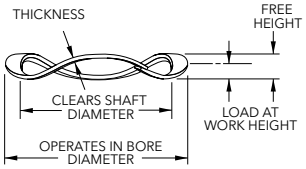
[1] Wave Spring fits snug in housing.

SSR Series

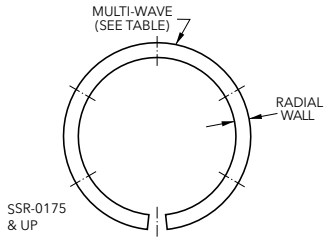
Imperial Single-Turn Overlap-Type and Gap-Type Springs

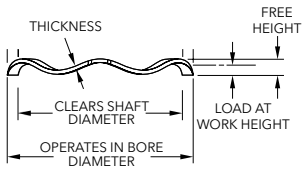












Product Dimensions: All dimensions in inches unless otherwise specified.

Smalley Part Number		Operates in Bore Diameter (in)	Clears Shaft Diameter (in)	Load (lb)	Work Height (in)	Free Height[1] (in)	Number of Waves	Number of Turns	Thickness (in)	Radial Wall (in)	Spring Rate[2] (lb/in)
Carbon Steel	Add Suffix 17-7 SS										
Single-Turn Overlap-Type Springs											
SSR-0050	**-S17**	0,500	0,390	7	0,050	0,085	3	1	0,008	0,040	200
SSR-0062	**-S17**	0,625	0,480	10	0,050	0,095	3	1	0,010	0,058	222
SSR-0075	**-S17**	0,750	0,500	14	0,062	0,160	3	1	0,010	0,078	143
SSR-0087	**-S17**	0,875	0,620	16	0,062	0,130	3	1	0,012	0,094	235
SSR-0100	**-S17**	1,000	0,780	18	0,062	0,190	3	1	0,012	0,094	184
SSR-0112	**-S17**	1,125	0,835	20	0,078	0,130	3	1	0,016	0,133	385
SSR-0125	**-S17**	1,250	0,960	22	0,078	0,150	3	1	0,016	0,133	306
SSR-0137	**-S17**	1,375	1,090	24	0,078	0,210	3	1	0,016	0,133	214
SSR-0150	**-S17**	1,500	1,170	26	0,078	0,170	3	1	0,018	0,143	283
SSR-0162	**-S17**	1,625	1,310	28	0,078	0,200	3	1	0,018	0,143	230
Single-Turn Gap-Type Springs											
SSR-0175	**-S17**	1,750	1,440	30	0,078	0,140	4	1	0,018	0,143	484
SSR-0187	**-S17**	1,875	1,560	32	0,078	0,150	4	1	0,018	0,143	444
SSR-0200	**-S17**	2,000	1,680	34	0,093	0,140	4	1	0,024	0,148	723
SSR-0212	**-S17**	2,125	1,800	36	0,093	0,150	4	1	0,024	0,148	632
SSR-0225	**-S17**	2,250	1,930	38	0,093	0,170	4	1	0,024	0,148	494
SSR-0237	**-S17**	2,375	1,990	40	0,093	0,160	4	1	0,024	0,178	597
SSR-0250	**-S17**	2,500	2,120	42	0,093	0,170	4	1	0,024	0,178	545
SSR-0262	**-S17**	2,625	2,240	44	0,093	0,190	4	1	0,024	0,178	454
SSR-0275	**-S17**	2,750	2,340	46	0,109	0,170	4	1	0,030	0,188	754
SSR-0287	**-S17**	2,875	2,470	48	0,109	0,180	4	1	0,030	0,188	676
SSR-0300	**-S17**	3,000	2,590	50	0,109	0,190	4	1	0,030	0,188	617
SSR-0312	**-S17**	3,125	2,710	52	0,109	0,210	4	1	0,030	0,188	515
SSR-0325	**-S17**	3,250	2,750	54	0,109	0,200	4	1	0,030	0,233	593
SSR-0337	**-S17**	3,375	2,845	56	0,109	0,220	4	1	0,030	0,233	505
SSR-0350	**-S17**	3,500	3,000	58	0,109	0,230	4	1	0,030	0,233	479
SSR-0362	**-S17**	3,625	3,120	60	0,109	0,240	4	1	0,030	0,233	458
SSR-0375	**-S17**	3,750	3,250	62	0,109	0,260	4	1	0,030	0,233	411
SSR-0387	**-S17**	3,875	3,370	64	0,109	0,300	4	1	0,030	0,233	335
SSR-0400	**-S17**	4,000	3,500	66	0,109	0,190	5	1	0,030	0,233	815
SSR-0412	**-S17**	4,125	3,620	67	0,109	0,200	5	1	0,030	0,233	736
SSR-0425	**-S17**	4,250	3,740	69	0,109	0,210	5	1	0,030	0,233	683
SSR-0437	**-S17**	4,375	3,860	70	0,109	0,210	5	1	0,030	0,233	693
SSR-0450	**-S17**	4,500	3,990	72	0,109	0,230	5	1	0,030	0,233	595
SSR-0462	**-S17**	4,625	4,110	73	0,125	0,270	5	1	0,030	0,233	503
SSR-0475	**-S17**	4,750	4,240	75	0,125	0,285	5	1	0,030	0,233	405
SSR-0487	**-S17**	4,875	4,370	76	0,125	0,310	5	1	0,030	0,233	461
SSR-0500	**-S17**	5,000	4,490	78	0,125	0,310	5	1	0,030	0,233	422
SSR-0512	**-S17**	5,125	4,610	80	0,125	0,340	5	1	0,030	0,233	372
Single-Turn Gap-Type Springs											
SSR-0525	**-S17**	5,250	4,740	82	0,125	0,370	5	1	0,030	0,233	335
SSR-0537	**-S17**	5,375	4,860	84	0,125	0,380	5	1	0,030	0,233	329
SSR-0550	**-S17**	5,500	4,990	86	0,125	0,250	6	1	0,030	0,233	688

[1] Reference dimension.
[2] Theoretical dimension.

SSR Series

Imperial Single-Turn Overlap-Type and Gap-Type Springs Continued

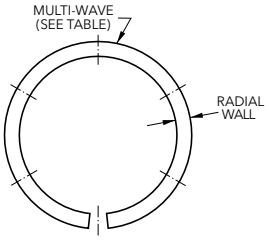
Smalley Part Number		Operates in Bore Diameter (in)	Clears Shaft Diameter (in)	Load (lb)	Work Height (in)	Free Height[1] (in)	Number of Waves	Number of Turns	Thickness (in)	Radial Wall (in)	Spring Rate[2] (lb/in)
Carbon Steel	Add Suffix 17-7 SS										
SSR-0562	**-S17**	5,625	5,110	88	0,125	0,270	6	1	0,030	0,233	607
SSR-0575	**-S17**	5,750	5,240	90	0,125	0,280	6	1	0,030	0,233	581
SSR-0587	**-S17**	5,875	5,360	92	0,125	0,310	6	1	0,030	0,233	526
SSR-0600	**-S17**	6,000	5,490	94	0,125	0,310	6	1	0,030	0,233	537
SSR-0612	**-S17**	6,125	5,610	96	0,125	0,340	6	1	0,030	0,233	519
SSR-0625	**-S17**	6,250	5,730	98	0,125	0,340	6	1	0,030	0,233	456
SSR-0637	**-S17**	6,375	5,860	100	0,125	0,350	6	1	0,030	0,233	444
SSR-0650	**-S17**	6,500	5,980	102	0,125	0,390	6	1	0,030	0,233	385
SSR-0675	**-S17**	6,750	6,230	104	0,125	0,420	6	1	0,030	0,233	353
SSR-0700	**-S17**	7,000	6,160	106	0,156	0,320	6	1	0,032	0,375	646
SSR-0725	**-S17**	7,250	6,440	108	0,156	0,350	6	1	0,032	0,375	557
SSR-0750	**-S17**	7,500	6,690	110	0,156	0,380	6	1	0,032	0,375	539
SSR-0775	**-S17**	7,750	6,940	114	0,156	0,380	6	1	0,032	0,375	509
SSR-0800	**-S17**	8,000	7,190	118	0,156	0,390	6	1	0,032	0,375	504
SSR-0825	**-S17**	8,250	7,440	122	0,156	0,430	6	1	0,032	0,375	445
SSR-0850	**-S17**	8,500	7,680	126	0,156	0,340	7	1	0,032	0,375	685
SSR-0875	**-S17**	8,750	7,930	130	0,156	0,340	7	1	0,032	0,375	707
SSR-0900	**-S17**	9,000	8,180	134	0,156	0,290	8	1	0,032	0,375	1000
SSR-0950	**-S17**	9,500	8,680	142	0,156	0,240	9	1	0,032	0,375	1690
SSR-1000	**-S17**	10,000	9,170	150	0,156	0,290	9	1	0,032	0,375	1119
SSR-1050	**-S17**	10,500	9,670	158	0,156	0,310	9	1	0,032	0,375	1026
SSR-1100	**-S17**	11,000	10,170	166	0,156	0,350	9	1	0,032	0,375	856
SSR-1150	**-S17**	11,500	10,660	174	0,156	0,360	9	1	0,032	0,375	853
SSR-1200	**-S17**	12,000	11,160	182	0,156	0,440	9	1	0,032	0,375	641
SSR-1250	**-S17**	12,500	11,660	190	0,156	0,350	10	1	0,032	0,375	979
SSR-1300	**-S17**	13,000	12,160	198	0,156	0,380	10	1	0,032	0,375	780
SSR-1350	**-S17**	13,500	12,650	206	0,156	0,430	10	1	0,032	0,375	752
SSR-1400	**-S17**	14,000	13,150	214	0,156	0,300	12	1	0,032	0,375	1486
SSR-1450	**-S17**	14,500	13,650	221	0,156	0,320	12	1	0,032	0,375	1348
SSR-1500	**-S17**	15,000	14,130	230	0,156	0,350	12	1	0,032	0,375	1186
SSR-1550	**-S17**	15,500	14,640	239	0,156	0,310	13	1	0,032	0,375	1552
SSR-1600	**-S17**	16,000	15,140	248	0,156	0,310	13	1	0,032	0,375	1348

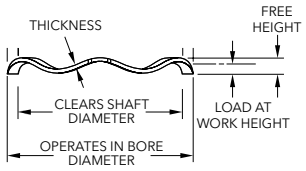
[1] Reference dimension.
[2] Theoretical dimension.

SSR-N Series

Imperial Narrow Section Gap-Type Springs







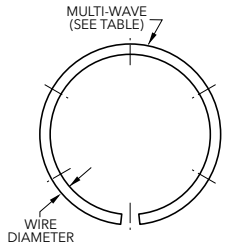
Product Dimensions: All dimensions in inches unless otherwise specified.

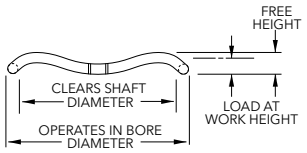
Smalley Part Number		Operates in Bore Diameter (in)	Clears Shaft Diameter (in)	Load (lb)	Work Height (in)	Free Height[1] (in)	Number of Waves	Number of Turns	Thickness (in)	Radial Wall (in)	Spring Rate[2] (lb/in)
Carbon Steel	Add Suffix 17-7 SS										
SSR-0325-N	**-S17**	3,250	2,820	54	0,109	0,230	4	1	0,030	0,188	593
SSR-0337-N	**-S17**	3,375	2,940	56	0,109	0,220	4	1	0,030	0,188	505
SSR-0350-N	**-S17**	3,500	3,070	58	0,109	0,260	4	1	0,030	0,188	384
SSR-0362-N	**-S17**	3,625	3,190	60	0,109	0,270	4	1	0,030	0,188	373
SSR-0375-N	**-S17**	3,750	3,320	62	0,109	0,330	4	1	0,030	0,188	363
SSR-0387-N	**-S17**	3,875	3,440	64	0,109	0,310	4	1	0,030	0,188	318
SSR-0400-N	**-S17**	4,000	3,570	66	0,109	0,200	5	1	0,030	0,188	725
SSR-0412-N	**-S17**	4,125	3,690	67	0,109	0,200	5	1	0,030	0,188	736
SSR-0425-N	**-S17**	4,250	3,820	69	0,109	0,240	5	1	0,030	0,188	527
SSR-0437-N	**-S17**	4,375	3,940	70	0,109	0,210	5	1	0,030	0,188	693
SSR-0450-N	**-S17**	4,500	4,070	72	0,109	0,280	5	1	0,030	0,188	421
SSR-0462-N	**-S17**	4,625	4,190	73	0,125	0,270	5	1	0,030	0,188	503
SSR-0475-N	**-S17**	4,750	4,320	75	0,125	0,320	5	1	0,030	0,188	385
SSR-0487-N	**-S17**	4,875	4,440	76	0,125	0,320	5	1	0,030	0,188	390
SSR-0500-N	**-S17**	5,000	4,570	78	0,125	0,350	5	1	0,030	0,188	347
SSR-0512-N	**-S17**	5,125	4,690	80	0,125	0,350	5	1	0,030	0,188	356
SSR-0525-N	**-S17**	5,250	4,820	82	0,125	0,360	5	1	0,030	0,188	349
SSR-0537-N	**-S17**	5,375	4,940	84	0,125	0,440	5	1	0,030	0,188	267
SSR-0550-N	**-S17**	5,500	5,070	86	0,125	0,280	6	1	0,030	0,188	555
SSR-0562-N	**-S17**	5,625	5,190	88	0,125	0,290	6	1	0,030	0,188	533
SSR-0575-N	**-S17**	5,750	5,320	90	0,125	0,340	6	1	0,030	0,188	419
SSR-0587-N	**-S17**	5,875	5,440	92	0,125	0,340	6	1	0,030	0,188	428
SSR-0600-N	**-S17**	6,000	5,570	94	0,125	0,340	6	1	0,030	0,188	437
SSR-0612-N	**-S17**	6,125	5,690	96	0,125	0,280	7	1	0,030	0,188	619
SSR-0625-N	**-S17**	6,250	5,820	98	0,125	0,280	7	1	0,030	0,188	632
SSR-0637-N	**-S17**	6,375	5,940	100	0,125	0,300	7	1	0,030	0,188	571
SSR-0650-N	**-S17**	6,500	6,070	102	0,125	0,300	7	1	0,030	0,188	583
SSR-0675-N	**-S17**	6,750	6,320	104	0,125	0,300	7	1	0,030	0,188	594
SSR-0700-N	**-S17**	7,000	6,480	106	0,156	0,320	7	1	0,030	0,233	646
SSR-0725-N	**-S17**	7,250	6,730	108	0,156	0,330	7	1	0,030	0,233	621
SSR-0750-N	**-S17**	7,500	6,980	110	0,156	0,360	7	1	0,030	0,233	539
SSR-0775-N	**-S17**	7,750	7,230	114	0,156	0,380	7	1	0,030	0,233	509

[1] Reference dimension.
[2] Theoretical dimension.

RW Series
Imperial Wavo® Springs







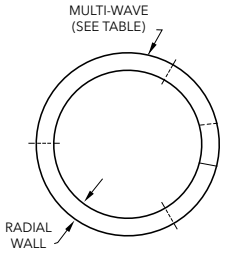
Product Dimensions: All dimensions in inches unless otherwise specified.

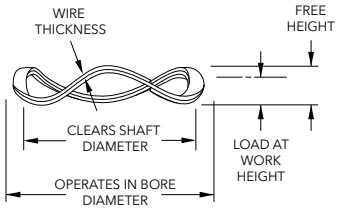
Smalley Part Number		Operates in Bore Diameter (in)	Clears Shaft Diameter (in)	Load (lb)	Work Height (in)	Free Height[1] (in)	Number of Waves	Number of Turns	Wire Diameter (in)	Spring Rate[2] (lb/in)
Carbon Steel	Add Suffix 17-7 SS									
RW-0050	**-S17**	0,500	0,408	35	0,052	0,062	3	1	0,031	3,500
RW-0062	**-S17**	0,625	0,517	50	0,064	0,077	3	1	0,038	3,846
RW-0075	**-S17**	0,750	0,628	70	0,076	0,092	3	1	0,045	4,375
RW-0087	**-S17**	0,875	0,740	80	0,086	0,104	3	1	0,051	4,444
RW-0100	**-S17**	1,000	0,855	90	0,095	0,116	3	1	0,056	4,286
RW-0112	**-S17**	1,125	0,967	100	0,102	0,127	3	1	0,060	4,000
RW-0125	**-S17**	1,250	1,081	110	0,110	0,138	3	1	0,065	3,929
RW-0137	**-S17**	1,375	1,223	120	0,095	0,121	4	1	0,056	4,615
RW-0150	**-S17**	1,500	1,339	130	0,102	0,128	4	1	0,060	5,000
RW-0162	**-S17**	1,625	1,444	140	0,110	0,137	4	1	0,065	5,185
RW-0175	**-S17**	1,750	1,564	150	0,113	0,144	4	1	0,067	4,839
RW-0187	**-S17**	1,875	1,682	160	0,119	0,155	4	1	0,070	4,444
RW-0200	**-S17**	2,000	1,803	170	0,124	0,165	4	1	0,072	4,146
RW-0212	**-S17**	2,125	1,906	180	0,129	0,162	4	1	0,076	5,455
RW-0225	**-S17**	2,250	2,023	190	0,136	0,168	4	1	0,080	5,938
RW-0237	**-S17**	2,375	2,141	200	0,141	0,178	4	1	0,083	5,405
RW-0250	**-S17**	2,500	2,261	210	0,144	0,185	4	1	0,085	5,122
RW-0262	**-S17**	2,625	2,374	220	0,153	0,203	4	1	0,090	4,400
RW-0275	**-S17**	2,750	2,497	230	0,154	0,212	4	1	0,091	3,966
RW-0287	**-S17**	2,875	2,618	240	0,158	0,210	4	1	0,093	4,615
RW-0300	**-S17**	3,000	2,767	250	0,141	0,179	5	1	0,083	6,579
RW-0312	**-S17**	3,125	2,878	260	0,144	0,184	5	1	0,085	6,500
RW-0325	**-S17**	3,250	2,992	270	0,153	0,190	5	1	0,090	7,297
RW-0337	**-S17**	3,375	3,115	280	0,154	0,195	5	1	0,091	6,829
RW-0350	**-S17**	3,500	3,236	290	0,158	0,201	5	1	0,093	6,744
RW-0362	**-S17**	3,625	3,356	300	0,161	0,206	5	1	0,095	6,667
RW-0375	**-S17**	3,750	3,475	310	0,166	0,212	5	1	0,098	6,739
RW-0387	**-S17**	3,875	3,595	320	0,170	0,208	5	1	0,100	8,421
RW-0400	**-S17**	4,000	3,718	330	0,170	0,225	5	1	0,100	6,000
RW-0412	**-S17**	4,125	3,827	335	0,175	0,221	5	1	0,105	7,283
RW-0425	**-S17**	4,250	3,948	345	0,178	0,225	5	1	0,105	7,340
RW-0437	**-S17**	4,375	4,063	350	0,187	0,240	5	1	0,110	6,604
RW-0450	**-S17**	4,500	4,185	360	0,187	0,247	5	1	0,110	6,000
RW-0462	**-S17**	4,625	4,310	365	0,187	0,253	5	1	0,110	5,530
RW-0475	**-S17**	4,750	4,431	375	0,190	0,257	5	1	0,112	5,597
RW-0487	**-S17**	4,875	4,555	380	0,190	0,264	5	1	0,112	5,135
RW-0500	**-S17**	5,000	4,672	390	0,195	0,265	5	1	0,116	5,571
RW-0512	**-S17**	5,125	4,772	400	0,200	0,274	5	1	0,118	5,405
RW-0525	**-S17**	5,250	4,893	410	0,204	0,279	5	1	0,120	5,467
RW-0537	**-S17**	5,375	5,037	420	0,187	0,245	6	1	0,110	7,241
RW-0550	**-S17**	5,500	5,162	430	0,187	0,251	6	1	0,110	6,719
RW-0562	**-S17**	5,625	5,283	440	0,190	0,245	6	1	0,112	8,000
RW-0575	**-S17**	5,750	5,406	450	0,190	0,251	6	1	0,112	7,377
RW-0587	**-S17**	5,875	5,524	460	0,197	0,262	6	1	0,116	7,077
RW-0600	**-S17**	6,000	5,644	470	0,200	0,268	6	1	0,118	6,912

[1] Reference dimension.
[2] Theoretical dimension.

NSSB Series
Nested Spirawave® Springs







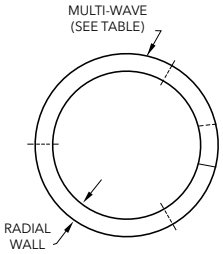
Product Dimensions: All dimensions in millimeters unless otherwise specified.

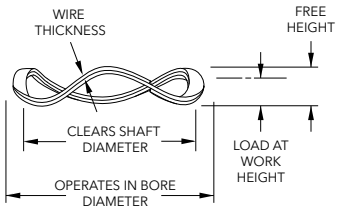
Smalley Part Number		Operates in Bore Diameter (mm)	Clears Shaft Diameter (mm)	Load at Work Height (N)	Work Height (mm)	Load at Free Height (N)	Free Height[1] (mm)	Number of Waves	Number of Turns	Wire Thickness (mm)	Radial Wall (mm)	Spring Rate[2] (N/mm)
Carbon Steel	Add Suffix for 17-7 PH SS											
NSSB-0063-L2	**-S17**	16,00	11,46	89,0	1,83	4,5	2,46	3	2	0,28	1,52	140
NSSB-0063-L3	**-S17**	16,00	11,46	133,5	2,08	4,5	3,15	3	3	0,28	1,52	125
NSSB-0075-L2	**-S17**	19,00	13,36	106,8	1,83	4,5	2,77	3	2	0,28	1,98	114
NSSB-0075-L3	**-S17**	19,00	13,36	160,2	2,08	4,5	3,18	3	3	0,28	1,98	146
NSSB-0087-L2	**-S17**	22,00	15,75	124,6	1,88	4,5	3,14	3	2	0,30	2,39	99
NSSB-0087-L3	**-S17**	22,00	15,75	186,9	2,18	4,5	3,56	3	3	0,30	2,39	136
NSSB-0095-L2	**-S17**	24,00	17,02	133,5	1,88	4,5	3,56	3	2	0,30	2,39	80
NSSB-0095-L3	**-S17**	24,00	17,02	200,3	2,18	4,5	3,86	3	3	0,30	2,39	119
NSSB-0102-L2	**-S17**	26,00	18,14	142,4	2,34	4,5	3,37	3	2	0,36	3,18	138
NSSB-0102-L3	**-S17**	26,00	18,14	213,6	2,69	4,5	3,73	3	3	0,36	3,18	205
NSSB-0110-L2	**-S17**	28,00	20,07	151,3	2,34	4,5	3,68	3	2	0,36	3,18	113
NSSB-0110-L3	**-S17**	28,00	20,07	227,0	2,69	4,5	4,04	3	3	0,36	3,18	168
NSSB-0118-L2	**-S17**	30,00	21,87	169,1	2,34	4,5	4,24	3	2	0,36	3,18	89
NSSB-0118-L3	**-S17**	30,00	21,87	253,7	2,69	4,5	4,78	3	3	0,36	3,18	121
NSSB-0126-L2	**-S17**	32,00	23,67	178,0	2,39	4,5	4,07	3	2	0,41	3,38	106
NSSB-0126-L3	**-S17**	32,00	23,67	267,0	2,79	4,5	4,48	3	3	0,41	3,38	158
NSSB-0138-L2	**-S17**	35,00	26,42	195,8	2,39	4,5	4,94	3	2	0,41	3,38	77
NSSB-0138-L3	**-S17**	35,00	26,42	293,7	2,79	4,5	5,35	3	3	0,41	3,38	115
NSSB-0146-L2	**-S17**	37,00	28,65	204,7	2,44	4,5	4,72	3	2	0,46	3,38	90
NSSB-0146-L3	**-S17**	37,00	28,65	307,1	2,90	4,5	5,18	3	3	0,46	3,38	135
NSSB-0158-L2	**-S17**	40,00	31,01	222,5	2,44	4,5	5,70	3	2	0,46	3,38	68
NSSB-0158-L3	**-S17**	40,00	31,01	333,8	2,90	4,5	6,15	3	3	0,46	3,38	103
NSSB-0165-L2	**-S17**	42,00	33,50	231,4	2,44	4,5	3,71	4	2	0,46	3,38	182
NSSB-0165-L3	**-S17**	42,00	33,50	347,1	2,90	4,5	4,17	4	3	0,46	3,38	273
NSSB-0185-L2	**-S17**	47,00	38,18	258,1	2,44	4,5	4,52	4	2	0,46	3,38	124
NSSB-0185-L3	**-S17**	47,00	38,18	387,2	2,90	4,5	4,98	4	3	0,46	3,38	186
NSSB-0205-L2	**-S17**	52,00	42,37	284,8	2,97	4,5	4,15	4	2	0,61	3,76	241
NSSB-0205-L3	**-S17**	52,00	42,37	427,2	3,58	4,5	4,76	4	3	0,61	3,76	362
NSSB-0217-L2	**-S17**	55,00	45,31	302,6	2,97	4,5	4,48	4	2	0,61	3,76	200
NSSB-0217-L3	**-S17**	55,00	45,31	453,9	3,58	4,5	5,09	4	3	0,61	3,76	301
NSSB-0244-L2	**-S17**	62,00	50,65	338,2	2,97	4,5	4,93	4	2	0,61	4,52	173
NSSB-0244-L3	**-S17**	62,00	50,65	507,3	3,58	4,5	5,54	4	3	0,61	4,52	259
NSSB-0268-L2	**-S17**	68,00	56,16	373,8	3,53	4,5	4,94	4	2	0,76	4,78	265
NSSB-0268-L3	**-S17**	68,00	56,16	560,7	4,29	4,5	5,70	4	3	0,76	4,78	398
NSSB-0276-L2	**-S17**	70,00	58,14	382,7	3,53	4,5	5,12	4	2	0,76	4,78	241
NSSB-0276-L3	**-S17**	70,00	58,14	574,1	4,29	4,5	5,88	4	3	0,76	4,78	361
NSSB-0284-L2	**-S17**	72,00	60,07	391,6	3,53	4,5	5,32	4	2	0,76	4,78	219
NSSB-0284-L3	**-S17**	72,00	60,07	587,4	4,29	4,5	6,08	4	3	0,76	4,78	328
NSSB-0295-L2	**-S17**	75,00	62,97	409,4	3,53	4,5	5,68	4	2	0,76	4,78	190
NSSB-0295-L3	**-S17**	75,00	62,97	614,1	4,29	4,5	6,44	4	3	0,76	4,78	286
NSSB-0315-L2	**-S17**	80,00	67,49	436,1	3,53	4,5	6,37	4	2	0,76	4,78	154
NSSB-0315-L3	**-S17**	80,00	67,49	654,2	4,29	4,5	7,13	4	3	0,76	4,78	230
NSSB-0335-L2	**-S17**	85,00	70,26	462,8	3,53	4,5	6,29	4	2	0,76	5,92	168
NSSB-0335-L3	**-S17**	85,00	70,26	694,2	4,29	4,5	7,05	4	3	0,76	5,92	252
NSSB-0354-L2	**-S17**	90,00	74,98	498,4	3,53	4,5	7,13	4	2	0,76	5,92	138
NSSB-0354-L3	**-S17**	90,00	74,98	747,6	4,29	4,5	7,89	4	3	0,76	5,92	208
NSSB-0374-L2	**-S17**	95,00	79,65	525,1	3,53	4,5	8,08	4	2	0,76	5,92	115
NSSB-0374-L3	**-S17**	95,00	79,65	787,7	4,29	4,5	8,84	4	3	0,76	5,92	173
NSSB-0394-L2	**-S17**	100,00	85,42	551,8	3,53	23,0	5,27	5	2	0,76	5,92	317
NSSB-0394-L3	**-S17**	100,00	85,42	827,7	4,29	23,0	6,03	5	3	0,76	5,92	476

[1] Reference dimension.
[2] Theoretical dimension.

NSSR Series
Imperial Nested Spirawave® Springs







Product Dimensions: All dimensions in inches unless otherwise specified.

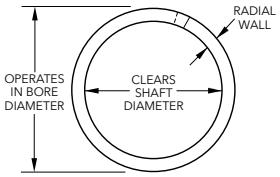
Smalley Part Number		Operates in Bore Diameter (in)	Clears Shaft Diameter (in)	Load at Work Height (lb)	Work Height (in)	Load at Free Height (lb)	Free Height[1] (in)	Number of Waves	Number of Turns	Wire Thickness (in)	Radial Wall (in)	Spring Rate[2] (lb/in)
Carbon Steel	Add Suffix for 17-7 PH SS											
NSSR-0050-L2	**-S17**	0,500	0,355	14	0,058	1,0	0,079	3	2	0,009	0,046	667
NSSR-0050-L3	**-S17**	0,500	0,355	22	0,066	1,0	0,087	3	3	0,009	0,046	1024
NSSR-0062-L2	**-S17**	0,625	0,445	20	0,059	1,0	0,093	3	2	0,010	0,058	571
NSSR-0062-L3	**-S17**	0,625	0,445	30	0,068	1,0	0,110	3	3	0,010	0,058	714
NSSR-0075-L2	**-S17**	0,750	0,523	28	0,072	1,0	0,115	3	2	0,012	0,072	651
NSSR-0075-L3	**-S17**	0,750	0,523	42	0,082	1,0	0,126	3	3	0,012	0,072	955
NSSR-0087-L2	**-S17**	0,875	0,625	32	0,074	1,0	0,133	3	2	0,012	0,094	542
NSSR-0087-L3	**-S17**	0,875	0,625	48	0,086	1,0	0,140	3	3	0,012	0,094	889
NSSR-0100-L2	**-S17**	1,000	0,741	36	0,074	1,0	0,190	3	2	0,012	0,089	310
NSSR-0100-L3	**-S17**	1,000	0,741	54	0,086	1,0	0,202	3	3	0,012	0,089	466
NSSR-0112-L2	**-S17**	1,125	0,807	40	0,092	1,0	0,164	3	2	0,014	0,125	556
NSSR-0112-L3	**-S17**	1,125	0,807	60	0,106	1,0	0,178	3	3	0,014	0,125	833
NSSR-0125-L2	**-S17**	1,250	0,921	44	0,094	1,0	0,165	3	2	0,016	0,133	620
NSSR-0125-L3	**-S17**	1,250	0,921	66	0,110	1,0	0,181	3	3	0,016	0,133	930
NSSR-0137-L2	**-S17**	1,375	1,033	48	0,094	1,0	0,203	3	2	0,016	0,133	440
NSSR-0137-L3	**-S17**	1,375	1,033	72	0,110	1,0	0,219	3	3	0,016	0,133	661
NSSR-0150-L2	**-S17**	1,500	1,136	52	0,096	1,0	0,197	3	2	0,018	0,143	515
NSSR-0150-L3	**-S17**	1,500	1,136	78	0,114	1,0	0,215	3	3	0,018	0,143	772
NSSR-0162-L2	**-S17**	1,625	1,249	56	0,096	1,0	0,240	3	2	0,018	0,143	389
NSSR-0162-L3	**-S17**	1,625	1,249	84	0,114	1,0	0,258	3	3	0,018	0,143	583
NSSR-0175-L2	**-S17**	1,750	1,390	60	0,096	1,0	0,159	4	2	0,018	0,143	952
NSSR-0175-L3	**-S17**	1,750	1,390	90	0,114	1,0	0,177	4	3	0,018	0,143	1429
NSSR-0187-L2	**-S17**	1,875	1,507	64	0,096	1,0	0,181	4	2	0,018	0,143	753
NSSR-0187-L3	**-S17**	1,875	1,507	96	0,114	1,0	0,199	4	3	0,018	0,143	1129
NSSR-0200-L2	**-S17**	2,000	1,626	68	0,117	1,0	0,162	4	2	0,024	0,148	1511
NSSR-0200-L3	**-S17**	2,000	1,626	102	0,141	1,0	0,186	4	3	0,024	0,148	2267
NSSR-0212-L2	**-S17**	2,125	1,743	72	0,117	1,0	0,176	4	2	0,024	0,148	1220
NSSR-0212-L3	**-S17**	2,125	1,743	108	0,141	1,0	0,200	4	3	0,024	0,148	1831
NSSR-0225-L2	**-S17**	2,250	1,863	76	0,117	1,0	0,193	4	2	0,024	0,148	1000
NSSR-0225-L3	**-S17**	2,250	1,863	114	0,141	1,0	0,217	4	3	0,024	0,148	1500
NSSR-0237-L2	**-S17**	2,375	1,964	80	0,117	1,0	0,204	4	2	0,024	0,158	920
NSSR-0237-L3	**-S17**	2,375	1,964	120	0,141	1,0	0,228	4	3	0,024	0,158	1379
NSSR-0250-L2	**-S17**	2,500	2,044	84	0,117	1,0	0,210	4	2	0,024	0,178	903
NSSR-0250-L3	**-S17**	2,500	2,044	126	0,141	1,0	0,234	4	3	0,024	0,178	1355
NSSR-0262-L2	**-S17**	2,625	2,159	88	0,117	1,0	0,231	4	2	0,024	0,178	772
NSSR-0262-L3	**-S17**	2,625	2,159	132	0,141	1,0	0,255	4	3	0,024	0,178	1158
NSSR-0275-L2	**-S17**	2,750	2,281	92	0,139	1,0	0,205	4	2	0,030	0,188	394
NSSR-0275-L3	**-S17**	2,750	2,281	138	0,169	1,0	0,235	4	3	0,030	0,188	2091
NSSR-0287-L2	**-S17**	2,875	2,402	96	0,139	1,0	0,220	4	2	0,030	0,188	1185
NSSR-0287-L3	**-S17**	2,875	2,402	144	0,169	1,0	0,250	4	3	0,030	0,188	1778
NSSR-0300-L2	**-S17**	3,000	2,519	100	0,139	1,0	0,236	4	2	0,030	0,188	1031
NSSR-0300-L3	**-S17**	3,000	2,519	150	0,169	1,0	0,266	4	3	0,030	0,188	1546
NSSR-0312-L2	**-S17**	3,125	2,630	104	0,139	1,0	0,254	4	2	0,030	0,188	904
NSSR-0312-L3	**-S17**	3,125	2,630	156	0,169	1,0	0,284	4	3	0,030	0,188	1357
NSSR-0325-L2	**-S17**	3,250	2,672	108	0,139	1,0	0,241	4	2	0,030	0,233	1059
NSSR-0325-L3	**-S17**	3,250	2,672	162	0,169	1,0	0,271	4	3	0,030	0,233	1588
NSSR-0337-L2	**-S17**	3,375	2,791	112	0,139	1,0	0,259	4	2	0,030	0,233	933
NSSR-0337-L3	**-S17**	3,375	2,791	168	0,169	1,0	0,289	4	3	0,030	0,233	1400
NSSR-0350-L2	**-S17**	3,500	2,908	116	0,139	1,0	0,280	4	2	0,030	0,233	823
NSSR-0350-L3	**-S17**	3,500	2,908	174	0,169	1,0	0,310	4	3	0,030	0,233	1234
NSSR-0362-L2	**-S17**	3,625	3,026	120	0,139	1,0	0,303	4	2	0,030	0,233	732
NSSR-0362-L3	**-S17**	3,625	3,026	180,0	0,169	1,0	0,333	4	3	0,030	0,233	1098
NSSR-0375-L2	**-S17**	3,750	3,141	124,0	0,139	1,0	0,329	4	2	0,030	0,233	653
NSSR-0375-L3	**-S17**	3,750	3,141	186,0	0,169	1,0	0,359	4	3	0,030	0,233	979
NSSR-0387-L2	**-S17**	3,875	3,255	128,0	0,139	1,0	0,357	4	2	0,030	0,233	587
NSSR-0387-L3	**-S17**	3,875	3,255	192,0	0,169	1,0	0,387	4	3	0,030	0,233	881
NSSR-0400-L2	**-S17**	4,000	3,423	132,0	0,139	5,0	0,216	5	2	0,030	0,233	1714
NSSR-0400-L3	**-S17**	4,000	3,423	198,0	0,169	5,0	0,246	5	3	0,030	0,233	2571

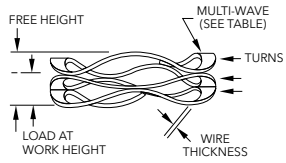
[1] Reference dimension.
[2] Theoretical dimension.

CM/CMS Series
Crest-To-Crest® Springs

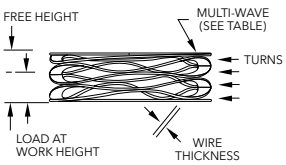


CM-Plain Ends *CMS-Shim Ends*





CM-Plain Ends



CMS-Shim Ends

Product Dimensions: All dimensions in millimeters unless otherwise specified.

Smalley Part Number [1]		Operates in Bore Diameter (mm)	Clears Shaft Diameter (mm)	Load (N)	Work Height (mm)	Free Height[2] (mm)	Number of Waves	Number of Turns	Thickness (mm)	Radial Wall (mm)	Spring Rate[3] (N/mm)
Carbon Steel	Add Suffix 17-7 SS										
NA	**CM05-L1-S17**[4]	5	3,5	5	1,14	1,84	2,5	3	0,13	0,46	7,14
NA	**CM05-L2-S17**[4]	5	3,5	5	1,52	2,45	2,5	4	0,13	0,46	5,38
NA	**CM05-L3-S17**[4]	5	3,5	5	1,91	3,06	2,5	5	0,13	0,46	4,35
NA	**CM05-L4-S17**[4]	5	3,5	5	2,26	3,68	2,5	6	0,13	0,46	3,52
NA	**CM05-L5-S17**[4]	5	3,5	5	2,67	4,29	2,5	7	0,13	0,46	3,09
NA	**CM05-L6-S17**[4]	5	3,5	5	3,02	4,90	2,5	8	0,13	0,46	2,66
NA	**CM05-L7-S17**[4]	5	3,5	5	3,43	5,52	2,5	9	0,13	0,46	2,39
NA	**CM05-L8-S17**[4]	5	3,5	5	4,14	6,74	2,5	11	0,13	0,46	1,92
NA	**CM05-L9-S17**[4]	5	3,5	5	4,90	7,97	2,5	13	0,13	0,46	1,63
NA	**CM05-M1-S17**[4]	5	3,5	10	1,14	1,89	2,5	3	0,15	0,46	13,33
NA	**CM05-M2-S17**[4]	5	3,5	10	1,52	2,52	2,5	4	0,15	0,46	10,00
NA	**CM05-M3-S17**[4]	5	3,5	10	1,91	3,15	2,5	5	0,15	0,46	8,06
NA	**CM05-M4-S17**[4]	5	3,5	10	2,26	3,78	2,5	6	0,15	0,46	6,58
NA	**CM05-M5-S17**[4]	5	3,5	10	2,67	4,41	2,5	7	0,15	0,46	5,75
NA	**CM05-M6-S17**[4]	5	3,5	10	3,02	5,04	2,5	8	0,15	0,46	4,95
NA	**CM05-M7-S17**[4]	5	3,5	10	3,43	5,67	2,5	9	0,15	0,46	4,46
NA	**CM05-M8-S17**[4]	5	3,5	10	4,14	6,93	2,5	11	0,15	0,46	3,58
NA	**CM05-M9-S17**[4]	5	3,5	10	4,90	8,19	2,5	13	0,15	0,46	3,04
NA	**CM06-L1-S17**[4]	6	4	6	0,61	1,52	2,5	3	0,13	0,51	6,59
NA	**CM06-L2-S17**[4]	6	4	6	0,81	2,03	2,5	4	0,13	0,51	4,92
NA	**CM06-L3-S17**[4]	6	4	6	1,02	2,54	2,5	5	0,13	0,51	3,95
NA	**CM06-L4-S17**[4]	6	4	6	1,22	3,05	2,5	6	0,13	0,51	3,28
NA	**CM06-L5-S17**[4]	6	4	6	1,42	3,56	2,5	7	0,13	0,51	2,80
NA	**CM06-L6-S17**[4]	6	4	6	1,63	4,06	2,5	8	0,13	0,51	2,47
NA	**CM06-L7-S17**[4]	6	4	6	1,83	4,57	2,5	9	0,13	0,51	2,19
NA	**CM06-L8-S17**[4]	6	4	6	2,24	5,59	2,5	11	0,13	0,51	1,79
NA	**CM06-L9-S17**[4]	6	4	6	2,64	6,60	2,5	13	0,13	0,51	1,52
NA	**CM06-M1-S17**[4]	6	4	12	0,74	1,52	2,5	3	0,15	0,61	15,38
NA	**CM06-M2-S17**[4]	6	4	12	0,97	2,03	2,5	4	0,15	0,61	11,32
NA	**CM06-M3-S17**[4]	6	4	12	1,22	2,54	2,5	5	0,15	0,61	9,09
NA	**CM06-M4-S17**[4]	6	4	12	1,47	3,05	2,5	6	0,15	0,61	7,59
NA	**CM06-M5-S17**[4]	6	4	12	1,70	3,56	2,5	7	0,15	0,61	6,45
NA	**CM06-M6-S17**[4]	6	4	12	1,96	4,06	2,5	8	0,15	0,61	5,71
NA	**CM06-M7-S17**[4]	6	4	12	2,18	4,57	2,5	9	0,15	0,61	5,02
NA	**CM06-M8-S17**[4]	6	4	12	2,69	5,59	2,5	11	0,15	0,61	4,14
NA	**CM06-M9-S17**[4]	6	4	12	3,18	6,60	2,5	13	0,15	0,61	3,51
CM08-L1	**-S17**	8	5	15	1,70	2,82	2,5	3	0,20	0,81	13,39
CM08-L2	**-S17**	8	5	15	2,39	3,76	2,5	4	0,20	0,81	10,95
CM08-L3	**-S17**	8	5	15	2,74	4,70	2,5	5	0,20	0,81	7,65
CM08-L4	**-S17**	8	5	15	3,56	5,64	2,5	6	0,20	0,81	7,21
CM08-L5	**-S17**	8	5	15	4,01	6,58	2,5	7	0,20	0,81	5,84
CM08-L6	**-S17**	8	5	15	4,57	7,52	2,5	8	0,20	0,81	5,08
CM08-L7	**-S17**	8	5	15	5,26	8,46	2,5	9	0,20	0,81	4,69
CM08-L8	**-S17**	8	5	15	6,35	10,34	2,5	11	0,20	0,81	3,76
CM08-L9	**-S17**	8	5	15	7,37	12,22	2,5	13	0,20	0,81	3,09
CM08-M1	**-S17**	8	5	30	1,78	3,05	2,5	3	0,25	0,81	23,62
CM08-M2	**-S17**	8	5	30	2,54	4,06	2,5	4	0,25	0,81	19,74
CM08-M3	**-S17**	8	5	30	3,05	5,08	2,5	5	0,25	0,81	14,78
CM08-M4	**-S17**	8	5	30	3,81	6,10	2,5	6	0,25	0,81	13,10
CM08-M5	**-S17**	8	5	30	4,32	7,11	2,5	7	0,25	0,81	10,75
CM08-M6	**-S17**	8	5	30	4,95	8,13	2,5	8	0,25	0,81	9,43
CM08-M7	**-S17**	8	5	30	5,59	9,14	2,5	9	0,25	0,81	8,45
CM08-M8	**-S17**	8	5	30	6,86	10,34	2,5	11	0,25	0,81	8,62
CM08-M9	**-S17**	8	5	30	7,87	12,22	2,5	13	0,25	0,81	6,90
CM10-L1	**-S17**	10	7	18	1,91	3,96	2,5	3	0,20	0,81	8,78
CM10-L2	**-S17**	10	7	18	2,54	5,28	2,5	4	0,20	0,81	6,57

[1] Use "CM" prefix for plain ends. Use "CMS" prefix for squared-shim ends.
[2] Reference dimension.
[3] Theoretical dimension.
[4] Not available with shim ends

CM/CMS Series

Crest-To-Crest® Springs Continued

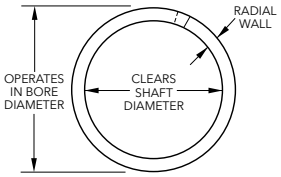
Smalley Part Number [1]		Operates in Bore Diameter (mm)	Clears Shaft Diameter (mm)	Load (N)	Work Height (mm)	Free Height [2] (mm)	Number of Waves	Number of Turns	Thickness (mm)	Radial Wall (mm)	Spring Rate [3] (N/mm)
Carbon Steel	Add Suffix 17-7 SS										
CM10-L3	**-S17**	10	7	18	3,15	6,60	2,5	5	0,20	0,81	5,22
CM10-L4	**-S17**	10	7	18	3,78	7,92	2,5	6	0,20	0,81	4,35
CM10-L5	**-S17**	10	7	18	4,42	9,25	2,5	7	0,20	0,81	3,73
CM10-L6	**-S17**	10	7	18	5,05	10,57	2,5	8	0,20	0,81	3,26
CM10-L7	**-S17**	10	7	18	5,69	11,89	2,5	9	0,20	0,81	2,90
CM10-L8	**-S17**	10	7	18	6,32	13,21	2,5	10	0,20	0,81	2,61
CM10-L9	**-S17**	10	7	18	6,96	14,53	2,5	11	0,20	0,81	2,38
CM10-M1	**-S17**	10	7	35	2,03	3,96	2,5	3	0,28	0,81	18,13
CM10-M2	**-S17**	10	7	35	2,79	5,28	2,5	4	0,28	0,81	14,06
CM10-M3	**-S17**	10	7	35	3,56	6,60	2,5	5	0,28	0,81	11,51
CM10-M4	**-S17**	10	7	35	4,32	7,92	2,5	6	0,28	0,81	9,72
CM10-M5	**-S17**	10	7	35	5,08	9,25	2,5	7	0,28	0,81	8,39
CM10-M6	**-S17**	10	7	35	5,84	10,57	2,5	8	0,28	0,81	7,40
CM10-M7	**-S17**	10	7	35	6,60	11,89	2,5	9	0,28	0,81	6,62
CM10-M8	**-S17**	10	7	35	7,37	13,21	2,5	10	0,28	0,81	5,99
CM10-M9	**-S17**	10	7	35	8,13	14,53	2,5	11	0,28	0,81	5,47
CM12-L1	**-S17**	12	9	20	1,47	4,34	2,5	3	0,20	1,02	6,97
CM12-L2	**-S17**	12	9	20	1,98	5,79	2,5	4	0,20	1,02	5,25
CM12-L3	**-S17**	12	9	20	2,46	7,24	2,5	5	0,20	1,02	4,18
CM12-L4	**-S17**	12	9	20	2,95	8,69	2,5	6	0,20	1,02	3,48
CM12-L5	**-S17**	12	9	20	3,45	10,13	2,5	7	0,20	1,02	2,99
CM12-L6	**-S17**	12	9	20	3,94	11,58	2,5	8	0,20	1,02	2,62
CM12-L7	**-S17**	12	9	20	4,45	13,03	2,5	9	0,20	1,02	2,33
CM12-L8	**-S17**	12	9	20	4,93	14,48	2,5	10	0,20	1,02	2,09
CM12-L9	**-S17**	12	9	20	5,44	15,93	2,5	11	0,20	1,02	1,91
CM12-M1	**-S17**	12	8,5	40	2,36	4,34	2,5	3	0,28	1,17	20,20
CM12-M2	**-S17**	12	8,5	40	3,18	5,79	2,5	4	0,28	1,17	15,33
CM12-M3	**-S17**	12	8,5	40	3,96	7,24	2,5	5	0,28	1,17	12,20
CM12-M4	**-S17**	12	8,5	40	4,75	8,69	2,5	6	0,28	1,17	10,15
CM12-M5	**-S17**	12	8,5	40	5,54	10,13	2,5	7	0,28	1,17	8,71
CM12-M6	**-S17**	12	8,5	40	6,32	11,58	2,5	8	0,28	1,17	7,60
CM12-M7	**-S17**	12	8,5	40	7,11	13,03	2,5	9	0,28	1,17	6,76
CM12-M8	**-S17**	12	8,5	40	7,92	14,48	2,5	10	0,28	1,17	6,10
CM12-M9	**-S17**	12	8,5	40	8,71	15,93	2,5	11	0,28	1,17	5,54
CM12-H1	**-S17**	12	8,5	60	1,98	4,34	2,5	3	0,30	1,14	25,42
CM12-H2	**-S17**	12	8,5	60	2,64	5,79	2,5	4	0,30	1,14	19,05
CM12-H3	**-S17**	12	8,5	60	3,30	7,24	2,5	5	0,30	1,14	15,23
CM12-H4	**-S17**	12	8,5	60	3,99	8,69	2,5	6	0,30	1,14	12,77
CM12-H5	**-S17**	12	8,5	60	4,65	10,13	2,5	7	0,30	1,14	10,95
CM12-H6	**-S17**	12	8,5	60	5,31	11,58	2,5	8	0,30	1,14	9,57
CM12-H7	**-S17**	12	8,5	60	5,97	13,03	2,5	9	0,30	1,14	8,50
CM12-H8	**-S17**	12	8,5	60	6,63	14,48	2,5	10	0,30	1,14	7,64
CM12-H9	**-S17**	12	8,5	60	7,29	15,93	2,5	11	0,30	1,14	6,94
CM14-L1	**-S17**	14	10	22	2,18	4,95	2,5	3	0,23	1,47	7,94
CM14-L2	**-S17**	14	10	22	2,92	6,60	2,5	4	0,23	1,47	5,98
CM14-L3	**-S17**	14	10	22	3,66	8,26	2,5	5	0,23	1,47	4,78
CM14-L4	**-S17**	14	10	22	4,37	9,91	2,5	6	0,23	1,47	3,97
CM14-L5	**-S17**	14	10	22	5,10	11,56	2,5	7	0,23	1,47	3,40
CM14-L6	**-S17**	14	10	22	5,84	13,21	2,5	8	0,23	1,47	2,99
CM14-L7	**-S17**	14	10	22	6,58	14,86	2,5	9	0,23	1,47	2,66
CM14-L8	**-S17**	14	10	22	7,29	16,51	2,5	10	0,23	1,47	2,39
CM14-L9	**-S17**	14	10	22	8,03	18,16	2,5	11	0,23	1,47	2,17
CM14-M1	**-S17**	14	10	50	2,18	4,95	2,5	3	0,30	1,52	18,05
CM14-M2	**-S17**	14	10	50	2,95	6,60	2,5	4	0,30	1,52	13,70
CM14-M3	**-S17**	14	10	50	3,71	8,26	2,5	5	0,30	1,52	10,99
CM14-M4	**-S17**	14	10	50	4,52	9,91	2,5	6	0,30	1,52	9,28
CM14-M5	**-S17**	14	10	50	5,33	11,56	2,5	7	0,30	1,52	8,03
CM14-M6	**-S17**	14	10	50	6,17	13,21	2,5	8	0,30	1,52	7,10
CM14-M7	**-S17**	14	10	50	7,01	14,86	2,5	9	0,30	1,52	6,37
CM14-M8	**-S17**	14	10	50	7,85	16,51	2,5	10	0,30	1,52	5,77
CM14-M9	**-S17**	14	10	50	8,71	18,16	2,5	11	0,30	1,52	5,29
CM14-H1	**-S17**	14	9	80	3,15	4,95	2,5	3	0,38	1,52	44,44
CM14-H2	**-S17**	14	9	80	4,19	6,60	2,5	4	0,38	1,52	33,20
CM14-H3	**-S17**	14	9	80	5,26	8,26	2,5	5	0,38	1,52	26,67
CM14-H4	**-S17**	14	9	80	6,30	9,91	2,5	6	0,38	1,52	22,16
CM14-H5	**-S17**	14	9	80	7,34	11,56	2,5	7	0,38	1,52	18,96
CM14-H6	**-S17**	14	9	80	8,41	13,21	2,5	8	0,38	1,52	16,67
CM14-H7	**-S17**	14	9	80	9,45	14,86	2,5	9	0,38	1,52	14,79
CM14-H8	**-S17**	14	9	80	10,49	16,51	2,5	10	0,38	1,52	13,29
CM14-H9	**-S17**	14	9	80	11,56	18,16	2,5	11	0,38	1,52	12,12
CM15-L1	**-S17**	15	11	25	2,57	5,18	2,5	3	0,25	1,47	9,58
CM15-L2	**-S17**	15	11	25	3,43	6,91	2,5	4	0,25	1,47	7,18
CM15-L3	**-S17**	15	11	25	4,27	8,64	2,5	5	0,25	1,47	5,72

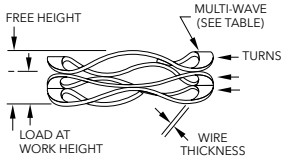
[1] Use "CM" prefix for plain ends. Use "CMS" prefix for squared-shim ends.
[2] Reference dimension.
[3] Theoretical dimension.

CM/CMS Series
Crest-To-Crest® Springs

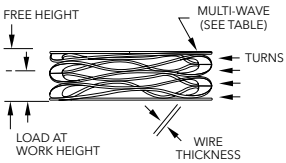


CM-Plain Ends *CMS-Shim Ends*





CM-Plain Ends



CMS-Shim Ends

Product Dimensions: All dimensions in millimeters unless otherwise specified.

Smalley Part Number [1]		Operates in Bore Diameter (mm)	Clears Shaft Diameter (mm)	Load (N)	Work Height (mm)	Free Height[2] (mm)	Number of Waves	Number of Turns	Thickness (mm)	Radial Wall (mm)	Spring Rate[3] (N/mm)
Carbon Steel	Add Suffix 17-7 SS										
CM15-L4	**-S17**	15	11	25	5,13	10,36	2,5	6	0,25	1,47	4,78
CM15-L5	**-S17**	15	11	25	5,99	12,09	2,5	7	0,25	1,47	4,10
CM15-L6	**-S17**	15	11	25	6,83	13,82	2,5	8	0,25	1,47	3,58
CM15-L7	**-S17**	15	11	25	7,70	15,54	2,5	9	0,25	1,47	3,19
CM15-L8	**-S17**	15	11	25	8,53	17,27	2,5	10	0,25	1,47	2,86
CM15-L9	**-S17**	15	11	25	9,40	19,00	2,5	11	0,25	1,47	2,60
CM15-M1	**-S17**	15	10	50	3,43	5,18	3,5	3	0,23	1,47	28,57
CM15-M2	**-S17**	15	10	50	4,57	6,91	3,5	4	0,23	1,47	21,37
CM15-M3	**-S17**	15	10	50	5,72	8,64	3,5	5	0,23	1,47	17,12
CM15-M4	**-S17**	15	10	50	6,86	10,36	3,5	6	0,23	1,47	14,29
CM15-M5	**-S17**	15	10	50	8,00	12,09	3,5	7	0,23	1,47	12,22
CM15-M6	**-S17**	15	10	50	9,14	13,82	3,5	8	0,23	1,47	10,68
CM15-M7	**-S17**	15	10	50	10,29	15,54	3,5	9	0,23	1,47	9,52
CM15-M8	**-S17**	15	10	50	11,43	17,27	3,5	10	0,23	1,47	8,56
CM15-M9	**-S17**	15	10	50	12,57	19,00	3,5	11	0,23	1,47	7,78
CM15-H1	**-S17**	15	10	80	3,20	5,18	3,5	3	0,25	1,47	40,40
CM15-H2	**-S17**	15	10	80	4,19	6,91	3,5	4	0,25	1,47	29,41
CM15-H3	**-S17**	15	10	80	5,23	8,64	3,5	5	0,25	1,47	23,46
CM15-H4	**-S17**	15	10	80	6,27	10,36	3,5	6	0,25	1,47	19,56
CM15-H5	**-S17**	15	10	80	7,32	12,09	3,5	7	0,25	1,47	16,77
CM15-H6	**-S17**	15	10	80	8,36	13,82	3,5	8	0,25	1,47	14,65
CM15-H7	**-S17**	15	10	80	9,40	15,54	3,5	9	0,25	1,47	13,03
CM15-H8	**-S17**	15	10	80	10,46	17,27	3,5	10	0,25	1,47	11,75
CM15-H9	**-S17**	15	10	80	11,51	19,00	3,5	11	0,25	1,47	10,68
CM16-L1	**-S17**	16	11	25	2,11	5,41	2,5	3	0,25	1,47	7,58
CM16-L2	**-S17**	16	11	25	2,79	7,21	2,5	4	0,25	1,47	5,66
CM16-L3	**-S17**	16	11	25	3,51	9,02	2,5	5	0,25	1,47	4,54
CM16-L4	**-S17**	16	11	25	4,19	10,82	2,5	6	0,25	1,47	3,77
CM16-L5	**-S17**	16	11	25	4,90	12,62	2,5	7	0,25	1,47	3,24
CM16-L6	**-S17**	16	11	25	6,30	16,23	2,5	9	0,25	1,47	2,52
CM16-L7	**-S17**	16	11	25	7,70	19,84	2,5	11	0,25	1,47	2,06
CM16-L8	**-S17**	16	11	25	9,09	23,44	2,5	13	0,25	1,47	1,74
CM16-M1	**-S17**	16	11	55	3,63	5,41	3,5	3	0,25	1,47	30,90
CM16-M2	**-S17**	16	11	55	4,83	7,21	3,5	4	0,25	1,47	23,11
CM16-M3	**-S17**	16	11	55	6,05	9,02	3,5	5	0,25	1,47	18,52
CM16-M4	**-S17**	16	11	55	7,24	10,82	3,5	6	0,25	1,47	15,36
CM16-M5	**-S17**	16	11	55	8,46	12,62	3,5	7	0,25	1,47	13,22
CM16-M6	**-S17**	16	11	55	10,87	16,23	3,5	9	0,25	1,47	10,26
CM16-M7	**-S17**	16	11	55	13,28	19,84	3,5	11	0,25	1,47	8,38
CM16-M8	**-S17**	16	11	55	15,70	23,44	3,5	13	0,25	1,47	7,11
CM16-H1	**-S17**	16	11	90	3,30	5,41	3,5	3	0,30	1,52	42,65
CM16-H2	**-S17**	16	11	90	4,57	7,21	3,5	4	0,30	1,52	34,09
CM16-H3	**-S17**	16	11	90	5,59	9,02	3,5	5	0,30	1,52	26,24
CM16-H4	**-S17**	16	11	90	6,86	10,82	3,5	6	0,30	1,52	22,73
CM16-H5	**-S17**	16	11	90	7,87	12,62	3,5	7	0,30	1,52	18,95
CM16-H6	**-S17**	16	11	90	10,16	16,23	3,5	9	0,30	1,52	14,83
CM16-H7	**-S17**	16	11	90	12,45	19,84	3,5	11	0,30	1,52	12,18
CM16-H8	**-S17**	16	11	90	14,73	23,44	3,5	13	0,30	1,52	10,33
CM18-L1	**-S17**	18	13	30	3,63	5,72	3,5	3	0,20	1,80	14,35
CM18-L2	**-S17**	18	13	30	4,75	7,62	3,5	4	0,20	1,80	10,45
CM18-L3	**-S17**	18	13	30	5,94	9,53	3,5	5	0,20	1,80	8,36
CM18-L4	**-S17**	18	13	30	7,14	11,43	3,5	6	0,20	1,80	6,99
CM18-L5	**-S17**	18	13	30	8,31	13,34	3,5	7	0,20	1,80	5,96
CM18-L6	**-S17**	18	13	30	10,69	17,15	3,5	9	0,20	1,80	4,64
CM18-L7	**-S17**	18	13	30	14,25	22,86	3,5	12	0,20	1,80	3,48
CM18-M1	**-S17**	18	13	55	3,68	5,72	3,5	3	0,25	1,83	26,96

[1] Use "CM" prefix for plain ends. Use "CMS" prefix for squared-shim ends.
[2] Reference dimension.
[3] Theoretical dimension.

CM/CMS Series

Crest-To-Crest® Springs Continued

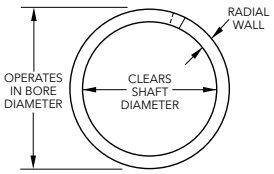
Smalley Part Number [1]		Operates in Bore Diameter (mm)	Clears Shaft Diameter (mm)	Load (N)	Work Height (mm)	Free Height [2] (mm)	Number of Waves	Number of Turns	Thickness (mm)	Radial Wall (mm)	Spring Rate [3] (N/mm)
Carbon Steel	Add Suffix 17-7 SS										
CM18-M2	**-S17**	18	13	55	4,98	7,62	3,5	4	0,25	1,83	20,83
CM18-M3	**-S17**	18	13	55	6,22	9,53	3,5	5	0,25	1,83	16,62
CM18-M4	**-S17**	18	13	55	7,47	11,43	3,5	6	0,25	1,83	13,89
CM18-M5	**-S17**	18	13	55	8,74	13,34	3,5	7	0,25	1,83	11,96
CM18-M6	**-S17**	18	13	55	11,23	17,15	3,5	9	0,25	1,83	9,29
CM18-M7	**-S17**	18	13	55	14,96	22,86	3,5	12	0,25	1,83	6,96
CM18-H1	**-S17**	18	13	90	3,84	5,72	3,5	3	0,30	1,83	47,87
CM18-H2	**-S17**	18	13	90	5,13	7,62	3,5	4	0,30	1,83	36,14
CM18-H3	**-S17**	18	13	90	6,40	9,53	3,5	5	0,30	1,83	28,75
CM18-H4	**-S17**	18	13	90	7,70	11,43	3,5	6	0,30	1,83	24,13
CM18-H5	**-S17**	18	13	90	8,97	13,34	3,5	7	0,30	1,83	20,59
CM18-H6	**-S17**	18	13	90	11,53	17,15	3,5	9	0,30	1,83	16,01
CM18-H7	**-S17**	18	13	90	15,37	22,86	3,5	12	0,30	1,83	12,02
CM20-L1	**-S17**	20	15	35	2,72	6,32	3,5	3	0,20	1,80	9,72
CM20-L2	**-S17**	20	15	35	3,61	8,43	3,5	4	0,20	1,80	7,26
CM20-L3	**-S17**	20	15	35	4,52	10,54	3,5	5	0,20	1,80	5,81
CM20-L4	**-S17**	20	15	35	5,41	12,65	3,5	6	0,20	1,80	4,83
CM20-L5	**-S17**	20	15	35	6,32	14,76	3,5	7	0,20	1,80	4,15
CM20-L6	**-S17**	20	15	35	8,13	18,97	3,5	9	0,20	1,80	3,23
CM20-L7	**-S17**	20	15	35	10,82	25,30	3,5	12	0,20	1,80	2,42
CM20-M1	**-S17**	20	14	70	3,05	6,32	3,5	3	0,25	1,98	21,41
CM20-M2	**-S17**	20	14	70	4,06	8,43	3,5	4	0,25	1,98	16,02
CM20-M3	**-S17**	20	14	70	5,08	10,54	3,5	5	0,25	1,98	12,82
CM20-M4	**-S17**	20	14	70	6,27	12,65	3,5	6	0,25	1,98	10,97
CM20-M5	**-S17**	20	14	70	7,32	14,76	3,5	7	0,25	1,98	9,41
CM20-M6	**-S17**	20	14	70	9,17	18,97	3,5	9	0,25	1,98	7,14
CM20-M7	**-S17**	20	14	70	12,22	25,30	3,5	12	0,25	1,98	5,35
CM20-H1	**-S17**	20	14	100	4,24	6,32	3,5	3	0,33	2,01	48,08
CM20-H2	**-S17**	20	14	100	5,66	8,43	3,5	4	0,33	2,01	36,10
CM20-H3	**-S17**	20	14	100	7,06	10,54	3,5	5	0,33	2,01	28,74
CM20-H4	**-S17**	20	14	100	8,48	12,65	3,5	6	0,33	2,01	23,98
CM20-H5	**-S17**	20	14	100	9,91	14,76	3,5	7	0,33	2,01	20,62
CM20-H6	**-S17**	20	14	100	12,73	18,97	3,5	9	0,33	2,01	16,03
CM20-H7	**-S17**	20	14	100	16,97	25,30	3,5	12	0,33	2,01	12,00
CM25-L1	**-S17**	25	19	50	2,06	6,63	3,5	3	0,25	2,18	10,94
CM25-L2	**-S17**	25	19	50	2,74	8,84	3,5	4	0,25	2,18	8,20
CM25-L3	**-S17**	25	19	50	3,43	11,05	3,5	5	0,25	2,18	6,56
CM25-L4	**-S17**	25	19	50	4,11	13,26	3,5	6	0,25	2,18	5,46
CM25-L5	**-S17**	25	19	50	4,80	15,47	3,5	7	0,25	2,18	4,69
CM25-L6	**-S17**	25	19	50	6,20	19,89	3,5	9	0,25	2,18	3,65
CM25-L7	**-S17**	25	19	50	8,26	26,52	3,5	12	0,25	2,18	2,74
CM25-M1	**-S17**	25	19	80	2,95	6,63	3,5	3	0,30	2,39	21,74
CM25-M2	**-S17**	25	19	80	3,94	8,84	3,5	4	0,30	2,39	16,33
CM25-M3	**-S17**	25	19	80	4,90	11,05	3,5	5	0,30	2,39	13,01
CM25-M4	**-S17**	25	19	80	5,89	13,26	3,5	6	0,30	2,39	10,85
CM25-M5	**-S17**	25	19	80	6,88	15,47	3,5	7	0,30	2,39	9,31
CM25-M6	**-S17**	25	19	80	8,84	19,89	3,5	9	0,30	2,39	7,24
CM25-M7	**-S17**	25	19	80	11,79	26,52	3,5	12	0,30	2,39	5,43
CM25-H1	**-S17**	25	19	110	4,04	6,63	3,5	3	0,38	2,39	42,47
CM25-H2	**-S17**	25	19	110	5,38	8,84	3,5	4	0,38	2,39	31,79
CM25-H3	**-S17**	25	19	110	6,73	11,05	3,5	5	0,38	2,39	25,46
CM25-H4	**-S17**	25	19	110	8,08	13,26	3,5	6	0,38	2,39	21,24
CM25-H5	**-S17**	25	19	110	9,40	15,47	3,5	7	0,38	2,39	18,12
CM25-H6	**-S17**	25	19	110	12,12	19,89	3,5	9	0,38	2,39	14,16
CM25-H7	**-S17**	25	19	110	16,15	26,52	3,5	12	0,38	2,39	10,61
CM28-L1	**-S17**	28	22	50	3,76	7,24	3,5	3	0,30	2,39	14,37
CM28-L2	**-S17**	28	22	50	5,00	9,65	3,5	4	0,30	2,39	10,75
CM28-L3	**-S17**	28	22	50	6,27	12,07	3,5	5	0,30	2,39	8,62
CM28-L4	**-S17**	28	22	50	7,52	14,48	3,5	6	0,30	2,39	7,18
CM28-L5	**-S17**	28	22	50	8,79	16,89	3,5	7	0,30	2,39	6,17
CM28-L6	**-S17**	28	22	50	10,03	19,30	3,5	8	0,30	2,39	5,39
CM28-L7	**-S17**	28	22	50	11,28	21,72	3,5	9	0,30	2,39	4,79
CM28-L8	**-S17**	28	22	50	13,79	26,54	3,5	11	0,30	2,39	3,92
CM28-L9	**-S17**	28	22	50	16,31	31,37	3,5	13	0,30	2,39	3,32
CM28-M1	**-S17**	28	22	80	4,39	7,24	3,5	3	0,38	2,39	28,07
CM28-M2	**-S17**	28	22	80	5,84	9,65	3,5	4	0,38	2,39	21,00
CM28-M3	**-S17**	28	22	80	7,32	12,07	3,5	5	0,38	2,39	16,84
CM28-M4	**-S17**	28	22	80	8,79	14,48	3,5	6	0,38	2,39	14,06
CM28-M5	**-S17**	28	22	80	10,24	16,89	3,5	7	0,38	2,39	12,03
CM28-M6	**-S17**	28	22	80	11,71	19,30	3,5	8	0,38	2,39	10,54
CM28-M7	**-S17**	28	22	80	13,18	21,72	3,5	9	0,38	2,39	9,37
CM28-M8	**-S17**	28	22	80	16,10	26,54	3,5	11	0,38	2,39	7,66
CM28-M9	**-S17**	28	22	80	19,02	31,37	3,5	13	0,38	2,39	6,48

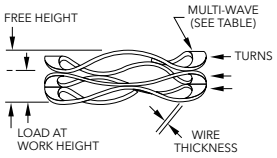
[1] Use "CM" prefix for plain ends. Use "CMS" prefix for squared-shim ends.
[2] Reference dimension.
[3] Theoretical dimension.

CM/CMS Series
Crest-To-Crest® Springs

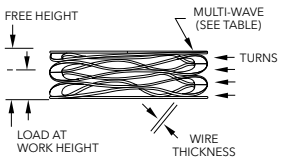


CM-Plain Ends *CMS-Shim Ends*





CM-Plain Ends



CMS-Shim Ends

Product Dimensions: All dimensions in millimeters unless otherwise specified.

Smalley Part Number [1]		Operates in Bore Diameter (mm)	Clears Shaft Diameter (mm)	Load (N)	Work Height (mm)	Free Height[2] (mm)	Number of Waves	Number of Turns	Thickness (mm)	Radial Wall (mm)	Spring Rate[3] (N/mm)
Carbon Steel	Add Suffix 17-7 SS										
CM28-H1	**-S17**	28	22	130	4,57	7,24	3,5	3	0,46	2,39	48,69
CM28-H2	**-S17**	28	22	130	6,07	9,65	3,5	4	0,46	2,39	36,31
CM28-H3	**-S17**	28	22	130	7,59	12,07	3,5	5	0,46	2,39	29,02
CM28-H4	**-S17**	28	22	130	9,12	14,48	3,5	6	0,46	2,39	24,25
CM28-H5	**-S17**	28	22	130	10,64	16,89	3,5	7	0,46	2,39	20,80
CM28-H6	**-S17**	28	22	130	12,17	19,30	3,5	8	0,46	2,39	18,23
CM28-H7	**-S17**	28	22	130	13,69	21,72	3,5	9	0,46	2,39	16,19
CM28-H8	**-S17**	28	22	130	16,71	26,54	3,5	11	0,46	2,39	13,22
CM28-H9	**-S17**	28	22	130	19,76	31,37	3,5	13	0,46	2,39	11,20
CM30-L1	**-S17**	30	24	50	3,18	7,62	3,5	3	0,30	2,39	11,26
CM30-L2	**-S17**	30	24	50	4,22	10,16	3,5	4	0,30	2,39	8,42
CM30-L3	**-S17**	30	24	50	5,28	12,70	3,5	5	0,30	2,39	6,74
CM30-L4	**-S17**	30	24	50	6,32	15,24	3,5	6	0,30	2,39	5,61
CM30-L5	**-S17**	30	24	50	7,39	17,78	3,5	7	0,30	2,39	4,81
CM30-L6	**-S17**	30	24	50	8,43	20,32	3,5	8	0,30	2,39	4,21
CM30-L7	**-S17**	30	24	50	9,50	22,86	3,5	9	0,30	2,39	3,74
CM30-L8	**-S17**	30	24	50	11,61	27,94	3,5	11	0,30	2,39	3,06
CM30-L9	**-S17**	30	24	50	13,72	33,02	3,5	13	0,30	2,39	2,59
CM30-M1	**-S17**	30	24	90	3,51	7,62	3,5	3	0,38	2,39	21,90
CM30-M2	**-S17**	30	24	90	4,70	10,16	3,5	4	0,38	2,39	16,48
CM30-M3	**-S17**	30	24	90	5,87	12,70	3,5	5	0,38	2,39	13,18
CM30-M4	**-S17**	30	24	90	7,04	15,24	3,5	6	0,38	2,39	10,98
CM30-M5	**-S17**	30	24	90	8,20	17,78	3,5	7	0,38	2,39	9,39
CM30-M6	**-S17**	30	24	90	9,37	20,32	3,5	8	0,38	2,39	8,22
CM30-M7	**-S17**	30	24	90	10,54	22,86	3,5	9	0,38	2,39	7,31
CM30-M8	**-S17**	30	24	90	12,90	27,94	3,5	11	0,38	2,39	5,98
CM30-M9	**-S17**	30	24	90	15,24	33,02	3,5	13	0,38	2,39	5,06
CM30-H1	**-S17**	30	24	130	4,19	7,62	3,5	3	0,46	2,39	37,90
CM30-H2	**-S17**	30	24	130	5,59	10,16	3,5	4	0,46	2,39	28,45
CM30-H3	**-S17**	30	24	130	6,99	12,70	3,5	5	0,46	2,39	22,77
CM30-H4	**-S17**	30	24	130	8,38	15,24	3,5	6	0,46	2,39	18,95
CM30-H5	**-S17**	30	24	130	9,78	17,78	3,5	7	0,46	2,39	16,25
CM30-H6	**-S17**	30	24	130	11,18	20,32	3,5	8	0,46	2,39	14,22
CM30-H7	**-S17**	30	24	130	12,57	22,86	3,5	9	0,46	2,39	12,63
CM30-H8	**-S17**	30	24	130	15,37	27,94	3,5	11	0,46	2,39	10,34
CM30-H9	**-S17**	30	24	130	18,16	33,02	3,5	13	0,46	2,39	8,75
CM35-L1	**-S17**	35	27	70	3,94	8,38	3,5	3	0,36	3,18	15,77
CM35-L2	**-S17**	35	27	70	5,23	11,18	3,5	4	0,36	3,18	11,76
CM35-L3	**-S17**	35	27	70	6,55	13,97	3,5	5	0,36	3,18	9,43
CM35-L4	**-S17**	35	27	70	7,87	16,76	3,5	6	0,36	3,18	7,87
CM35-L5	**-S17**	35	27	70	9,17	19,56	3,5	7	0,36	3,18	6,74
CM35-L6	**-S17**	35	27	70	10,49	22,35	3,5	8	0,36	3,18	5,90
CM35-L7	**-S17**	35	27	70	11,81	25,15	3,5	9	0,36	3,18	5,25
CM35-L8	**-S17**	35	27	70	14,43	30,73	3,5	11	0,36	3,18	4,29
CM35-L9	**-S17**	35	27	70	17,04	36,32	3,5	13	0,36	3,18	3,63
CM35-M1	**-S17**	35	27	110	4,14	8,38	3,5	3	0,41	3,38	25,94
CM35-M2	**-S17**	35	27	110	5,51	11,18	3,5	4	0,41	3,38	19,40
CM35-M3	**-S17**	35	27	110	6,88	13,97	3,5	5	0,41	3,38	15,51
CM35-M4	**-S17**	35	27	110	8,26	16,76	3,5	6	0,41	3,38	12,94
CM35-M5	**-S17**	35	27	110	9,63	19,56	3,5	7	0,41	3,38	11,08
CM35-M6	**-S17**	35	27	110	11,02	22,35	3,5	8	0,41	3,38	9,71
CM35-M7	**-S17**	35	27	110	12,40	25,15	3,5	9	0,41	3,38	8,63
CM35-M8	**-S17**	35	27	110	15,14	30,73	3,5	11	0,41	3,38	7,06
CM35-M9	**-S17**	35	27	110	17,91	36,32	3,5	13	0,41	3,38	5,98
CM35-H1	**-S17**	35	27	160	4,04	8,38	3,5	3	0,46	3,38	36,87
CM35-H2	**-S17**	35	27	160	5,38	11,18	3,5	4	0,46	3,38	27,59

[1] Use "CM" prefix for plain ends. Use "CMS" prefix for squared-shim ends.
[2] Reference dimension.
[3] Theoretical dimension.

CM/CMS Series

Crest-To-Crest® Springs Continued

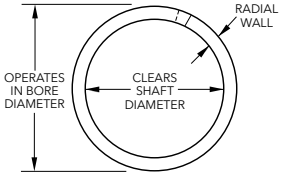
Smalley Part Number [1]		Operates in Bore Diameter (mm)	Clears Shaft Diameter (mm)	Load (N)	Work Height (mm)	Free Height [2] (mm)	Number of Waves	Number of Turns	Thickness (mm)	Radial Wall (mm)	Spring Rate [3] (N/mm)
Carbon Steel	Add Suffix 17-7 SS										
CM35-H3	**-S17**	35	27	160	6,73	13,97	3,5	5	0,46	3,38	22,10
CM35-H4	**-S17**	35	27	160	8,08	16,76	3,5	6	0,46	3,38	18,43
CM35-H5	**-S17**	35	27	160	9,42	19,56	3,5	7	0,46	3,38	15,78
CM35-H6	**-S17**	35	27	160	10,77	22,35	3,5	8	0,46	3,38	13,82
CM35-H7	**-S17**	35	27	160	12,12	25,15	3,5	9	0,46	3,38	12,28
CM35-H8	**-S17**	35	27	160	14,81	30,73	3,5	11	0,46	3,38	10,05
CM35-H9	**-S17**	35	27	160	17,50	36,32	3,5	13	0,46	3,38	8,50
CM40-L1	**-S17**	40	30	100	2,90	9,14	3,5	3	0,41	3,38	16,03
CM40-L2	**-S17**	40	30	100	3,86	12,19	3,5	4	0,41	3,38	12,00
CM40-L3	**-S17**	40	30	100	4,80	15,24	3,5	5	0,41	3,38	9,58
CM40-L4	**-S17**	40	30	100	5,77	18,29	3,5	6	0,41	3,38	7,99
CM40-L5	**-S17**	40	30	100	6,73	21,34	3,5	7	0,41	3,38	6,84
CM40-L6	**-S17**	40	30	100	7,70	24,38	3,5	8	0,41	3,38	6,00
CM40-L7	**-S17**	40	30	100	8,66	27,43	3,5	9	0,41	3,38	5,33
CM40-L8	**-S17**	40	30	100	10,59	33,53	3,5	11	0,41	3,38	4,36
CM40-L9	**-S17**	40	30	100	12,52	39,62	3,5	13	0,41	3,38	3,69
CM40-M1	**-S17**	40	30	150	5,44	9,14	3,5	3	0,53	3,63	40,54
CM40-M2	**-S17**	40	30	150	7,24	12,19	3,5	4	0,53	3,63	30,30
CM40-M3	**-S17**	40	30	150	9,04	15,24	3,5	5	0,53	3,63	24,19
CM40-M4	**-S17**	40	30	150	10,85	18,29	3,5	6	0,53	3,63	20,16
CM40-M5	**-S17**	40	30	150	12,65	21,34	3,5	7	0,53	3,63	17,26
CM40-M6	**-S17**	40	30	150	14,48	24,38	3,5	8	0,53	3,63	15,15
CM40-M7	**-S17**	40	30	150	16,28	27,43	3,5	9	0,53	3,63	13,45
CM40-M8	**-S17**	40	30	150	19,89	33,53	3,5	11	0,53	3,63	11,00
CM40-M9	**-S17**	40	30	150	23,50	39,62	3,5	13	0,53	3,63	9,31
CM40-H1	**-S17**	40	30	300	5,66	9,14	4,5	3	0,46	3,38	86,21
CM40-H2	**-S17**	40	30	300	7,54	12,19	4,5	4	0,46	3,38	64,52
CM40-H3	**-S17**	40	30	300	9,42	15,24	4,5	5	0,46	3,38	51,55
CM40-H4	**-S17**	40	30	300	11,33	18,29	4,5	6	0,46	3,38	43,10
CM40-H5	**-S17**	40	30	300	13,21	21,34	4,5	7	0,46	3,38	36,90
CM40-H6	**-S17**	40	30	300	15,09	24,38	4,5	8	0,46	3,38	32,29
CM40-H7	**-S17**	40	30	300	16,97	27,43	4,5	9	0,46	3,38	28,68
CM40-H8	**-S17**	40	30	300	20,75	33,53	4,5	11	0,46	3,38	23,47
CM40-H9	**-S17**	40	30	300	24,54	39,62	4,5	13	0,46	3,38	19,89
CM45-L1	**-S17**	45	35	110	3,38	9,91	3,5	3	0,46	3,63	16,85
CM45-L2	**-S17**	45	35	110	4,52	13,21	3,5	4	0,46	3,63	12,66
CM45-L3	**-S17**	45	35	110	5,64	16,51	3,5	5	0,46	3,63	10,12
CM45-L4	**-S17**	45	35	110	6,76	19,81	3,5	6	0,46	3,63	8,43
CM45-L5	**-S17**	45	35	110	7,90	23,11	3,5	7	0,46	3,63	7,23
CM45-L6	**-S17**	45	35	110	9,02	26,42	3,5	8	0,46	3,63	6,32
CM45-L7	**-S17**	45	35	110	10,16	29,72	3,5	9	0,46	3,63	5,62
CM45-L8	**-S17**	45	35	110	12,40	36,32	3,5	11	0,46	3,63	4,60
CM45-L9	**-S17**	45	35	110	14,66	42,93	3,5	13	0,46	3,63	3,89
CM45-M1	**-S17**	45	35	225	5,33	9,91	4,5	3	0,46	3,63	49,13
CM45-M2	**-S17**	45	35	225	6,99	13,21	4,5	4	0,46	3,63	36,17
CM45-M3	**-S17**	45	35	225	9,14	16,51	4,5	5	0,46	3,63	30,53
CM45-M4	**-S17**	45	35	225	10,80	19,81	4,5	6	0,46	3,63	24,97
CM45-M5	**-S17**	45	35	225	12,70	23,11	4,5	7	0,46	3,63	21,61
CM45-M6	**-S17**	45	35	225	14,48	26,42	4,5	8	0,46	3,63	18,84
CM45-M7	**-S17**	45	35	225	16,26	29,72	4,5	9	0,46	3,63	16,72
CM45-M8	**-S17**	45	35	225	19,81	36,32	4,5	11	0,46	3,63	13,63
CM45-M9	**-S17**	45	35	225	23,37	42,93	4,5	13	0,46	3,63	11,50
CM45-H1	**-S17**	45	35	400	6,43	9,91	4,5	3	0,61	3,76	114,94
CM45-H2	**-S17**	45	35	400	8,38	13,21	4,5	4	0,61	3,76	82,82
CM45-H3	**-S17**	45	35	400	11,20	16,51	4,5	5	0,61	3,76	75,33
CM45-H4	**-S17**	45	35	400	12,95	19,81	4,5	6	0,61	3,76	58,31
CM45-H5	**-S17**	45	35	400	15,37	23,11	4,5	7	0,61	3,76	51,68
CM45-H6	**-S17**	45	35	400	17,27	26,42	4,5	8	0,61	3,76	43,72
CM45-H7	**-S17**	45	35	400	19,68	29,72	4,5	9	0,61	3,76	39,88
CM45-H8	**-S17**	45	35	400	24,26	36,32	4,5	11	0,61	3,76	33,17
CM45-H9	**-S17**	45	35	400	28,45	42,93	4,5	13	0,61	3,76	27,62
CM50-L1	**-S17**	50	40	110	4,83	10,29	3,5	3	0,53	3,63	20,15
CM50-L2	**-S17**	50	40	110	6,10	13,72	3,5	4	0,53	3,63	14,44
CM50-L3	**-S17**	50	40	110	7,87	17,15	3,5	5	0,53	3,63	11,85
CM50-L4	**-S17**	50	40	110	9,40	20,57	3,5	6	0,53	3,63	9,85
CM50-L5	**-S17**	50	40	110	11,30	24,00	3,5	7	0,53	3,63	8,66
CM50-L6	**-S17**	50	40	110	12,70	27,43	3,5	8	0,53	3,63	7,47
CM50-L7	**-S17**	50	40	110	14,99	30,86	3,5	9	0,53	3,63	6,93
CM50-L8	**-S17**	50	40	110	18,16	37,72	3,5	11	0,53	3,63	5,62
CM50-L9	**-S17**	50	40	110	21,34	44,58	3,5	13	0,53	3,63	4,73
CM50-L10	**-S17**	50	40	110	24,64	51,44	3,5	15	0,53	3,63	4,10
CM50-M1	**-S17**	50	40	225	4,62	10,29	4,5	3	0,46	3,63	39,68
CM50-M2	**-S17**	50	40	225	5,84	13,72	4,5	4	0,46	3,63	30,53

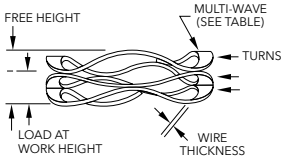
[1] Use "CM" prefix for plain ends. Use "CMS" prefix for squared-shim ends.
[2] Reference dimension.
[3] Theoretical dimension.

CM/CMS Series
Crest-To-Crest® Springs

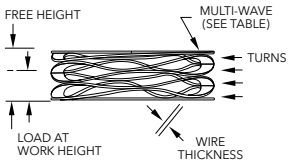


CM-Plain Ends *CMS-Shim Ends*





CM-Plain Ends



CMS-Shim Ends

Product Dimensions: All dimensions in millimeters unless otherwise specified.

Smalley Part Number [1]		Operates in Bore Diameter (mm)	Clears Shaft Diameter (mm)	Load (N)	Work Height (mm)	Free Height[2] (mm)	Number of Waves	Number of Turns	Thickness (mm)	Radial Wall (mm)	Spring Rate[3] (N/mm)
Carbon Steel	Add Suffix 17-7 SS										
CM50-M3	**-S17**	50	40	225	7,49	17,15	4,5	5	0,46	3,63	23,29
CM50-M4	**-S17**	50	40	225	8,89	20,57	4,5	6	0,46	3,63	19,26
CM50-M5	**-S17**	50	40	225	10,54	24,00	4,5	7	0,46	3,63	16,72
CM50-M6	**-S17**	50	40	225	11,89	27,43	4,5	8	0,46	3,63	14,48
CM50-M7	**-S17**	50	40	225	13,59	30,86	4,5	9	0,46	3,63	13,03
CM50-M8	**-S17**	50	40	225	16,71	37,72	4,5	11	0,46	3,63	10,71
CM50-M9	**-S17**	50	40	225	19,61	44,58	4,5	13	0,46	3,63	9,01
CM50-M10	**-S17**	50	40	225	22,48	51,44	4,5	15	0,46	3,63	7,77
CM50-H1	**-S17**	50	40	400	5,92	10,29	4,5	3	0,61	3,76	91,53
CM50-H2	**-S17**	50	40	400	7,80	13,72	4,5	4	0,61	3,76	67,57
CM50-H3	**-S17**	50	40	400	10,16	17,15	4,5	5	0,61	3,76	57,22
CM50-H4	**-S17**	50	40	400	11,79	20,57	4,5	6	0,61	3,76	45,56
CM50-H5	**-S17**	50	40	400	14,15	24,00	4,5	7	0,61	3,76	40,61
CM50-H6	**-S17**	50	40	400	15,62	27,43	4,5	8	0,61	3,76	33,87
CM50-H7	**-S17**	50	40	400	17,91	30,86	4,5	9	0,61	3,76	30,89
CM50-H8	**-S17**	50	40	400	21,54	37,72	4,5	11	0,61	3,76	24,72
CM50-H9	**-S17**	50	40	400	25,65	44,58	4,5	13	0,61	3,76	21,13
CM50-H10	**-S17**	50	40	400	29,21	51,44	4,5	15	0,61	3,76	17,99
CM55-L1	**-S17**	55	45	125	5,59	11,05	3,5	3	0,61	3,76	22,89
CM55-L2	**-S17**	55	45	125	7,72	14,73	3,5	4	0,61	3,76	17,83
CM55-L3	**-S17**	55	45	125	9,68	18,41	3,5	5	0,61	3,76	14,32
CM55-L4	**-S17**	55	45	125	11,48	22,10	3,5	6	0,61	3,76	11,77
CM55-L5	**-S17**	55	45	125	13,92	25,78	3,5	7	0,61	3,76	10,54
CM55-L6	**-S17**	55	45	125	15,52	29,46	3,5	8	0,61	3,76	8,97
CM55-L7	**-S17**	55	45	125	18,42	33,15	3,5	9	0,61	3,76	8,49
CM55-L8	**-S17**	55	45	125	21,67	40,51	3,5	11	0,61	3,76	6,63
CM55-L9	**-S17**	55	45	125	25,65	47,88	3,5	13	0,61	3,76	5,62
CM55-L10	**-S17**	55	45	125	29,77	55,25	3,5	15	0,61	3,76	4,91
CM55-M1	**-S17**	55	45	250	3,10	11,05	4,5	3	0,46	3,63	31,45
CM55-M2	**-S17**	55	45	250	4,11	14,73	4,5	4	0,46	3,63	23,54
CM55-M3	**-S17**	55	45	250	5,16	18,41	4,5	5	0,46	3,63	18,85
CM55-M4	**-S17**	55	45	250	6,20	22,10	4,5	6	0,46	3,63	15,72
CM55-M5	**-S17**	55	45	250	7,21	25,78	4,5	7	0,46	3,63	13,46
CM55-M6	**-S17**	55	45	250	8,26	29,46	4,5	8	0,46	3,63	11,79
CM55-M7	**-S17**	55	45	250	9,27	33,15	4,5	9	0,46	3,63	10,47
CM55-M8	**-S17**	55	45	250	11,33	40,51	4,5	11	0,46	3,63	8,57
CM55-M9	**-S17**	55	45	250	13,41	47,88	4,5	13	0,46	3,63	7,25
CM55-M10	**-S17**	55	45	250	15,47	55,25	4,5	15	0,46	3,63	6,28
CM55-H1	**-S17**	55	45	400	5,31	11,05	4,5	3	0,61	3,76	69,69
CM55-H2	**-S17**	55	45	400	7,24	14,73	4,5	4	0,61	3,76	53,40
CM55-H3	**-S17**	55	45	400	9,09	18,41	4,5	5	0,61	3,76	42,87
CM55-H4	**-S17**	55	45	400	10,64	22,10	4,5	6	0,61	3,76	34,90
CM55-H5	**-S17**	55	45	400	12,24	25,78	4,5	7	0,61	3,76	29,54
CM55-H6	**-S17**	55	45	400	14,10	29,46	4,5	8	0,61	3,76	26,04
CM55-H7	**-S17**	55	45	400	15,82	33,15	4,5	9	0,61	3,76	23,08
CM55-H8	**-S17**	55	45	400	19,30	40,51	4,5	11	0,61	3,76	18,86
CM55-H9	**-S17**	55	45	400	23,11	47,88	4,5	13	0,61	3,76	16,15
CM55-H10	**-S17**	55	45	400	26,54	55,25	4,5	15	0,61	3,76	13,93
CM60-L1	**-S17**	60	50	135	5,59	11,43	4,5	3	0,46	3,63	23,12
CM60-L2	**-S17**	60	50	135	7,47	15,24	4,5	4	0,46	3,63	17,37
CM60-L3	**-S17**	60	50	135	9,32	19,05	4,5	5	0,46	3,63	13,87
CM60-L4	**-S17**	60	50	135	11,20	22,86	4,5	6	0,46	3,63	11,58
CM60-L5	**-S17**	60	50	135	13,06	26,67	4,5	7	0,46	3,63	9,92
CM60-L6	**-S17**	60	50	135	14,94	30,48	4,5	8	0,46	3,63	8,69
CM60-L7	**-S17**	60	50	135	16,79	34,29	4,5	9	0,46	3,63	7,71
CM60-L8	**-S17**	60	50	135	20,52	41,91	4,5	11	0,46	3,63	6,31

[1] Use "CM" prefix for plain ends. Use "CMS" prefix for squared-shim ends.
[2] Reference dimension.
[3] Theoretical dimension.

CM/CMS Series

Crest-To-Crest® Springs Continued

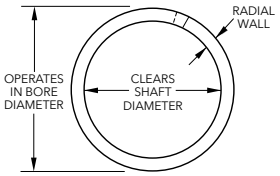
Smalley Part Number [1]		Operates in Bore Diameter (mm)	Clears Shaft Diameter (mm)	Load (N)	Work Height (mm)	Free Height [2] (mm)	Number of Waves	Number of Turns	Thickness (mm)	Radial Wall (mm)	Spring Rate [3] (N/mm)
Carbon Steel	Add Suffix 17-7 SS										
CM60-L9	**-S17**	60	50	135	24,26	49,53	4,5	13	0,46	3,63	5,34
CM60-L10	**-S17**	60	50	135	27,99	57,15	4,5	15	0,46	3,63	4,63
CM60-M1	**-S17**	60	50	275	6,65	11,43	4,5	3	0,61	3,76	57,53
CM60-M2	**-S17**	60	50	275	8,86	15,24	4,5	4	0,61	3,76	43,10
CM60-M3	**-S17**	60	50	275	11,07	19,05	4,5	5	0,61	3,76	34,46
CM60-M4	**-S17**	60	50	275	13,28	22,86	4,5	6	0,61	3,76	28,71
CM60-M5	**-S17**	60	50	275	15,49	26,67	4,5	7	0,61	3,76	24,60
CM60-M6	**-S17**	60	50	275	17,70	30,48	4,5	8	0,61	3,76	21,52
CM60-M7	**-S17**	60	50	275	19,94	34,29	4,5	9	0,61	3,76	19,16
CM60-M8	**-S17**	60	50	275	24,36	41,91	4,5	11	0,61	3,76	15,67
CM60-M9	**-S17**	60	50	275	28,78	49,53	4,5	13	0,61	3,76	13,25
CM60-M10	**-S17**	60	50	275	33,22	57,15	4,5	15	0,61	3,76	11,49
CM60-H1	**-S17**	60	50	450	7,75	11,43	4,5	3	0,76	4,01	122,28
CM60-H2	**-S17**	60	50	450	10,31	15,24	4,5	4	0,76	4,01	91,28
CM60-H3	**-S17**	60	50	450	12,90	19,05	4,5	5	0,76	4,01	73,17
CM60-H4	**-S17**	60	50	450	15,47	22,86	4,5	6	0,76	4,01	60,89
CM60-H5	**-S17**	60	50	450	18,06	26,67	4,5	7	0,76	4,01	52,26
CM60-H6	**-S17**	60	50	450	20,62	30,48	4,5	8	0,76	4,01	45,64
CM60-H7	**-S17**	60	50	450	23,22	34,29	4,5	9	0,76	4,01	40,65
CM60-H8	**-S17**	60	50	450	28,37	41,91	4,5	11	0,76	4,01	33,23
CM60-H9	**-S17**	60	50	450	33,53	49,53	4,5	13	0,76	4,01	28,13
CM60-H10	**-S17**	60	50	450	38,68	57,15	4,5	15	0,76	4,01	24,36

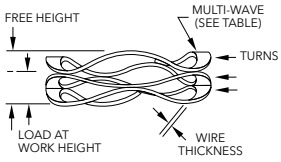
[1] Use "CM" prefix for plain ends. Use "CMS" prefix for squared-shim ends.
[2] Reference dimension.
[3] Theoretical dimension.

C/CS Series
Imperial Crest-To-Crest® Springs

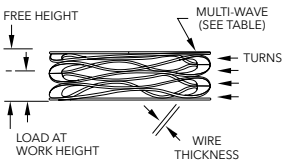


CM-Plain Ends *CMS-Shim Ends*





C-Plain Ends



CS-Shim Ends

Product Dimensions: All dimensions in inches unless otherwise specified.

Smalley Part Number [1]		Operates in Bore Diameter (in)	Clears Shaft Diameter (in)	Load (lb)	Work Height (in)	Free Height[2] (in)	Number of Waves	Number of Turns	Thickness (in)	Radial Wall (in)	Spring Rate[3] (lb/in)
Carbon Steel	Add Suffix 17-7 SS										
N/A	**C018-L1-S17**	0,188	0,125	1,0	0,035	0,075	2,5	3	0,004	0,015	25,0
N/A	**C018-L2-S17**	0,188	0,125	1,0	0,046	0,100	2,5	4	0,004	0,015	18,5
N/A	**C018-L3-S17**	0,188	0,125	1,0	0,057	0,125	2,5	5	0,004	0,015	14,7
N/A	**C018-L4-S17**	0,188	0,125	1,0	0,068	0,150	2,5	6	0,004	0,015	12,2
N/A	**C018-L5-S17**	0,188	0,125	1,0	0,079	0,175	2,5	7	0,004	0,015	10,4
N/A	**C018-L6-S17**	0,188	0,125	1,0	0,090	0,200	2,5	8	0,004	0,015	9,1
N/A	**C018-L7-S17**	0,188	0,125	1,0	0,101	0,226	2,5	9	0,004	0,015	8,0
N/A	**C018-L8-S17**	0,188	0,125	1,0	0,123	0,276	2,5	11	0,004	0,015	6,5
N/A	**C018-L9-S17**	0,188	0,125	1,0	0,145	0,326	2,5	13	0,004	0,015	5,5
N/A	**C018-M1-S17**	0,188	0,125	2,2	0,047	0,089	2,5	3	0,005	0,020	52,4
N/A	**C018-M2-S17**	0,188	0,125	2,2	0,063	0,119	2,5	4	0,005	0,020	39,3
N/A	**C018-M3-S17**	0,188	0,125	2,2	0,079	0,149	2,5	5	0,005	0,020	31,4
N/A	**C018-M4-S17**	0,188	0,125	2,2	0,095	0,179	2,5	6	0,005	0,020	26,2
N/A	**C018-M5-S17**	0,188	0,125	2,2	0,111	0,209	2,5	7	0,005	0,020	22,4
N/A	**C018-M6-S17**	0,188	0,125	2,2	0,127	0,239	2,5	8	0,005	0,020	19,6
N/A	**C018-M7-S17**	0,188	0,125	2,2	0,143	0,268	2,5	9	0,005	0,020	17,6
N/A	**C018-M8-S17**	0,188	0,125	2,2	0,174	0,328	2,5	11	0,005	0,020	14,3
N/A	**C018-M9-S17**	0,188	0,125	2,2	0,203	0,388	2,5	13	0,005	0,020	11,9
N/A	**C021-L1-S17**	0,219	0,140	1,5	0,040	0,079	2,5	3	0,005	0,020	38,5
N/A	**C021-L2-S17**	0,219	0,140	1,5	0,053	0,105	2,5	4	0,005	0,020	28,8
N/A	**C021-L3-S17**	0,219	0,140	1,5	0,066	0,131	2,5	5	0,005	0,020	23,1
N/A	**C021-L4-S17**	0,219	0,140	1,5	0,080	0,157	2,5	6	0,005	0,020	19,5
N/A	**C021-L5-S17**	0,219	0,140	1,5	0,092	0,183	2,5	7	0,005	0,020	16,5
N/A	**C021-L6-S17**	0,219	0,140	1,5	0,106	0,209	2,5	8	0,005	0,020	14,6
N/A	**C021-L7-S17**	0,219	0,140	1,5	0,120	0,236	2,5	9	0,005	0,020	12,9
N/A	**C021-L8-S17**	0,219	0,140	1,5	0,146	0,288	2,5	11	0,005	0,020	10,6
N/A	**C021-L9-S17**	0,219	0,140	1,5	0,171	0,340	2,5	13	0,005	0,020	8,9
N/A	**C021-M1-S17**	0,219	0,140	4,5	0,051	0,080	2,5	3	0,008	0,020	155,2
N/A	**C021-M2-S17**	0,219	0,140	4,5	0,068	0,107	2,5	4	0,008	0,020	115,4
N/A	**C021-M3-S17**	0,219	0,140	4,5	0,085	0,133	2,5	5	0,008	0,020	93,8
N/A	**C021-M4-S17**	0,219	0,140	4,5	0,101	0,160	2,5	6	0,008	0,020	76,3
N/A	**C021-M5-S17**	0,219	0,140	4,5	0,118	0,187	2,5	7	0,008	0,020	65,2
N/A	**C021-M6-S17**	0,219	0,140	4,5	0,135	0,214	2,5	8	0,008	0,020	57,0
N/A	**C021-M7-S17**	0,219	0,140	4,5	0,152	0,240	2,5	9	0,008	0,020	51,1
N/A	**C021-M8-S17**	0,219	0,140	4,5	0,187	0,294	2,5	11	0,008	0,020	42,1
N/A	**C021-M9-S17**	0,219	0,140	4,5	0,217	0,347	2,5	13	0,008	0,020	34,6

[1] Not available with shim ends.
[2] Reference dimension.
[3] Theoretical dimension.

C/CS Series

Imperial Crest-To-Crest® Springs Continued

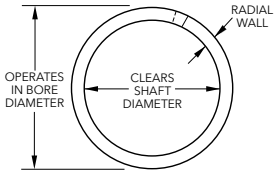
Smalley Part Number [3]		Operates in Bore Diameter (in)	Clears Shaft Diameter (in)	Load (lb)	Work Height (in)	Free Height[2] (in)	Number of Waves	Number of Turns	Thickness (in)	Radial Wall (in)	Spring Rate[4] (lb/in)
Carbon Steel	Add Suffix 17-7 SS										
C025-L1[1]	**-S17**	0,250	0,150	2	0,033	0,075	2,5	3	0,006	0,024	48
C025-L2[1]	**-S17**	0,250	0,150	2	0,050	0,100	2,5	4	0,006	0,024	40
C025-L3[1]	**-S17**	0,250	0,150	2	0,060	0,125	2,5	5	0,006	0,024	31
C025-L4[1]	**-S17**	0,250	0,150	2	0,075	0,150	2,5	6	0,006	0,024	27
C025-L5[1]	**-S17**	0,250	0,150	2	0,085	0,175	2,5	7	0,006	0,024	22
C025-L6[1]	**-S17**	0,250	0,150	2	0,095	0,200	2,5	8	0,006	0,024	19
C025-L7[1]	**-S17**	0,250	0,150	2	0,120	0,225	2,5	9	0,006	0,024	19
C025-L8[1]	**-S17**	0,250	0,150	2	0,140	0,275	2,5	11	0,006	0,024	15
C025-L9[1]	**-S17**	0,250	0,150	2	0,170	0,325	2,5	13	0,006	0,024	13
C025-M1[1]	**-S17**	0,250	0,150	5	0,037	0,075	2,5	3	0,008	0,024	132
C025-M2[1]	**-S17**	0,250	0,150	5	0,048	0,100	2,5	4	0,008	0,024	96
C025-M3[1]	**-S17**	0,250	0,150	5	0,065	0,125	2,5	5	0,008	0,024	83
C025-M4[1]	**-S17**	0,250	0,150	5	0,075	0,150	2,5	6	0,008	0,024	67
C025-M5[1]	**-S17**	0,250	0,150	5	0,090	0,175	2,5	7	0,008	0,024	59
C025-M6[1]	**-S17**	0,250	0,150	5	0,100	0,200	2,5	8	0,008	0,024	50
C025-M7[1]	**-S17**	0,250	0,150	5	0,120	0,225	2,5	9	0,008	0,024	48
C025-M8[1]	**-S17**	0,250	0,150	5	0,148	0,275	2,5	11	0,008	0,024	39
C025-M9[1]	**-S17**	0,250	0,150	5	0,175	0,325	2,5	13	0,008	0,024	33
C031-L1	**-S17**	0,312	0,200	3	0,070	0,114	2,5	3	0,008	0,032	68
C031-L2	**-S17**	0,312	0,200	3	0,096	0,152	2,5	4	0,008	0,032	54
C031-L3	**-S17**	0,312	0,200	3	0,118	0,190	2,5	5	0,008	0,032	42
C031-L4	**-S17**	0,312	0,200	3	0,145	0,228	2,5	6	0,008	0,032	36
C031-L5	**-S17**	0,312	0,200	3	0,165	0,266	2,5	7	0,008	0,032	30
C031-L6	**-S17**	0,312	0,200	3	0,195	0,304	2,5	8	0,008	0,032	28
C031-L7	**-S17**	0,312	0,200	3	0,215	0,342	2,5	9	0,008	0,032	24
C031-L8	**-S17**	0,312	0,200	3	0,262	0,418	2,5	11	0,008	0,032	19
C031-L9	**-S17**	0,312	0,200	3	0,309	0,494	2,5	13	0,008	0,032	16
C031-M1	**-S17**	0,312	0,200	6	0,072	0,114	2,5	3	0,010	0,032	143
C031-M2	**-S17**	0,312	0,200	6	0,096	0,152	2,5	4	0,010	0,032	107
C031-M3	**-S17**	0,312	0,200	6	0,123	0,190	2,5	5	0,010	0,032	90
C031-M4	**-S17**	0,312	0,200	6	0,144	0,228	2,5	6	0,010	0,032	71
C031-M5	**-S17**	0,312	0,200	6	0,176	0,266	2,5	7	0,010	0,032	67
C031-M6	**-S17**	0,312	0,200	6	0,197	0,304	2,5	8	0,010	0,032	56
C031-M7	**-S17**	0,312	0,200	6	0,227	0,342	2,5	9	0,010	0,032	52
C031-M8	**-S17**	0,312	0,200	6	0,278	0,418	2,5	11	0,010	0,032	43
C031-M9	**-S17**	0,312	0,200	6	0,336	0,494	2,5	13	0,010	0,032	38
C037-L1	**-S17**	0,375	0,250	4	0,062	0,150	2,5	3	0,008	0,032	45
C037-L2	**-S17**	0,375	0,250	4	0,098	0,200	2,5	4	0,008	0,032	39
C037-L3	**-S17**	0,375	0,250	4	0,108	0,250	2,5	5	0,008	0,032	28
C037-L4	**-S17**	0,375	0,250	4	0,135	0,300	2,5	6	0,008	0,032	24
C037-L5	**-S17**	0,375	0,250	4	0,150	0,350	2,5	7	0,008	0,032	20
C037-L6	**-S17**	0,375	0,250	4	0,184	0,400	2,5	8	0,008	0,032	19
C037-L7	**-S17**	0,375	0,250	4	0,195	0,450	2,5	9	0,008	0,032	16
C037-L8	**-S17**	0,375	0,250	4	0,228	0,500	2,5	10	0,008	0,032	15
C037-L9	**-S17**	0,375	0,250	4	0,240	0,550	2,5	11	0,008	0,032	13
C037-M1	**-S17**	0,375	0,250	7	0,081	0,150	2,5	3	0,011	0,032	101
C037-M2	**-S17**	0,375	0,250	7	0,119	0,200	2,5	4	0,011	0,032	86
C037-M3	**-S17**	0,375	0,250	7	0,145	0,250	2,5	5	0,011	0,032	67
C037-M4	**-S17**	0,375	0,250	7	0,180	0,300	2,5	6	0,011	0,032	58
C037-M5	**-S17**	0,375	0,250	7	0,202	0,350	2,5	7	0,011	0,032	47
C037-M6	**-S17**	0,375	0,250	7	0,240	0,400	2,5	8	0,011	0,032	44
C037-M7	**-S17**	0,375	0,250	7	0,262	0,450	2,5	9	0,011	0,032	37
C037-M8	**-S17**	0,375	0,250	7	0,298	0,500	2,5	10	0,011	0,032	35
C037-M9	**-S17**	0,375	0,250	7	0,327	0,550	2,5	11	0,011	0,032	31
C043-L1	**-S17**	0,437	0,281	4	0,063	0,165	2,5	3	0,008	0,040	39
C043-L2	**-S17**	0,437	0,281	4	0,093	0,220	2,5	4	0,008	0,040	31
C043-L3	**-S17**	0,437	0,281	4	0,109	0,275	2,5	5	0,008	0,040	24
C043-L4	**-S17**	0,437	0,281	4	0,143	0,330	2,5	6	0,008	0,040	21
C043-L5	**-S17**	0,437	0,281	4	0,160	0,385	2,5	7	0,008	0,040	18
C043-L6	**-S17**	0,437	0,281	4	0,195	0,440	2,5	8	0,008	0,040	16
C043-L7	**-S17**	0,437	0,281	4	0,210	0,495	2,5	9	0,008	0,040	14
C043-L8	**-S17**	0,437	0,281	4	0,240	0,550	2,5	10	0,008	0,040	13
C043-L9	**-S17**	0,437	0,281	4	0,260	0,605	2,5	11	0,008	0,040	12
C043-M1	**-S17**	0,437	0,281	8	0,082	0,165	2,5	3	0,011	0,046	96
C043-M2	**-S17**	0,437	0,281	8	0,115	0,220	2,5	4	0,011	0,046	76
C043-M3	**-S17**	0,437	0,281	8	0,142	0,275	2,5	5	0,011	0,046	60
C043-M4	**-S17**	0,437	0,281	8	0,179	0,330	2,5	6	0,011	0,046	53
C043-M5	**-S17**	0,437	0,281	8	0,198	0,385	2,5	7	0,011	0,046	43
C043-M6	**-S17**	0,437	0,281	8	0,231	0,440	2,5	8	0,011	0,046	38
C043-M7	**-S17**	0,437	0,281	8	0,255	0,495	2,5	9	0,011	0,046	33
C043-M8	**-S17**	0,437	0,281	8	0,290	0,550	2,5	10	0,011	0,046	31
C043-M9	**-S17**	0,437	0,281	8	0,319	0,605	2,5	11	0,011	0,046	28
C050-L1	**-S17**	0,500	0,312	5	0,062	0,180	2,5	3	0,008	0,056	42

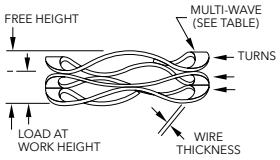
[1] Not available with shim ends.
[2] Reference dimension.
[3] Use "C" prefix for plain ends. Use "CS" prefix for squared-shim ends.
[4] Theoretical dimension.

C/CS Series
Imperial Crest-To-Crest® Springs

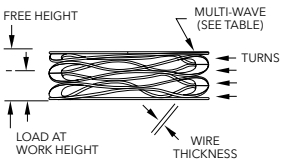


CM-Plain Ends *CMS-Shim Ends*





C-Plain Ends



CS-Shim Ends

Product Dimensions: All dimensions in inches unless otherwise specified.

Smalley Part Number [3]		Operates in Bore Diameter (in)	Clears Shaft Diameter (in)	Load (lb)	Work Height (in)	Free Height [2] (in)	Number of Waves	Number of Turns	Thickness (in)	Radial Wall (in)	Spring Rate [4] (lb/in)
Carbon Steel	Add Suffix 17-7 SS										
C050-L2	**-S17**	0,500	0,312	5	0,090	0,240	2,5	4	0,008	0,056	33
C050-L3	**-S17**	0,500	0,312	5	0,107	0,300	2,5	5	0,008	0,056	26
C050-L4	**-S17**	0,500	0,312	5	0,136	0,360	2,5	6	0,008	0,056	22
C050-L5	**-S17**	0,500	0,312	5	0,150	0,420	2,5	7	0,008	0,056	19
C050-L6	**-S17**	0,500	0,312	5	0,180	0,480	2,5	8	0,008	0,056	17
C050-L7	**-S17**	0,500	0,312	5	0,195	0,540	2,5	9	0,008	0,056	14
C050-L8	**-S17**	0,500	0,312	5	0,220	0,600	2,5	10	0,008	0,056	13
C050-L9	**-S17**	0,500	0,312	5	0,240	0,660	2,5	11	0,008	0,056	12
C050-M1	**-S17**	0,500	0,312	10	0,065	0,180	2,5	3	0,010	0,058	87
C050-M2	**-S17**	0,500	0,312	10	0,092	0,240	2,5	4	0,010	0,058	68
C050-M3	**-S17**	0,500	0,312	10	0,114	0,300	2,5	5	0,010	0,058	54
C050-M4	**-S17**	0,500	0,312	10	0,147	0,360	2,5	6	0,010	0,058	47
C050-M5	**-S17**	0,500	0,312	10	0,162	0,420	2,5	7	0,010	0,058	39
C050-M6	**-S17**	0,500	0,312	10	0,196	0,480	2,5	8	0,010	0,058	35
C050-M7	**-S17**	0,500	0,312	10	0,207	0,540	2,5	9	0,010	0,058	30
C050-M8	**-S17**	0,500	0,312	10	0,246	0,600	2,5	10	0,010	0,058	28
C050-M9	**-S17**	0,500	0,312	10	0,264	0,660	2,5	11	0,010	0,058	25
C050-H1	**-S17**	0,500	0,312	15	0,075	0,180	2,5	3	0,012	0,060	143
C050-H2	**-S17**	0,500	0,312	15	0,110	0,240	2,5	4	0,012	0,060	115
C050-H3	**-S17**	0,500	0,312	15	0,136	0,300	2,5	5	0,012	0,060	91
C050-H4	**-S17**	0,500	0,312	15	0,167	0,360	2,5	6	0,012	0,060	78
C050-H5	**-S17**	0,500	0,312	15	0,182	0,420	2,5	7	0,012	0,060	63
C050-H6	**-S17**	0,500	0,312	15	0,216	0,480	2,5	8	0,012	0,060	57
C050-H7	**-S17**	0,500	0,312	15	0,240	0,540	2,5	9	0,012	0,060	50
C050-H8	**-S17**	0,500	0,312	15	0,280	0,600	2,5	10	0,012	0,060	47
C050-H9	**-S17**	0,500	0,312	15	0,312	0,660	2,5	11	0,012	0,060	43
C056-L1	**-S17**	0,562	0,375	5	0,080	0,195	2,5	3	0,009	0,058	43
C056-L2	**-S17**	0,562	0,375	5	0,125	0,260	2,5	4	0,009	0,058	37
C056-L3	**-S17**	0,562	0,375	5	0,135	0,325	2,5	5	0,009	0,058	26
C056-L4	**-S17**	0,562	0,375	5	0,180	0,390	2,5	6	0,009	0,058	24
C056-L5	**-S17**	0,562	0,375	5	0,190	0,455	2,5	7	0,009	0,058	19
C056-L6	**-S17**	0,562	0,375	5	0,230	0,520	2,5	8	0,009	0,058	17
C056-L7	**-S17**	0,562	0,375	5	0,260	0,585	2,5	9	0,009	0,058	15
C056-L8	**-S17**	0,562	0,375	5	0,285	0,650	2,5	10	0,009	0,058	14
C056-L9	**-S17**	0,562	0,375	5	0,315	0,715	2,5	11	0,009	0,058	13
C056-M1	**-S17**	0,562	0,375	11	0,086	0,195	2,5	3	0,012	0,060	101
C056-M2	**-S17**	0,562	0,375	11	0,123	0,260	2,5	4	0,012	0,060	80
C056-M3	**-S17**	0,562	0,375	11	0,145	0,325	2,5	5	0,012	0,060	61
C056-M4	**-S17**	0,562	0,375	11	0,187	0,390	2,5	6	0,012	0,060	54
C056-M5	**-S17**	0,562	0,375	11	0,209	0,455	2,5	7	0,012	0,060	45
C056-M6	**-S17**	0,562	0,375	11	0,253	0,520	2,5	8	0,012	0,060	41
C056-M7	**-S17**	0,562	0,375	11	0,273	0,585	2,5	9	0,012	0,060	35
C056-M8	**-S17**	0,562	0,375	11	0,318	0,650	2,5	10	0,012	0,060	33
C056-M9	**-S17**	0,562	0,375	11	0,343	0,715	2,5	11	0,012	0,060	30
C056-H1	**-S17**	0,562	0,375	18	0,093	0,195	2,5	3	0,015	0,060	176
C056-H2	**-S17**	0,562	0,375	18	0,136	0,260	2,5	4	0,015	0,060	145
C056-H3	**-S17**	0,562	0,375	18	0,165	0,325	2,5	5	0,015	0,060	113
C056-H4	**-S17**	0,562	0,375	18	0,212	0,390	2,5	6	0,015	0,060	101
C056-H5	**-S17**	0,562	0,375	18	0,245	0,455	2,5	7	0,015	0,060	86
C056-H6	**-S17**	0,562	0,375	18	0,282	0,520	2,5	8	0,015	0,060	76
C056-H7	**-S17**	0,562	0,375	18	0,323	0,585	2,5	9	0,015	0,060	69
C056-H8	**-S17**	0,562	0,375	18	0,360	0,650	2,5	10	0,015	0,060	62
C056-H9	**-S17**	0,562	0,375	18	0,408	0,715	2,5	11	0,015	0,060	59
C062-L1	**-S17**	0,625	0,450	6	0,055	0,180	2,5	3	0,010	0,058	48
C062-L2	**-S17**	0,625	0,450	6	0,068	0,240	2,5	4	0,010	0,058	35
C062-L3	**-S17**	0,625	0,450	6	0,085	0,300	2,5	5	0,010	0,058	28

[1] Not available with shim ends.
[2] Reference dimension.
[3] Use "C" prefix for plain ends. Use "CS" prefix for squared-shim ends.
[4] Theoretical dimension.

C/CS Series

Imperial Crest-To-Crest® Springs Continued

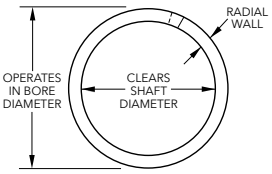
Smalley Part Number [3]		Operates in Bore Diameter (in)	Clears Shaft Diameter (in)	Load (lb)	Work Height (in)	Free Height[2] (in)	Number of Waves	Number of Turns	Thickness (in)	Radial Wall (in)	Spring Rate[4] (lb/in)
Carbon Steel	Add Suffix 17-7 SS										
C062-L4	**-S17**	0,625	0,450	6	0,106	0,360	2,5	6	0,010	0,058	24
C062-L5	**-S17**	0,625	0,450	6	0,128	0,420	2,5	7	0,010	0,058	21
C062-L6	**-S17**	0,625	0,450	6	0,165	0,540	2,5	9	0,010	0,058	16
C062-L7	**-S17**	0,625	0,450	6	0,202	0,660	2,5	11	0,010	0,058	13
C062-L8	**-S17**	0,625	0,450	6	0,238	0,780	2,5	13	0,010	0,058	11
C062-M1	**-S17**	0,625	0,450	12	0,104	0,180	3,5	3	0,010	0,058	158
C062-M2	**-S17**	0,625	0,450	12	0,130	0,240	3,5	4	0,010	0,058	109
C062-M3	**-S17**	0,625	0,450	12	0,175	0,300	3,5	5	0,010	0,058	96
C062-M4	**-S17**	0,625	0,450	12	0,206	0,360	3,5	6	0,010	0,058	78
C062-M5	**-S17**	0,625	0,450	12	0,246	0,420	3,5	7	0,010	0,058	69
C062-M6	**-S17**	0,625	0,450	12	0,317	0,540	3,5	9	0,010	0,058	54
C062-M7	**-S17**	0,625	0,450	12	0,386	0,660	3,5	11	0,010	0,058	44
C062-M8	**-S17**	0,625	0,450	12	0,454	0,780	3,5	13	0,010	0,058	37
C062-H1	**-S17**	0,625	0,450	20	0,102	0,180	3,5	3	0,012	0,060	256
C062-H2	**-S17**	0,625	0,450	20	0,135	0,240	3,5	4	0,012	0,060	190
C062-H3	**-S17**	0,625	0,450	20	0,175	0,300	3,5	5	0,012	0,060	160
C062-H4	**-S17**	0,625	0,450	20	0,205	0,360	3,5	6	0,012	0,060	129
C062-H5	**-S17**	0,625	0,450	20	0,245	0,420	3,5	7	0,012	0,060	114
C062-H6	**-S17**	0,625	0,450	20	0,315	0,540	3,5	9	0,012	0,060	89
C062-H7	**-S17**	0,625	0,450	20	0,390	0,660	3,5	11	0,012	0,060	74
C062-H8	**-S17**	0,625	0,450	20	0,465	0,780	3,5	13	0,012	0,060	63
C075-L1	**-S17**	0,750	0,550	7	0,142	0,250	3,5	3	0,008	0,071	65
C075-L2	**-S17**	0,750	0,550	7	0,187	0,333	3,5	4	0,008	0,071	48
C075-L3	**-S17**	0,750	0,550	7	0,246	0,417	3,5	5	0,008	0,071	41
C075-L4	**-S17**	0,750	0,550	7	0,285	0,500	3,5	6	0,008	0,071	33
C075-L5	**-S17**	0,750	0,550	7	0,348	0,583	3,5	7	0,008	0,071	30
C075-L6	**-S17**	0,750	0,550	7	0,446	0,750	3,5	9	0,008	0,071	23
C075-L7	**-S17**	0,750	0,550	7	0,580	1,000	3,5	12	0,008	0,071	17
C075-M1	**-S17**	0,750	0,550	13	0,159	0,250	3,5	3	0,010	0,078	143
C075-M2	**-S17**	0,750	0,550	13	0,203	0,333	3,5	4	0,010	0,078	100
C075-M3	**-S17**	0,750	0,550	13	0,270	0,417	3,5	5	0,010	0,078	88
C075-M4	**-S17**	0,750	0,550	13	0,314	0,500	3,5	6	0,010	0,078	70
C075-M5	**-S17**	0,750	0,550	13	0,381	0,583	3,5	7	0,010	0,078	64
C075-M6	**-S17**	0,750	0,550	13	0,489	0,750	3,5	9	0,010	0,078	50
C075-M7	**-S17**	0,750	0,550	13	0,649	1,000	3,5	12	0,010	0,078	37
C075-H1	**-S17**	0,750	0,550	22	0,169	0,250	3,5	3	0,013	0,079	272
C075-H2	**-S17**	0,750	0,550	22	0,215	0,333	3,5	4	0,013	0,079	186
C075-H3	**-S17**	0,750	0,550	22	0,291	0,417	3,5	5	0,013	0,079	175
C075-H4	**-S17**	0,750	0,550	22	0,335	0,500	3,5	6	0,013	0,079	133
C075-H5	**-S17**	0,750	0,550	22	0,405	0,583	3,5	7	0,013	0,079	124
C075-H6	**-S17**	0,750	0,550	22	0,526	0,750	3,5	9	0,013	0,079	98
C075-H7	**-S17**	0,750	0,550	22	0,699	1,000	3,5	12	0,013	0,079	73
C087-L1	**-S17**	0,875	0,600	12	0,117	0,250	3,5	3	0,010	0,086	90
C087-L2	**-S17**	0,875	0,600	12	0,158	0,333	3,5	4	0,010	0,086	69
C087-L3	**-S17**	0,875	0,600	12	0,207	0,417	3,5	5	0,010	0,086	57
C087-L4	**-S17**	0,875	0,600	12	0,242	0,500	3,5	6	0,010	0,086	47
C087-L5	**-S17**	0,875	0,600	12	0,287	0,583	3,5	7	0,010	0,086	41
C087-L6	**-S17**	0,875	0,600	12	0,378	0,750	3,5	9	0,010	0,086	32
C087-L7	**-S17**	0,875	0,600	12	0,498	1,000	3,5	12	0,010	0,086	24
C087-M1	**-S17**	0,875	0,600	18	0,124	0,250	3,5	3	0,012	0,094	143
C087-M2	**-S17**	0,875	0,600	18	0,164	0,333	3,5	4	0,012	0,094	107
C087-M3	**-S17**	0,875	0,600	18	0,214	0,417	3,5	5	0,012	0,094	89
C087-M4	**-S17**	0,875	0,600	18	0,252	0,500	3,5	6	0,012	0,094	73
C087-M5	**-S17**	0,875	0,600	18	0,296	0,583	3,5	7	0,012	0,094	63
C087-M6	**-S17**	0,875	0,600	18	0,385	0,750	3,5	9	0,012	0,094	50
C087-M7	**-S17**	0,875	0,600	18	0,509	1,000	3,5	12	0,012	0,094	37
C087-H1	**-S17**	0,875	0,600	25	0,166	0,250	3,5	3	0,015	0,094	298
C087-H2	**-S17**	0,875	0,600	25	0,214	0,333	3,5	4	0,015	0,094	210
C087-H3	**-S17**	0,875	0,600	25	0,278	0,417	3,5	5	0,015	0,094	180
C087-H4	**-S17**	0,875	0,600	25	0,327	0,500	3,5	6	0,015	0,094	145
C087-H5	**-S17**	0,875	0,600	25	0,395	0,583	3,5	7	0,015	0,094	133
C087-H6	**-S17**	0,875	0,600	25	0,510	0,750	3,5	9	0,015	0,094	104
C087-H7	**-S17**	0,875	0,600	25	0,670	1,000	3,5	12	0,015	0,094	76
C100-L1	**-S17**	1,000	0,730	12	0,084	0,250	3,5	3	0,010	0,086	72
C100-L2	**-S17**	1,000	0,730	12	0,108	0,333	3,5	4	0,010	0,086	53
C100-L3	**-S17**	1,000	0,730	12	0,145	0,417	3,5	5	0,010	0,086	44
C100-L4	**-S17**	1,000	0,730	12	0,165	0,500	3,5	6	0,010	0,086	36
C100-L5	**-S17**	1,000	0,730	12	0,201	0,583	3,5	7	0,010	0,086	31
C100-L6	**-S17**	1,000	0,730	12	0,258	0,750	3,5	9	0,010	0,086	24
C100-L7	**-S17**	1,000	0,730	12	0,342	1,000	3,5	12	0,010	0,086	18
C100-L8	**-S17**	1,000	0,730	12	0,445	1,250	3,5	15	0,010	0,086	15
C100-L9	**-S17**	1,000	0,730	12	0,519	1,500	3,5	18	0,010	0,086	12
C100-L10	**-S17**	1,000	0,730	12	0,633	1,750	3,5	21	0,010	0,086	11

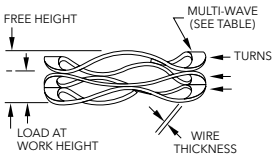
[1] Not available with shim ends.
[2] Reference dimension.
[3] Use "C" prefix for plain ends. Use "CS" prefix for squared-shim ends.
[4] Theoretical dimension.

C/CS Series
Imperial Crest-To-Crest® Springs

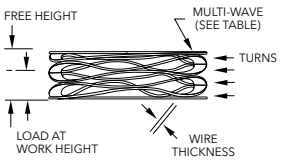


CM-Plain Ends *CMS-Shim Ends*





C-Plain Ends



CS-Shim Ends

Product Dimensions: All dimensions in inches unless otherwise specified.

Smalley Part Number [3]		Operates in Bore Diameter (in)	Clears Shaft Diameter (in)	Load (lb)	Work Height (in)	Free Height[2] (in)	Number of Waves	Number of Turns	Thickness (in)	Radial Wall (in)	Spring Rate[4] (lb/in)
Carbon Steel	Add Suffix 17-7 SS										
C100-L11	**-S17**	1,000	0,730	12	0,710	2,000	3,5	24	0,010	0,086	9
C100-M1	**-S17**	1,000	0,730	18	0,087	0,250	3,5	3	0,012	0,094	110
C100-M2	**-S17**	1,000	0,730	18	0,113	0,333	3,5	4	0,012	0,094	82
C100-M3	**-S17**	1,000	0,730	18	0,148	0,417	3,5	5	0,012	0,094	67
C100-M4	**-S17**	1,000	0,730	18	0,175	0,500	3,5	6	0,012	0,094	55
C100-M5	**-S17**	1,000	0,730	18	0,212	0,583	3,5	7	0,012	0,094	49
C100-M6	**-S17**	1,000	0,730	18	0,276	0,750	3,5	9	0,012	0,094	38
C100-M7	**-S17**	1,000	0,730	18	0,360	1,000	3,5	12	0,012	0,094	28
C100-M8	**-S17**	1,000	0,730	18	0,452	1,250	3,5	15	0,012	0,094	23
C100-M9	**-S17**	1,000	0,730	18	0,549	1,500	3,5	18	0,012	0,094	19
C100-M10	**-S17**	1,000	0,730	18	0,650	1,750	3,5	21	0,012	0,094	16
C100-M11	**-S17**	1,000	0,730	18	0,720	2,000	3,5	24	0,012	0,094	14
C100-H1	**-S17**	1,000	0,730	25	0,131	0,250	3,5	3	0,015	0,094	210
C100-H2	**-S17**	1,000	0,730	25	0,174	0,333	3,5	4	0,015	0,094	157
C100-H3	**-S17**	1,000	0,730	25	0,227	0,417	3,5	5	0,015	0,094	132
C100-H4	**-S17**	1,000	0,730	25	0,266	0,500	3,5	6	0,015	0,094	107
C100-H5	**-S17**	1,000	0,730	25	0,319	0,583	3,5	7	0,015	0,094	95
C100-H6	**-S17**	1,000	0,730	25	0,406	0,750	3,5	9	0,015	0,094	73
C100-H7	**-S17**	1,000	0,730	25	0,541	1,000	3,5	12	0,015	0,094	54
C100-H8	**-S17**	1,000	0,730	25	0,688	1,250	3,5	15	0,015	0,094	45
C100-H9	**-S17**	1,000	0,730	25	0,813	1,500	3,5	18	0,015	0,094	36
C100-H10	**-S17**	1,000	0,730	25	0,957	1,750	3,5	21	0,015	0,094	32
C100-H11	**-S17**	1,000	0,730	25	1,083	2,000	3,5	24	0,015	0,094	27
C112-L1	**-S17**	1,125	0,850	12	0,146	0,300	3,5	3	0,012	0,094	78
C112-L2	**-S17**	1,125	0,850	12	0,186	0,400	3,5	4	0,012	0,094	56
C112-L3	**-S17**	1,125	0,850	12	0,250	0,500	3,5	5	0,012	0,094	48
C112-L4	**-S17**	1,125	0,850	12	0,295	0,600	3,5	6	0,012	0,094	39
C112-L5	**-S17**	1,125	0,850	12	0,344	0,700	3,5	7	0,012	0,094	34
C112-L6	**-S17**	1,125	0,850	12	0,392	0,800	3,5	8	0,012	0,094	29
C112-L7	**-S17**	1,125	0,850	12	0,488	1,000	3,5	10	0,012	0,094	23
C112-L8	**-S17**	1,125	0,850	12	0,659	1,300	3,5	13	0,012	0,094	19
C112-L9	**-S17**	1,125	0,850	12	0,807	1,600	3,5	16	0,012	0,094	15
C112-L10	**-S17**	1,125	0,850	12	0,983	2,000	3,5	20	0,012	0,094	12
C112-M1	**-S17**	1,125	0,850	20	0,160	0,300	3,5	3	0,015	0,094	143
C112-M2	**-S17**	1,125	0,850	20	0,202	0,400	3,5	4	0,015	0,094	101
C112-M3	**-S17**	1,125	0,850	20	0,270	0,500	3,5	5	0,015	0,094	87
C112-M4	**-S17**	1,125	0,850	20	0,318	0,600	3,5	6	0,015	0,094	71
C112-M5	**-S17**	1,125	0,850	20	0,381	0,700	3,5	7	0,015	0,094	63
C112-M6	**-S17**	1,125	0,850	20	0,427	0,800	3,5	8	0,015	0,094	54
C112-M7	**-S17**	1,125	0,850	20	0,536	1,000	3,5	10	0,015	0,094	43
C112-M8	**-S17**	1,125	0,850	20	0,708	1,300	3,5	13	0,015	0,094	34
C112-M9	**-S17**	1,125	0,850	20	0,861	1,600	3,5	16	0,015	0,094	27
C112-M10	**-S17**	1,125	0,850	20	1,088	2,000	3,5	20	0,015	0,094	22
C112-H1	**-S17**	1,125	0,850	30	0,178	0,300	3,5	3	0,018	0,094	246
C112-H2	**-S17**	1,125	0,850	30	0,229	0,400	3,5	4	0,018	0,094	175
C112-H3	**-S17**	1,125	0,850	30	0,303	0,500	3,5	5	0,018	0,094	152
C112-H4	**-S17**	1,125	0,850	30	0,350	0,600	3,5	6	0,018	0,094	120
C112-H5	**-S17**	1,125	0,850	30	0,421	0,700	3,5	7	0,018	0,094	108
C112-H6	**-S17**	1,125	0,850	30	0,470	0,800	3,5	8	0,018	0,094	91
C112-H7	**-S17**	1,125	0,850	30	0,593	1,000	3,5	10	0,018	0,094	74
C112-H8	**-S17**	1,125	0,850	30	0,787	1,300	3,5	13	0,018	0,094	58
C112-H9	**-S17**	1,125	0,850	30	0,956	1,600	3,5	16	0,018	0,094	47
C112-H10	**-S17**	1,125	0,850	30	1,202	2,000	3,5	20	0,018	0,094	38
C125-L1	**-S17**	1,250	1,000	12	0,084	0,300	3,5	3	0,012	0,094	56
C125-L2	**-S17**	1,250	1,000	12	0,113	0,400	3,5	4	0,012	0,094	42
C125-L3	**-S17**	1,250	1,000	12	0,149	0,500	3,5	5	0,012	0,094	34

[1] Not available with shim ends.
[2] Reference dimension.
[3] Use "C" prefix for plain ends. Use "CS" prefix for squared-shim ends.
[4] Theoretical dimension.

C/CS Series

Imperial Crest-To-Crest® Springs Continued

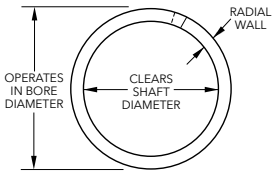
Smalley Part Number [3]		Operates in Bore Diameter (in)	Clears Shaft Diameter (in)	Load (lb)	Work Height (in)	Free Height[2] (in)	Number of Waves	Number of Turns	Thickness (in)	Radial Wall (in)	Spring Rate[4] (lb/in)
Carbon Steel	Add Suffix 17-7 SS										
C125-L4	**-S17**	1,250	1,000	12	0,172	0,600	3,5	6	0,012	0,094	28
C125-L5	**-S17**	1,250	1,000	12	0,207	0,700	3,5	7	0,012	0,094	24
C125-L6	**-S17**	1,250	1,000	12	0,227	0,800	3,5	8	0,012	0,094	21
C125-L7	**-S17**	1,250	1,000	12	0,301	1,000	3,5	10	0,012	0,094	17
C125-L8	**-S17**	1,250	1,000	12	0,395	1,300	3,5	13	0,012	0,094	13
C125-L9	**-S17**	1,250	1,000	12	0,467	1,600	3,5	16	0,012	0,094	11
C125-L10	**-S17**	1,250	1,000	12	0,591	2,000	3,5	20	0,012	0,094	9
C125-M1	**-S17**	1,250	1,000	20	0,124	0,300	3,5	3	0,015	0,094	114
C125-M2	**-S17**	1,250	1,000	20	0,165	0,400	3,5	4	0,015	0,094	85
C125-M3	**-S17**	1,250	1,000	20	0,215	0,500	3,5	5	0,015	0,094	70
C125-M4	**-S17**	1,250	1,000	20	0,253	0,600	3,5	6	0,015	0,094	58
C125-M5	**-S17**	1,250	1,000	20	0,303	0,700	3,5	7	0,015	0,094	50
C125-M6	**-S17**	1,250	1,000	20	0,341	0,800	3,5	8	0,015	0,094	44
C125-M7	**-S17**	1,250	1,000	20	0,427	1,000	3,5	10	0,015	0,094	35
C125-M8	**-S17**	1,250	1,000	20	0,577	1,300	3,5	13	0,015	0,094	28
C125-M9	**-S17**	1,250	1,000	20	0,692	1,600	3,5	16	0,015	0,094	22
C125-M10	**-S17**	1,250	1,000	20	0,866	2,000	3,5	20	0,015	0,094	18
C125-H1	**-S17**	1,250	1,000	30	0,158	0,300	3,5	3	0,019	0,094	210
C125-H2	**-S17**	1,250	1,000	30	0,210	0,400	3,5	4	0,019	0,094	158
C125-H3	**-S17**	1,250	1,000	30	0,272	0,500	3,5	5	0,019	0,094	132
C125-H4	**-S17**	1,250	1,000	30	0,320	0,600	3,5	6	0,019	0,094	107
C125-H5	**-S17**	1,250	1,000	30	0,384	0,700	3,5	7	0,019	0,094	95
C125-H6	**-S17**	1,250	1,000	30	0,433	0,800	3,5	8	0,019	0,094	82
C125-H7	**-S17**	1,250	1,000	30	0,538	1,000	3,5	10	0,019	0,094	65
C125-H8	**-S17**	1,250	1,000	30	0,717	1,300	3,5	13	0,019	0,094	51
C125-H9	**-S17**	1,250	1,000	30	0,878	1,600	3,5	16	0,019	0,094	42
C125-H10	**-S17**	1,250	1,000	30	1,103	2,000	3,5	20	0,019	0,094	33
C137-L1	**-S17**	1,375	1,030	15	0,075	0,300	3,5	3	0,012	0,122	67
C137-L2	**-S17**	1,375	1,030	15	0,099	0,400	3,5	4	0,012	0,122	50
C137-L3	**-S17**	1,375	1,030	15	0,129	0,500	3,5	5	0,012	0,122	40
C137-L4	**-S17**	1,375	1,030	15	0,155	0,600	3,5	6	0,012	0,122	34
C137-L5	**-S17**	1,375	1,030	15	0,179	0,700	3,5	7	0,012	0,122	29
C137-L6	**-S17**	1,375	1,030	15	0,206	0,800	3,5	8	0,012	0,122	25
C137-L7	**-S17**	1,375	1,030	15	0,256	1,000	3,5	10	0,012	0,122	20
C137-L8	**-S17**	1,375	1,030	15	0,341	1,300	3,5	13	0,012	0,122	16
C137-L9	**-S17**	1,375	1,030	15	0,424	1,600	3,5	16	0,012	0,122	13
C137-L10	**-S17**	1,375	1,030	15	0,530	2,000	3,5	20	0,012	0,122	10
C137-M1	**-S17**	1,375	1,030	25	0,142	0,300	3,5	3	0,016	0,133	158
C137-M2	**-S17**	1,375	1,030	25	0,186	0,400	3,5	4	0,016	0,133	117
C137-M3	**-S17**	1,375	1,030	25	0,240	0,500	3,5	5	0,016	0,133	96
C137-M4	**-S17**	1,375	1,030	25	0,281	0,600	3,5	6	0,016	0,133	78
C137-M5	**-S17**	1,375	1,030	25	0,340	0,700	3,5	7	0,016	0,133	69
C137-M6	**-S17**	1,375	1,030	25	0,384	0,800	3,5	8	0,016	0,133	60
C137-M7	**-S17**	1,375	1,030	25	0,486	1,000	3,5	10	0,016	0,133	49
C137-M8	**-S17**	1,375	1,030	25	0,632	1,300	3,5	13	0,016	0,133	37
C137-M9	**-S17**	1,375	1,030	25	0,788	1,600	3,5	16	0,016	0,133	31
C137-M10	**-S17**	1,375	1,030	25	0,982	2,000	3,5	20	0,016	0,133	25
C137-H1	**-S17**	1,375	1,030	35	0,149	0,300	3,5	3	0,018	0,133	232
C137-H2	**-S17**	1,375	1,030	35	0,189	0,400	3,5	4	0,018	0,133	166
C137-H3	**-S17**	1,375	1,030	35	0,247	0,500	3,5	5	0,018	0,133	138
C137-H4	**-S17**	1,375	1,030	35	0,287	0,600	3,5	6	0,018	0,133	112
C137-H5	**-S17**	1,375	1,030	35	0,343	0,700	3,5	7	0,018	0,133	98
C137-H6	**-S17**	1,375	1,030	35	0,390	0,800	3,5	8	0,018	0,133	85
C137-H7	**-S17**	1,375	1,030	35	0,490	1,000	3,5	10	0,018	0,133	69
C137-H8	**-S17**	1,375	1,030	35	0,646	1,300	3,5	13	0,018	0,133	54
C137-H9	**-S17**	1,375	1,030	35	0,793	1,600	3,5	16	0,018	0,133	43
C137-H10	**-S17**	1,375	1,030	35	1,000	2,000	3,5	20	0,018	0,133	35
C150-L1	**-S17**	1,500	1,140	20	0,129	0,300	3,5	3	0,016	0,133	117
C150-L2	**-S17**	1,500	1,140	20	0,164	0,400	3,5	4	0,016	0,133	85
C150-L3	**-S17**	1,500	1,140	20	0,213	0,500	3,5	5	0,016	0,133	70
C150-L4	**-S17**	1,500	1,140	20	0,247	0,600	3,5	6	0,016	0,133	57
C150-L5	**-S17**	1,500	1,140	20	0,301	0,700	3,5	7	0,016	0,133	50
C150-L6	**-S17**	1,500	1,140	20	0,337	0,800	3,5	8	0,016	0,133	43
C150-L7	**-S17**	1,500	1,140	20	0,430	1,000	3,5	10	0,016	0,133	35
C150-L8	**-S17**	1,500	1,140	20	0,565	1,300	3,5	13	0,016	0,133	27
C150-L9	**-S17**	1,500	1,140	20	0,694	1,600	3,5	16	0,016	0,133	22
C150-L10	**-S17**	1,500	1,140	20	0,866	2,000	3,5	20	0,016	0,133	18
C150-M1	**-S17**	1,500	1,140	35	0,122	0,300	3,5	3	0,018	0,133	197
C150-M2	**-S17**	1,500	1,140	35	0,158	0,400	3,5	4	0,018	0,133	145
C150-M3	**-S17**	1,500	1,140	35	0,206	0,500	3,5	5	0,018	0,133	119
C150-M4	**-S17**	1,500	1,140	35	0,241	0,600	3,5	6	0,018	0,133	97
C150-M5	**-S17**	1,500	1,140	35	0,291	0,700	3,5	7	0,018	0,133	86

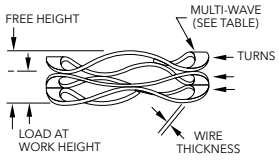
[1] Not available with shim ends.
[2] Reference dimension.
[3] Use "C" prefix for plain ends. Use "CS" prefix for squared-shim ends.
[4] Theoretical dimension.

C/CS Series
Imperial Crest-To-Crest® Springs

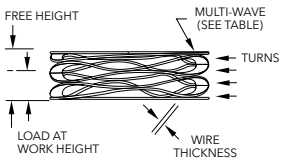


CM-Plain Ends *CMS-Shim Ends*





C-Plain Ends



CS-Shim Ends

Product Dimensions: All dimensions in inches unless otherwise specified.

Smalley Part Number [3]		Operates in Bore Diameter (in)	Clears Shaft Diameter (in)	Load (lb)	Work Height (in)	Free Height[2] (in)	Number of Waves	Number of Turns	Thickness (in)	Radial Wall (in)	Spring Rate[4] (lb/in)
Carbon Steel	Add Suffix 17-7 SS										
C150-M6	**-S17**	1,500	1,140	35	0,324	0,800	3,5	8	0,018	0,133	74
C150-M7	**-S17**	1,500	1,140	35	0,409	1,000	3,5	10	0,018	0,133	59
C150-M8	**-S17**	1,500	1,140	35	0,540	1,300	3,5	13	0,018	0,133	46
C150-M9	**-S17**	1,500	1,140	35	0,657	1,600	3,5	16	0,018	0,133	37
C150-M10	**-S17**	1,500	1,140	35	0,835	2,000	3,5	20	0,018	0,133	30
C150-H1	**-S17**	1,500	1,140	60	0,166	0,300	4,5	3	0,018	0,133	448
C150-H2	**-S17**	1,500	1,140	60	0,216	0,400	4,5	4	0,018	0,133	326
C150-H3	**-S17**	1,500	1,140	60	0,278	0,500	4,5	5	0,018	0,133	270
C150-H4	**-S17**	1,500	1,140	60	0,329	0,600	4,5	6	0,018	0,133	221
C150-H5	**-S17**	1,500	1,140	60	0,390	0,700	4,5	7	0,018	0,133	194
C150-H6	**-S17**	1,500	1,140	60	0,443	0,800	4,5	8	0,018	0,133	168
C150-H7	**-S17**	1,500	1,140	60	0,555	1,000	4,5	10	0,018	0,133	135
C150-H8	**-S17**	1,500	1,140	60	0,726	1,300	4,5	13	0,018	0,133	105
C150-H9	**-S17**	1,500	1,140	60	0,890	1,600	4,5	16	0,018	0,133	85
C150-H10	**-S17**	1,500	1,140	60	1,119	2,000	4,5	20	0,018	0,133	68
C175-L1	**-S17**	1,750	1,340	25	0,155	0,375	3,5	3	0,018	0,143	114
C175-L2	**-S17**	1,750	1,340	25	0,200	0,500	3,5	4	0,018	0,143	83
C175-L3	**-S17**	1,750	1,340	25	0,265	0,625	3,5	5	0,018	0,143	69
C175-L4	**-S17**	1,750	1,340	25	0,310	0,750	3,5	6	0,018	0,143	57
C175-L5	**-S17**	1,750	1,340	25	0,367	0,870	3,5	7	0,018	0,143	50
C175-L6	**-S17**	1,750	1,340	25	0,415	1,000	3,5	8	0,018	0,143	43
C175-L7	**-S17**	1,750	1,340	25	0,523	1,250	3,5	10	0,018	0,143	34
C175-L8	**-S17**	1,750	1,340	25	0,638	1,500	3,5	12	0,018	0,143	29
C175-L9	**-S17**	1,750	1,340	25	0,737	1,750	3,5	14	0,018	0,143	25
C175-L10	**-S17**	1,750	1,340	25	0,844	2,000	3,5	16	0,018	0,143	22
C175-M1	**-S17**	1,750	1,340	50	0,188	0,375	4,5	3	0,018	0,143	267
C175-M2	**-S17**	1,750	1,340	50	0,244	0,500	4,5	4	0,018	0,143	195
C175-M3	**-S17**	1,750	1,340	50	0,315	0,625	4,5	5	0,018	0,143	161
C175-M4	**-S17**	1,750	1,340	50	0,374	0,750	4,5	6	0,018	0,143	133
C175-M5	**-S17**	1,750	1,340	50	0,452	0,870	4,5	7	0,018	0,143	120
C175-M6	**-S17**	1,750	1,340	50	0,505	1,000	4,5	8	0,018	0,143	101
C175-M7	**-S17**	1,750	1,340	50	0,629	1,250	4,5	10	0,018	0,143	81
C175-M8	**-S17**	1,750	1,340	50	0,768	1,500	4,5	12	0,018	0,143	68
C175-M9	**-S17**	1,750	1,340	50	0,899	1,750	4,5	14	0,018	0,143	59
C175-M10	**-S17**	1,750	1,340	50	1,026	2,000	4,5	16	0,018	0,143	51
C175-H1	**-S17**	1,750	1,340	90	0,232	0,375	4,5	3	0,024	0,148	629
C175-H2	**-S17**	1,750	1,340	90	0,314	0,500	4,5	4	0,024	0,148	484
C175-H3	**-S17**	1,750	1,340	90	0,409	0,625	4,5	5	0,024	0,148	417
C175-H4	**-S17**	1,750	1,340	90	0,482	0,750	4,5	6	0,024	0,148	336
C175-H5	**-S17**	1,750	1,340	90	0,577	0,870	4,5	7	0,024	0,148	307
C175-H6	**-S17**	1,750	1,340	90	0,651	1,000	4,5	8	0,024	0,148	258
C175-H7	**-S17**	1,750	1,340	90	0,813	1,250	4,5	10	0,024	0,148	206
C175-H8	**-S17**	1,750	1,340	90	0,980	1,500	4,5	12	0,024	0,148	173
C175-H9	**-S17**	1,750	1,340	90	1,147	1,750	4,5	14	0,024	0,148	149
C175-H10	**-S17**	1,750	1,340	90	1,317	2,000	4,5	16	0,024	0,148	132
C200-L1	**-S17**	2,000	1,600	25	0,094	0,375	3,5	3	0,018	0,143	89
C200-L2	**-S17**	2,000	1,600	25	0,120	0,500	3,5	4	0,018	0,143	66
C200-L3	**-S17**	2,000	1,600	25	0,158	0,625	3,5	5	0,018	0,143	54
C200-L4	**-S17**	2,000	1,600	25	0,179	0,750	3,5	6	0,018	0,143	44
C200-L5	**-S17**	2,000	1,600	25	0,217	0,870	3,5	7	0,018	0,143	38
C200-L6	**-S17**	2,000	1,600	25	0,243	1,000	3,5	8	0,018	0,143	33
C200-L7	**-S17**	2,000	1,600	25	0,306	1,250	3,5	10	0,018	0,143	26
C200-L8	**-S17**	2,000	1,600	25	0,365	1,500	3,5	12	0,018	0,143	22
C200-L9	**-S17**	2,000	1,600	25	0,433	1,750	3,5	14	0,018	0,143	19
C200-L10	**-S17**	2,000	1,600	25	0,490	2,000	3,5	16	0,018	0,143	17
C200-M1	**-S17**	2,000	1,600	50	0,140	0,375	4,5	3	0,018	0,143	213

[1] Not available with shim ends.
[2] Reference dimension.
[3] Use "C" prefix for plain ends. Use "CS" prefix for squared-shim ends.
[4] Theoretical dimension.

C/CS Series

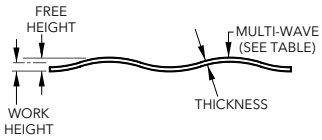
Imperial Crest-To-Crest® Springs Continued

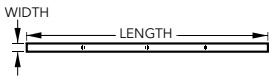
Smalley Part Number [3]		Operates in Bore Diameter (in)	Clears Shaft Diameter (in)	Load (lb)	Work Height (in)	Free Height[2] (in)	Number of Waves	Number of Turns	Thickness (in)	Radial Wall (in)	Spring Rate[4] (lb/in)
Carbon Steel	Add Suffix 17-7 SS										
C200-M2	**-S17**	2,000	1,600	50	0,184	0,500	4,5	4	0,018	0,143	158
C200-M3	**-S17**	2,000	1,600	50	0,245	0,625	4,5	5	0,018	0,143	132
C200-M4	**-S17**	2,000	1,600	50	0,278	0,750	4,5	6	0,018	0,143	106
C200-M5	**-S17**	2,000	1,600	50	0,345	0,870	4,5	7	0,018	0,143	95
C200-M6	**-S17**	2,000	1,600	50	0,395	1,000	4,5	8	0,018	0,143	83
C200-M7	**-S17**	2,000	1,600	50	0,498	1,250	4,5	10	0,018	0,143	66
C200-M8	**-S17**	2,000	1,600	50	0,593	1,500	4,5	12	0,018	0,143	55
C200-M9	**-S17**	2,000	1,600	50	0,694	1,750	4,5	14	0,018	0,143	47
C200-M10	**-S17**	2,000	1,600	50	0,800	2,000	4,5	16	0,018	0,143	42
C200-H1	**-S17**	2,000	1,600	90	0,197	0,375	4,5	3	0,024	0,148	506
C200-H2	**-S17**	2,000	1,600	90	0,258	0,500	4,5	4	0,024	0,148	372
C200-H3	**-S17**	2,000	1,600	90	0,332	0,625	4,5	5	0,024	0,148	307
C200-H4	**-S17**	2,000	1,600	90	0,389	0,750	4,5	6	0,024	0,148	249
C200-H5	**-S17**	2,000	1,600	90	0,465	0,870	4,5	7	0,024	0,148	222
C200-H6	**-S17**	2,000	1,600	90	0,525	1,000	4,5	8	0,024	0,148	189
C200-H7	**-S17**	2,000	1,600	90	0,661	1,250	4,5	10	0,024	0,148	153
C200-H8	**-S17**	2,000	1,600	90	0,781	1,500	4,5	12	0,024	0,148	125
C200-H9	**-S17**	2,000	1,600	90	0,941	1,750	4,5	14	0,024	0,148	111
C200-H10	**-S17**	2,000	1,600	90	1,069	2,000	4,5	16	0,024	0,148	97

[1] Not available with shim ends.
[2] Reference dimension.
[3] Use "C" prefix for plain ends. Use "CS" prefix for squared-shim ends.
[4] Theoretical dimension.

LS Series
Imperial Linear Springs







Product Dimensions: All dimensions in inches unless otherwise specified.

Smalley Part Number		Width (in)	Length (in)	Load (lb)	Work Height (in)	Free Height[1] (in)	Number of Waves	Thickness (in)	Spring Rate[2] (lb/in)
Carbon Steel	Add Suffix 17-7 SS								
LS12188-1	**-S17**	0,188	1,500	1,5	0,125	0,225	1	0,012	11
LS12188-2	**-S17**	0,188	3,000	5,6	0,125	0,225	2	0,012	91
LS12188-3	**-S17**	0,188	4,500	10,4	0,125	0,225	3	0,012	136
LS12188-4	**-S17**	0,188	6,000	14,8	0,125	0,225	4	0,012	182
LS12250-1	**-S17**	0,250	1,500	2,2	0,125	0,225	1	0,012	15
LS12250-2	**-S17**	0,250	3,000	7,8	0,125	0,225	2	0,012	121
LS12250-3	**-S17**	0,250	4,500	13,9	0,125	0,225	3	0,012	181
LS12250-4	**-S17**	0,250	6,000	19,8	0,125	0,225	4	0,012	242
LS12312-1	**-S17**	0,312	1,500	2,9	0,125	0,225	1	0,012	19
LS12312-2	**-S17**	0,312	3,000	10,2	0,125	0,225	2	0,012	151
LS12312-3	**-S17**	0,312	4,500	17,6	0,125	0,225	3	0,012	226
LS12312-4	**-S17**	0,312	6,000	26,0	0,125	0,225	4	0,012	302
LS12375-1	**-S17**	0,375	1,500	3,5	0,125	0,225	1	0,012	23
LS12375-2	**-S17**	0,375	3,000	11,3	0,125	0,225	2	0,012	181
LS12375-3	**-S17**	0,375	4,500	20,1	0,125	0,225	3	0,012	272
LS12375-4	**-S17**	0,375	6,000	25,2	0,125	0,225	4	0,012	362
LS20188-1	**-S17**	0,188	1,875	3,0	0,150	0,250	1	0,020	27
LS20188-2	**-S17**	0,188	3,750	11,4	0,150	0,250	2	0,020	215
LS20188-3	**-S17**	0,188	5,625	23,5	0,150	0,250	3	0,020	323
LS20188-4	**-S17**	0,188	7,500	32,5	0,150	0,250	4	0,020	431
LS20250-1	**-S17**	0,250	1,875	5,6	0,150	0,250	1	0,020	36
LS20250-2	**-S17**	0,250	3,750	17,6	0,150	0,250	2	0,020	286
LS20250-3	**-S17**	0,250	5,625	31,7	0,150	0,250	3	0,020	430
LS20250-4	**-S17**	0,250	7,500	44,9	0,150	0,250	4	0,020	573
LS20312-1	**-S17**	0,312	1,875	6,0	0,150	0,250	1	0,020	45
LS20312-2	**-S17**	0,312	3,750	20,5	0,150	0,250	2	0,020	357
LS20312-3	**-S17**	0,312	5,625	34,9	0,150	0,250	3	0,020	536
LS20312-4	**-S17**	0,312	7,500	50,8	0,150	0,250	4	0,020	715
LS20375-1	**-S17**	0,375	1,875	6,4	0,150	0,250	1	0,020	54
LS20375-2	**-S17**	0,375	3,750	23,3	0,150	0,250	2	0,020	430
LS20375-3	**-S17**	0,375	5,625	52,0	0,150	0,250	3	0,020	644
LS20375-4	**-S17**	0,375	7,500	74,5	0,150	0,250	4	0,020	859
LS25188-1	**-S17**	0,188	2,250	3,5	0,175	0,275	1	0,025	30
LS25188-2	**-S17**	0,188	4,500	15,4	0,175	0,275	2	0,025	243
LS25188-3	**-S17**	0,188	6,750	27,9	0,175	0,275	3	0,025	365
LS25188-4	**-S17**	0,188	9,000	42,5	0,175	0,275	4	0,025	487
LS25250-1	**-S17**	0,250	2,250	6,5	0,175	0,275	1	0,025	40
LS25250-2	**-S17**	0,250	4,500	21,7	0,175	0,275	2	0,025	324
LS25250-3	**-S17**	0,250	6,750	34,7	0,175	0,275	3	0,025	486
LS25250-4	**-S17**	0,250	9,000	50,5	0,175	0,275	4	0,025	647
LS25312-1	**-S17**	0,312	2,250	6,6	0,175	0,275	1	0,025	51
LS25312-2	**-S17**	0,312	4,500	24,0	0,175	0,275	2	0,025	404
LS25312-3	**-S17**	0,312	6,750	43,2	0,175	0,275	3	0,025	606
LS25312-4	**-S17**	0,312	9,000	62,0	0,175	0,275	4	0,025	808
LS25375-1	**-S17**	0,375	2,250	7,7	0,175	0,275	1	0,025	61
LS25375-2	**-S17**	0,375	4,500	29,4	0,175	0,275	2	0,025	486
LS25375-3	**-S17**	0,375	6,750	53,8	0,175	0,275	3	0,025	728
LS25375-4	**-S17**	0,375	9,000	76,9	0,175	0,275	4	0,025	971
LS38188-1	**-S17**	0,188	2,625	7,5	0,200	0,300	1	0,038	67
LS38188-2	**-S17**	0,188	5,250	25,0	0,200	0,300	2	0,038	538
LS38188-3	**-S17**	0,188	7,875	58,5	0,200	0,300	3	0,038	808
LS38188-4	**-S17**	0,188	10,500	90,0	0,200	0,300	4	0,038	1077
LS38250-1	**-S17**	0,250	2,625	11,9	0,200	0,300	1	0,038	89
LS38250-2	**-S17**	0,250	5,250	45,7	0,200	0,300	2	0,038	716
LS38250-3	**-S17**	0,250	7,875	74,3	0,200	0,300	3	0,038	1074
LS38250-4	**-S17**	0,250	10,500	111,5	0,200	0,300	4	0,038	1432

[1] Reference dimension.
[2] Theoretical dimension.

LS Series

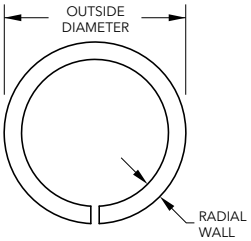
Imperial Linear Springs Continued

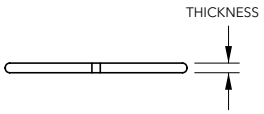
Smalley Part Number		Width (in)	Length (in)	Load (lb)	Work Height (in)	Free Height[1] (in)	Number of Waves	Thickness (in)	Spring Rate[2] (lb/in)
Carbon Steel	Add Suffix 17-7 SS								
LS38312-1	**-S17**	0,312	2,625	9,9	0,200	0,300	1	0,038	112
LS38312-2	**-S17**	0,312	5,250	49,3	0,200	0,300	2	0,038	893
LS38312-3	**-S17**	0,312	7,875	92,8	0,200	0,300	3	0,038	1340
LS38312-4	**-S17**	0,312	10,500	131,0	0,200	0,300	4	0,038	1787
LS38375-1	**-S17**	0,375	2,625	16,9	0,200	0,300	1	0,038	134
LS38375-2	**-S17**	0,375	5,250	61,7	0,200	0,300	2	0,038	1074
LS38375-3	**-S17**	0,375	7,875	105,0	0,200	0,300	3	0,038	1611
LS38375-4	**-S17**	0,375	10,500	153,0	0,200	0,300	4	0,038	2148
LS45188-1	**-S17**	0,188	3,000	9,3	0,225	0,325	1	0,045	75
LS45188-2	**-S17**	0,188	6,000	36,0	0,225	0,325	2	0,045	599
LS45188-3	**-S17**	0,188	9,000	65,0	0,225	0,325	3	0,045	898
LS45188-4	**-S17**	0,188	12,000	89,0	0,225	0,325	4	0,045	1198
LS45250-1	**-S17**	0,250	3,000	12,5	0,225	0,325	1	0,045	100
LS45250-2	**-S17**	0,250	6,000	42,5	0,225	0,325	2	0,045	797
LS45250-3	**-S17**	0,250	9,000	83,0	0,225	0,325	3	0,045	1195
LS45250-4	**-S17**	0,250	12,000	120,5	0,225	0,325	4	0,045	1593
LS45312-1	**-S17**	0,312	3,000	14,7	0,225	0,325	1	0,045	124
LS45312-2	**-S17**	0,312	6,000	60,3	0,225	0,325	2	0,045	994
LS45312-3	**-S17**	0,312	9,000	108,9	0,225	0,325	3	0,045	1491
LS45312-4	**-S17**	0,312	12,000	160,7	0,225	0,325	4	0,045	1988
LS45375-1	**-S17**	0,375	3,000	20,4	0,225	0,325	1	0,045	149
LS45375-2	**-S17**	0,375	6,000	73,1	0,225	0,325	2	0,045	1195
LS45375-3	**-S17**	0,375	9,000	133,5	0,225	0,325	3	0,045	1792
LS45375-4	**-S17**	0,375	12,000	190,0	0,225	0,325	4	0,045	2390
LS62188-1	**-S17**	0,188	3,375	14,3	0,250	0,350	1	0,062	138
LS62188-2	**-S17**	0,188	6,750	67,5	0,250	0,350	2	0,062	1100
LS62188-3	**-S17**	0,188	10,125	105,5	0,250	0,350	3	0,062	1650
LS62188-4	**-S17**	0,188	13,500	159,5	0,250	0,350	4	0,062	2200
LS62250-1	**-S17**	0,250	3,375	22,5	0,250	0,350	1	0,062	183
LS62250-2	**-S17**	0,250	6,750	104,0	0,250	0,350	2	0,062	463
LS62250-3	**-S17**	0,250	10,125	161,0	0,250	0,350	3	0,062	2195
LS62250-4	**-S17**	0,250	13,500	234,0	0,250	0,350	4	0,062	2926
LS62312-1	**-S17**	0,312	3,375	27,8	0,250	0,350	1	0,062	228
LS62312-2	**-S17**	0,312	6,750	104,0	0,250	0,350	2	0,062	1826
LS62312-3	**-S17**	0,312	10,125	174,5	0,250	0,350	3	0,062	2739
LS62312-4	**-S17**	0,312	13,500	262,5	0,250	0,350	4	0,062	3652
LS62375-1	**-S17**	0,375	3,375	42,0	0,250	0,350	1	0,062	274
LS62375-2	**-S17**	0,375	6,750	139,5	0,250	0,350	2	0,062	2195
LS62375-3	**-S17**	0,375	10,125	240,0	0,250	0,350	3	0,062	3292
LS62375-4	**-S17**	0,375	13,500	333,6	0,250	0,350	4	0,062	4389

[1] Reference dimension.
[2] Theoretical dimension.

SSRS Series
Imperial Circular-Grain® Shims







Product Dimensions: All dimensions in inches unless otherwise specified.

Smalley Part Number		Outside Diameter (in)		Thickness (in)	Radial Wall (in)	Part Weight[1] (lb)
Carbon Steel	Add Suffix 17-7 SS					
SSRS-0075	**-S17**	0,750	+0,000/-0,015	0,024	0,093	1,31
SSRS-0087	**-S17**	0,875		0,024	0,093	1,55
SSRS-0100	**-S17**	1,000		0,024	0,103	1,97
SSRS-0112	**-S17**	1,125		0,024	0,138	2,91
SSRS-0125	**-S17**	1,250		0,024	0,138	3,28
SSRS-0137	**-S17**	1,375		0,024	0,138	3,65
SSRS-0150	**-S17**	1,500		0,024	0,150	4,33
SSRS-0162	**-S17**	1,625	+0,000/-0,020	0,024	0,150	4,73
SSRS-0175	**-S17**	1,750		0,024	0,150	5,13
SSRS-0187	**-S17**	1,875		0,024	0,150	5,53
SSRS-0200	**-S17**	2,000		0,024	0,150	5,93
SSRS-0212	**-S17**	2,125		0,024	0,150	6,33
SSRS-0225	**-S17**	2,250	+0,000/-0,025	0,024	0,150	6,73
SSRS-0237	**-S17**	2,375		0,024	0,178	8,35
SSRS-0250	**-S17**	2,500		0,024	0,178	8,83
SSRS-0262	**-S17**	2,625		0,024	0,178	9,30
SSRS-0275	**-S17**	2,750		0,030	0,188	12,86
SSRS-0287	**-S17**	2,875		0,030	0,188	13,49
SSRS-0300	**-S17**	3,000		0,030	0,188	14,12
SSRS-0312	**-S17**	3,125		0,030	0,188	14,74
SSRS-0325	**-S17**	3,250	+0,000/-0,030	0,030	0,233	18,77
SSRS-0337	**-S17**	3,375		0,030	0,233	19,55
SSRS-0350	**-S17**	3,500		0,030	0,233	20,32
SSRS-0362	**-S17**	3,625		0,030	0,233	21,10
SSRS-0375	**-S17**	3,750		0,030	0,233	21,88
SSRS-0387	**-S17**	3,875		0,030	0,233	22,66
SSRS-0400	**-S17**	4,000		0,030	0,233	23,44
SSRS-0412	**-S17**	4,125		0,030	0,233	24,21
SSRS-0425	**-S17**	4,250		0,030	0,233	24,99
SSRS-0437	**-S17**	4,375	+0,000/-0,035	0,030	0,233	25,77
SSRS-0450	**-S17**	4,500		0,030	0,233	26,55
SSRS-0462	**-S17**	4,625		0,030	0,233	27,32
SSRS-0475	**-S17**	4,750		0,030	0,233	28,10
SSRS-0487	**-S17**	4,875		0,030	0,233	28,88
SSRS-0500	**-S17**	5,000		0,030	0,233	29,66
SSRS-0512	**-S17**	5,125		0,030	0,233	30,43
SSRS-0525	**-S17**	5,250		0,030	0,233	31,21
SSRS-0537	**-S17**	5,375		0,030	0,233	31,99
SSRS-0550	**-S17**	5,500	+0,000/-0,045	0,030	0,233	32,77
SSRS-0562	**-S17**	5,625		0,030	0,233	33,54
SSRS-0575	**-S17**	5,750		0,030	0,233	34,32
SSRS-0587	**-S17**	5,875		0,030	0,233	35,10
SSRS-0600	**-S17**	6,000		0,030	0,233	35,88
SSRS-0612	**-S17**	6,125		0,030	0,233	36,66
SSRS-0625	**-S17**	6,250		0,030	0,233	37,43
SSRS-0637	**-S17**	6,375		0,030	0,233	38,21
SSRS-0650	**-S17**	6,500		0,030	0,233	38,99
SSRS-0675	**-S17**	6,750		0,030	0,233	40,54
SSRS-0700	**-S17**	7,000		0,032	0,375	70,76
SSRS-0725	**-S17**	7,250		0,032	0,375	73,43

[1] Lb per 1000.

SSRS Series

Imperial Circular-Grain® Shims Continued

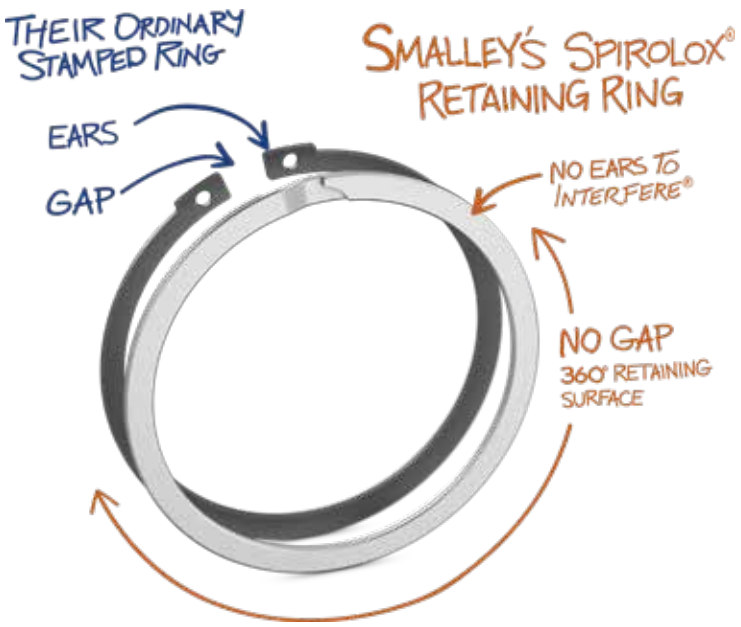
Smalley Part Number		Outside Diameter (in)		Thickness (in)	Radial Wall (in)	Part Weight[1] (lb)
Carbon Steel	Add Suffix 17-7 SS					
SSRS-0750	**-S17**	7,500	+0,000/-0,060	0,032	0,375	76,10
SSRS-0775	**-S17**	7,750		0,032	0,375	78,77
SSRS-0800	**-S17**	8,000		0,032	0,375	81,44
SSRS-0825	**-S17**	8,250		0,032	0,375	84,11
SSRS-0850	**-S17**	8,500		0,032	0,375	86,78
SSRS-0875	**-S17**	8,750		0,032	0,375	89,45
SSRS-0900	**-S17**	9,000		0,032	0,375	92,12
SSRS-0950	**-S17**	9,500		0,032	0,375	97,46
SSRS-1000	**-S17**	10,000	+0,000/-0,070	0,032	0,375	102,80
SSRS-1050	**-S17**	10,500		0,032	0,375	108,14
SSRS-1100	**-S17**	11,000		0,032	0,375	113,48
SSRS-1150	**-S17**	11,500		0,032	0,375	118,82
SSRS-1200	**-S17**	12,000	+0,000/-0,080	0,032	0,375	124,16
SSRS-1250	**-S17**	12,500		0,032	0,375	129,50
SSRS-1300	**-S17**	13,000		0,032	0,375	134,84
SSRS-1350	**-S17**	13,500		0,032	0,375	140,18
SSRS-1400	**-S17**	14,000		0,032	0,375	145,52
SSRS-1450	**-S17**	14,500	+0,000/-0,090	0,032	0,375	150,86
SSRS-1500	**-S17**	15,000		0,032	0,375	156,20
SSRS-1550	**-S17**	15,500		0,032	0,375	161,54
SSRS-1600	**-S17**	16,000		0,032	0,375	166,88

[1] Lb per 1000.

Retaining Ring Introduction

No Ordinary Ring®

Smalley stocks thousands of standard retaining rings to meet your applications requirements in carbon steel, 302 and 316 stainless steel. Our retaining rings are manufactured using our edgewinding process, also known as coiling on edge. This puts Smalley's rings at an advantage for many reasons, including No Ears to Interfere® to produce undesired interference with components and ease of installation and removal.



Standard Smalley Retaining Rings include:

- Spirolox®
- Constant Section
- WaveRing®
- Hoopster®

Custom Retaining Rings

If one of our standard retaining rings does not fit your exact needs, Smalley Engineers are happy to assist you in designing one that does. Because all of our products are edgewound (coiled, not stamped), there is no new tooling required for custom configurations. This means that we can produce prototypes quickly and economically for high or low volume orders, and easily make adjustments to designs throughout the No-Tooling-Charges™ production process.

Customizable features include:

- Coil direction
- Crimp
- Deburring
- Diameter (4 to 3000 mm; 0,157 to 120")
- Dished
- End configurations
- Finishes, platings, coatings
- Laser-etching/marking
- Material
- Number of turns
- Packaging/labeling
- Pitch
- Quality Assurance certifications
- Radial wall
- Round/square edge
- Tolerance
- Wire size
- Work height (for WaveRing)

You can find more information about these terms in the glossary on page 151.

Retaining Ring Types

Spirolox®

Standard Spirolox Retaining Rings are available in single-turn, two-turn, and three-turn configurations. They are easier to install and remove than traditional stamped rings as they can be wound in and out of grooves with no special tools. This leads to safer installation because there is no risk of a ring flying off a set of pliers. Multiple-turn Spirolox rings provide a secure 360° retaining surface.

There are many Spirolox ring series, ranging from light duty to heavy duty.

Series	Page	Material	Diameter	Internal or External
VHM – light duty	63	Carbon Steel, 302 or 316 SS	6 – 300 mm	Internal
VH – light duty	65	Carbon Steel, 302 or 316 SS	0,25 – 10"	Internal
VSM – light duty	91	Carbon Steel, 302 or 316 SS	6 – 300 mm	External
VS – light duty	93	Carbon Steel, 302 or 316 SS	0,25 – 10"	External
EH – aerospace	67	Carbon Steel, 302 or 316 SS	6 – 280 mm	Internal
ES – aerospace	95	Carbon Steel, 302 or 316 SS	6 – 280 mm	External
DNH – DIN interchange	69	Carbon Steel, 302 or 316 SS	13 – 400 mm	Internal
DNS – DIN interchange	97	Carbon Steel, 302 or 316 SS	13 – 400 mm	External
WH – medium duty	71	Carbon Steel, 302 or 316 SS	0,5 – 11"	Internal
WS – medium duty	99	Carbon Steel, 302 or 316 SS	0,5 – 11"	External
WHT – medium/heavy duty	75	Carbon Steel, 302 or 316 SS	0,5 – 11"	Internal
WST – medium/heavy duty	103	Carbon Steel, 302 or 316 SS	0,469 – 10"	External
WHM – heavy duty	77	Carbon Steel, 302 or 316 SS	0,25 – 15"	Internal
WSM – heavy duty	105	Carbon Steel, 302 or 316 SS	0,25 – 15"	External



Retaining Ring Types

Constant Section

Smalley's Constant Section Retaining Rings are single-turn, square edge rings that have a gap. They are available with a removal provision dependent on internal or external usage. Many of our constant section rings are groove interchangeable with Eaton rings. These retaining rings are heavy duty rings capable of withstanding very high forces and thrust loads.

Series	Page	Material	Diameter	Internal or External
FH	83	Carbon Steel or 302 SS	13 – 300 mm	Internal
FS	111	Carbon Steel or 302 SS	13 – 300 mm	External
FHE	85	Carbon Steel or 302 SS	0,5 – 11"	Internal
FSE	113	Carbon Steel or 302 SS	0,5 – 11"	External
XAH	87	Carbon Steel or 302 SS	0,375 – 10"	Internal
XAS	115	Carbon Steel or 302 SS	0,312 – 10"	External
XDH	89	Carbon Steel or 302 SS	1,125 – 8"	Internal
XDS	117	Carbon Steel or 302 SS	0,5 – 8"	External



WaveRing®

WaveRings are two-turn Spirolox® Retaining Rings with an axial wave form. These rings function similarly to a traditional retaining ring (providing a removable shoulder), but when installed offer a spring force that applies pressure against both the groove wall and the assembly components. This spring force compensates for tolerance stack-up or play.

Series	Page	Material	Diameter	Internal or External
WHW	74	Carbon Steel or 17-7 PH SS	0,75 - 5"	Internal
WSW	102	Carbon Steel or 17-7 PH SS	0,75 - 5"	External



Retaining Ring Types

Hoopster®

Hoopster Retaining Rings are single-turn, square edge rings. They are specified for applications that have shallow groove depths due to tight space constraints. These rings have a minimal radial projection and provide a removable shoulder in assemblies with thin walls, such as cylinders. Hoopsters are suitable for light-to-medium loads and have optional removal provisions.

Series	Page	Material	Diameter	Internal or External
HHM*/HHMU	79	Carbon Steel or 302 SS	10 - 76 mm	Internal
HH*/HHU	81	Carbon Steel or 302 SS	0,375 - 3"	Internal
HSM	107	Carbon Steel or 302 SS	10 - 76 mm	External
HS	109	Carbon Steel or 302 SS	0,375 - 3"	External

* With removal provision



Popular Custom Rings

In addition to customizing our stock ring types by changing diameter, turns, materials, or other characteristics, Smalley Engineers can help design the following alternative ring types:

Self-Locking

Smalley's Self-Locking Retaining Rings are multiple-turn rings that have a small tab on either the inside, outside, or middle of the radial wall, along with an aligned slot on the next turn for the tab to "lock" into. These locks allow a retaining ring to function properly at speeds which normally exceed the recommended rotational capacity of a standard retaining ring. They are ideal for applications that operate at very high RPM, like in transmissions or clutch assemblies.



Balanced

Balanced Retaining Rings are retaining rings with cut-out notches opposite the gap end to centralize the rings' center of gravity. The size, placement, and number of notches are dependent on the weight distribution required and on the amount of material absent in the gap. Balanced rings are ideal in applications where weight distribution is critical and it is necessary to reduce eccentric loading. They are used often in the aerospace industry.



Retaining Ring Selection Guide

STEP 1: Do you need to meet any specifications?

Yes: See table below. **No:** Move to step 2.

Specification	Smalley Series	Page
Military MIL- DTL-27426/3	WH	71
Military MIL- DTL-27426/1	WS	99
Military MIL- DTL-27426/4	WHM	77
Military MIL- DTL-27426/2	WSM	105
Aerospace AS4299, AS3217, AS3219	WH	71
Aerospace AS4299, AS3218, AS3219	WS	99
Aerospace AS4299, AS3215, AS3219	WHM	77
Aerospace AS4299, AS3216, AS3219	WSM	105
Metric Aerospace MA 4017	EH	67
Metric Aerospace MA 4016	ES	95

** If you need a part to include added inspections or other quality requirements, please contact one of our engineers.*

STEP 2: Do you need an interchangeable ring based on a groove?

Yes: See table below. **No:** Move to step 3.

Manufacturer	Smalley Series	Page
Truarc N5000 & 5008	WHM	77
Truarc 5100 & 5108	WSM	105
Eaton NAN	WHT	75
Eaton XAN	WST	103
Eaton I-N	WHM	77
Eaton E-N	WSM	105
Industrial RR 3000 & 4000	WHM	77
Industrial RR 3100 & 4100	WSM	105
Anderton N1300	WHM	77
Anderton N1400	WSM	105
Anderton D1300	DNH	69
Anderton D1400	DNS	97
European Specification DIN 472	DNH	69
European Specification DIN 471	DNS	97

STEP 3: Choose by the thrust capacity needed OR see step 4.

Standard Units (inches)

Series	Load[1]	Housing	Page	Shaft	Page
Light Duty	4100	VH	65	VS	93
Medium Duty	4950	WH	71	WS	99
Medium/Heavy Duty	7070	WHT	75	WST	103
Heavy Duty	8340	WHM	77	WSM	105
Constant Section Rings	8341	FHE	85	FSE	113
WaveRing	–	WHW	74	WSW	102

[1] Representative examples shows the load capacity (lb.) for a 2" ring.

Metric Units (mm)

Series	Load[1]	Housing	Page	Shaft	Page
Light Duty	18,03	VHM	63	VSM	91
DIN Series [2]	36,55	DNH	69	DNS	97
Aerospace Series	38,96	EH	67	ES	95
Constant Section Rings	36,53	FH	83	FS	111

[1] Representative examples shows the load capacity (kN) for a 50 mm ring.
[2] Manufactured to DIN groove specifications.

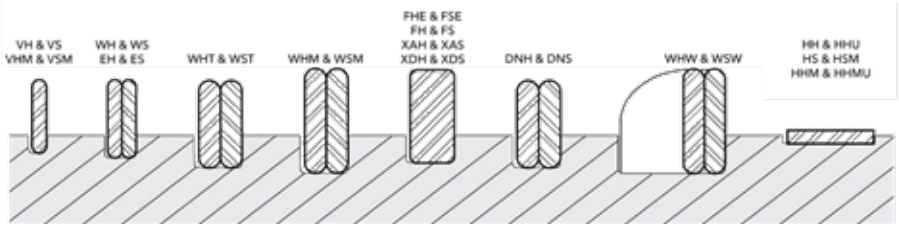
STEP 4: Still not sure?

Call our Engineering team at +1 847.719.5900.

Retaining Ring Selection Guide

Relative proportions of rings in grooves

A cross-section of each Spirolox Retaining Ring configuration is illustrated below, comparing groove and ring sections in the same diameter bore or shaft. The heavier retaining ring cross-sections are in deeper and wider grooves, to provide significantly greater thrust capacity.



Interchange Listing

Smalley retaining rings are interchangeable with both imperial and metric retaining ring grooves. Smalley offers free samples of all stock retaining rings to test in your application. Cross reference a standard stamped or snap ring to find the appropriate Smalley retaining ring to fit your application.

SMALLEY®	SPIROLOX® SERIES	MILITARY MIL-DTL-27426	AEROSPACE AS3219	METRIC AEROSPACE MA 4035	EUROPEAN SPECIFICATION DIN	WALDES TRUARC	EATON	INDUSTRIAL RETAINING RING	OTHER RINGS	ANDERTON
VH	UR	---	---	---	**Groove Interchange Only** Use a Smalley Retaining Ring to fit into the same groove of these stamped Retaining Rings (circlips).					
VS	US	---	---	---						
WH	RR	/3	AS4299 AS3217	---						
WS	RS	/1	AS4299 AS3218	---						
WHT	RRT	---	---	---	---	---	NAN	---	UHB	---
WST	RST	---	---	---	---	---	XAN	---	USC	---
WHM	RRN	/4	AS4299 AS3215	---	---	N5000 5008	IN	3000 4000	HO HOI UHO	N1300
WSM	RSN	/2	AS4299 AS3216	---	---	5100 5108	EN	3100 4100	SH SHI USH	N1400
DNH	---	---	---	---	DIN 472	---	---	---	DHO	D1300
DNS	---	---	---	---	DIN 471	---	---	---	DSH	D1400
EH	---	---	---	MA 4017	---	---	---	---	---	---
ES	---	---	---	MA 4016	---	---	---	---	---	---
FH	---	---	---	---	DIN 472	---	---	---	DHO	D1300
FS	---	---	---	---	DIN 471	---	---	---	DSH	D1400
XAH	---	---	---	---	---	---	NAN	---	UHB	---
XAS	---	---	---	---	---	---	XAN	---	USC	---
XDH	---	---	---	---	---	---	ND	---	HN	---
XDS	---	---	---	---	---	---	XD	---	SNL	---
XNH	---	---	---	---	---	---	IN	---	UHO	---
XNS	---	---	---	---	---	---	EN	---	USH	---

Retaining Ring Applications

Spirolox® Single-Turn



Hose Fitting

The single-turn ring was made to fit in the shallow groove and keep the cap on the fitting.



Air Vent

A light-duty, single-turn ring fits tightly into the groove of the plastic air vent housing. It has a very small gap to provide nearly 360° support.



Hip Replacement

This titanium ring secures the shell and liner together to form the socket of the new hip.

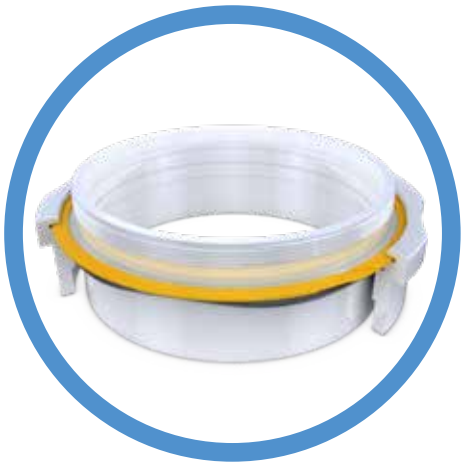


Ratchet Wrench

This one and a half-turn external ring retains the internal mechanical components of the wrench, with the extra half-turn giving the strength to retain if dropped.

Retaining Ring Applications

Spirolox® Two-Turn



Electrical Coupler

A wave spring is coupled with a retaining ring to allow the components to rotate independently.



Rubber Boot

The retaining ring clamps the rubber boot onto the groove, making a nearly perfect seal when the boot fills with grease.

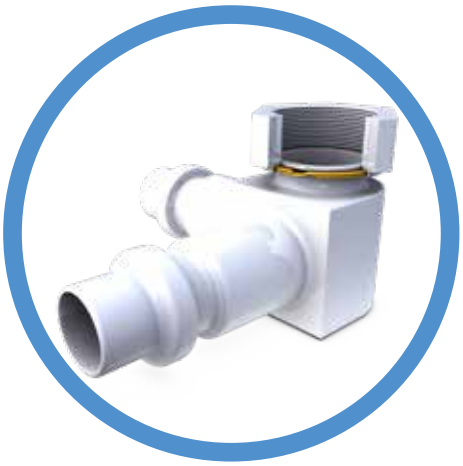


Bolt Replacement

Instead of utilizing multiple bolts, a two-turn ring is installed to retain the two components of the gear assembly together, allowing for simple assembly and leading to weight savings.

Retaining Ring Applications

Spirolox® Two-Turn



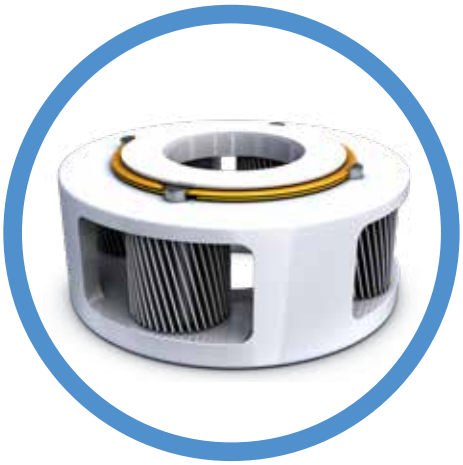
Pneumatic Fitting

This ring creates an ID/OD lock (see more on page 58) permitting 360° rotation of the nut while staying in place on the shaft.



Bike Lock

A tamper-proof ring with reverse removal notches and a heavy cross-section holds the lock within the assembly.



Gear Assembly

A ring is wound into the groove and extends outward radially, clearing the four flat pinion shaft pins and preventing the pins from spinning when the gears rotate.



Pulley

Retaining rings provide 360° side walls, eliminating the need for pressed-on stamped side walls.

Retaining Ring Applications

Spirolox® Two-Turn

Belt Pulley

Three hold-down screws are used with this ring to form a bi-directional shoulder. The ring rests on the pulley securing the inserted shaft in one direction, with the screws clamping the ring to prevent movement in the other direction.





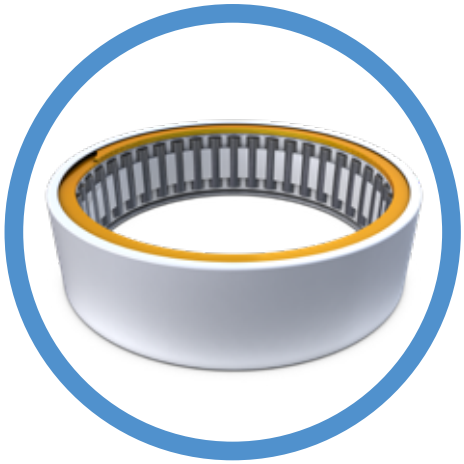
Slip Clutch

The retaining ring provides a surface for the wave spring to be mounted against, allowing the two main components to rotate independently, developing the slip mechanism.

Axial Piston Pump

The bearing and spindle are held in the housing by the ring. The removal notch allows for easy installation and removal for modifications or repairs.





Needle Bearing

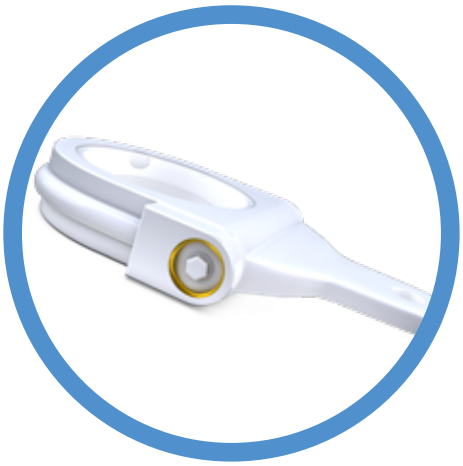
The ring secures the bearing cage assembly within the housing, replacing the formerly unreliable operation of roll-forming the housing.

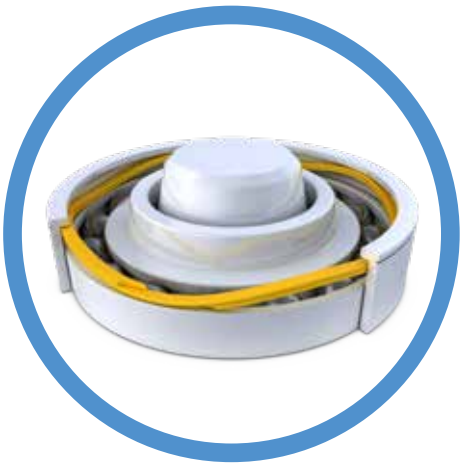
Retaining Ring Applications

WaveRing®

Gear Bracket

The worm gear shaft is preloaded and held in place by a two-turn WaveRing, which fits in an internal groove and allows the gear/shaft to float axially as the gear rotates.



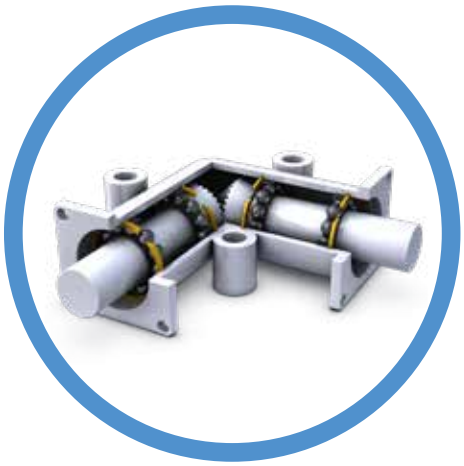


Bearing Preload

This WaveRing keeps the assembly together and also preloads the bearing cage, eliminating vibration caused by high radial speeds.

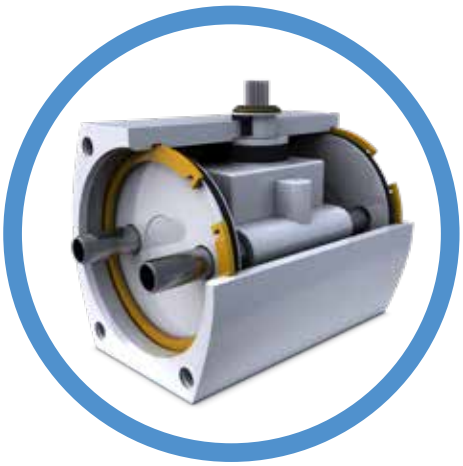
Retaining Ring Applications

Constant Section



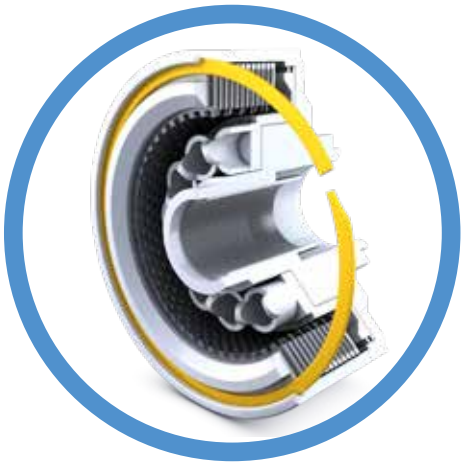
Right Angle Drive

Multiple retaining rings secure the assembly by providing removable shoulders in the bore, simplifying the design of the gear box and replacing flanged end plates.



Valve Actuator

A heavy duty ring with removal notches absorbs the occasional shock loading of the pistons.



Pneumatic Clutch

Internal clutch components are held in the housing by a heavy duty ring. The removal notch allows for quick removal for frequent field repairs.



Pressure Gauge

In this assembly, the ring exerts a light pressure on the glass lens, providing optimum load at all points along the circumference without breaking the glass.

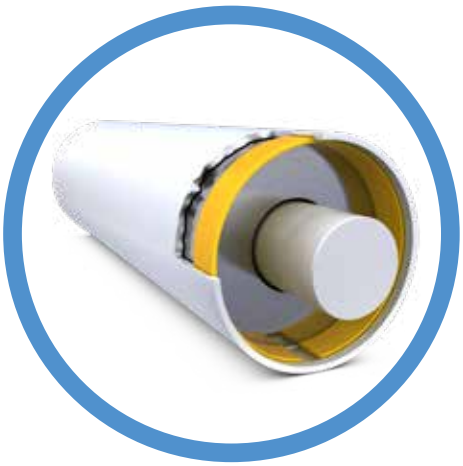
Retaining Ring Applications

Hoopster®



Pin Retainer

The Hoopster is retaining the pin, not the component, in a very shallow groove that a traditional retaining ring would not fit in.



Cylinder Housing

The cylinder is very thin walled, but the Hoopster still allows for forces to be applied even though there is a shallow groove.

Custom



Conduit Connector

A dished retaining ring was custom designed with sharp edges, and when the nut is screwed in, clamping force is achieved, holding the conduit in place.

Retaining Ring Application Spotlight
ID/OD Lock

What is an ID/OD Lock?

An ID/OD lock is when a retaining ring is used to hold two mating components together in an assembly. There is a groove in both components that traps the ring, locking the ring on both the ID and OD (hence, the term ID/OD lock). The ring cannot be removed, and the two components cannot be disassembled without damaging the assembly.

Typically, the groove diameter in the housing is oversized to accommodate the ring diameter as it expands over the shaft. The ring is installed loosely into the housing groove, then the housing is pushed onto the mating component (shaft). The ring ID expands to the shaft diameter, then snaps into the shaft groove. The ring will then cling tightly to the shaft groove. The oversized groove in the housing allows the two components to rotate relative to each other, while the ring keeps both components locked together. The ring is hidden from view, keeping two pieces connected in an easy and inexpensive manner that is aesthetically pleasing.



Retaining Ring Assembly Methods

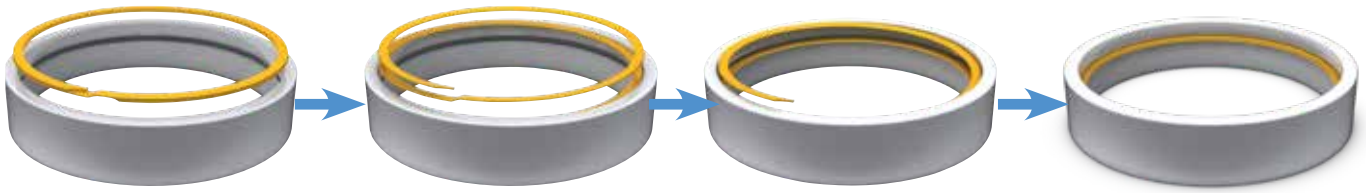
Installation Methods

Smalley's Spirolox Retaining Rings require no special tools to install or remove. For large volumes or assemblies with tight space constraints, there are a number of installation methods to consider.

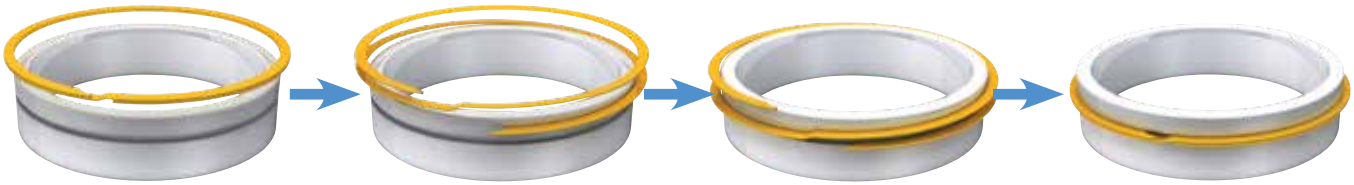
Manual Installation

Separate the end of the ring and insert into the groove. Wind the ring into the groove by pressing down around the circumference until the entire ring is inside of the groove. This operation is the same for internal or external installation. Watch how at smalley.com/videos.

Internal:



External:

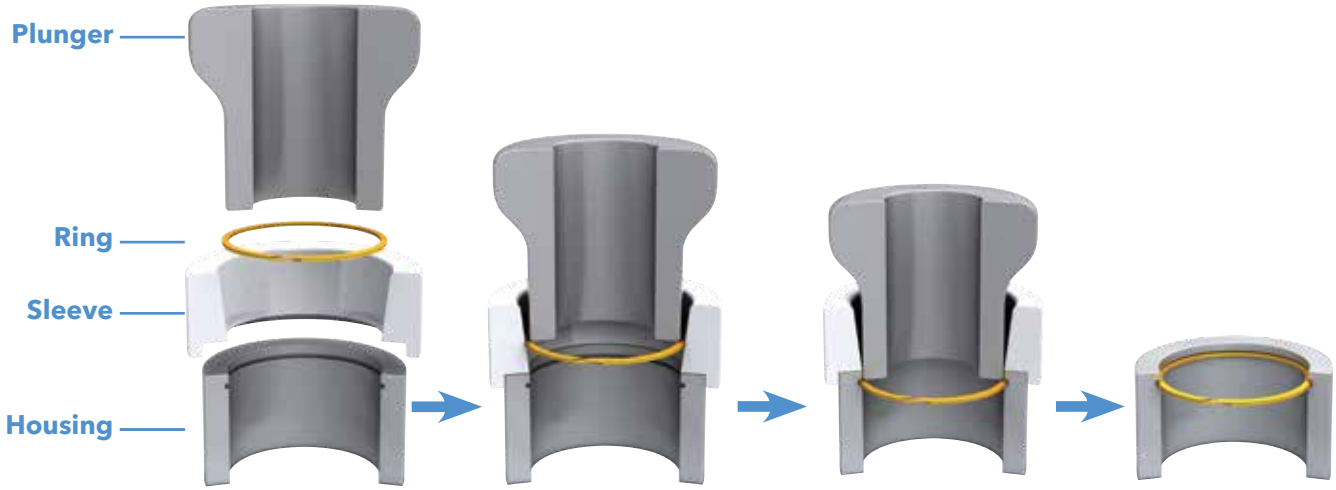


Semi-Automated and Automated Installation

For higher speed or large quantity assemblies, simple tooling can be used to aid in installation.

For internal installation, a tapered sleeve angled at 5° contacts the ring and acts as a plunger, pushing the retaining ring into the groove. Hardened work surfaces work best for this type of tooling to prevent wear. Watch how at smalley.com/videos.

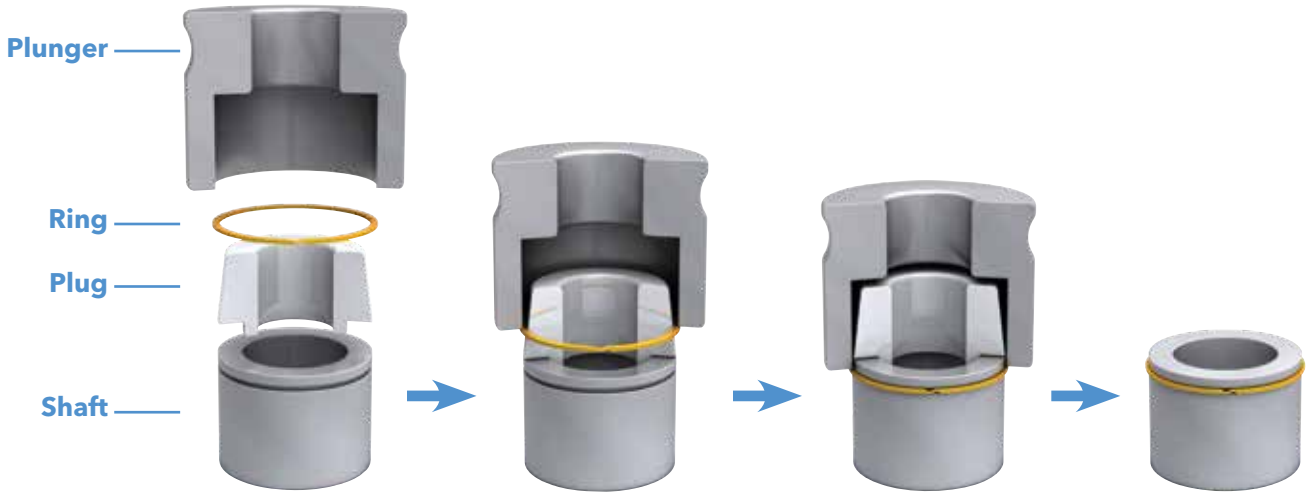
Internal:



Retaining Ring Assembly Methods

For external installation, a tapered plug is centered over the shaft, and the ring is placed over the plug. A loose-fitting plug is centered at the recommended 5° angle over the shaft and the plunger pushes the ring down over the plug and into the groove. An arbor press or air cylinder is commonly used to automate this process. Watch how at smalley.com/videos.

External:



Removal Methods

Our standard rings are manufactured with removal notches so they are easily extracted from a groove with simple tools such as a flat head screwdriver or a dental pick.

The notch on the end of the ring creates a small gap between the groove and the ring, so that the screwdriver or pick can be inserted behind it to pry the visible end out of the groove. Then simply manually wind the ring out of the groove. This method is the same for internal and external removal.







Removal Tooling

Smalley offers a Retaining Ring Removal Tool, part number RT-108, which fits between the individual layers of a Spirolox Retaining Ring. The end of the tool is slotted, fitting over the notch so that it can be pried from the groove and wound out. This tool is available with a variety of different end options.

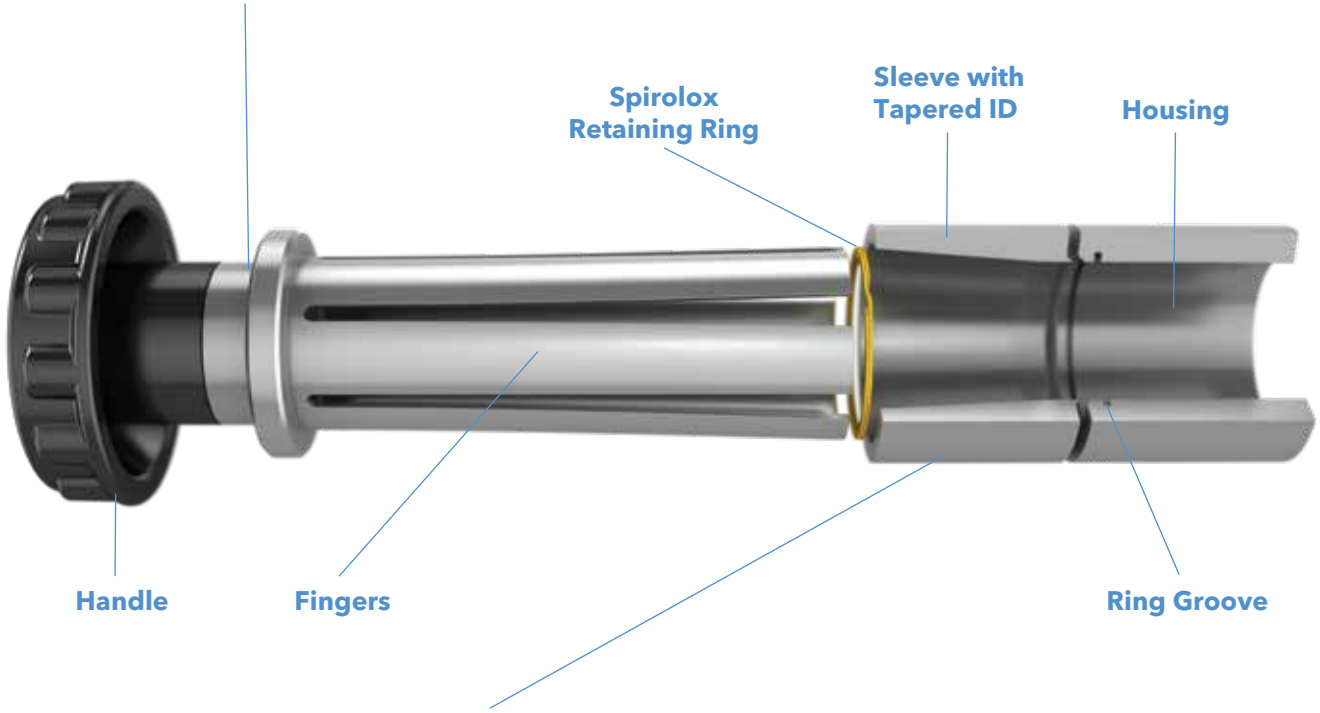
Assembly Tooling
Optional Tooling for High Volumes

Installation of an Internal Spirolox® Retaining Ring

The internal assembly tool consists of a flexible plunger that pushes a retaining ring through a tapered sleeve and into a housing groove. Each assembly tool is designed to install a specific size ring. Tool sizing is available in incremental sizes for rings up to 49 mm, or 2" in diameter.

Internal Retaining Ring Tooling

Plunger
Spring Fingers fit into and hug the tapered ID of the sleeve to remain in contact with the ring as it advances through the taper during installation. The fingers are designed with stiffness for durability, yet are sufficiently flexible for ease of assembly.



Sleeve
Made from hardened steel, the inside diameter is tapered at 5° to facilitate installation by gradually contracting the ring's diameter down to the housing diameter. Installation will be successful as long as the sleeve stays concentric to the housing. To accomplish this orientation, a chamfer exists on the face of the sleeve, designed to locate on the chamfer of the mating housing. The face surface of the sleeve provides a small thin-wall flange, which accomplishes the concentric location of the sleeve to the housing.

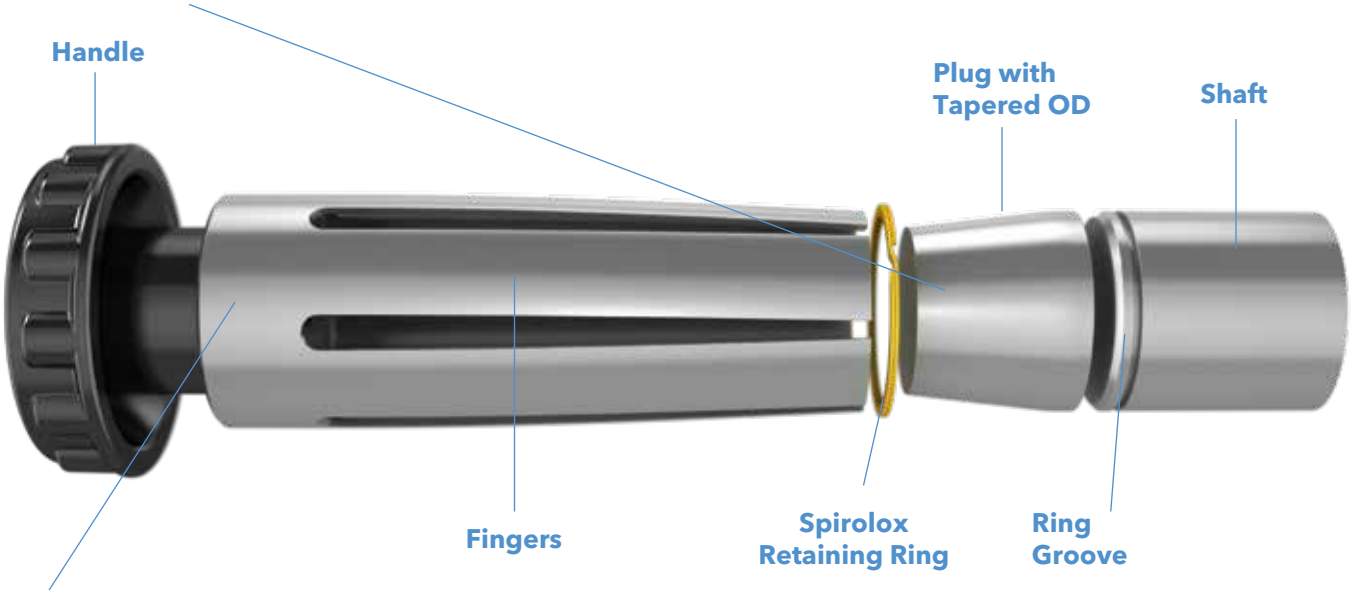
Assembly Tooling
Optional Tooling for High Volumes

Installation of an External Spirolox® Retaining Ring

The external assembly tool consists of a flexible plunger that pushes a retaining over a plug and into a shaft groove. Each assembly tool is designed to install a specific size ring. Tool sizing is available in incremental sizes for rings up to 49 mm, or 2" in diameter.

External Retaining Ring Tooling

Plug
Made from hardened steel, the outside diameter is tapered at 5° to facilitate installation by gradually increasing the ring's diameter up to the shaft diameter. Installation will be successful as long as the plug stays concentric to the shaft. To accomplish this orientation, a chamfer exists on the face of the plug, designed to locate on the chamfer of the mating shaft. The face surface of the plug provides a small thin wall flange, which accomplishes the concentric location of the plug to the shaft.



Plunger
Spring Fingers fit onto and hug the tapered OD of the plug to remain in contact with the ring as it advances over the taper during installation. The fingers are designed with stiffness for durability, yet are sufficiently flexible for ease of assembly.

Custom Engineering and Design Assistance

In addition to our standard installation tooling, Smalley engineers can develop custom tooling for your Smalley custom ring to assist with your manual or semi-automated assembly.



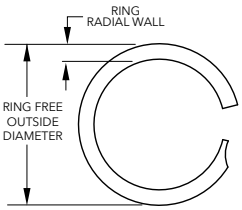


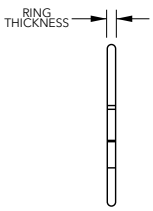


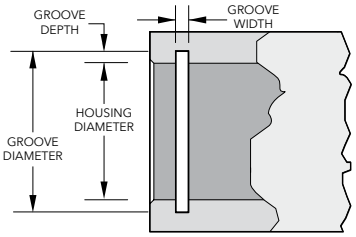
VHM Series

Spirolox® Light Duty Rings Internal









Product Dimensions: All dimensions in millimeters unless otherwise specified.

Smalley Part Number			Housing Diameter		Ring			Groove		Thrust Capacity	
Carbon Steel	Add Suffix				Outside Diameter (mm)	Radial Wall (mm)	Thickness (mm)	Diameter (mm)	Width (mm)	Groove Yield[1] (N)	Ring Shear[2] (N)
	302 SS	316 SS	mm	in							
VHM-6[3,4]	**-S02**	**-S16**	6,00	0,236	6,35 +0,25/-0,00	0,51	0,30	6,30	0,38	439	1988
VHM-7[3,4]	**-S02**	**-S16**	7,00	0,276	7,38	0,51	0,30	7,32	0,38	546	2320
VHM-8[3,4]	**-S02**	**-S16**	8,00	0,315	8,44	0,64	0,38	8,36	0,46	702	3183
VHM-9[3,4]	**-S02**	**-S16**	9,00	0,354	9,54	0,76	0,38	9,46	0,46	1003	3580
VHM-10[3,4]	**-S02**	**-S16**	10,00	0,394	10,58	0,76	0,38	10,50	0,46	1238	3978
VHM-11[3,4]	**-S02**	**-S16**	11,00	0,433	11,68	0,89	0,38	11,60	0,46	1634	4388
VHM-12[4]	**-S02**	**-S16**	12,00	0,472	12,74 +0,30/-0,00	0,89	0,38	12,66 ±0,05	0,46	1930	4774
VHM-13	**-S02**	**-S16**	13,00	0,512	13,80	1,14	0,46	13,72	0,56	2281	6261
VHM-14	**-S02**	**-S16**	14,00	0,551	14,80	1,14	0,46	14,72	0,56	2456	6742
VHM-15	**-S02**	**-S16**	15,00	0,591	15,80	1,14	0,46	15,72	0,56	2632	7224
VHM-16	**-S02**	**-S16**	16,00	0,630	16,80	1,14	0,46	16,72	0,56	2807	7705
VHM-17	**-S02**	**-S16**	17,00	0,669	17,82	1,14	0,46	17,72	0,56	2983	8187
VHM-18	**-S02**	**-S16**	18,00	0,709	18,82	1,14	0,46	18,72	0,56	3158	8669
VHM-19	**-S02**	**-S16**	19,00	0,748	19,86	1,14	0,46	19,76	0,56 +0,05/-0,00	3519	9150
VHM-20	**-S02**	**-S16**	20,00	0,787	21,26 +0,33/-0,00	1,65	0,53 ±0,04	21,06	0,66	5166	11097
VHM-21	**-S02**	**-S16**	21,00	0,827	22,27	1,65	0,53	22,06 ±0,08	0,66	5424	11652
VHM-22	**-S02**	**-S16**	22,00	0,866	23,28	1,65	0,53	23,06	0,66	5683	12207
VHM-24	**-S02**	**-S16**	24,00	0,945	25,29	1,65	0,53	25,06	0,66	6199	13317
VHM-25	**-S02**	**-S16**	25,00	0,984	26,30	1,65	0,53	26,06	0,66	6458	13872
VHM-26	**-S02**	**-S16**	26,00	1,024	27,31	1,65	0,53	27,06	0,66	6716	14427
VHM-28	**-S02**	**-S16**	28,00	1,102	29,40	2,24	0,64	29,12	0,79	7642	16303
VHM-29	**-S02**	**-S16**	29,00	1,142	30,41	2,24	0,64	30,12	0,79	7915	16885
VHM-30	**-S02**	**-S16**	30,00	1,181	31,42	2,24	0,64	31,12	0,79	8188	17467
VHM-31	**-S02**	**-S16**	31,00	1,220	32,43	2,24	0,64	32,12	0,79	8461	18049
VHM-32	**-S02**	**-S16**	32,00	1,260	33,44	2,24 ±0,10	0,64	33,12 ±0,10	0,79	8734	18632
VHM-34	**-S02**	**-S16**	34,00	1,339	35,45	2,24	0,64	35,12	0,79	9279	19796
VHM-35	**-S02**	**-S16**	35,00	1,378	36,47	2,24	0,64	36,12	0,79	9552	20378
VHM-36	**-S02**	**-S16**	36,00	1,417	37,48	2,24	0,64	37,12	0,79	9825	20960
VHM-37	**-S02**	**-S16**	37,00	1,457	38,49	2,24	0,64	38,12	0,79	10098	21543
VHM-38	**-S02**	**-S16**	38,00	1,496	39,50 +0,38/-0,00	2,24	0,64	39,12	0,79	10371	22125
VHM-40	**-S02**	**-S16**	40,00	1,575	41,94	3,00	0,79	41,48	0,99	14426	28748
VHM-42	**-S02**	**-S16**	42,00	1,654	43,96	3,00	0,79	43,48	0,99	15147	30185
VHM-45	**-S02**	**-S16**	45,00	1,772	46,99	3,00	0,79	46,48	0,99	16229	32341
VHM-47	**-S02**	**-S16**	47,00	1,850	49,00	3,00	0,79	48,48 ±0,13	0,99	16950	33779
VHM-48	**-S02**	**-S16**	48,00	1,890	50,01	3,00	0,79	49,48	0,99	17311	34497
VHM-50	**-S02**	**-S16**	50,00	1,969	52,04 +0,51/-0,00	3,00	0,79	51,48	0,99	18032	35935
VHM-52	**-S02**	**-S16**	52,00	2,047	54,55	4,01	0,79	53,94	0,99	24583	37372
VHM-55	**-S02**	**-S16**	55,00	2,165	57,57	4,01	0,79	56,94	0,99	26001	39528
VHM-56	**-S02**	**-S16**	56,00	2,205	58,58	4,01	0,79	57,94	0,99	26473	40247
VHM-58	**-S02**	**-S16**	58,00	2,283	60,60	4,01	0,79 ±0,05	59,94	0,99	27419	41684
VHM-60	**-S02**	**-S16**	60,00	2,362	62,64	4,01	0,79	61,94	0,99	28364	43122
VHM-62	**-S02**	**-S16**	62,00	2,441	64,67 +0,64/-0,00	4,01	0,79	63,94	0,99	29310	44559
VHM-63	**-S02**	**-S16**	63,00	2,480	65,69	4,01	0,79	64,94	0,99	29783	45278
VHM-65	**-S02**	**-S16**	65,00	2,559	67,70	4,01	0,79	66,94 ±0,15	0,99	30728	46715
VHM-68	**-S02**	**-S16**	68,00	2,677	70,72	4,01	0,79	69,94	0,99	32146	48871
VHM-70	**-S02**	**-S16**	70,00	2,756	72,74	4,01	0,79	71,94	0,99	33092	50309
VHM-72	**-S02**	**-S16**	72,00	2,835	74,77	4,01	0,79	73,94	0,99	34037	51746
VHM-75	**-S02**	**-S16**	75,00	2,953	77,80	4,01	0,79	76,94	0,99	35456	53902
VHM-78	**-S02**	**-S16**	78,00	3,071	81,20 +0,76/-0,00	4,78 ±0,13	0,99	80,34	1,12	44477	70250
VHM-80	**-S02**	**-S16**	80,00	3,150	83,23	4,78	0,99	82,34	1,12	45617	72052

[1] Based on a groove material yield strength of 310 N/mm² and a safety factor of 2.
[2] Based on a safety factor of 3.
[3] No removal notch.
[4] Square edge wire.

VHM Series

Spirolox® Light Duty Rings Internal Continued

Smalley Part Number			Housing Diameter		Ring			Groove		Thrust Capacity	
Carbon Steel	Add Suffix				Outside Diameter (mm)	Radial Wall (mm)	Thickness (mm)	Diameter (mm)	Width (mm)	Groove Yield[1] (N)	Ring Shear[2] (N)
	302 SS	316 SS	mm	in							
VHM-82	**-S02**	**-S16**	82,00	3,228	85,25	4,78	0,99	84,34	1,12	46757	73853
VHM-85	**-S02**	**-S16**	85,00	3,346	88,29	4,78	0,99	87,34	1,12	48468	76555
VHM-88	**-S02**	**-S16**	88,00	3,465	91,32	4,78	0,99	90,34	1,12	50179	79257
VHM-90	**-S02**	**-S16**	90,00	3,543	93,36	4,78	0,99	92,34	1,12	51319	81058
VHM-92	**-S02**	**-S16**	92,00	3,622	95,37	4,78	0,99	94,34	1,12	52460	82859
VHM-95	**-S02**	**-S16**	95,00	3,740	98,39	4,78	0,99	97,34	1,12	54170	85561
VHM-98	**-S02**	**-S16**	98,00	3,858	101,41	4,78	0,99	100,34	1,12	55881	88263
VHM-100	**-S02**	**-S16**	100,00	3,937	103,43	4,78	0,99	102,34	1,12	57021	90064
VHM-102	**-S02**	**-S16**	102,00	4,016	105,44	4,78	0,99	104,34	1,12	58162	91866
VHM-105	**-S02**	**-S16**	105,00	4,134	108,92	5,72	1,17	107,80	1,32	71642	106440
VHM-110	**-S02**	**-S16**	110,00	4,331	113,98	5,72	1,17	112,80	1,32	75054	111508
VHM-112	**-S02**	**-S16**	112,00	4,409	116,01	5,72	1,17	114,80	1,32	76418	113536
VHM-115	**-S02**	**-S16**	115,00	4,528	119,12	5,72	1,17	117,88	1,32	80707	116577
VHM-120	**-S02**	**-S16**	120,00	4,724	124,30	5,72	1,17	123,00	1,32	87725	121645
VHM-125	**-S02**	**-S16**	125,00	4,921	129,47	5,72	1,17	128,12	1,32	95036	126714
VHM-130	**-S02**	**-S16**	130,00	5,118	134,66	5,72	1,17	133,26	1,32	103272	131783
VHM-135	**-S02**	**-S16**	135,00	5,315	139,83	5,72	1,55	138,38	1,70	111192	181299
VHM-140	**-S02**	**-S16**	140,00	5,512	145,00	5,72	1,55	143,50	1,70	119404	188013
VHM-145	**-S02**	**-S16**	145,00	5,709	150,17	5,72	1,55	148,62	1,70	127974	194907
VHM-150	**-S02**	**-S16**	150,00	5,906	155,30	6,73	1,55	153,76	1,70	137436	201443
VHM-155	**-S02**	**-S16**	155,00	6,102	160,46	6,73	1,55	158,88	1,70	146361	208158
VHM-160	**-S02**	**-S16**	160,00	6,299	165,64	6,73	1,55	164,00	1,70	155956	214872
VHM-165	**-S02**	**-S16**	165,00	6,496	170,82	6,73	1,55	169,11	1,70	165855	221587
VHM-170	**-S02**	**-S16**	170,00	6,693	175,99	6,73	1,55	174,25	1,70	176059	228302
VHM-175	**-S02**	**-S16**	175,00	6,890	181,17	6,73	1,55	179,38	1,70	186568	235017
VHM-180	**-S02**	**-S16**	180,00	7,087	186,35	6,73	1,55	184,50	1,70	197381	241731
VHM-185	**-S02**	**-S16**	185,00	7,283	191,52	6,73	1,55	189,63	1,70	208499	248446
VHM-190	**-S02**	**-S16**	190,00	7,480	196,70	6,73	1,55	194,75	1,70	219922	255161
VHM-195	**-S02**	**-S16**	195,00	7,677	201,87	7,62	1,55	199,88	1,70	231649	261876
VHM-200	**-S02**	**-S16**	200,00	7,874	207,05	7,62	1,55	205,00	1,70	243681	268590
VHM-210	**-S02**	**-S16**	210,00	8,268	217,40	7,62	1,55	215,25	1,70	268658	282020
VHM-220	**-S02**	**-S16**	220,00	8,661	227,76	8,76	1,93	225,50	2,08	294854	367882
VHM-230	**-S02**	**-S16**	230,00	9,055	238,11	8,76	1,93	235,75	2,08	322268	384604
VHM-240	**-S02**	**-S16**	240,00	9,449	248,46	8,76	1,93	246,00	2,08	350900	401326
VHM-250	**-S02**	**-S16**	250,00	9,843	258,81	8,76	1,93	256,25	2,08	380751	418048
VHM-260	**-S02**	**-S16**	260,00	10,236	269,17	9,65	1,93	266,50	2,08	411821	434770
VHM-270	**-S02**	**-S16**	270,00	10,630	279,52	9,65	1,93	276,75	2,08	444108	451492
VHM-280	**-S02**	**-S16**	280,00	11,024	289,87	9,65	1,93	287,00	2,08	477614	468214
VHM-290	**-S02**	**-S16**	290,00	11,417	300,22	9,65	1,93	297,25	2,08	512339	484936
VHM-300	**-S02**	**-S16**	300,00	11,811	310,58	9,65	1,93	307,50	2,08	548282	501658

+0,76/-0,00 (Outside Diameter) · +0,89/-0,00 (Outside Diameter) · +1,14/-0,00 (Outside Diameter) · +1,52/-0,00 (Outside Diameter) · +1,78/-0,00 (Outside Diameter)

±0,13 (Radial Wall) · ±0,15 (Radial Wall)

±0,05 (Thickness)

±0,15 (Diameter) · ±0,18 (Diameter) · ±0,20 (Diameter)

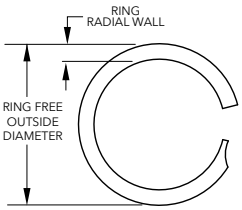
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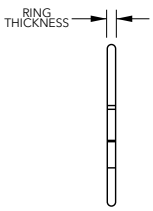
[1] Based on a groove material yield strength of 310 N/mm² and a safety factor of 2.
[2] Based on a safety factor of 3.

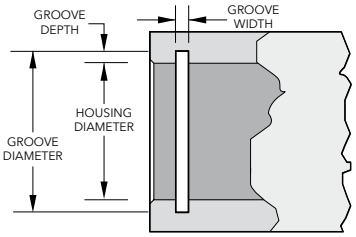
VH Series

Spirolox® Imperial Light Duty Rings Internal









Product Dimensions: All dimensions in inches unless otherwise specified.

Smalley Part Number			Housing Diameter		Ring			Groove		Thrust Capacity	
Carbon Steel	Add Suffix				Outside Diameter (in)	Radial Wall (in)	Thickness (in)	Diameter (in)	Width (in)	Groove Yield [1] (lb)	Ring Shear [2] (lb)
	302 SS	316 SS	in	mm							
VH-25[3,4]	**-S02**	**-S16**	0,250	6,35	0,264 +0,010/-0,000	0,020	0,012	0,262	0,015	106	481
VH-31[3,4]	**-S02**	**-S16**	0,312	7,92	0,329 +0,010/-0,000	0,025	0,015	0,326	0,018	154	750
VH-37[3,4]	**-S02**	**-S16**	0,375	9,53	0,398 +0,010/-0,000	0,030	0,015	0,395	0,018	265	901
VH-43[4]	**-S02**	**-S16**	0,437	11,10	0,466 +0,013/-0,000	0,030	0,015	0,463 ±0,002	0,018	402	1050
VH-50	**-S02**	**-S16**	0,500	12,70	0,531	0,045	0,018	0,528	0,022	500	1300
VH-56	**-S02**	**-S16**	0,562	14,27	0,593	0,045	0,018	0,590	0,022	560	1460
VH-62	**-S02**	**-S16**	0,625	15,88	0,656	0,045	0,018	0,653	0,022	620	1630
VH-68	**-S02**	**-S16**	0,687	17,45	0,719	0,045	0,018	0,715	0,022	680	1790
VH-75	**-S02**	**-S16**	0,750	19,05	0,783 +0,013/-0,000	0,045	0,018	0,779	0,022	800	1950
VH-81	**-S02**	**-S16**	0,812	20,62	0,862	0,065	0,021 ±0,0015	0,854	0,026	1210	2460
VH-87	**-S02**	**-S16**	0,875	22,23	0,926	0,065	0,021	0,917 ±0,003	0,026	1300	2660
VH-93	**-S02**	**-S16**	0,937	23,80	0,989	0,065	0,021	0,979	0,026	1390	2840
VH-100	**-S02**	**-S16**	1,000	25,40	1,052	0,065	0,021	1,042	0,026	1480	3040
VH-106	**-S02**	**-S16**	1,062	26,97	1,117	0,088	0,025	1,106	0,031	1650	3500
VH-112	**-S02**	**-S16**	1,125	28,58	1,180	0,088	0,025	1,169	0,031	1750	3710
VH-118	**-S02**	**-S16**	1,187	30,15	1,242	0,088	0,025	1,231	0,031	1850	3920
VH-125	**-S02**	**-S16**	1,250	31,75	1,307	0,088	0,025	1,294	0,031	1940	4120
VH-131	**-S02**	**-S16**	1,312	33,32	1,369	0,088	0,025	1,356 ±0,004	0,031	2040	4330
VH-137	**-S02**	**-S16**	1,375	34,93	1,433	0,088	0,025	1,419	0,031	2140	4540
VH-143	**-S02**	**-S16**	1,437	36,50	1,496 +0,015/-0,000	0,088	0,025	1,481	0,031	2240	4740
VH-150	**-S02**	**-S16**	1,500	38,10	1,559	0,088	0,025	1,544	0,031	2330	4950
VH-156	**-S02**	**-S16**	1,562	39,67	1,637	0,118	0,031	1,619	0,039	3200	6390
VH-162	**-S02**	**-S16**	1,625	41,28	1,701	0,118	0,031	1,682	0,039	3330	6650
VH-168	**-S02**	**-S16**	1,687	42,85	1,763	0,118	0,031	1,744	0,039	3460	6900
VH-175	**-S02**	**-S16**	1,750	44,45	1,827	0,118	0,031	1,807	0,039	3590	7160
VH-181	**-S02**	**-S16**	1,812	46,02	1,890	0,118	0,031	1,869 ±0,005	0,039	3710	7410
VH-187	**-S02**	**-S16**	1,875	47,63	1,953	0,118	0,031	1,932	0,039	3840	7670
VH-193	**-S02**	**-S16**	1,937	49,20	2,016	0,118	0,031	1,994	0,039	3970	7920
VH-200	**-S02**	**-S16**	2,000	50,80	2,079 +0,020/-0,000	0,118	0,031	2,057	0,039	4100	8180
VH-206	**-S02**	**-S16**	2,062	52,37	2,162	0,158	0,031	2,138	0,039	5540	8430
VH-212	**-S02**	**-S16**	2,125	53,98	2,226	0,158	0,031	2,201	0,039	5710	8690
VH-218	**-S02**	**-S16**	2,187	55,55	2,289	0,158	0,031	2,263	0,039	5870	8950
VH-225	**-S02**	**-S16**	2,250	57,15	2,352	0,158	0,031	2,326	0,039	6040	9200
VH-231	**-S02**	**-S16**	2,312	58,72	2,415	0,158	0,031	2,388	0,039	6210	9460
VH-237	**-S02**	**-S16**	2,375	60,33	2,478	0,158	0,031	2,451	0,039	6380	9720
VH-243	**-S02**	**-S16**	2,437	61,90	2,541	0,158	0,031 ±0,002	2,513	0,039	6550	9970
VH-250	**-S02**	**-S16**	2,500	63,50	2,605	0,158	0,031	2,576	0,039	6720	10230
VH-256	**-S02**	**-S16**	2,562	65,07	2,667	0,158	0,031	2,638	0,039	6880	10480
VH-262	**-S02**	**-S16**	2,625	66,68	2,731	0,158	0,031	2,701	0,039	7050	10740
VH-268	**-S02**	**-S16**	2,687	68,25	2,794	0,158	0,031	2,763 ±0,006	0,039	7220	10990
VH-275	**-S02**	**-S16**	2,750	69,85	2,857	0,158	0,031	2,826	0,039	7390	11250
VH-281	**-S02**	**-S16**	2,812	71,42	2,920	0,158	0,031	2,888	0,039	7550	11500
VH-287	**-S02**	**-S16**	2,875	73,03	2,983	0,158	0,031	2,951	0,039	7720	11760
VH-293	**-S02**	**-S16**	2,937	74,60	3,046	0,158	0,031	3,013	0,039	7890	12010
VH-300	**-S02**	**-S16**	3,000	76,20	3,110 +0,025/-0,000	0,158	0,031	3,076	0,039	8060	12270
VH-306	**-S02**	**-S16**	3,062	77,77	3,188	0,188	0,039	3,154	0,044	9960	15760
VH-312	**-S02**	**-S16**	3,125	79,38	3,251	0,188	0,039	3,217	0,044	10160	16080
VH-318	**-S02**	**-S16**	3,187	80,95	3,314	0,188	0,039	3,279	0,044	10360	16400
VH-325	**-S02**	**-S16**	3,250	82,55	3,377	0,188	0,039	3,342	0,044	10570	16720
VH-331	**-S02**	**-S16**	3,312	84,12	3,440 +0,030/-0,000	0,188 ±0,005	0,039	3,404	0,044	10770	17040

[1] Based on a groove material yield strength of 45000 psi and a safety factor of 2.
[2] Based on a safety factor of 3.
[3] No removal notch.
[4] Square edge wire.

VH Series

Spirolox® Imperial Light Duty Rings Internal Continued

Smalley Part Number			Housing Diameter		Ring			Groove		Thrust Capacity	
Carbon Steel	Add Suffix				Outside Diameter (in)	Radial Wall (in)	Thickness (in)	Diameter (in)	Width (in)	Groove Yield [1] (lb)	Ring Shear [2] (lb)
	302 SS	316 SS	in	mm							
VH-337	**-S02**	**-S16**	3,375	85,73	3,504	0,188	0,039	3,467	0,044	10970	17370
VH-343	**-S02**	**-S16**	3,437	87,30	3,566	0,188	0,039	3,529	0,044	11180	17690
VH-350	**-S02**	**-S16**	3,500	88,90	3,630	0,188	0,039	3,592	0,044	11380	18010
VH-356	**-S02**	**-S16**	3,562	90,47	3,692	0,188	0,039	3,654	0,044	11580	18330
VH-362	**-S02**	**-S16**	3,625	92,08	3,756	0,188	0,039	3,717	0,044	11790	18650
VH-368	**-S02**	**-S16**	3,687	93,65	3,819	0,188	0,039	3,779	0,044	11990	18970
VH-375	**-S02**	**-S16**	3,750	95,25	3,882	0,188	0,039	3,842	0,044	12190	19300
VH-381	**-S02**	**-S16**	3,812	96,82	3,945	0,188	0,039	3,904	0,044	12400	19620
VH-387	**-S02**	**-S16**	3,875	98,43	4,009	0,188	0,039	3,967	0,044	12600	19940
VH-393	**-S02**	**-S16**	3,937	100,00	4,071	0,188	0,039	4,029	0,044	12800	20260
VH-400	**-S02**	**-S16**	4,000	101,60	4,135	0,188	0,039	4,092	0,044	13010	20580
VH-412	**-S02**	**-S16**	4,125	104,78	4,279	0,225	0,046	4,235	0,052	16040	23850
VH-425	**-S02**	**-S16**	4,250	107,95	4,405	0,225	0,046	4,360	0,052	16520	24570
VH-437	**-S02**	**-S16**	4,375	111,13	4,531	0,225	0,046	4,485	0,052	17010	25290
VH-450	**-S02**	**-S16**	4,500	114,30	4,658	0,225	0,046	4,610	0,052	17500	26010
VH-462	**-S02**	**-S16**	4,625	117,48	4,784	0,225	0,046	4,735	0,052	17980	26740
VH-475	**-S02**	**-S16**	4,750	120,65	4,910	0,225	0,046	4,860	0,052	18470	27460
VH-487	**-S02**	**-S16**	4,875	123,83	5,036	0,225	0,046	4,985	0,052	18950	28180
VH-500	**-S02**	**-S16**	5,000	127,00	5,163	0,225	0,046	5,110	0,052	19440	28900
VH-525	**-S02**	**-S16**	5,250	133,35	5,435	0,225	0,061	5,381	0,067	24490	40240
VH-550	**-S02**	**-S16**	5,500	139,70	5,694	0,225	0,061	5,638	0,067	26830	42160
VH-575	**-S02**	**-S16**	5,750	146,05	5,953	0,225	0,061	5,894	0,067	29260	44080
VH-600	**-S02**	**-S16**	6,000	152,40	6,212	0,265	0,061	6,150	0,067	31810	45990
VH-625	**-S02**	**-S16**	6,250	158,75	6,470	0,265	0,061	6,406	0,067	34460	47910
VH-650	**-S02**	**-S16**	6,500	165,10	6,730	0,265	0,061	6,663	0,067	37680	49830
VH-675	**-S02**	**-S16**	6,750	171,45	6,988	0,265	0,061	6,919	0,067	40560	51740
VH-700	**-S02**	**-S16**	7,000	177,80	7,247	0,265	0,061	7,175	0,067	43540	53660
VH-725	**-S02**	**-S16**	7,250	184,15	7,505	0,265	0,061	7,431	0,067	46640	55580
VH-750	**-S02**	**-S16**	7,500	190,50	7,765	0,265	0,061	7,688	0,067	49830	57490
VH-775	**-S02**	**-S16**	7,750	196,85	8,023	0,300	0,061	7,944	0,067	53140	59410
VH-800	**-S02**	**-S16**	8,000	203,20	8,282	0,300	0,061	8,200	0,067	56550	61320
VH-825	**-S02**	**-S16**	8,250	209,55	8,541	0,300	0,061	8,456	0,067	60070	63240
VH-850	**-S02**	**-S16**	8,500	215,90	8,800	0,300	0,061	8,713	0,067	64290	65160
VH-875	**-S02**	**-S16**	8,750	222,25	9,059	0,345	0,076	8,969	0,082	68040	83570
VH-900	**-S02**	**-S16**	9,000	228,60	9,317	0,345	0,076	9,225	0,082	71890	85950
VH-925	**-S02**	**-S16**	9,250	234,95	9,576	0,345	0,076	9,481	0,082	75850	88340
VH-950	**-S02**	**-S16**	9,500	241,30	9,835	0,345	0,076	9,738	0,082	79910	90730
VH-975	**-S02**	**-S16**	9,750	247,65	10,094	0,345	0,076	9,994	0,082	84080	93120
VH-1000	**-S02**	**-S16**	10,000	254,00	10,353	0,345	0,076	10,250	0,082	88360	95500

+0,030/-0,000 (Outside Diameter)
+0,035/-0,000 (Outside Diameter)
+0,045/-0,000 (Outside Diameter)
+0,060/-0,000 (Outside Diameter)
+0,070/-0,000 (Outside Diameter)
±0,005 (Radial Wall)
±0,002 (Thickness)
±0,006 (Diameter)
±0,007 (Diameter)
±0,008 (Diameter)
+0,003/-0,000 (Width)
+0,004/-0,000 (Width)
+0,005/-0,000 (Width)

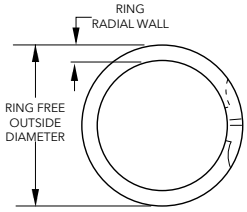
[1] Based on a groove material yield strength of 45000 psi and a safety factor of 2.
[2] Based on a safety factor of 3.
[3] No removal notch.
[4] Square edge wire.

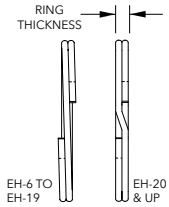
EH Series

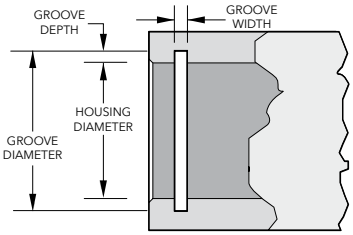
Spirolox® Aerospace Rings Internal

**Compliance with MA 4017 specification*









Product Dimensions: All dimensions in millimeters unless otherwise specified.

Smalley Part Number			Housing Diameter		Ring				Groove				Thrust Capacity	
Carbon Steel	Add Suffix				Outside Diameter (mm)		Radial Wall (mm)	Thickness (mm)		Diameter (mm)		Width (mm)		Groove Yield[1] (N)	Ring Shear[2] (N)
	302 SS	316 SS	mm	in											
EH-6[3,4]	**-S02**	**-S16**	6,00	0,236	6,35	+0,25/-0,00	0,33 - 0,53	0,38	±0,05	6,30	±0,05	0,51	+0,08/-0,00	440	1880
EH-7[3,4]	**-S02**	**-S16**	7,00	0,276	7,37		0,33 - 0,53	0,38		7,32		0,51		550	2190
EH-8[3,4]	**-S02**	**-S16**	8,00	0,315	8,51		0,51 - 0,71	0,38		8,43		0,51		840	2500
EH-9[3,4]	**-S02**	**-S16**	9,00	0,354	9,60		0,64 - 0,84	0,64		9,50		0,74		1100	4740
EH-10[3,4]	**-S02**	**-S16**	10,00	0,394	10,62		0,64 - 0,84	0,64		10,52		0,74		1270	5270
EH-11[4]	**-S02**	**-S16**	11,00	0,433	11,79	+0,30/-0,00	0,76 - 0,96	0,64		11,71		0,74		1900	5790
EH-12	**-S02**	**-S16**	12,00	0,472	12,89		1,02 - 1,22	0,60		12,70		0,70		2050	7950
EH-13	**-S02**	**-S16**	13,00	0,512	13,95		1,02 - 1,22	0,89		13,75		1,00		2410	12110
EH-14	**-S02**	**-S16**	14,00	0,551	15,07		1,27 - 1,47	0,89		14,85		1,00		2930	13040
EH-15	**-S02**	**-S16**	15,00	0,591	16,14		1,27 - 1,47	0,89		15,90		1,00		3290	13970
EH-16	**-S02**	**-S16**	16,00	0,630	17,15		1,27 - 1,47	0,89		16,95		1,00		3740	14900
EH-17	**-S02**	**-S16**	17,00	0,669	18,32		1,52 - 1,73	0,89		18,05		1,00		4390	15830
EH-18	**-S02**	**-S16**	18,00	0,709	19,39		1,52 - 1,73	0,89		19,10		1,00		4820	16760
EH-19	**-S02**	**-S16**	19,00	0,748	20,48		1,52 - 1,73	0,89		20,17	±0,075	1,00		5460	17690
EH-20	**-S02**	**-S16**	20,00	0,787	21,51		1,78 - 1,98	0,89		21,22		1,00		5940	18620
EH-21	**-S02**	**-S16**	21,00	0,827	22,56		1,78 - 1,98	0,89		22,27		1,00		6550	19550
EH-22	**-S02**	**-S16**	22,00	0,866	23,65		1,78 - 1,98	1,07		23,37		1,20		7390	24630
EH-23	**-S02**	**-S16**	23,00	0,906	24,69	+0,35/-0,00	2,03 - 2,24	1,07		24,42		1,20		7950	25750
EH-24	**-S02**	**-S16**	24,00	0,945	25,73		2,03 - 2,24	1,07		25,47		1,20		8650	26870
EH-25	**-S02**	**-S16**	25,00	0,984	27,03		2,03 - 2,24	1,07		26,67		1,20		10230	27990
EH-26	**-S02**	**-S16**	26,00	1,024	28,07		2,03 - 2,24	1,07		27,77		1,20		11270	29110
EH-27	**-S02**	**-S16**	27,00	1,063	29,11		2,49 - 2,69	1,27		28,87		1,40		12360	31170
EH-28	**-S02**	**-S16**	28,00	1,102	30,10		2,49 - 2,69	1,27		29,87		1,40		12820	32330
EH-29	**-S02**	**-S16**	29,00	1,142	31,21		2,49 - 2,69	1,27		30,95		1,40		13840	33480
EH-30	**-S02**	**-S16**	30,00	1,181	32,28		2,49 - 2,69	1,27		32,00		1,40		14610	34640
EH-31	**-S02**	**-S16**	31,00	1,220	33,32		2,49 - 2,69	1,27		33,05		1,40		15550	35790
EH-32	**-S02**	**-S16**	32,00	1,260	34,23		2,49 - 2,69	1,27		34,00		1,40		15880	36950
EH-34	**-S02**	**-S16**	34,00	1,339	36,46		2,87 - 3,07	1,27		36,20		1,40		18210	39260
EH-35	**-S02**	**-S16**	35,00	1,378	37,55		2,87 - 3,07	1,27		37,30		1,40		19600	40410
EH-36	**-S02**	**-S16**	36,00	1,417	38,68		2,87 - 3,07	1,27		38,40		1,40		21040	41560
EH-37	**-S02**	**-S16**	37,00	1,457	39,60		2,87 - 3,07	1,27		39,40	±0,10	1,40		21620	42720
EH-38	**-S02**	**-S16**	38,00	1,496	40,77		2,87 - 3,07	1,27		40,50		1,40		23130	43870
EH-40	**-S02**	**-S16**	40,00	1,575	42,91	+0,51/-0,00	3,12 - 3,33	1,57	±0,75	42,50		1,75	+0,10/-0,00	24350	57090
EH-42	**-S02**	**-S16**	42,00	1,654	45,01		3,12 - 3,33	1,57		44,60		1,75		26590	59950
EH-45	**-S02**	**-S16**	45,00	1,772	48,13		3,12 - 3,33	1,57		47,70		1,75		29590	64230
EH-46	**-S02**	**-S16**	46,00	1,811	49,28		3,12 - 3,33	1,57		48,80		1,75		31370	65660
EH-47	**-S02**	**-S16**	47,00	1,850	50,32		3,89 - 4,09	1,57		49,90		1,75		33190	67080
EH-48	**-S02**	**-S16**	48,00	1,890	51,46		3,89 - 4,09	1,57		51,00		1,75		35070	68510
EH-50	**-S02**	**-S16**	50,00	1,969	53,66		3,89 - 4,09	1,57		53,20		1,75		38960	71370
EH-52	**-S02**	**-S16**	52,00	2,047	54,30	+0,50/-0,00	3,12 - 3,33	1,25		53,79	±0,125	1,42		22790	59090
EH-53	**-S02**	**-S16**	53,00	2,087	55,32		3,12 - 3,33	1,25		54,79		1,42		23230	60230
EH-55	**-S02**	**-S16**	55,00	2,165	57,38		3,38 - 3,58	1,25		56,85		1,42		24910	62500
EH-56	**-S02**	**-S16**	56,00	2,205	58,40		3,38 - 3,58	1,25		57,85		1,42		25360	63640
EH-58	**-S02**	**-S16**	58,00	2,283	60,43		3,38 - 3,58	1,25		59,85		1,42		26270	65910
EH-59	**-S02**	**-S16**	59,00	2,323	61,54	+0,63/-0,00	3,38 - 3,58	1,25	±0,08	60,93	±0,15	1,42		27870	67050
EH-60	**-S02**	**-S16**	60,00	2,362	62,57		3,38 - 3,58	1,25		61,99		1,42		29220	68180
EH-61	**-S02**	**-S16**	61,00	2,402	63,65		3,63 - 3,84	1,25		63,09		1,42		31190	69320
EH-62	**-S02**	**-S16**	62,00	2,441	64,70		3,63 - 3,84	1,25		64,09		1,42		31700	70460
EH-63	**-S02**	**-S16**	63,00	2,480	65,70		3,63 - 3,84	1,25		65,09		1,42		32220	71590
EH-64	**-S02**	**-S16**	64,00	2,520	66,77		3,63 - 3,84	1,25		66,19		1,42		34290	72730

[1] Based on a groove material yield strength of 310 N/mm² and a safety factor of 2.
[2] Based on a safety factor of 3.
[3] No removal notch.
[4] Square edge wire.
* Contact Smalley for details/information on how to order parts to be in compliance with this specification.

EH Series

Spirolox® Aerospace Rings Internal Continued

Smalley Part Number			Housing Diameter		Ring				Groove				Thrust Capacity	
Carbon Steel	Add Suffix				Outside Diameter (mm)		Radial Wall (mm)	Thickness (mm)	Diameter (mm)		Width (mm)		Groove Yield[1] (N)	Ring Shear[2] (N)
	302 SS	316 SS	mm	in										
EH-65	**-S02**	**-S16**	65,00	2,559	67,82	+0,63/-0,00	3,63 - 3,84	1,25 ±0,08	67,19	±0,15	1,42	+0,10/-0,00	34820	73870
EH-66	**-S02**	**-S16**	66,00	2,598	68,80		3,63 - 3,84	1,25	68,19		1,42		35360	75000
EH-67	**-S02**	**-S16**	67,00	2,638	69,90		3,63 - 3,84	1,25	69,25		1,42		36870	76140
EH-68	**-S02**	**-S16**	68,00	2,677	70,94		3,89 - 4,09	1,25	70,29		1,42		38090	77270
EH-69	**-S02**	**-S16**	69,00	2,717	71,94		3,89 - 4,09	1,25	71,29		1,42		38650	78410
EH-70	**-S02**	**-S16**	70,00	2,756	72,94		3,89 - 4,09	1,25	72,29		1,42		39210	79550
EH-71	**-S02**	**-S16**	71,00	2,795	73,99		3,89 - 4,09	1,25	73,29		1,42		39770	80680
EH-72	**-S02**	**-S16**	72,00	2,835	75,04		4,11 - 4,39	1,25	74,39		1,42		40910	81510
EH-75	**-S02**	**-S16**	75,00	2,953	78,07		4,11 - 4,39	1,25	77,39		1,42		43830	85230
EH-78	**-S02**	**-S16**	78,00	3,071	81,21	+0,76/-0,00	4,11 - 4,39	1,55	80,45		1,73	+0,13/-0,00	46730	109910
EH-80	**-S02**	**-S16**	80,00	3,150	83,22		4,37 - 4,62	1,55	82,49		1,73		48700	112730
EH-82	**-S02**	**-S16**	82,00	3,228	85,28		4,37 - 4,62	1,55	84,55		1,73		51120	115550
EH-85	**-S02**	**-S16**	85,00	3,346	88,38		4,62 - 4,88	1,55	87,65		1,73		55060	119780
EH-88	**-S02**	**-S16**	88,00	3,465	91,45		4,62 - 4,88	1,55	90,69		1,73		57860	124000
EH-90	**-S02**	**-S16**	90,00	3,543	93,58		4,88 - 5,13	1,55	92,79		1,73		61370	126820
EH-92	**-S02**	**-S16**	92,00	3,622	95,66		4,88 - 5,13	1,55	94,85		1,73		64070	129640
EH-95	**-S02**	**-S16**	95,00	3,740	98,69		4,88 - 5,13	1,55	97,85		1,73		66160	133870
EH-98	**-S02**	**-S16**	98,00	3,858	101,83		5,13 - 5,38	1,55	100,99		1,73		71590	138090
EH-100	**-S02**	**-S16**	100,00	3,937	103,83		5,13 - 5,38	1,55	102,99		1,73		73050	140910
EH-102	**-S02**	**-S16**	102,00	4,016	106,00		5,38 - 5,64	1,55	105,15		1,73		78490	143730
EH-105	**-S02**	**-S16**	105,00	4,134	109,00	+0,90/-0,00	5,38 - 5,64	1,55	108,15		1,73		80800	147960
EH-108	**-S02**	**-S16**	108,00	4,252	112,22		5,64 - 5,89	1,55	111,31		1,73		87310	152190
EH-110	**-S02**	**-S16**	110,00	4,331	114,25		5,64 - 5,89	1,55	113,31		1,73		88510	155000
EH-112	**-S02**	**-S16**	112,00	4,409	116,44		5,89 - 6,15	1,55	115,45		1,73		94370	157820
EH-115	**-S02**	**-S16**	115,00	4,528	119,44		5,89 - 6,15	1,55	118,45		1,73		96890	162050
EH-120	**-S02**	**-S16**	120,00	4,724	124,54	+1,14/-0,00	6,20 - 6,45	1,83 ±0,10	123,55	±0,18	2,00		104030	199640
EH-125	**-S02**	**-S16**	125,00	4,921	129,59		6,20 - 6,45	1,83	128,55		2,00		108360	207960
EH-130	**-S02**	**-S16**	130,00	5,118	134,71		6,20 - 6,45	1,83	133,65		2,00		115860	216280
EH-135	**-S02**	**-S16**	135,00	5,315	139,74		6,20 - 6,45	1,83	138,62		2,00		119000	224600
EH-140	**-S02**	**-S16**	140,00	5,512	144,87		6,20 - 6,45	1,83	143,72		2,00		126820	232920
EH-145	**-S02**	**-S16**	145,00	5,709	150,04		6,20 - 6,45	1,83	148,82		2,00		134880	241230
EH-150	**-S02**	**-S16**	150,00	5,906	155,07		6,20 - 6,45	1,83	153,82		2,00		139530	249550
EH-155	**-S02**	**-S16**	155,00	6,102	160,72	+1,40/-0,00	7,72 - 8,03	2,18	159,40	±0,20	2,40	+0,15/-0,00	166080	307190
EH-160	**-S02**	**-S16**	160,00	6,299	165,74		7,72 - 8,03	2,18	164,40		2,40		171433	317100
EH-165	**-S02**	**-S16**	165,00	6,496	170,77		7,72 - 8,03	2,18	169,40		2,40		176790	327010
EH-170	**-S02**	**-S16**	170,00	6,693	176,05		7,72 - 8,03	2,18	174,60		2,40		190430	336920
EH-175	**-S02**	**-S16**	175,00	6,890	181,05		7,72 - 8,03	2,18	179,60		2,40		196030	346830
EH-180	**-S02**	**-S16**	180,00	7,087	186,38		7,72 - 8,03	2,18	184,88		2,40		213900	356740
EH-185	**-S02**	**-S16**	185,00	7,283	191,10	+1,65/-0,00	7,72 - 8,03	2,18	189,88		2,40		219840	366650
EH-190	**-S02**	**-S16**	190,00	7,480	196,45		7,72 - 8,03	2,18	194,88		2,40		225790	376560
EH-195	**-S02**	**-S16**	195,00	7,677	201,74		7,72 - 8,03	2,18	200,14		2,40		244070	386460
EH-200	**-S02**	**-S16**	200,00	7,874	206,76		7,72 - 8,03	2,18	205,14		2,40		250330	396370
EH-210	**-S02**	**-S16**	210,00	8,268	217,10		9,32 - 9,63	2,18	215,40		2,40		276140	416490
EH-220	**-S02**	**-S16**	220,00	8,661	227,40		9,32 - 9,63	2,18	225,64		2,40		257150	436010
EH-230	**-S02**	**-S16**	230,00	9,055	237,73		9,32 - 9,63	2,18	235,90		2,40		330450	455830
EH-240	**-S02**	**-S16**	240,00	9,449	247,80		9,32 - 9,63	2,18	245,90		2,40		344810	475650
EH-250	**-S02**	**-S16**	250,00	9,843	258,10		9,32 - 9,63	2,18	256,16		2,40		375010	495470
EH-260	**-S02**	**-S16**	260,00	10,236	268,43		9,32 - 9,63	2,18	266,40		2,40		405210	515290
EH-270	**-S02**	**-S16**	270,00	10,630	278,50		9,32 - 9,63	2,18	276,40		2,40		420790	535100
EH-280	**-S02**	**-S16**	280,00	11,024	288,82		9,32 - 9,63	2,18	286,66		2,40		454100	554920

[1] Based on a groove material yield strength of 310 N/mm² and a safety factor of 2.
[2] Based on a safety factor of 3.

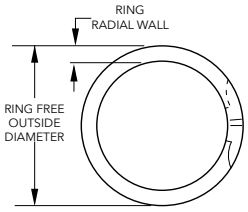
* Contact Smalley for details/information on how to order parts to be in compliance with this specification.

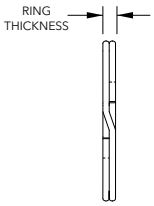
DNH Series

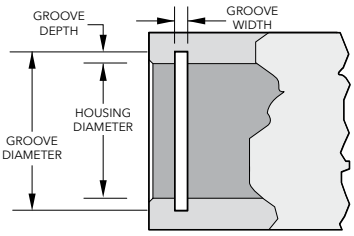
Spirolox® DIN Rings Internal

**Groove compliance with DIN 472*









Product Dimensions: All dimensions in millimeters unless otherwise specified.

Smalley Part Number			Housing Diameter		Ring			Groove		Thrust Capacity	
Carbon Steel	Add Suffix				Outside Diameter (mm)	Radial Wall (mm)	Thickness (mm)	Diameter (mm)	Width (mm)	Groove Yield[1] (N)	Ring Shear[2] (N)
	302 SS	316 SS	mm	in							
DNH-13	**-S02**	**-S16**	13,00	0,512	13,72	1,40	0,99	13,60	1,10	1901	13474
DNH-14	**-S02**	**-S16**	14,00	0,551	14,75	1,40	0,99	14,60	1,10	2047	14510
DNH-15	**-S02**	**-S16**	15,00	0,591	15,85	1,40	0,99	15,70	1,10	2559	15547
DNH-16	**-S02**	**-S16**	16,00	0,630	16,97	1,65	0,99	16,80	1,10	3119	16583
DNH-17	**-S02**	**-S16**	17,00	0,669	17,98	1,65	0,99	17,80	1,10	3314	17620
DNH-18	**-S02**	**-S16**	18,00	0,709	19,18	1,91	0,99	19,00	1,10	4386	18656
DNH-19	**-S02**	**-S16**	19,00	0,748	20,19	1,91	0,99	20,00	1,10	4630	19693
DNH-20	**-S02**	**-S16**	20,00	0,787	21,21	1,91	0,99	21,00	1,10	4874	20729
DNH-21	**-S02**	**-S16**	21,00	0,827	22,23	1,91	0,99	22,00	1,10	5117	21766
DNH-22	**-S02**	**-S16**	22,00	0,866	23,23	1,91	0,99	23,00	1,10	5361	22802
DNH-23	**-S02**	**-S16**	23,00	0,906	24,33	2,18	1,14	24,10	1,30	6165	23853
DNH-24	**-S02**	**-S16**	24,00	0,945	25,45	2,18	1,14	25,20	1,30	7018	24891
DNH-25	**-S02**	**-S16**	25,00	0,984	26,45	2,18	1,14	26,20	1,30	7310	25928
DNH-26	**-S02**	**-S16**	26,00	1,024	27,48	2,18	1,14	27,20	1,30	7603	26965
DNH-27	**-S02**	**-S16**	27,00	1,063	28,68	2,41	1,14	28,40	1,30	9211	28002
DNH-28	**-S02**	**-S16**	28,00	1,102	29,69	2,41	1,14	29,40	1,30	9552	29039
DNH-29	**-S02**	**-S16**	29,00	1,142	30,71	2,41	1,14	30,40	1,30	9893	30076
DNH-30	**-S02**	**-S16**	30,00	1,181	31,71	2,41	1,14	31,40	1,30	10235	31113
DNH-31	**-S02**	**-S16**	31,00	1,220	33,02	2,41	1,14	32,70	1,30	12842	32150
DNH-32	**-S02**	**-S16**	32,00	1,260	34,04	2,41	1,14	33,70	1,30	13256	33187
DNH-33	**-S02**	**-S16**	33,00	1,299	35,05	2,41	1,14	34,70	1,30	13670	34224
DNH-34	**-S02**	**-S16**	34,00	1,339	36,07	3,25	1,44	35,70	1,60	14085	44541
DNH-35	**-S02**	**-S16**	35,00	1,378	37,38	3,25	1,44	37,00	1,60	17058	45851
DNH-36	**-S02**	**-S16**	36,00	1,417	38,39	3,25	1,44	38,00	1,60	17545	47161
DNH-37	**-S02**	**-S16**	37,00	1,457	39,40	3,25	1,44	39,00	1,60	18032	48471
DNH-38	**-S02**	**-S16**	38,00	1,496	40,41	3,25	1,44	40,00	1,60	18520	49781
DNH-40	**-S02**	**-S16**	40,00	1,575	42,93	4,01	1,69	42,50	1,85	24368	61498
DNH-41	**-S02**	**-S16**	41,00	1,614	43,94	4,01	1,69	43,50	1,85	24977	63036
DNH-42	**-S02**	**-S16**	42,00	1,654	44,96	4,01	1,69	44,50	1,85	25586	64573
DNH-45	**-S02**	**-S16**	45,00	1,772	47,98	4,01	1,69	47,50	1,85	27414	69186
DNH-47	**-S02**	**-S16**	47,00	1,850	49,99	4,01	1,69	49,50	1,85	28633	72261
DNH-48	**-S02**	**-S16**	48,00	1,890	51,00	4,01	1,69	50,50	1,85	29242	73798
DNH-50	**-S02**	**-S16**	50,00	1,969	53,54	5,08	1,93	53,00	2,15	36552	87790
DNH-51	**-S02**	**-S16**	51,00	2,008	54,54	5,08	1,93	54,00	2,15	37283	89546
DNH-52	**-S02**	**-S16**	52,00	2,047	55,55	5,08	1,93	55,00	2,15	38014	91302
DNH-55	**-S02**	**-S16**	55,00	2,165	58,57	5,08	1,93	58,00	2,15	40207	96569
DNH-56	**-S02**	**-S16**	56,00	2,205	59,59	5,08	1,93	59,00	2,15	40938	98325
DNH-57	**-S02**	**-S16**	57,00	2,244	60,60	5,08	1,93	60,00	2,15	41669	100081
DNH-58	**-S02**	**-S16**	58,00	2,283	61,62	5,08	1,93	61,00	2,15	42400	101836
DNH-60	**-S02**	**-S16**	60,00	2,362	63,63	5,08	1,93	63,00	2,15	43863	105348
DNH-62	**-S02**	**-S16**	62,00	2,441	65,66	5,08	1,93	65,00	2,15	45325	108860
DNH-63	**-S02**	**-S16**	63,00	2,480	66,67	5,08	1,93	66,00	2,15	46056	110615
DNH-64	**-S02**	**-S16**	64,00	2,520	67,67	5,08	1,93	67,00	2,15	46787	112371
DNH-65	**-S02**	**-S16**	65,00	2,559	68,67	5,08	2,41	68,00	2,65	47518	135725
DNH-67	**-S02**	**-S16**	67,00	2,638	70,67	5,08	2,41	70,00	2,65	48980	139901
DNH-68	**-S02**	**-S16**	68,00	2,677	71,67	5,08	2,41	71,00	2,65	49711	141989
DNH-70	**-S02**	**-S16**	70,00	2,756	73,67	5,08	2,41	73,00	2,65	51173	146165
DNH-72	**-S02**	**-S16**	72,00	2,835	75,67	5,08	2,41	75,00	2,65	52635	150341
DNH-75	**-S02**	**-S16**	75,00	2,953	78,68	5,08	2,41	78,00	2,65	54828	156605
DNH-76	**-S02**	**-S16**	76,00	2,992	79,68	5,08	2,41	79,00	2,65	55559	158694

+0,33/-0,00 (Outside Diameter)
+0,38/-0,00 (Outside Diameter)
+0,51/-0,00 (Outside Diameter)
+0,63/-0,00 (Outside Diameter)
+0,76/-0,00 (Outside Diameter)
±0,10 (Radial Wall)
±0,12 (Radial Wall)
±0,05 (Thickness)
±0,08 (Thickness)
+0,11/-0,00 (Diameter)
+0,13/-0,00 (Diameter)
+0,21/-0,00 (Diameter)
+0,25/-0,00 (Diameter)
+0,30/-0,00 (Diameter)
+0,14/-0,00 (Width)

[1] Based on a groove material yield strength of 310 N/mm² and a safety factor of 2.
[2] Based on a safety factor of 3.

* Contact Smalley for details/information on how to order parts to be in compliance with this specification.

DNH Series

Spirolox® DIN Rings Internal Continued

Smalley Part Number			Housing Diameter		Ring			Groove		Thrust Capacity	
Carbon Steel	Add Suffix 302 SS	Add Suffix 316 SS	mm	in	Outside Diameter (mm)	Radial Wall (mm)	Thickness (mm)	Diameter (mm)	Width (mm)	Groove Yield[1] (N)	Ring Shear[2] (N)
DNH-78	-S02	-S16	78,00	3,071	81,69 +0,76/-0,00	5,08 ±0,12	2,41 ±0,08	81,00 +0,35/-0,00	2,65 +0,14/-0,00	57021	162870
DNH-80	-S02	-S16	80,00	3,150	84,19	6,05 ±0,13	2,41	83,50	2,65	68231	167046
DNH-82	-S02	-S16	82,00	3,228	86,20	6,05	2,41	85,50	2,65	69936	171222
DNH-85	-S02	-S16	85,00	3,346	89,20	6,05	2,91	88,50	3,15	72495	214309
DNH-88	-S02	-S16	88,00	3,465	92,21	6,05	2,91	91,50	3,15	75054	221873
DNH-90	-S02	-S16	90,00	3,543	94,21	6,05	2,91	93,50	3,15	76759	226915
DNH-92	-S02	-S16	92,00	3,622	96,22	6,05	2,91	95,50	3,15	78465	231958
DNH-95	-S02	-S16	95,00	3,740	99,24 +0,89/-0,00	6,05	2,91	98,50	3,15	81024	239522
DNH-98	-S02	-S16	98,00	3,858	102,26	6,05	2,91	101,50	3,15	83583	247086
DNH-100	-S02	-S16	100,00	3,937	104,29	6,05	2,91	103,50	3,15	85288	252128
DNH-102	-S02	-S16	102,00	4,016	106,79	6,73	3,89 ±0,10	106,00	4,15	99422	343778
DNH-105	-S02	-S16	105,00	4,134	109,79	6,73	3,89	109,00 +0,54/-0,00	4,15	102346	353889
DNH-108	-S02	-S16	108,00	4,252	112,80	6,73	3,89	112,00	4,15	105270	364000
DNH-110	-S02	-S16	110,00	4,331	114,83	6,73	3,89	114,00	4,15	107220	370741
DNH-112	-S02	-S16	112,00	4,409	116,84	6,73	3,89	116,00	4,15	109169	377482
DNH-115	-S02	-S16	115,00	4,528	119,86	6,73	3,89	119,00	4,15	112093	387593
DNH-120	-S02	-S16	120,00	4,724	124,92 +1,30/-0,00	6,73	3,89	124,00	4,15	116967	404445
DNH-125	-S02	-S16	125,00	4,921	129,97	6,73	3,89	129,00	4,15	121840	421297
DNH-127	-S02	-S16	127,00	5,000	131,97	6,73	3,89	131,00	4,15	123790	428038
DNH-130	-S02	-S16	130,00	5,118	135,00	6,73	3,89	134,00	4,15	126714	438149
DNH-135	-S02	-S16	135,00	5,315	140,03	6,73	3,89	139,00	4,15	131588	455001
DNH-140	-S02	-S16	140,00	5,512	145,11	6,73	3,89	144,00 +0,63/-0,00	4,15	136461	471852
DNH-145	-S02	-S16	145,00	5,709	150,11	6,73	3,89	149,00	4,15	141335	488704
DNH-150	-S02	-S16	150,00	5,906	156,13	7,92	3,89	155,00	4,15	182761	505556
DNH-155	-S02	-S16	155,00	6,102	161,19	7,92	3,89	160,00	4,15	188853	522408
DNH-160	-S02	-S16	160,00	6,299	166,22	7,92	3,89	165,00	4,15	194945	539260
DNH-165	-S02	-S16	165,00	6,496	171,27	7,92	3,89	170,00	4,15	201037	556112
DNH-170	-S02	-S16	170,00	6,693	176,33 +1,40/-0,00	7,92	3,89	175,00	4,15	207129	572964
DNH-175	-S02	-S16	175,00	6,890	181,36	7,92	3,89	180,00	4,15	213221	589815
DNH-180	-S02	-S16	180,00	7,087	186,39	7,92	3,89	185,00	4,15	219313	606667
DNH-185	-S02	-S16	185,00	7,283	191,44	7,92	3,89	190,00	4,15	225405	623519
DNH-190	-S02	-S16	190,00	7,480	196,47	7,92	3,89	195,00 +0,72/-0,00	4,15	231497	640371
DNH-195	-S02	-S16	195,00	7,677	201,52	7,92	3,89	200,00	4,15	237589	657223
DNH-200	-S02	-S16	200,00	7,874	206,58	7,92 ±0,15	3,89	205,00	4,15	243681	674075
DNH-210	-S02	-S16	210,00	8,268	217,58 +1,78/-0,00	9,53	4,86 ±0,13	216,00	5,15	307038	884268
DNH-220	-S02	-S16	220,00	8,661	227,66	9,53	4,86	226,00	5,15	321659	926376
DNH-230	-S02	-S16	230,00	9,055	237,72	9,53	4,86	236,00	5,15	336280	968484
DNH-240	-S02	-S16	240,00	9,449	247,80	9,53	4,86	246,00	5,15	350900	1010592
DNH-250	-S02	-S16	250,00	9,843	257,89	9,53	4,86	256,00	5,15	365521	1052700
DNH-260	-S02	-S16	260,00	10,236	269,93	11,18	4,86	268,00 +0,81/-0,00	5,15	506856	1094808
DNH-270	-S02	-S16	270,00	10,630	280,01	11,18	4,86	278,00	5,15	526351	1136916
DNH-280	-S02	-S16	280,00	11,024	290,09	11,18	4,86	288,00	5,15	545845	1179024
DNH-290	-S02	-S16	290,00	11,417	300,15 +3,05/-0,00	11,18	4,86	298,00	5,15	565340	1221132
DNH-300	-S02	-S16	300,00	11,811	310,24	11,18	4,86	308,00	5,15	584834	1263241
DNH-310	-S02	-S16	310,00	12,205	322,25	12,70 ±0,19	5,87	320,00	6,20	755411	1576625
DNH-320	-S02	-S16	320,00	12,598	332,33	12,70	5,87	330,00	6,20	779779	1627484
DNH-330	-S02	-S16	330,00	12,992	342,42	12,70	5,87	340,00	6,20	804147	1678342
DNH-340	-S02	-S16	340,00	13,386	352,50	12,70	5,87	350,00 +0,89/-0,00	6,20	828515	1729201
DNH-350	-S02	-S16	350,00	13,780	362,56	12,70	5,87	360,00	6,20	852883	1780060
DNH-360	-S02	-S16	360,00	14,173	372,64	12,70	5,87	370,00	6,20	877251	1830919
DNH-370	-S02	-S16	370,00	14,567	382,73 +3,56/-0,00	12,70	5,87	380,00	6,20 +0,22/-0,00	901619	1881778
DNH-380	-S02	-S16	380,00	14,961	392,79	12,70	5,87	390,00	6,20	925987	1932637
DNH-390	-S02	-S16	390,00	15,354	402,84	12,70	5,87	400,00	6,20	950355	1983496
DNH-400	-S02	-S16	400,00	15,748	412,93	12,70	5,87	410,00	6,20	974723	2034354

[1] Based on a groove material yield strength of 310 N/mm² and a safety factor of 2.
[2] Based on a safety factor of 3.

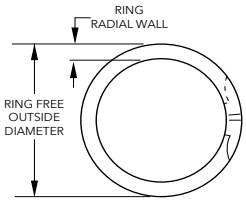
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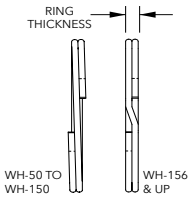
WH Series

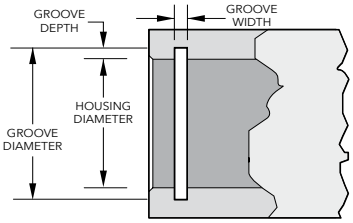
Spirolox® Imperial Medium Duty Rings Internal

**Compliance with AS3217, AS4299, MIL-DTL-27426/3*









Product Dimensions: All dimensions in inches unless otherwise specified.

Smalley Part Number			Housing Diameter		Ring			Groove		Thrust Capacity	
Carbon Steel	Add Suffix				Outside Diameter (in)	Radial Wall (in)	Thickness (in)	Diameter (in)	Width (in)	Groove Yield[1] (lb)	Ring Shear[2] (lb)
	302 SS	316 SS	in	mm							
WH-50	**-S02**	**-S16**	0,500	12,70	0,532	0,045	0,025	0,526	0,030	460	2000
WH-51	**-S02**	**-S16**	0,512	13,00	0,544	0,045	0,025	0,538	0,030	470	2050
WH-53	**-S02**	**-S16**	0,531	13,49	0,564	0,045	0,025	0,557	0,030	490	2130
WH-56	**-S02**	**-S16**	0,562	14,27	0,594	0,045	0,025	0,588	0,030	520	2250
WH-59	**-S02**	**-S16**	0,594	15,09	0,626	0,045	0,025	0,619	0,030	550	2380
WH-62	**-S02**	**-S16**	0,625	15,88	0,658	0,045	0,025	0,651	0,030	570	2500
WH-65	**-S02**	**-S16**	0,656	16,66	0,689	0,045	0,025	0,682	0,030	600	2630
WH-68	**-S02**	**-S16**	0,687	17,45	0,720	0,045	0,025	0,713	0,030	630	2750
WH-71	**-S02**	**-S16**	0,718	18,24	0,751	0,045	0,025	0,744	0,030	660	2870
WH-75	**-S02**	**-S16**	0,750	19,05	0,790	0,065	0,031	0,782	0,036	850	3360
WH-77	**-S02**	**-S16**	0,777	19,74	0,817	0,065	0,031	0,808	0,036	880	3480
WH-78	**-S02**	**-S16**	0,781	19,84	0,821	0,065	0,031	0,812	0,036	880	3500
WH-81	**-S02**	**-S16**	0,812	20,62	0,853	0,065	0,031	0,843	0,036	920	3640
WH-84	**-S02**	**-S16**	0,843	21,41	0,889	0,065	0,031	0,880	0,036	1130	3780
WH-86	**-S02**	**-S16**	0,866	22,00	0,913	0,065	0,031	0,903	0,036	1160	3880
WH-87	**-S02**	**-S16**	0,875	22,23	0,922	0,065	0,031	0,912	0,036	1180	3920
WH-90	**-S02**	**-S16**	0,906	23,01	0,949	0,065	0,031	0,939	0,036	1220	4060
WH-93	**-S02**	**-S16**	0,938	23,83	0,986	0,065	0,031	0,975	0,036	1260	4200
WH-96	**-S02**	**-S16**	0,968	24,59	1,025	0,075	0,037	1,015	0,042	1440	5180
WH-98	**-S02**	**-S16**	0,987	25,07	1,041	0,075	0,037	1,030	0,042	1470	5280
WH-100	**-S02**	**-S16**	1,000	25,40	1,054	0,075	0,037	1,043	0,042	1480	5350
WH-102	**-S02**	**-S16**	1,023	25,98	1,078	0,075	0,037	1,066	0,042	1520	5470
WH-103	**-S02**	**-S16**	1,031	26,19	1,084	0,075	0,037	1,074	0,042	1530	5510
WH-106	**-S02**	**-S16**	1,062	26,97	1,117	0,075	0,037	1,104	0,042	1580	5680
WH-109	**-S02**	**-S16**	1,093	27,76	1,147	0,075	0,037	1,135	0,042	1620	5840
WH-112	**-S02**	**-S16**	1,125	28,58	1,180	0,075	0,037	1,167	0,042	1670	6020
WH-115	**-S02**	**-S16**	1,156	29,36	1,210	0,075	0,037	1,198	0,042	1720	6180
WH-118	**-S02**	**-S16**	1,188	30,18	1,249	0,085	0,043	1,236	0,048	2020	7380
WH-121	**-S02**	**-S16**	1,218	30,94	1,278	0,085	0,043	1,266	0,048	2070	7570
WH-125	**-S02**	**-S16**	1,250	31,75	1,312	0,085	0,043	1,298	0,048	2120	7770
WH-128	**-S02**	**-S16**	1,281	32,54	1,342	0,085	0,043	1,329	0,048	2170	7960
WH-131	**-S02**	**-S16**	1,312	33,32	1,374	0,085	0,043	1,360	0,048	2230	8150
WH-134	**-S02**	**-S16**	1,343	34,11	1,408	0,085	0,043	1,395	0,048	2470	8350
WH-137	**-S02**	**-S16**	1,375	34,93	1,442	0,095	0,043	1,427	0,048	2530	8540
WH-140	**-S02**	**-S16**	1,406	35,71	1,472	0,095	0,043	1,458	0,048	2580	8740
WH-143	**-S02**	**-S16**	1,437	36,50	1,504	0,095	0,043	1,489	0,048	2640	8930
WH-145	**-S02**	**-S16**	1,456	36,98	1,523	0,095	0,043	1,508	0,048	2680	9050
WH-146	**-S02**	**-S16**	1,468	37,29	1,535	0,095	0,043	1,520	0,048	2700	9120
WH-150	**-S02**	**-S16**	1,500	38,10	1,567	0,095	0,043	1,552	0,048	2760	9320
WH-156	**-S02**	**-S16**	1,562	39,67	1,634	0,108	0,049	1,617	0,056	3090	10100
WH-157	**-S02**	**-S16**	1,574	39,98	1,649	0,108	0,049	1,633	0,056	3340	10180
WH-162	**-S02**	**-S16**	1,625	41,28	1,701	0,108	0,049	1,684	0,056	3350	10510
WH-165	**-S02**	**-S16**	1,653	41,99	1,730	0,108	0,049	1,712	0,056	3510	10690
WH-168	**-S02**	**-S16**	1,687	42,85	1,768	0,118	0,049	1,750	0,056	3700	10910
WH-175	**-S02**	**-S16**	1,750	44,45	1,834	0,118	0,049	1,813	0,056	3840	11310
WH-181	**-S02**	**-S16**	1,813	46,05	1,894	0,118	0,049	1,875	0,056	3970	11720
WH-185	**-S02**	**-S16**	1,850	46,99	1,937	0,118	0,049	1,917	0,056	4450	11960
WH-187	**-S02**	**-S16**	1,875	47,63	1,960	0,118	0,049	1,942	0,056	4510	12120
WH-193	**-S02**	**-S16**	1,938	49,23	2,025	0,118	0,049	2,005	0,056	4660	12530
WH-200	**-S02**	**-S16**	2,000	50,80	2,091	0,128	0,049	2,071	0,056	4950	12930

+0,013/-0,000 (Outside Diameter)
+0,003/-0,005 (Radial Wall)
±0,002 (Thickness)
±0,002 (Diameter)
±0,003 (Diameter)
±0,004 (Diameter)
±0,005 (Diameter)
+0,003/-0,000 (Width)
+0,004/-0,000 (Width)
+0,015/-0,000 (Outside Diameter)
+0,020/-0,000 (Outside Diameter)
±0,003 (Thickness)

[1] Based on a groove material yield strength of 45000 psi and a safety factor of 2.
[2] Based on a safety factor of 3.

* Contact Smalley for details/information on how to order parts to be in compliance with this specification.

WH Series

Spirolox® Imperial Medium Duty Rings Internal Continued

Smalley Part Number			Housing Diameter		Ring			Groove		Thrust Capacity	
Carbon Steel	Add Suffix 302 SS	Add Suffix 316 SS	in	mm	Outside Diameter (in)	Radial Wall (in)	Thickness (in)	Diameter (in)	Width (in)	Groove Yield[1] (lb)	Ring Shear[2] (lb)
WH-204	-S02	-S16	2,047	51,99	2,138 +0,020/-0,000	0,128	0,049	2,118 ±0,005	0,056	5060	13240
WH-206	-S02	-S16	2,062	52,37	2,154	0,128	0,049	2,132	0,056	5100	13330
WH-212	-S02	-S16	2,125	53,98	2,217	0,128	0,049	2,195	0,056	5260	13740
WH-216	-S02	-S16	2,165	54,99	2,260	0,138	0,049	2,239	0,056	5660	14000
WH-218	-S02	-S16	2,188	55,58	2,284	0,138	0,049	2,262	0,056	5720	14150
WH-225	-S02	-S16	2,250	57,15	2,347	0,138	0,049	2,324	0,056	5890	14550
WH-231	-S02	-S16	2,312	58,72	2,413	0,138	0,049	2,390	0,056	6370	14950
WH-237	-S02	-S16	2,375	60,33	2,476	0,138	0,049	2,453	0,056	6550	15360
WH-243	-S02	-S16	2,437	61,90	2,543	0,148	0,049	2,519	0,056	7060	15760
WH-244	-S02	-S16	2,440	61,98	2,546	0,148	0,049	2,522	0,056	7070	15780
WH-250	-S02	-S16	2,500	63,50	2,606	0,148	0,049	2,582	0,056	7250	16160
WH-253	-S02	-S16	2,531	64,29	2,641	0,148	0,049	2,617	0,056	7690	16360
WH-256	-S02	-S16	2,562	65,07	2,673	0,148	0,049	2,648	0,056	7790	16560
WH-262	-S02	-S16	2,625	66,68	2,736	0,148	0,049	2,711	0,056	7980	16970
WH-267	-S02	-S16	2,677	68,00	2,789	0,158	0,049	2,767	0,056	8520	17310
WH-268	-S02	-S16	2,688	68,28	2,803	0,158	0,049	2,778	0,056	8550	17380
WH-275	-S02	-S16	2,750	69,85	2,865	0,158	0,049	2,841	0,056	8750	17780
WH-281	-S02	-S16	2,813	71,45	2,929	0,158	0,049	2,903	0,056	8950	18190
WH-283	-S02	-S16	2,834	71,98	2,954	0,168	0,049	2,928	0,056	9520	18320
WH-287	-S02	-S16	2,875	73,03	2,995	0,168	0,049	2,969	0,056	9550	18590
WH-293	-S02	-S16	2,937	74,60	3,058	0,168	0,049	3,031	0,056	9760	18990
WH-295	-S02	-S16	2,952	74,98	3,073	0,168	0,049	3,046	0,056	9810	19090
WH-300	-S02	-S16	3,000	76,20	3,122	0,168	0,061	3,096	0,068	10180	24150
WH-306	-S02	-S16	3,062	77,77	3,186	0,168	0,061	3,158	0,068	10390	24650
WH-312	-S02	-S16	3,125	79,38	3,251	0,178	0,061	3,223	0,068	10600	25150
WH-314	-S02	-S16	3,149	79,98	3,276	0,178	0,061	3,247	0,068	10680	25350
WH-318	-S02	-S16	3,187	80,95	3,311	0,178	0,061	3,283	0,068	10810	25650
WH-325	-S02	-S16	3,250	82,55	3,379	0,178	0,061	3,350	0,068	11490	26160
WH-331	-S02	-S16	3,312	84,12	3,446	0,188	0,061	3,416	0,068	12170	26660
WH-334	-S02	-S16	3,346	84,99	3,479	0,188	0,061	3,450	0,068	12300	26930
WH-337	-S02	-S16	3,375	85,73	3,509	0,188	0,061	3,479	0,068	12410	27170
WH-343	-S02	-S16	3,437	87,30	3,574	0,188	0,061	3,543	0,068	12880	27660
WH-350	-S02	-S16	3,500	88,90	3,636	0,188	0,061	3,606	0,068	13110	28170
WH-354	-S02	-S16	3,543	89,99	3,684	0,198	0,061	3,653	0,068	13770	28520
WH-356	-S02	-S16	3,562	90,47	3,703	0,198	0,061	3,672	0,068	13850	28670
WH-362	-S02	-S16	3,625	92,08	3,769	0,198	0,061	3,737	0,068	14350	29180
WH-368	-S02	-S16	3,687	93,65	3,832	0,198	0,061	3,799	0,068	14600	29680
WH-374	-S02	-S16	3,740	95,00	3,885	0,198	0,061	3,852	0,068	14800	30100
WH-375	-S02	-S16	3,750	95,25	3,894	0,198	0,061	3,862	0,068	14840	30180
WH-381	-S02	-S16	3,812	96,82	3,963	0,208	0,061	3,930	0,068	15900	30680
WH-387	-S02	-S16	3,875	98,43	4,025	0,208	0,061	3,993	0,068	16160	31190
WH-393	-S02	-S16	3,938	100,03	4,089	0,208	0,061	4,056	0,068	16420	31700
WH-400	-S02	-S16	4,000	101,60	4,157	0,218	0,061	4,124	0,068	17530	32200
WH-406	-S02	-S16	4,063	103,20	4,222	0,218	0,061	4,187	0,068	17810	32700
WH-412	-S02	-S16	4,125	104,78	4,284	0,218	0,061	4,249	0,068	18080	33200
WH-418	-S02	-S16	4,188	106,38	4,347	0,218	0,061	4,311	0,068	18350	33710
WH-425	-S02	-S16	4,250	107,95	4,416	0,228	0,061	4,380	0,068	19530	34210
WH-431	-S02	-S16	4,312	109,52	4,479	0,228	0,061	4,442	0,068	19810	34710
WH-433	-S02	-S16	4,330	109,98	4,497	0,228	0,061	4,460	0,068	19900	34850
WH-437	-S02	-S16	4,375	111,13	4,543	0,228	0,061	4,505	0,068	20100	35210
WH-443	-S02	-S16	4,437	112,70	4,611	0,238	0,061	4,573	0,068	21330	35710
WH-450	-S02	-S16	4,500	114,30	4,674	0,238	0,061	4,636	0,068	21630	36220
WH-452	-S02	-S16	4,527	114,99	4,701	0,238	0,061	4,663	0,068	21760	36440
WH-456	-S02	-S16	4,562	115,87	4,737	0,238	0,061	4,698	0,068	21930	36720
WH-462	-S02	-S16	4,625	117,48	4,803	0,250	0,072	4,765	0,079	22890	43940
WH-468	-S02	-S16	4,687	119,05	4,867	0,250	0,072	4,827	0,079	23190	44530
WH-472	-S02	-S16	4,724	119,99	4,903	0,250	0,072	4,864	0,079	23370	44880
WH-475	-S02	-S16	4,750	120,65	4,930	0,250	0,072	4,890	0,079	23500	45130
WH-481	-S02	-S16	4,812	122,22	4,993	0,250	0,072	4,952	0,079	23810	45720
WH-487	-S02	-S16	4,875	123,83	5,055	0,250	0,072	5,015	0,079	24120	46310
WH-492	-S02	-S16	4,921	124,99	5,102	0,250	0,072	5,061	0,079	24350	46750
WH-493	-S02	-S16	4,937	125,40	5,122	0,250	0,072	5,081	0,079	25130	46900
WH-500	-S02	-S16	5,000	127,00	5,185	0,250	0,072	5,144	0,079	25450	47500
WH-511	-S02	-S16	5,118	130,00	5,304	0,250	0,072	5,262	0,079	26050	48620
WH-512	-S02	-S16	5,125	130,18	5,311	0,250	0,072	5,269	0,079	26100	48690
WH-525	-S02	-S16	5,250	133,35	5,436 +0,045/-0,000	0,250	0,072	5,393 ±0,007	0,079	26720	49880

Outside Diameter: +0,025/-0,000 (WH-204 to WH-262); +0,030/-0,000 (WH-267 to WH-387); +0,035/-0,000 (WH-393 to WH-525)

Radial Wall: +0,003/-0,005 (WH-204 to WH-262); +0,004/-0,006 (WH-267 to WH-525)

Thickness: ±0,003 (WH-204 to WH-387); ±0,004 (WH-393 to WH-525)

Diameter: ±0,006 (WH-204 to WH-525)

Width: +0,004/-0,000 (WH-204 to WH-262); +0,005/-0,000 (WH-267 to WH-525)

[1] Based on a groove material yield strength of 45000 psi and a safety factor of 2.
[2] Based on a safety factor of 3.

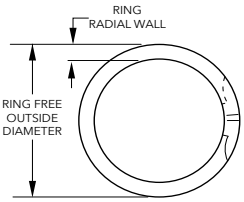
* Contact Smalley for details/information on how to order parts to be in compliance with this specification.

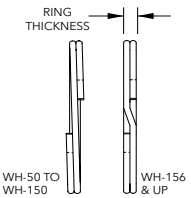
WH Series

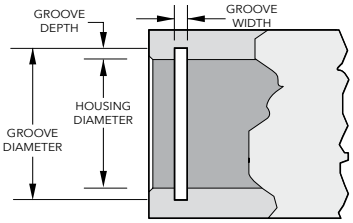
Spirolox® Imperial Medium Duty Rings Internal

**Compliance with AS3217, AS4299, MIL-DTL-27426/3*









Product Dimensions: All dimensions in inches unless otherwise specified.

Smalley Part Number			Housing Diameter		Ring			Groove		Thrust Capacity	
Carbon Steel	Add Suffix				Outside Diameter (in)	Radial Wall (in)	Thickness (in)	Diameter (in)	Width (in)	Groove Yield[1] (lb)	Ring Shear[2] (lb)
	302 SS	316 SS	in	mm							
WH-537	**-S02**	**-S16**	5,375	136,53	5,566	0,250	0,072	5,522	0,079	28120	51060
WH-550	**-S02**	**-S16**	5,500	139,70	5,693	0,250	0,072	5,647	0,079	28770	52250
WH-551	**-S02**	**-S16**	5,511	139,98	5,703	0,250	0,072	5,658	0,079	28830	52360
WH-562	**-S02**	**-S16**	5,625	142,88	5,818	0,250	0,072	5,772	0,079	29400	53440
WH-570	**-S02**	**-S16**	5,708	144,98	5,909	0,250	0,072	5,861	0,079	31070	54230
WH-575	**-S02**	**-S16**	5,750	146,05	5,950	0,250	0,072	5,903	0,079	31300	54630
WH-587	**-S02**	**-S16**	5,875	149,23	6,077	0,250	0,072	6,028	0,079	31980	55810
WH-590	**-S02**	**-S16**	5,905	149,99	6,106	0,250	0,072	6,058	0,079	32140	56100
WH-600	**-S02**	**-S16**	6,000	152,40	6,202	0,250	0,072	6,153	0,079	32660	57000
WH-612	**-S02**	**-S16**	6,125	155,58	6,349	0,312	0,086	6,297	0,094	37200	69500
WH-625	**-S02**	**-S16**	6,250	158,75	6,474	0,312	0,086	6,422	0,094	37990	70920
WH-629	**-S02**	**-S16**	6,299	159,99	6,524	0,312	0,086	6,471	0,094	38290	71480
WH-637	**-S02**	**-S16**	6,375	161,93	6,601	0,312	0,086	6,547	0,094	38750	72340
WH-650	**-S02**	**-S16**	6,500	165,10	6,726	0,312	0,086	6,672	0,094	39510	73760
WH-662	**-S02**	**-S16**	6,625	168,28	6,863	0,312	0,086	6,807	0,094	42620	75180
WH-669	**-S02**	**-S16**	6,692	169,98	6,931	0,312	0,086	6,874	0,094	43050	75940
WH-675	**-S02**	**-S16**	6,750	171,45	6,987	0,312	0,086	6,932	0,094	43420	76600
WH-687	**-S02**	**-S16**	6,875	174,63	7,114	0,312	0,086	7,057	0,094	44220	78010
WH-700	**-S02**	**-S16**	7,000	177,80	7,239	0,312	0,086	7,182	0,094	45030	79430
WH-708	**-S02**	**-S16**	7,086	179,98	7,337	0,312	0,086	7,278	0,094	48080	80410
WH-712	**-S02**	**-S16**	7,125	180,98	7,376	0,312	0,086	7,317	0,094	48350	80850
WH-725	**-S02**	**-S16**	7,250	184,15	7,501	0,312	0,086	7,442	0,094	49200	82270
WH-737	**-S02**	**-S16**	7,375	187,33	7,628	0,312	0,086	7,567	0,094	50050	83690
WH-748	**-S02**	**-S16**	7,480	189,99	7,734	0,312	0,086	7,672	0,094	50760	84880
WH-750	**-S02**	**-S16**	7,500	190,50	7,754	0,312	0,086	7,692	0,094	50890	85110
WH-762	**-S02**	**-S16**	7,625	193,68	7,890	0,312	0,086	7,827	0,094	54440	86520
WH-775	**-S02**	**-S16**	7,750	196,85	8,014	0,312	0,086	7,952	0,094	55330	87940
WH-787	**-S02**	**-S16**	7,875	200,03	8,131	0,312	0,086	8,077	0,094	63360	89360
WH-800	**-S02**	**-S16**	8,000	203,20	8,266	0,312	0,086	8,202	0,094	57110	90780
WH-825	**-S02**	**-S16**	8,250	209,55	8,528	0,375	0,086	8,462	0,094	61820	93620
WH-826	**-S02**	**-S16**	8,267	209,98	8,546	0,375	0,086	8,479	0,094	61940	93810
WH-846	**-S02**	**-S16**	8,464	214,99	8,744	0,375	0,086	8,676	0,094	63420	96050
WH-850	**-S02**	**-S16**	8,500	215,90	8,780	0,375	0,086	8,712	0,094	63690	96450
WH-875	**-S02**	**-S16**	8,750	222,25	9,041	0,375	0,086	8,972	0,094	68650	99290
WH-885	**-S02**	**-S16**	8,858	224,99	9,151	0,375	0,086	9,080	0,094	69500	100520
WH-900	**-S02**	**-S16**	9,000	228,60	9,293	0,375	0,086	9,222	0,094	70620	102130
WH-905	**-S02**	**-S16**	9,055	230,00	9,359	0,375	0,086	9,287	0,094	74250	102750
WH-925	**-S02**	**-S16**	9,250	234,95	9,555	0,375	0,086	9,482	0,094	75850	104960
WH-944	**-S02**	**-S16**	9,448	239,98	9,755	0,375	0,086	9,680	0,094	77470	107210
WH-950	**-S02**	**-S16**	9,500	241,30	9,806	0,375	0,086	9,732	0,094	77900	107800
WH-975	**-S02**	**-S16**	9,750	247,65	10,068	0,375	0,086	9,992	0,094	83390	110640
WH-1000	**-S02**	**-S16**	10,000	254,00	10,320	0,375	0,086	10,242	0,094	85530	113470
WH-1025	**-S02**	**-S16**	10,250	260,35	10,582	0,375	0,086	10,502	0,094	91290	116310
WH-1050	**-S02**	**-S16**	10,500	266,70	10,834	0,375	0,086	10,752	0,094	93520	119150
WH-1075	**-S02**	**-S16**	10,750	273,05	11,095	0,375	0,086	11,012	0,094	99540	121990
WH-1100	**-S02**	**-S16**	11,000	279,40	11,347	0,375	0,086	11,262	0,094	101860	124820

+0,045/-0,000 (Outside Diameter, WH-537 to WH-600)
+0,055/-0,000 (Outside Diameter, WH-612 to WH-712)
+0,065/-0,000 (Outside Diameter, WH-725 to WH-1100)
+0,004/-0,006 (Radial Wall, WH-537 to WH-600)
+0,004/-0,008 (Radial Wall, WH-612 to WH-1100)
±0,004 (Thickness, WH-537 to WH-1100)
±0,007 (Diameter, WH-537 to WH-600)
±0,008 (Diameter, WH-612 to WH-1100)
+0,005/-0,000 (Width, WH-537 to WH-600)
+0,006/-0,000 (Width, WH-612 to WH-1100)

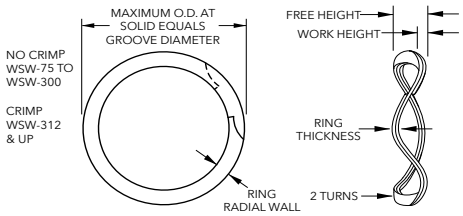
[1] Based on a groove material yield strength of 45000 psi and a safety factor of 2.
[2] Based on a safety factor of 3.

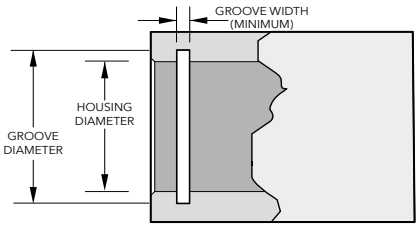
* Contact Smalley for details/information on how to order parts to be in compliance with this specification.

WHW Series

WaveRing® Imperial Internal







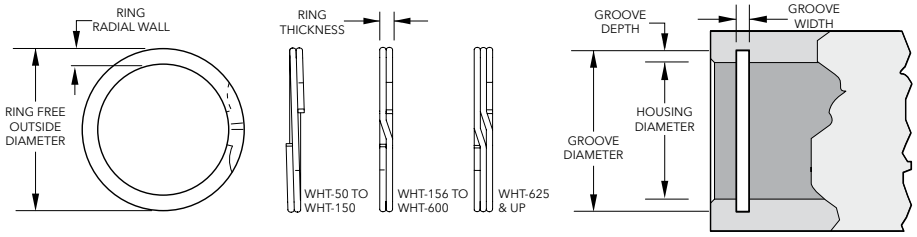
Product Dimensions: All dimensions in inches unless otherwise specified.

Smalley Part Number		Housing Diameter		Ring		Groove		Load (lb) @ Work Height	Max Free Height (in)	Number of Waves
Carbon Steel	Add Suffix 17-7	in	mm	Thickness (in)	Radial Wall (in)	Diameter (in)	Width Minimum (in)			
WHW-75	**-S17**	0,750	19,05	0,035	0,065	0,796	0,119	25 @ 0,080	0,114	3
WHW-87	**-S17**	0,875	22,23	0,042	0,085	0,931	0,115	30 @ 0,085	0,110	3
WHW-100	**-S17**	1,000	25,40	0,042	0,085	1,066	0,125	34 @ 0,085	0,120	3
WHW-112	**-S17**	1,125	28,58	0,050	0,128	1,197	0,130	38 @ 0,100	0,125	3
WHW-125	**-S17**	1,250	31,75	0,050	0,128	1,330	0,140	40 @ 0,100	0,135	3
WHW-137	**-S17**	1,375	34,93	0,050	0,128	1,461	0,130	45 @ 0,100	0,125	4
WHW-150	**-S17**	1,500	38,10	0,050	0,128	1,594	0,140	50 @ 0,100	0,135	4
WHW-162	**-S17**	1,625	41,28	0,062	0,158	1,725	0,140	55 @ 0,110	0,135	4
WHW-175	**-S17**	1,750	44,45	0,062	0,158	1,858	0,145	60 @ 0,110	0,140	4
WHW-187	**-S17**	1,875	47,63	0,062	0,158	1,989	0,146	63 @ 0,110	0,141	4
WHW-200	**-S17**	2,000	50,80	0,062	0,158	2,122	0,155	65 @ 0,110	0,150	4
WHW-212	**-S17**	2,125	53,98	0,078	0,188	2,251	0,175	70 @ 0,130	0,170	4
WHW-225	**-S17**	2,250	57,15	0,078	0,188	2,382	0,180	75 @ 0,130	0,175	4
WHW-237	**-S17**	2,375	60,33	0,078	0,188	2,517	0,185	80 @ 0,130	0,180	4
WHW-250	**-S17**	2,500	63,50	0,078	0,188	2,648	0,188	84 @ 0,130	0,183	4
WHW-262	**-S17**	2,625	66,68	0,093	0,225	2,781	0,225	88 @ 0,170	0,220	4
WHW-275	**-S17**	2,750	69,85	0,093	0,225	2,914	0,234	94 @ 0,170	0,229	4
WHW-287	**-S17**	2,875	73,03	0,093	0,225	3,051	0,230	97 @ 0,170	0,225	4
WHW-300	**-S17**	3,000	76,20	0,093	0,225	3,182	0,235	100 @ 0,170	0,230	4
WHW-312	**-S17**	3,125	79,38	0,111	0,281	3,315	0,255	103 @ 0,185	0,250	4
WHW-325	**-S17**	3,250	82,55	0,111	0,281	3,446	0,255	106 @ 0,185	0,250	4
WHW-350	**-S17**	3,500	88,90	0,111	0,281	3,710	0,250	115 @ 0,185	0,245	4
WHW-362	**-S17**	3,625	92,08	0,111	0,281	3,841	0,250	117 @ 0,185	0,250	4
WHW-375	**-S17**	3,750	95,25	0,111	0,312	3,974	0,260	121 @ 0,185	0,255	4
WHW-387	**-S17**	3,875	98,43	0,111	0,312	4,107	0,265	126 @ 0,185	0,260	4
WHW-400	**-S17**	4,000	101,60	0,111	0,312	4,240	0,260	130 @ 0,185	0,255	4
WHW-412	**-S17**	4,125	104,78	0,111	0,312	4,365	0,263	134 @ 0,185	0,258	4
WHW-425	**-S17**	4,250	107,95	0,111	0,312	4,490	0,269	140 @ 0,185	0,264	4
WHW-450	**-S17**	4,500	114,30	0,111	0,312	4,740	0,255	150 @ 0,185	0,250	5
WHW-475	**-S17**	4,750	120,65	0,111	0,312	4,995	0,257	160 @ 0,185	0,252	5
WHW-500	**-S17**	5,000	127,00	0,111	0,312	5,260	0,252	170 @ 0,185	0,247	5

WHT Series

Spirolox® Imperial Medium/Heavy Duty Rings Internal





Product Dimensions: All dimensions in inches unless otherwise specified.

Smalley Part Number			Housing Diameter		Ring				Groove				Thrust Capacity	
Carbon Steel	Add Suffix				Outside Diameter (in)		Radial Wall (in)		Thickness (in)		Diameter (in)		Width (in)		Groove Yield[1] (lb)	Ring Shear[2] (lb)
	302 SS	316 SS	in	mm												
Two-Turn																
WHT-50	**-S02**	**-S16**	0,500	12,70	0,529	+0,013/-0,000	0,045	±0,004	0,035	±0,002	0,524	±0,003	0,039	+0,003/-0,000	420	2530
WHT-51	**-S02**	**-S16**	0,512	13,00	0,541		0,045		0,035		0,536		0,039		430	2590
WHT-56	**-S02**	**-S16**	0,562	14,27	0,597		0,045		0,035		0,592		0,039		600	2840
WHT-62	**-S02**	**-S16**	0,625	15,88	0,665		0,045		0,035		0,659		0,039		750	3160
WHT-68	**-S02**	**-S16**	0,688	17,48	0,730		0,055		0,035		0,724		0,039		880	3480
WHT-75	**-S02**	**-S16**	0,750	19,05	0,796		0,055		0,035		0,790		0,039		1060	3790
WHT-77	**-S02**	**-S16**	0,777	19,74	0,825		0,065		0,042		0,819		0,046		1150	4720
WHT-81	**-S02**	**-S16**	0,812	20,62	0,864		0,065		0,042		0,857		0,046		1320	4930
WHT-86	**-S02**	**-S16**	0,866	22,00	0,919		0,065		0,042		0,912		0,046		1410	5260
WHT-87	**-S02**	**-S16**	0,875	22,23	0,929		0,065		0,042		0,922		0,046		1480	5310
WHT-90	**-S02**	**-S16**	0,901	22,89	0,957		0,065		0,042	±0,002	0,950		0,046		1590	5470
WHT-93	**-S02**	**-S16**	0,938	23,83	0,997		0,075		0,042		0,989		0,046		1720	5690
WHT-100	**-S02**	**-S16**	1,000	25,40	1,063		0,075		0,042		1,055		0,046		1980	6070
WHT-102	**-S02**	**-S16**	1,023	25,98	1,087		0,075		0,042		1,079		0,046		2030	6210
WHT-106	**-S02**	**-S16**	1,062	26,97	1,129	+0,015/-0,000	0,078		0,050		1,120		0,056		2180	7010
WHT-112	**-S02**	**-S16**	1,125	28,58	1,195		0,078		0,050		1,185		0,056		2390	7420
WHT-118	**-S02**	**-S16**	1,188	30,18	1,260		0,088		0,050		1,250		0,056		2600	7840
WHT-125	**-S02**	**-S16**	1,250	31,75	1,330		0,093		0,050		1,320	±0,004	0,056		3090	8250
WHT-131	**-S02**	**-S16**	1,312	33,32	1,395		0,093		0,050		1,385		0,056		3430	8660
WHT-137	**-S02**	**-S16**	1,375	34,93	1,461		0,098		0,050		1,450		0,056		3690	9070
WHT-143	**-S02**	**-S16**	1,438	36,53	1,526		0,103		0,050		1,515		0,056		3960	9490
WHT-145	**-S02**	**-S16**	1,456	36,98	1,546		0,108		0,050		1,535		0,056		4120	9610
WHT-150	**-S02**	**-S16**	1,500	38,10	1,591		0,108		0,050		1,580		0,056		4240	9900
WHT-156	**-S02**	**-S16**	1,562	39,67	1,659	+0,020/-0,000	0,113		0,062		1,647		0,068		4750	12780
WHT-162	**-S02**	**-S16**	1,625	41,28	1,727		0,113		0,062		1,715		0,068		5170	13290
WHT-165	**-S02**	**-S16**	1,653	41,99	1,757		0,118		0,062		1,745		0,068		5380	13520
WHT-168	**-S02**	**-S16**	1,688	42,88	1,793		0,118		0,062		1,780		0,068		5490	13810
WHT-175	**-S02**	**-S16**	1,750	44,45	1,858		0,118		0,062		1,845	±0,005	0,068		5940	14320
WHT-181	**-S02**	**-S16**	1,812	46,02	1,923		0,123		0,062		1,910		0,068		6280	14820
WHT-185	**-S02**	**-S16**	1,850	46,99	1,963		0,123		0,062		1,949		0,068		6540	15130
WHT-187	**-S02**	**-S16**	1,875	47,63	1,989		0,128		0,062		1,975		0,068		6630	15340
WHT-193	**-S02**	**-S16**	1,938	49,23	2,054		0,128		0,062		2,040		0,068		6990	15850
WHT-200	**-S02**	**-S16**	2,000	50,80	2,125		0,138		0,062		2,110		0,068		7780	16360
WHT-206	**-S02**	**-S16**	2,062	52,37	2,190	+0,025/-0,000	0,141		0,078	±0,003	2,175	±0,006	0,086	+0,005/-0,000	8310	21220
WHT-212	**-S02**	**-S16**	2,125	53,98	2,255		0,141		0,078		2,240		0,086		8710	21870
WHT-218	**-S02**	**-S16**	2,188	55,58	2,321		0,141		0,078		2,305		0,086		9130	22520
WHT-225	**-S02**	**-S16**	2,250	57,15	2,386		0,141		0,078		2,370		0,086		9540	23160
WHT-231	**-S02**	**-S16**	2,312	58,72	2,457		0,188		0,078		2,440		0,086		10460	23800
WHT-237	**-S02**	**-S16**	2,375	60,33	2,522		0,188		0,078		2,505		0,086		10910	24440
WHT-244	**-S02**	**-S16**	2,440	61,98	2,588		0,188		0,078		2,570		0,086		11210	25110
WHT-250	**-S02**	**-S16**	2,500	63,50	2,653		0,188		0,078		2,635		0,086		12020	25730
WHT-253	**-S02**	**-S16**	2,531	64,29	2,687		0,188		0,078		2,668		0,086		12350	26050
WHT-256	**-S02**	**-S16**	2,562	65,07	2,720		0,188	±0,005	0,093		2,700		0,103		12500	29940
WHT-262	**-S02**	**-S16**	2,625	66,68	2,785		0,188		0,093		2,765		0,103		12990	30680
WHT-268	**-S02**	**-S16**	2,688	68,28	2,855		0,188		0,093		2,834		0,103		13870	31410
WHT-275	**-S02**	**-S16**	2,750	69,85	2,921		0,188		0,093		2,900		0,103		14580	32140
WHT-281	**-S02**	**-S16**	2,813	71,45	2,987		0,188		0,093		2,965		0,103		15110	32880
WHT-283	**-S02**	**-S16**	2,834	71,98	3,009		0,188		0,093		2,987		0,103		15430	33120
WHT-287	**-S02**	**-S16**	2,875	73,03	3,053		0,188		0,093		3,030		0,103		15850	33600

[1] Based on a groove material yield strength of 45000 psi and a safety factor of 2.
[2] Based on a safety factor of 3.

WHT Series

Spirolox® Imperial Medium/Heavy Duty Rings Internal Continued

Smalley Part Number			Housing Diameter		Ring			Groove		Thrust Capacity	
Carbon Steel	Add Suffix				Outside Diameter (in)	Radial Wall (in)	Thickness (in)	Diameter (in)	Width (in)	Groove Yield[1] (lb)	Ring Shear[2] (lb)
	302 SS	316 SS	in	mm							
WHT-300	**-S02**	**-S16**	3,000	76,20	3,188 +0,025/-0,000	0,188	0,093	3,165	0,103	17600	35060
WHT-306	**-S02**	**-S16**	3,062	77,77	3,253	0,250	0,111	3,230	0,120	18180	42710
WHT-312	**-S02**	**-S16**	3,125	79,38	3,318	0,250	0,111	3,295	0,120	18780	43590
WHT-315	**-S02**	**-S16**	3,156	80,16	3,354	0,250	0,111	3,328	0,120	19190	44040
WHT-325	**-S02**	**-S16**	3,250	82,55	3,450	0,250	0,111	3,426	0,120	20220	45330
WHT-334	**-S02**	**-S16**	3,346	84,99	3,550	0,250	0,111	3,525	0,120	21290	46670
WHT-346	**-S02**	**-S16**	3,464	87,99	3,675	0,250	0,111	3,650	0,120	22770	48320
WHT-350	**-S02**	**-S16**	3,500	88,90	3,716	0,250	0,111	3,690	0,120	23500	48820
WHT-354	**-S02**	**-S16**	3,543	89,99	3,761	0,250	0,111	3,735	0,120	24040	49420
WHT-356	**-S02**	**-S16**	3,562	90,47	3,783	0,250	0,111	3,756	0,120	24420	49690
WHT-362	**-S02**	**-S16**	3,625	92,08	3,849	0,250	0,111	3,822	0,120	25370	50560
WHT-375	**-S02**	**-S16**	3,750	95,25	3,982	0,250	0,111	3,955	0,120	27300	52310
WHT-387	**-S02**	**-S16**	3,875	98,43	4,115	0,250	0,111	4,087	0,120	29030	54050
WHT-393	**-S02**	**-S16**	3,938	100,03	4,178	0,250	0,111	4,150	0,120	29510	54930
WHT-400	**-S02**	**-S16**	4,000	101,60	4,248	0,250	0,111	4,220	0,120	31100	55800
WHT-412	**-S02**	**-S16**	4,125	104,78	4,373	0,312	0,111	4,345	0,120	32070	57540
WHT-425	**-S02**	**-S16**	4,250	107,95	4,500	0,312	0,111	4,470	0,120	33050	59280
WHT-433	**-S02**	**-S16**	4,330	109,98	4,586	0,312	0,111	4,556	0,120	34590	60400
WHT-450	**-S02**	**-S16**	4,500	114,30	4,768	0,312	0,111	4,735	0,120	37530	62770
WHT-462	**-S02**	**-S16**	4,625	117,48	4,897	0,312	0,111	4,865	0,120	39230	64510
WHT-475	**-S02**	**-S16**	4,750	120,65	5,028	0,312	0,111	4,995	0,120	41300	66260
WHT-500	**-S02**	**-S16**	5,000	127,00	5,295	0,312	0,111	5,260	0,120	45950	69740
WHT-525	**-S02**	**-S16**	5,250	133,35	5,559	0,375	0,127	5,520	0,139	50100	83790
WHT-537	**-S02**	**-S16**	5,375	136,53	5,685	0,375	0,127	5,645	0,139	51290	85780
WHT-550	**-S02**	**-S16**	5,500	139,70	5,810	0,375	0,127	5,770	0,139	52480	87780
WHT-575	**-S02**	**-S16**	5,750	146,05	6,062	0,375	0,127	6,020	0,139	54870	91770
WHT-600	**-S02**	**-S16**	6,000	152,40	6,314	0,375	0,127	6,270	0,139	57260	95760
						Three-Turn					
WHT-625	**-S02**	**-S16**	6,250	158,75	6,576	0,312	0,165	6,530	0,174	61850	129590
WHT-650	**-S02**	**-S16**	6,500	165,10	6,837	0,312	0,165	6,790	0,174	66620	134780
WHT-662	**-S02**	**-S16**	6,625	168,28	6,973	0,312	0,165	6,925	0,174	70240	137370
WHT-675	**-S02**	**-S16**	6,750	171,45	7,104	0,312	0,165	7,055	0,174	73000	139960
WHT-700	**-S02**	**-S16**	7,000	177,80	7,366	0,312	0,165	7,315	0,174	78180	145140
WHT-725	**-S02**	**-S16**	7,250	184,15	7,628	0,375	0,189	7,575	0,209	83530	172190
WHT-750	**-S02**	**-S16**	7,500	190,50	7,895	0,375	0,189	7,840	0,209	90120	178130
WHT-775	**-S02**	**-S16**	7,750	196,85	8,156	0,375	0,189	8,100	0,209	95870	184070
WHT-800	**-S02**	**-S16**	8,000	203,20	8,418	0,375	0,189	8,360	0,209	101790	190000
WHT-825	**-S02**	**-S16**	8,250	209,55	8,680	0,375	0,189	8,620	0,209	107880	195940
WHT-850	**-S02**	**-S16**	8,500	215,90	8,942	0,375	0,189	8,880	0,209	114160	201880
WHT-875	**-S02**	**-S16**	8,750	222,25	9,209	0,375	0,189	9,145	0,209	122460	207820
WHT-900	**-S02**	**-S16**	9,000	228,60	9,471	0,375	0,189	9,405	0,209	129140	213750
WHT-925	**-S02**	**-S16**	9,250	234,95	9,736	0,375	0,189	9,669	0,209	137310	219690
WHT-950	**-S02**	**-S16**	9,500	241,30	9,999	0,375	0,189	9,930	0,209	144380	225630
WHT-975	**-S02**	**-S16**	9,750	247,65	10,260	0,375	0,189	10,189	0,209	151620	231570
WHT-1000	**-S02**	**-S16**	10,000	254,00	10,552	0,375	0,189	10,450	0,209	159040	237500
WHT-1050	**-S02**	**-S16**	10,500	266,70	11,072	0,375	0,189	10,970	0,209	174420	249380

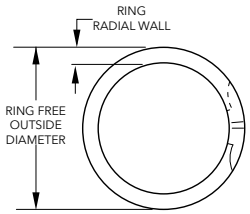
[1] Based on a groove material yield strength of 45000 psi and a safety factor of 2.
[2] Based on a safety factor of 3.

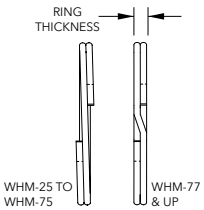
WHM Series

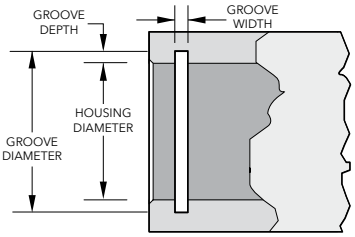
Spirolox® Imperial Heavy Duty Rings Internal

**Compliance with AS3215, AS4299, MIL-DTL-27426/4*









Product Dimensions: All dimensions in inches unless otherwise specified.

Smalley Part Number			Housing Diameter		Ring			Groove		Thrust Capacity	
Carbon Steel	Add Suffix 302 SS	Add Suffix 316 SS	in	mm	Outside Diameter (in)	Radial Wall (in)	Thickness (in)	Diameter (in)	Width (in)	Groove Yield[1] (lb)	Ring Shear[2] (lb)
						+0.010/-0.000					
WHM-25[3,4]	-S02	-S16	0,250	6,35	0,270	0,020	0,015	0,268	0,020	159	561
WHM-31[3,4]	-S02	-S16	0,312	7,92	0,333	0,025	0,015	0,330	0,020	198	700
WHM-37[3,4]	-S02	-S16	0,375	9,53	0,400	0,030	0,025	0,397	0,029	292	1442
WHM-43[4]	-S02	-S16	0,437	11,10	0,464	0,035	0,025	0,461	0,029	371	1680
					+0.012/-0.000						
WHM-50	-S02	-S16	0,500	12,70	0,538	0,045	0,035	0,530	0,039	530	2530
WHM-51	-S02	-S16	0,512	13,00	0,550	0,045	0,035	0,542	0,039	540	2590
WHM-56	-S02	-S16	0,562	14,27	0,605	0,055	0,035	0,596	0,039	680	2840
WHM-62	-S02	-S16	0,625	15,88	0,675	0,055	0,035	0,665	0,039	880	3160
WHM-68	-S02	-S16	0,688	17,48	0,743	0,065	0,035	0,732	0,039	1070	3480
WHM-75	-S02	-S16	0,750	19,05	0,807	0,065	0,035	0,796	0,039	1220	3790
WHM-77	-S02	-S16	0,777	19,74	0,836	0,075	0,042	0,825	0,046	1320	4720
WHM-81	-S02	-S16	0,812	20,62	0,873	0,075	0,042	0,862	0,046	1440	4930
WHM-86	-S02	-S16	0,866	22,00	0,931	0,075	0,042	0,920	0,046	1650	5260
WHM-87	-S02	-S16	0,875	22,23	0,943	0,085	0,042	0,931	0,046	1730	5310
WHM-90	-S02	-S16	0,901	22,89	0,972	0,085	0,042	0,959	0,046	1850	5470
WHM-93	-S02	-S16	0,938	23,83	1,013	0,085	0,042	1,000	0,046	2060	5690
WHM-100	-S02	-S16	1,000	25,40	1,080	0,085	0,042	1,066	0,046	2330	6070
WHM-102	-S02	-S16	1,023	25,98	1,105	0,085	0,042	1,091	0,046	2460	6210
WHM-106	-S02	-S16	1,062	26,97	1,138	0,103	0,050	1,130	0,056	2550	7010
WHM-112	-S02	-S16	1,125	28,58	1,205	0,103	0,050	1,197	0,056	2860	7420
WHM-118	-S02	-S16	1,188	30,18	1,271	0,103	0,050	1,262	0,056	3110	7840
WHM-125	-S02	-S16	1,250	31,75	1,339	0,103	0,050	1,330	0,056	3530	8250
WHM-131	-S02	-S16	1,312	33,32	1,406	0,118	0,050	1,396	0,056	3900	8660
WHM-137	-S02	-S16	1,375	34,93	1,471	0,118	0,050	1,461	0,056	4180	9070
WHM-143	-S02	-S16	1,439	36,55	1,539	0,118	0,050	1,528	0,056	4580	9490
WHM-145	-S02	-S16	1,456	36,98	1,559	0,118	0,050	1,548	0,056	4730	9610
WHM-150	-S02	-S16	1,500	38,10	1,605	0,118	0,050	1,594	0,056	4980	9900
WHM-156	-S02	-S16	1,562	39,67	1,675	0,128	0,062	1,658	0,068	5300	12780
WHM-162	-S02	-S16	1,625	41,28	1,742	0,128	0,062	1,725	0,068	5740	13290
WHM-165	-S02	-S16	1,653	41,99	1,772	0,128	0,062	1,755	0,068	5960	13520
WHM-168	-S02	-S16	1,688	42,88	1,810	0,128	0,062	1,792	0,068	6210	13810
WHM-175	-S02	-S16	1,750	44,45	1,876	0,128	0,062	1,858	0,068	6680	14320
WHM-181	-S02	-S16	1,812	46,02	1,940	0,128	0,062	1,922	0,068	7050	14820
WHM-185	-S02	-S16	1,850	46,99	1,981	0,158	0,062	1,962	0,068	7320	15130
WHM-187	-S02	-S16	1,875	47,63	2,008	0,158	0,062	1,989	0,068	7560	15340
WHM-193	-S02	-S16	1,938	49,23	2,075	0,158	0,062	2,056	0,068	8080	15850
WHM-200	-S02	-S16	2,000	50,80	2,142	0,158	0,062	2,122	0,068	8620	16360
WHM-206	-S02	-S16	2,062	52,37	2,201	0,168	0,078	2,186	0,086	9040	21220
WHM-212	-S02	-S16	2,125	53,98	2,267	0,168	0,078	2,251	0,086	9460	21870
WHM-218	-S02	-S16	2,188	55,58	2,334	0,168	0,078	2,318	0,086	10050	22520
WHM-225	-S02	-S16	2,250	57,15	2,399	0,168	0,078	2,382	0,086	10500	23160
WHM-231	-S02	-S16	2,312	58,72	2,467	0,200	0,078	2,450	0,086	11280	23800
WHM-237	-S02	-S16	2,375	60,33	2,535	0,200	0,078	2,517	0,086	11920	24440
WHM-244	-S02	-S16	2,440	61,98	2,602	0,200	0,078	2,584	0,086	12420	25110
WHM-250	-S02	-S16	2,500	63,50	2,667	0,200	0,078	2,648	0,086	13080	25730
WHM-253	-S02	-S16	2,531	64,29	2,700	0,200	0,078	2,681	0,086	13420	26050
WHM-256	-S02	-S16	2,562	65,07	2,733	0,225	0,093	2,714	0,103	13760	29940
WHM-262	-S02	-S16	2,625	66,68	2,801	0,225	0,093	2,781	0,103	14470	30680
WHM-268	-S02	-S16	2,688	68,28	2,868	0,225	0,093	2,848	0,103	15200	31410
WHM-275	-S02	-S16	2,750	69,85	2,934	0,225	0,093	2,914	0,103	15940	32140

[1] Based on a groove material yield strength of 45000 psi and a safety factor of 2.
[2] Based on a safety factor of 3.
[3] No removal notch.
[4] Square edge wire.
* Contact Smalley for details/information on how to order parts to be in compliance with this specification.

WHM Series

Spirolox® Imperial Heavy Duty Rings Internal Continued

Smalley Part Number			Housing Diameter		Ring			Groove		Thrust Capacity	
Carbon Steel	Add Suffix				Outside Diameter (in)	Radial Wall (in)	Thickness (in)	Diameter (in)	Width (in)	Groove Yield[1] (lb)	Ring Shear[2] (lb)
	302 SS	316 SS	in	mm							
WHM-281	**-S02**	**-S16**	2,813	71,45	3,001 +0,030/-0,000	0,225	0,093	2,980	0,103	16700	32880
WHM-283	**-S02**	**-S16**	2,834	71,98	3,027	0,225	0,093	3,006	0,103	17230	33120
WHM-287	**-S02**	**-S16**	2,875	73,03	3,072	0,225	0,093	3,051	0,103	17880	33600
WHM-300	**-S02**	**-S16**	3,000	76,20	3,204	0,225	0,093	3,182	0,103	18300	35060
WHM-306	**-S02**	**-S16**	3,062	77,77	3,271	0,281	0,111	3,248	0,120	20130	42710
WHM-312	**-S02**	**-S16**	3,125	79,38	3,338	0,281	0,111	3,315	0,120	20990	43590
WHM-315	**-S02**	**-S16**	3,157	80,19	3,371	0,281	0,111	3,348	0,120	21420	44040
WHM-325	**-S02**	**-S16**	3,250	82,55	3,470	0,281	0,111	3,446	0,120	22510	45330
WHM-334	**-S02**	**-S16**	3,346	84,99	3,571	0,281	0,111	3,546	0,120	23650	46670
WHM-347	**-S02**	**-S16**	3,464	87,99	3,701	0,281	0,111	3,675	0,120	25710	48320
WHM-350	**-S02**	**-S16**	3,500	88,90	3,736	0,281	0,111	3,710	0,120	25980	48820
WHM-354	**-S02**	**-S16**	3,543	89,99	3,781	0,281	0,111	3,755	0,120	26550	49420
WHM-356	**-S02**	**-S16**	3,562	90,47	3,802	0,281	0,111	3,776	0,120	26940	49690
WHM-362	**-S02**	**-S16**	3,625	92,08	3,868	0,281	0,111	3,841	0,120	27670	50560
WHM-375	**-S02**	**-S16**	3,750	95,25	4,002	0,312	0,111	3,974	0,120	29690	52310
WHM-387	**-S02**	**-S16**	3,875	98,43	4,136	0,312	0,111	4,107	0,120	31770	54050
WHM-393	**-S02**	**-S16**	3,938	100,03	4,203	0,312	0,111	4,174	0,120	32850	54930
WHM-400	**-S02**	**-S16**	4,000	101,60	4,270	0,312	0,111	4,240	0,120	33930	55800
WHM-412	**-S02**	**-S16**	4,125	104,78	4,369	0,312	0,111	4,339	0,120	34990	57540
WHM-425	**-S02**	**-S16**	4,250	107,95	4,501	0,312	0,111	4,470	0,120	36050	59280
WHM-433	**-S02**	**-S16**	4,330	109,98	4,588	0,312	0,111	4,556	0,120	36730	60400
WHM-450	**-S02**	**-S16**	4,500	114,30	4,768	0,312	0,111	4,735	0,120	38170	62770
WHM-462	**-S02**	**-S16**	4,625	117,48	4,899	0,312	0,111	4,865	0,120	39230	64510
WHM-475	**-S02**	**-S16**	4,750	120,65	5,030	0,312	0,111	4,995	0,120	41300	66260
WHM-500	**-S02**	**-S16**	5,000	127,00	5,297	0,312	0,111	5,260	0,120	45950	69740
WHM-525	**-S02**	**-S16**	5,250	133,35	5,559	0,350	0,127	5,520	0,139	50100	83790
WHM-537	**-S02**	**-S16**	5,375	136,53	5,690	0,350	0,127	5,650	0,139	51290	85780
WHM-550	**-S02**	**-S16**	5,500	139,70	5,810	0,350	0,127	5,770	0,139	52480	87780
WHM-575	**-S02**	**-S16**	5,750	146,05	6,062	0,350	0,127	6,020	0,139	54870	91770
WHM-600	**-S02**	**-S16**	6,000	152,40	6,314	0,350	0,127	6,270	0,139	57260	95760
WHM-625	**-S02**	**-S16**	6,250	158,75	6,576	0,380	0,156	6,530	0,174	61850	122520
WHM-650	**-S02**	**-S16**	6,500	165,10	6,838	0,380	0,156	6,790	0,174	66620	127420
WHM-662	**-S02**	**-S16**	6,625	168,28	6,974	0,380	0,156	6,925	0,174	70240	129870
WHM-675	**-S02**	**-S16**	6,750	171,45	7,105	0,380	0,156	7,055	0,174	73000	132320
WHM-700	**-S02**	**-S16**	7,000	177,80	7,366	0,380	0,156	7,315	0,174	78180	137230
WHM-725	**-S02**	**-S16**	7,250	184,15	7,628	0,418	0,187	7,575	0,209	83530	170370
WHM-750	**-S02**	**-S16**	7,500	190,50	7,895	0,418	0,187	7,840	0,209	90120	176240
WHM-775	**-S02**	**-S16**	7,750	196,85	8,157	0,418	0,187	8,100	0,209	95870	182120
WHM-800	**-S02**	**-S16**	8,000	203,20	8,419	0,418	0,187	8,360	0,209	101790	187990
WHM-825	**-S02**	**-S16**	8,250	209,55	8,680	0,437	0,187	8,620	0,209	107880	193870
WHM-850	**-S02**	**-S16**	8,500	215,90	8,942	0,437	0,187	8,880	0,209	114160	199740
WHM-875	**-S02**	**-S16**	8,750	222,25	9,209	0,437	0,187	9,145	0,209	122460	205620
WHM-900	**-S02**	**-S16**	9,000	228,60	9,471	0,437	0,187	9,405	0,209	129140	211490
WHM-925	**-S02**	**-S16**	9,250	234,95	9,737	0,437	0,187	9,669	0,209	137310	217370
WHM-950	**-S02**	**-S16**	9,500	241,30	10,000	0,500	0,187	9,930	0,209	144380	223240
WHM-975	**-S02**	**-S16**	9,750	247,65	10,260	0,500	0,187	10,189	0,209	150620	229120
WHM-1000	**-S02**	**-S16**	10,000	254,00	10,523	0,500	0,187	10,450	0,209	159040	234990
WHM-1025	**-S02**	**-S16**	10,250	260,35	10,786	0,500	0,187	10,711	0,209	167370	240870
WHM-1050	**-S02**	**-S16**	10,500	266,70	11,047	0,500	0,187	10,970	0,209	174420	246740
WHM-1075	**-S02**	**-S16**	10,750	273,05	11,313	0,500	0,187	11,234	0,209	183890	252620
WHM-1100	**-S02**	**-S16**	11,000	279,40	11,575	0,500	0,187	11,495	0,209	192830	258490
WHM-1125	**-S02**	**-S16**	11,250	285,75	11,838	0,500	0,187	11,756	0,209	201190	264370
WHM-1150	**-S02**	**-S16**	11,500	292,10	12,102	0,562	0,187	12,018	0,209	210540	270240
WHM-1175	**-S02**	**-S16**	11,750	298,45	12,365	0,562	0,187	12,279	0,209	220100	276120
WHM-1200	**-S02**	**-S16**	12,000	304,80	12,628	0,562	0,187	12,540	0,209	229020	281990
WHM-1225	**-S02**	**-S16**	12,250	311,15	12,891	0,562	0,187	12,801	0,209	238990	287860
WHM-1250	**-S02**	**-S16**	12,500	317,50	13,154	0,562	0,187	13,063	0,209	249170	293740
WHM-1275	**-S02**	**-S16**	12,750	323,85	13,417	0,562	0,187	13,324	0,209	258660	299610
WHM-1300	**-S02**	**-S16**	13,000	330,20	13,680	0,662	0,187	13,585	0,209	269240	305490
WHM-1325	**-S02**	**-S16**	13,250	336,55	13,943	0,662	0,187	13,846	0,209	279100	311360
WHM-1350	**-S02**	**-S16**	13,500	342,90	14,207	0,662	0,187	14,108	0,209	290100	317240
WHM-1375	**-S02**	**-S16**	13,750	349,25	14,470	0,662	0,187	14,369	0,209	301300	323110
WHM-1400	**-S02**	**-S16**	14,000	355,60	14,732	0,662	0,187	14,630	0,209	311730	328990
WHM-1425	**-S02**	**-S16**	14,250	361,95	14,995	0,662	0,187	14,891	0,209	323340	334860
WHM-1450	**-S02**	**-S16**	14,500	368,30	15,259	0,750	0,187	15,153	0,209	335160	340740
WHM-1475	**-S02**	**-S16**	14,750	374,65	15,522	0,750	0,187	15,414	0,209	346150	346610
WHM-1500	**-S02**	**-S16**	15,000	381,00	15,785	0,750	0,187	15,675	0,209	358380	352490

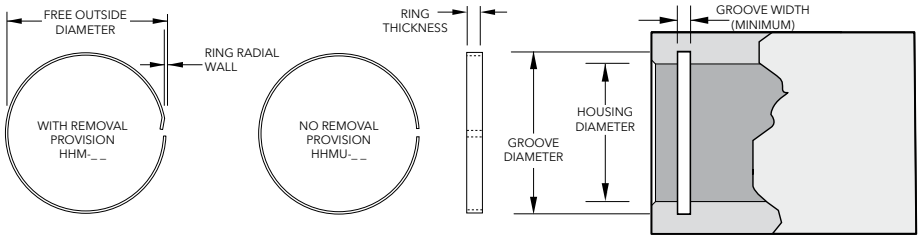
[1] Based on a groove material yield strength of 45000 psi and a safety factor of 2.
[2] Based on a safety factor of 3.

* Contact Smalley for details/information on how to order parts to be in compliance with this specification.

HHM/HHMU Series

Hoopster® Rings Internal





Product Dimensions: All dimensions in millimeters unless otherwise specified.

Smalley Part Number[3,4]		Housing Diameter		Ring				Groove				Thrust Capacity
Carbon Steel	Add Suffix 302 SS	mm	in	Outside Diameter (mm)		Radial Wall (mm)		Thickness (mm)		Diameter[2] (mm)		Width (mm)		Groove Yield[1] (N)
HHM-10	**-S02**	10,00	0,394	10,63	+0,30/-0,00	0,43		1,14		10,43		1,27		1052
HHM-11	**-S02**	11,00	0,433	11,65		0,43		1,14		11,43		1,27		1157
HHM-12	**-S02**	12,00	0,472	12,67		0,43		1,14		12,43		1,27		1263
HHM-13	**-S02**	13,00	0,512	13,79		0,53		1,65		13,53		1,78		1690
HHM-14	**-S02**	14,00	0,551	14,81		0,53		1,65		14,53	±0,05	1,78		1820
HHM-15	**-S02**	15,00	0,591	15,83		0,53		1,65		15,53		1,78		1950
HHM-16	**-S02**	16,00	0,630	16,85		0,53		1,65		16,53		1,78		2080
HHM-17	**-S02**	17,00	0,669	17,87	+0,38/-0,00	0,53	±0,04	1,65		17,53		1,78	+0,08/-0,00	2210
HHM-18	**-S02**	18,00	0,709	18,97		0,61		2,24		18,61		2,36		2674
HHM-19	**-S02**	19,00	0,748	19,99		0,61		2,24		19,61		2,36		2822
HHM-20	**-S02**	20,00	0,787	21,01		0,61		2,24		20,61		2,36		2971
HHM-21	**-S02**	21,00	0,827	22,03		0,61		2,24		21,61		2,36		3119
HHM-22	**-S02**	22,00	0,866	23,05		0,61		2,24		22,61		2,36		3268
HHM-23	**-S02**	23,00	0,906	24,07	+0,46/-0,00	0,61		2,24		23,61	±0,08	2,36		3417
HHM-24	**-S02**	24,00	0,945	25,09		0,61		2,24		24,61		2,36		3565
HHM-25	**-S02**	25,00	0,984	26,11		0,61		2,24	±0,10	25,61		2,36		3714
HHM-26	**-S02**	26,00	1,024	27,28		0,76		3,00		26,76		3,12		4828
HHM-27	**-S02**	27,00	1,063	28,30		0,76		3,00		27,76		3,12		5013
HHM-28	**-S02**	28,00	1,102	29,32		0,76		3,00		28,76		3,12		5199
HHM-29	**-S02**	29,00	1,142	30,34		0,76		3,00		29,76		3,12		5385
HHM-30	**-S02**	30,00	1,181	31,36		0,76		3,00		30,76		3,12		5570
HHM-31	**-S02**	31,00	1,220	32,38	+0,51/-0,00	0,76		3,00		31,76		3,12		5756
HHM-32	**-S02**	32,00	1,260	33,40		0,76		3,00		32,76		3,12		5942
HHM-33	**-S02**	33,00	1,299	34,52		0,86		3,81		33,86		3,94		6945
HHM-34	**-S02**	34,00	1,339	35,54		0,86		3,81		34,86	±0,10	3,94		7155
HHM-35	**-S02**	35,00	1,378	36,56		0,86		3,81		35,86		3,94		7365
HHM-36	**-S02**	36,00	1,417	37,58		0,86		3,81		36,86		3,94		7576
HHM-37	**-S02**	37,00	1,457	38,60		0,86		3,81		37,86		3,94		7786
HHM-38	**-S02**	38,00	1,496	39,62		0,86		3,81		38,86		3,94		7997
HHM-40	**-S02**	40,00	1,575	41,66		0,86		3,81		40,86		3,94		8418
HHM-41	**-S02**	41,00	1,614	42,68		0,86		3,81		41,86		3,94		8628
HHM-42	**-S02**	42,00	1,654	43,70		0,86		3,81		42,86		3,94		8838
HHM-45	**-S02**	45,00	1,772	46,87		0,97		4,75		45,97		4,88	+0,10/-0,00	10584
HHM-47	**-S02**	47,00	1,850	48,91		0,97		4,75		47,97		4,88		11054
HHM-48	**-S02**	48,00	1,890	49,93		0,97		4,75		48,97	±0,13	4,88		11289
HHM-50	**-S02**	50,00	1,969	51,97		0,97		4,75		50,97		4,88		11760
HHM-51	**-S02**	51,00	2,008	52,99		0,97		4,75		51,97		4,88		11995
HHM-52	**-S02**	52,00	2,047	54,01	+0,61/-0,00	0,97	±0,05	4,75		52,97		4,88		12230
HHM-55	**-S02**	55,00	2,165	57,07		0,97		4,75		55,97		4,90		12936
HHM-56	**-S02**	56,00	2,205	58,09		0,97		4,75		56,97		4,90		13171
HHM-57	**-S02**	57,00	2,244	59,11		0,97		4,75		57,97		4,90		13406
HHM-58	**-S02**	58,00	2,283	60,13		0,97		4,75	±0,13	58,97		4,90		13641
HHM-60	**-S02**	60,00	2,362	62,17		0,97		4,75		60,97		4,90		14112
HHM-62	**-S02**	62,00	2,441	64,38		1,14		5,72		63,14	±0,15	5,87		17268
HHM-63	**-S02**	63,00	2,480	65,40		1,14		5,72		64,14		5,87		17547
HHM-64	**-S02**	64,00	2,520	66,42	+0,76/-0,00	1,14		5,72		65,14		5,87	+0,13/-0,00	17826
HHM-65	**-S02**	65,00	2,559	67,44		1,14		5,72		66,14		5,87		18104
HHM-67	**-S02**	67,00	2,638	69,48		1,14		5,72		68,14		5,87		18661
HHM-68	**-S02**	68,00	2,677	70,50		1,14		5,72		69,14		5,87		18940
HHM-70	**-S02**	70,00	2,756	72,54		1,14		5,72		71,14		5,87		19497

[1] Based on a groove material yield strength of 310 N/mm² and a safety factor of 2.
[2] Sharp corners on the groove required, see page 142 for more information.
[3] Square edge wire.
[4] Use "HHM" prefix for removal provision end. Use "HHMU" prefix for no removal provision.

HHM/HHMU Series

Hoopster® Rings Internal Continued

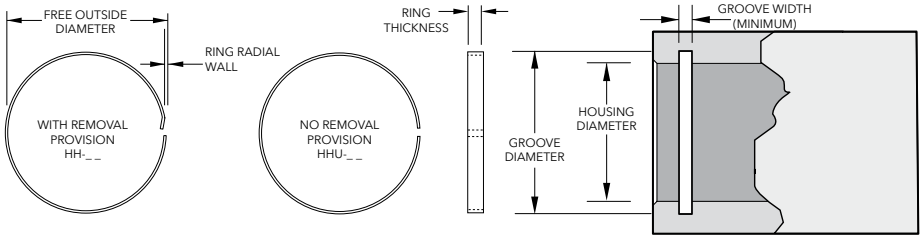
Smalley Part Number[3,4]		Housing Diameter		Ring						Groove				Thrust Capacity
Carbon Steel	Add Suffix 302 SS	mm	in	Outside Diameter (mm)		Radial Wall (mm)		Thickness (mm)		Diameter[2] (mm)		Width (mm)		Groove Yield[1] (N)
HHM-72	**-S02**	72,00	2,835	74,58	+0,76/ -0,00	1,14	±0,05	5,72	±0,013	73,14	±0,15	5,87	+0,13/ -0,00	20054
HHM-75	**-S02**	75,00	2,953	77,64		1,14		5,72		76,14		5,87		20889
HHM-76	**-S02**	76,00	2,992	78,66		1,14		5,72		77,14		5,87		21168

[1] Based on a groove material yield strength of 310 N/mm² and a safety factor of 2.
[2] Sharp corners on the groove required, see page 142 for more information.
[3] Square edge wire.
[4] Use "HHM" prefix for removal provision end. Use "HHMU" prefix for no removal provision.

HH/HHU Series

Hoopster® Imperial Rings Internal





Product Dimensions: All dimensions in inches unless otherwise specified.

Smalley Part Number [3,4]		Housing Diameter		Ring				Groove			Thrust Capacity
Carbon Steel	Add Suffix 302 SS	in	mm	Outside Diameter (in)		Radial Wall (in)		Thickness (in)		Diameter[2] (in)	Width (in)		Groove Yield[1] (lb)
HH-37	**-S02**	0,375	9,53	0,400	+0,012/-0,000	0,017	±0,0015	0,045	±0,004	0,392	0,050	+0,003/-0,000	225
HH-43	**-S02**	0,437	11,10	0,463		0,017		0,045		0,454	0,050		263
HH-46	**-S02**	0,469	11,91	0,495		0,017		0,045		0,486	0,050		282
HH-50	**-S02**	0,500	12,70	0,531	+0,015/-0,000	0,021		0,065		0,521	0,070		371
HH-53	**-S02**	0,531	13,49	0,563		0,021		0,065		0,552	0,070		394
HH-56	**-S02**	0,562	14,27	0,594		0,021		0,065		0,583	0,070		417
HH-59	**-S02**	0,594	15,09	0,627		0,021		0,065		0,615	0,070		441
HH-62	**-S02**	0,625	15,88	0,659		0,021		0,065		0,646	0,070		464
HH-65	**-S02**	0,656	16,66	0,690		0,021		0,065		0,677	0,070		487
HH-68	**-S02**	0,688	17,48	0,723		0,021		0,065		0,709	0,070		511
HH-71	**-S02**	0,718	18,24	0,756		0,024		0,088		0,742	0,093		609
HH-75	**-S02**	0,750	19,05	0,789		0,024		0,088		0,774	0,093		636
HH-78	**-S02**	0,781	19,84	0,821	+0,018/-0,000	0,024		0,088		0,805	0,093	±0,003	662
HH-81	**-S02**	0,812	20,62	0,852		0,024		0,088		0,836	0,093		689
HH-84	**-S02**	0,843	21,41	0,884		0,024		0,088		0,867	0,093		715
HH-87	**-S02**	0,875	22,23	0,917		0,024		0,088		0,899	0,093		742
HH-90	**-S02**	0,906	23,01	0,948		0,024		0,088		0,930	0,093		768
HH-93	**-S02**	0,938	23,83	0,981		0,024		0,088		0,962	0,093		796
HH-96	**-S02**	0,968	24,59	1,011		0,024		0,088		0,992	0,093		821
HH-100	**-S02**	1,000	25,40	1,044		0,024		0,088		1,024	0,093		848
HH-103	**-S02**	1,031	26,19	1,082		0,030	±0,002	0,118		1,061	0,123		1093
HH-106	**-S02**	1,062	26,97	1,113		0,030		0,118		1,092	0,123		1126
HH-109	**-S02**	1,093	27,76	1,145		0,030		0,118		1,123	0,123		1159
HH-112	**-S02**	1,125	28,58	1,178		0,030		0,118		1,155	0,123		1193
HH-115	**-S02**	1,156	29,36	1,209		0,030		0,118		1,186	0,123		1226
HH-118	**-S02**	1,188	30,18	1,242	+0,020/-0,000	0,030		0,118		1,218	0,123		1260
HH-121	**-S02**	1,218	30,94	1,272		0,030		0,118		1,248	0,123		1291
HH-125	**-S02**	1,250	31,75	1,305		0,030		0,118		1,280	0,123		1325
HH-128	**-S02**	1,281	32,54	1,337		0,030		0,118		1,311	0,123		1358
HH-131	**-S02**	1,312	33,32	1,372		0,034		0,150		1,346	0,155		1577
HH-134	**-S02**	1,343	34,11	1,404		0,034		0,150		1,377	0,155		1614
HH-137	**-S02**	1,375	34,93	1,437		0,034		0,150		1,409	0,155		1652
HH-140	**-S02**	1,406	35,71	1,468		0,034		0,150		1,440	0,155		1690
HH-143	**-S02**	1,437	36,50	1,500		0,034		0,150		1,471	0,155		1727
HH-146	**-S02**	1,468	37,29	1,531		0,034		0,150		1,502	0,155		1765
HH-150	**-S02**	1,500	38,10	1,564		0,034		0,150		1,534	0,155		1802
HH-156	**-S02**	1,562	39,67	1,627		0,034		0,150		1,596	0,155		1877
HH-162	**-S02**	1,625	41,28	1,692	+0,024/-0,000	0,034		0,150		1,659	0,155		1953
HH-168	**-S02**	1,688	42,88	1,755		0,034		0,150		1,722	0,155		2028
HH-175	**-S02**	1,750	44,45	1,823		0,038		0,187	±0,005	1,788	0,193		2350
HH-181	**-S02**	1,812	46,02	1,887		0,038		0,187		1,850	0,193		2434
HH-187	**-S02**	1,875	47,63	1,951		0,038		0,187		1,913	0,193		2518
HH-193	**-S02**	1,938	49,23	2,015		0,038		0,187		1,976	0,193		2603
HH-200	**-S02**	2,000	50,80	2,078		0,038		0,187		2,038	0,193		2686
HH-206	**-S02**	2,062	52,37	2,141		0,038		0,187		2,100	0,193		2769
HH-212	**-S02**	2,125	53,98	2,206		0,038		0,187		2,163	0,193		2854
HH-218	**-S02**	2,188	55,58	2,270		0,038		0,187		2,226	0,193		2939
HH-225	**-S02**	2,250	57,15	2,333		0,038		0,187		2,288	0,193		3022
HH-231	**-S02**	2,312	58,72	2,396		0,038		0,187		2,350	0,193		3105
HH-237	**-S02**	2,375	60,33	2,461		0,038		0,187		2,413	0,193		3190

[1] Based on a groove material yield strength of 45000 psi and a safety factor of 2.
[2] Sharp corners on the groove required, see page 142 for more information.
[3] Square edge wire.
[4] Use "HH" prefix for removal provision end. Use "HHU" prefix for no removal provision.

HH/HHU Series

Hoopster® Imperial Rings Internal Continued

Smalley Part Number [3,4]		Housing Diameter		Ring				Groove			Thrust Capacity
Carbon Steel	Add Suffix 302 SS	in	mm	Outside Diameter (in)		Radial Wall (in)		Thickness (in)	Diameter[2] (in)	Width (in)	Groove Yield[1] (lb)
HH-243	**-S02**	2,437	61,90	2,531	+0,030/-0,000	0,045	±0,002	0,225 ±0,005	2,482 ±0,006	0,232 +0,005/-0,000	3876
HH-250	**-S02**	2,500	63,50	2,595		0,045		0,225	2,545	0,232	3976
HH-256	**-S02**	2,562	65,07	2,658		0,045		0,225	2,607	0,232	4075
HH-262	**-S02**	2,625	66,68	2,723		0,045		0,225	2,670	0,232	4175
HH-268	**-S02**	2,688	68,28	2,787		0,045		0,225	2,733	0,232	4275
HH-275	**-S02**	2,750	69,85	2,850		0,045		0,225	2,795	0,232	4374
HH-281	**-S02**	2,812	71,42	2,914		0,045		0,225	2,858	0,232	4472
HH-287	**-S02**	2,875	73,03	2,978		0,045		0,225	2,920	0,232	4572
HH-293	**-S02**	2,938	74,63	3,041		0,045		0,225	2,982	0,232	4673
HH-300	**-S02**	3,000	76,20	3,105		0,045		0,225	3,045	0,232	4771

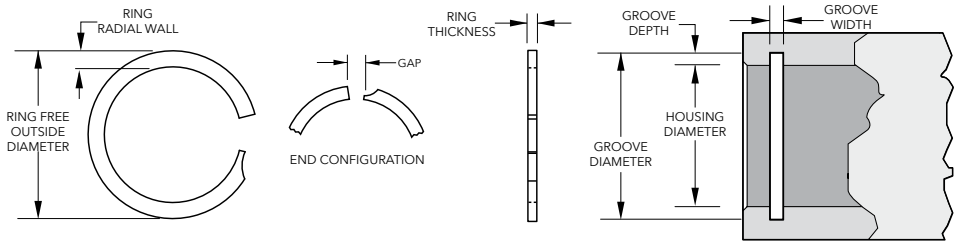
[1] Based on a groove material yield strength of 45000 psi and a safety factor of 2.
[2] Sharp corners on the groove required, see page 142 for more information.
[3] Square edge wire.
[4] Use "HH" prefix for removal provision end. Use "HHU" prefix for no removal provision.

FH Series

Constant Section Rings Internal

**Groove compatible with DIN 472*





Product Dimensions: All dimensions in millimeters unless otherwise specified.

Smalley Part Number[3]		Housing Diameter		Ring				Groove				Thrust Capacity	
Carbon Steel	Add Suffix 302 SS	mm	in	Outside Diameter (mm)		Radial Wall (mm)		Thickness (mm)		Diameter (mm)		Width (mm)		Groove Yield[1] (N)	Ring Shear[2] (N)
FH-013	**-S02**	13,00	0,512	13,73	+0,33/-0,00	1,40	±0,10	0,94	±0,05	13,60	+0,11/-0,00	1,10	+0,14/-0,00	1931	10591
FH-014	**-S02**	14,00	0,551	14,74		1,40		0,94		14,60		1,10		2077	11396
FH-015	**-S02**	15,00	0,591	15,85		1,40		0,94		15,70		1,10		2602	12224
FH-016	**-S02**	16,00	0,630	16,90		1,65		0,94		16,80		1,10		3172	13029
FH-017	**-S02**	17,00	0,669	17,97		1,65		0,94		17,80		1,10		3367	13838
FH-018	**-S02**	18,00	0,709	19,18		1,90		0,94		19,00	+0,13/-0,00	1,10		4457	14666
FH-019	**-S02**	19,00	0,748	20,25		1,90		0,94		20,00		1,10		4702	15471
FH-020	**-S02**	20,00	0,787	21,20		1,90		0,94		21,00		1,10		4951	16276
FH-021	**-S02**	21,00	0,827	22,21		1,90		0,94		22,00		1,10		5200	17103
FH-022	**-S02**	22,00	0,866	23,22		1,90		0,94		23,00		1,10		5445	17913
FH-023	**-S02**	23,00	0,906	24,23	+0,38/-0,00	1,90		0,94		24,00	+0,21/-0,00	1,10		5698	18736
FH-024	**-S02**	24,00	0,945	25,40		2,15		1,15		25,20		1,30		6539	23927
FH-025	**-S02**	25,00	0,984	26,45		2,15		1,15		26,20		1,30		6806	24914
FH-026	**-S02**	26,00	1,024	27,46		2,15		1,15		27,20		1,30		7082	25929
FH-027	**-S02**	27,00	1,063	28,47		2,38		1,15		28,20		1,30		7353	26916
FH-028	**-S02**	28,00	1,102	29,68		2,38		1,15		29,40		1,30		9702	27904
FH-029	**-S02**	29,00	1,142	30,69		2,38		1,15		30,40		1,30		10053	28918
FH-030	**-S02**	30,00	1,181	31,79		2,38		1,15		31,40	+0,25/-0,00	1,30		10395	29905
FH-031	**-S02**	31,00	1,220	33,01		2,38		1,15		32,70		1,30		12660	30893
FH-032	**-S02**	32,00	1,260	33,93		2,38		1,15		33,70		1,30		13073	31907
FH-033	**-S02**	33,00	1,299	35,03		2,38		1,15		34,70		1,30		13478	32895
FH-034	**-S02**	34,00	1,339	36,04		3,25		1,44		35,70		1,60		13892	40319
FH-035	**-S02**	35,00	1,378	37,35		3,25		1,44		37,00		1,60		16899	41493
FH-036	**-S02**	36,00	1,417	38,36		3,25		1,44		38,00		1,60		17375	42663
FH-037	**-S02**	37,00	1,457	39,37		3,25		1,44		39,00		1,60		17869	43868
FH-038	**-S02**	38,00	1,496	40,44		3,25		1,44		40,00		1,60		18344	45043
FH-040	**-S02**	40,00	1,575	42,86	+0,51/-0,00	4,01		1,69		42,50		1,85		24265	55621
FH-041	**-S02**	41,00	1,614	43,91		4,01		1,69		43,50		1,85		24866	56995
FH-042	**-S02**	42,00	1,654	44,92		4,01		1,69		44,50		1,85		25484	58410
FH-045	**-S02**	45,00	1,772	47,88		4,01		1,69		47,50		1,85		27303	62578
FH-047	**-S02**	47,00	1,850	49,97		4,01		1,69		49,50		1,85		28504	65331
FH-048	**-S02**	48,00	1,890	50,98		4,01		1,69		50,50		1,85		29118	66741
FH-050	**-S02**	50,00	1,969	53,50	+0,63/-0,00	5,08	±0,13	1,93	±0,08	53,00	+0,30/-0,00	2,15		36529	75282
FH-051	**-S02**	51,00	2,008	54,43		5,08		1,93		54,00		2,15		37249	76776
FH-052	**-S02**	52,00	2,047	55,52		5,08		1,93		55,00		2,15		37974	78266
FH-055	**-S02**	55,00	2,165	58,55		5,08		1,93		58,00		2,15		40163	82777
FH-056	**-S02**	56,00	2,205	59,56		5,08		1,93		59,00		2,15		40906	84307
FH-057	**-S02**	57,00	2,244	60,68		5,08		1,93		60,00		2,15		41631	85797
FH-058	**-S02**	58,00	2,283	61,58		5,08		1,93		61,00		2,15		42352	87287
FH-060	**-S02**	60,00	2,362	63,60		5,08		1,93		63,00		2,15		43819	90308
FH-062	**-S02**	62,00	2,441	65,58		5,08		1,93		65,00		2,15		45283	93328
FH-063	**-S02**	63,00	2,480	66,63		5,08		1,93		66,00		2,15		46008	94823
FH-064	**-S02**	64,00	2,520	67,64		5,08		2,41		67,00		2,65		46751	114742
FH-065	**-S02**	65,00	2,559	68,70		5,08		2,41		68,00		2,65		47471	116517
FH-067	**-S02**	67,00	2,638	70,54	+0,76/-0,00	5,08		2,41		70,00		2,65		48939	120115
FH-068	**-S02**	68,00	2,677	71,84		5,08		2,41		71,00		2,65		49660	121890
FH-070	**-S02**	70,00	2,756	73,64		5,08		2,41		73,00		2,65		51128	125489
FH-072	**-S02**	72,00	2,835	75,72		5,08		2,41		75,00		2,65		52591	129083
FH-075	**-S02**	75,00	2,953	78,75		5,08		2,41		78,00		2,65		54780	134456
FH-076	**-S02**	76,00	2,992	79,88		5,08		2,41		79,00		2,65		55505	136231

[1] Based on a groove material yield strength of 310 N/mm² and a safety factor of 2.
[2] Based on a safety factor of 3.
[3] Square edge wire.

* Contact Smalley for details/information on how to order parts to be in compliance with this specification.

FH Series

Constant Section Rings Internal Continued

Smalley Part Number[3]		Housing Diameter		Ring						Groove				Thrust Capacity	
Carbon Steel	Add Suffix 302 SS	mm	in	Outside Diameter (mm)		Radial Wall (mm)		Thickness (mm)		Diameter (mm)		Width (mm)		Groove Yield[1] (N)	Ring Shear[2] (N)
FH-078	**-S02**	78,00	3,071	81,73	+0,76/-0,00	5,08		2,41		81,00		2,65		56968	139830
FH-080	**-S02**	80,00	3,150	84,30		6,02		2,41		83,50		2,65	+0,14/-0,00	68342	143428
FH-082	**-S02**	82,00	3,228	86,32		6,02		2,41		85,50		2,65		70033	146978
FH-085	**-S02**	85,00	3,346	89,35		6,30		2,91		88,50		3,15		72595	175046
FH-088	**-S02**	88,00	3,465	92,38		6,30		2,91		91,50		3,15		75175	181269
FH-090	**-S02**	90,00	3,543	94,70	+0,89/-0,00	6,30		2,91	±0,08	93,50	+0,35/-0,00	3,15		76865	185353
FH-092	**-S02**	92,00	3,622	96,50		6,30		2,91		95,50		3,15		78582	189485
FH-095	**-S02**	95,00	3,740	99,62		6,30		2,91		98,50		3,15		81140	195659
FH-098	**-S02**	98,00	3,858	102,71		6,30		2,91		101,50		3,15		83702	201829
FH-100	**-S02**	100,00	3,937	104,50		6,30		2,91		103,50		3,15		85415	205962
FH-102	**-S02**	102,00	4,016	107,27		6,73		3,89		106,00		4,15		87127	269224
FH-105	**-S02**	105,00	4,134	109,96		6,73		3,89		109,00		4,15		102687	277133
FH-108	**-S02**	108,00	4,252	113,09		6,73	±0,13	3,89		112,00	+0,54/-0,00	4,15		105619	285042
FH-110	**-S02**	110,00	4,331	115,10		6,73		3,89		114,00		4,15		107580	290340
FH-112	**-S02**	112,00	4,409	117,12		6,73		3,89		116,00		4,15		109520	295567
FH-115	**-S02**	115,00	4,528	120,15		6,73		3,89		119,00		4,15		112473	303547
FH-120	**-S02**	120,00	4,724	125,60		6,73		3,89		124,00		4,15		117344	316687
FH-125	**-S02**	125,00	4,921	130,25	+1,30/-0,00	6,73		3,89		129,00		4,15		122237	329893
FH-127	**-S02**	127,00	5,000	132,27		6,73		3,89		131,00		4,15		124199	335187
FH-130	**-S02**	130,00	5,118	135,30		6,73		3,89		134,00		4,15		127130	343096
FH-135	**-S02**	135,00	5,315	140,35		6,73		3,89		139,00		4,15		132023	356303
FH-140	**-S02**	140,00	5,512	145,26		6,73		3,89	±0,10	144,00	+0,63/-0,00	4,15		136916	369509
FH-145	**-S02**	145,00	5,709	150,45		6,73		3,89		149,00		4,15		141809	382716
FH-150	**-S02**	150,00	5,906	156,50		8,03		3,89		155,00		4,15		181986	395923
FH-155	**-S02**	155,00	6,102	161,55		8,03		3,89		160,00		4,15		188026	409063
FH-160	**-S02**	160,00	6,299	166,60	+1,40/-0,00	8,03		3,89		165,00		4,15	+0,18/-0,00	194094	422270
FH-165	**-S02**	165,00	6,496	171,70		8,03		3,89		170,00		4,15		200166	435476
FH-170	**-S02**	170,00	6,693	176,70		8,03		3,89		175,00		4,15		206237	448683
FH-175	**-S02**	175,00	6,890	181,75		8,03		3,89		180,00		4,15		212305	461890
FH-180	**-S02**	180,00	7,087	186,80		8,03		3,89		185,00		4,15		218377	475097
FH-185	**-S02**	185,00	7,283	191,85		8,03		3,89		190,00		4,15		224417	488232
FH-190	**-S02**	190,00	7,480	197,15		8,03	±0,15	3,89		195,00	+0,72/-0,00	4,15		230489	501439
FH-195	**-S02**	195,00	7,677	201,95		8,03		3,89		200,00		4,15		236556	514646
FH-200	**-S02**	200,00	7,874	207,00		8,03		3,89		205,00		4,15		242628	527853
FH-210	**-S02**	210,00	8,268	217,93		9,48		4,87		216,00		5,15		306763	657096
FH-220	**-S02**	220,00	8,661	228,20		9,48		4,87		226,00		5,15		321344	688327
FH-230	**-S02**	230,00	9,055	238,30	+1,78/-0,00	9,48		4,87		236,00		5,15		335961	719638
FH-240	**-S02**	240,00	9,449	248,40		9,48		4,87		246,00		5,15		350578	750953
FH-250	**-S02**	250,00	9,843	258,50		9,48		4,87	±0,13	256,00		5,15		365199	782264
FH-260	**-S02**	260,00	10,236	270,77		11,05		4,87		268,00	+0,81/-0,00	5,15		505300	813500
FH-270	**-S02**	270,00	10,630	280,70		11,05	±0,18	4,87		278,00		5,15		524748	844811
FH-280	**-S02**	280,00	11,024	290,57		11,05		4,87		288,00		5,15		544200	876126
FH-290	**-S02**	290,00	11,417	300,90	+3,05/-0,00	11,05		4,87		298,00		5,15		563599	907357
FH-300	**-S02**	300,00	11,811	311,00		11,05		4,87		308,00		5,15		583051	938673

[1] Based on a groove material yield strength of 310 N/mm² and a safety factor of 2.
[2] Based on a safety factor of 3.
[3] Square edge wire.

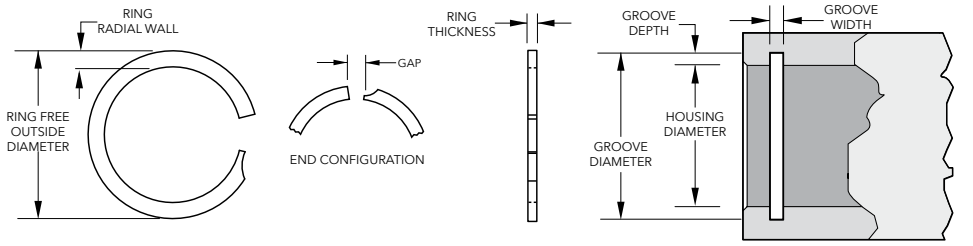
* Contact Smalley for details/information on how to order parts to be in compliance with this specification.

FHE Series

Constant Section Imperial Rings Internal

**Groove compliance with DIN 472*





Product Dimensions: All dimensions in inches unless otherwise specified.

Smalley Part Number [3]		Housing Diameter		Ring				Groove				Thrust Capacity	
Carbon Steel	Add Suffix 302 SS	in	mm	Outside Diameter (in)		Radial Wall (in)		Thickness (in)		Diameter (in)		Width (in)		Groove Yield[1] (lb)	Ring Shear[2] (lb)
FHE-0050	**-S02**	0,500	12,70	0,529	+0,013/-0,000	0,055	±0,004	0,037	±0,002	0,524	+0,004/-0,000	0,043	+0,006/-,000	424	2325
FHE-0056	**-S02**	0,562	14,27	0,591		0,055		0,037		0,586		0,043		477	2613
FHE-0062	**-S02**	0,625	15,88	0,665		0,065		0,037		0,657		0,043		707	2906
FHE-0068	**-S02**	0,687	17,45	0,726		0,065		0,037		0,719		0,043		777	3194
FHE-0075	**-S02**	0,750	19,05	0,797		0,075		0,037		0,790	+0,005/-0,000	0,043		1060	3487
FHE-0081	**-S02**	0,812	20,62	0,860		0,075		0,037		0,852		0,043		1148	3775
FHE-0087	**-S02**	0,875	22,23	0,924		0,075		0,037		0,915		0,043		1237	4068
FHE-0093	**-S02**	0,937	23,80	1,000	+0,015/-0,000	0,085		0,045		0,985	+0,008/-0,000	0,051		1590	5334
FHE-0100	**-S02**	1,000	25,40	1,058		0,085		0,045		1,048		0,051		1696	5693
FHE-0106	**-S02**	1,062	26,97	1,121		0,094		0,045		1,110		0,051		1802	6045
FHE-0112	**-S02**	1,125	28,58	1,192		0,094		0,045		1,181		0,051		2227	6404
FHE-0118	**-S02**	1,187	30,15	1,252		0,094		0,045		1,243	+0,010/-0,000	0,051		2349	6757
FHE-0125	**-S02**	1,250	31,75	1,336		0,094		0,045		1,316		0,051		2916	7116
FHE-0131	**-S02**	1,312	33,32	1,391		0,094		0,045		1,378		0,051		3060	7469
FHE-0137	**-S02**	1,375	34,93	1,470		0,128		0,057		1,453		0,063		3791	9307
FHE-0143	**-S02**	1,437	36,50	1,529		0,128		0,057		1,515		0,063		3961	9727
FHE-0150	**-S02**	1,500	38,10	1,592		0,128		0,057		1,578		0,063		4135	10153
FHE-0156	**-S02**	1,562	39,67	1,687	+0,020/-0,000	0,158		0,067		1,666		0,073		5741	12400
FHE-0162	**-S02**	1,625	41,28	1,746		0,158		0,067		1,729		0,073		5973	12901
FHE-0168	**-S02**	1,687	42,85	1,808		0,158		0,067		1,791		0,073		6201	13393
FHE-0175	**-S02**	1,750	44,45	1,885		0,158		0,067		1,862		0,073		6927	13893
FHE-0181	**-S02**	1,812	46,02	1,942		0,158		0,067		1,924		0,073		7173	14385
FHE-0187	**-S02**	1,875	47,63	2,007		0,158		0,067		1,987		0,073		7422	14885
FHE-0193	**-S02**	1,937	49,20	2,074	+0,025/-0,000	0,200		0,076		2,055		0,085		8078	16649
FHE-0200	**-S02**	2,000	50,80	2,143		0,200		0,076		2,118		0,085		8341	17191
FHE-0206	**-S02**	2,062	52,37	2,200		0,200		0,076		2,180		0,085		8599	17724
FHE-0212	**-S02**	2,125	53,98	2,264		0,200		0,076		2,243		0,085		8862	18265
FHE-0218	**-S02**	2,187	55,55	2,327		0,200		0,076		2,305		0,085		9,121	18798
FHE-0225	**-S02**	2,250	57,15	2,389		0,200		0,076		2,368		0,085		9,384	19340
FHE-0231	**-S02**	2,312	58,72	2,453		0,200		0,076		2,430		0,085		9,642	19873
FHE-0237	**-S02**	2,375	60,33	2,517		0,200		0,076		2,493		0,085		9,905	20414
FHE-0243	**-S02**	2,437	61,90	2,582		0,200		0,076		2,555		0,085		10163	20947
FHE-0250	**-S02**	2,500	63,50	2,643		0,200		0,076		2,618		0,085		10426	21488
FHE-0256	**-S02**	2,562	65,07	2,705	+0,030/-0,000	0,200	±0,005	0,095	±0,003	2,680	+0,012/-0,000	0,104		10685	26225
FHE-0262	**-S02**	2,625	66,68	2,777		0,200		0,095		2,743		0,104		10947	26870
FHE-0268	**-S02**	2,687	68,25	2,828		0,200		0,095		2,805		0,104		11206	27504
FHE-0275	**-S02**	2,750	69,85	2,899		0,200		0,095		2,868		0,104		11469	28149
FHE-0281	**-S02**	2,812	71,42	2,958		0,200		0,095		2,930		0,104		11727	28784
FHE-0287	**-S02**	2,875	73,03	3,022		0,200		0,095		2,993		0,104		11990	29429
FHE-0293	**-S02**	2,937	74,60	3,084		0,200		0,095		3,055		0,104		12249	30063
FHE-0300	**-S02**	3,000	76,20	3,145		0,200		0,095		3,118		0,104		12511	30708
FHE-0306	**-S02**	3,062	77,77	3,218		0,200		0,095		3,184		0,104		13203	31343
FHE-0312	**-S02**	3,125	79,38	3,294		0,237		0,095		3,263		0,104		15242	31988
FHE-0318	**-S02**	3,187	80,95	3,357		0,237		0,095		3,325		0,104		15544	32622
FHE-0325	**-S02**	3,250	82,55	3,420		0,237		0,095		3,388		0,104		15851	33267
FHE-0331	**-S02**	3,312	84,12	3,483	+0,035/-0,000	0,248		0,115		3,450	+0,013/-0,000	0,124		16154	38952
FHE-0337	**-S02**	3,375	85,73	3,547		0,248		0,115		3,513		0,124		16461	39693
FHE-0343	**-S02**	3,437	87,30	3,609		0,248		0,115		3,575		0,124		16763	40422
FHE-0350	**-S02**	3,500	88,90	3,673		0,248		0,115		3,638		0,124		17071	41163
FHE-0356	**-S02**	3,562	90,47	3,728		0,248		0,115		3,700		0,124		17373	41892

[1] Based on a groove material yield strength of 45000 psi and a safety factor of 2.
[2] Based on a safety factor of 3.
[3] Square edge wire.

* Contact Smalley for details/information on how to order parts to be in compliance with this specification.

FHE Series

Constant Section Imperial Rings Internal Continued

Smalley Part Number [3]		Housing Diameter		Ring						Groove				Thrust Capacity	
Carbon Steel	Add Suffix 302 SS	in	mm	Outside Diameter (in)		Radial Wall (in)		Thickness (in)		Diameter (in)		Width (in)		Groove Yield[1] (lb)	Ring Shear[2] (lb)
FHE-0362	**-S02**	3,625	92,08	3,799	+0,035/-0,000	0,248	±0,005	0,115	±0,003	3,763	+0,013/-0,000	0,124	+0,007/-0,000	17680	42633
FHE-0368	**-S02**	3,687	93,65	3,862		0,248		0,115		3,825		0,124		17983	43362
FHE-0375	**-S02**	3,750	95,25	3,922		0,248		0,115		3,888		0,124		18290	44103
FHE-0381	**-S02**	3,812	96,82	3,988		0,248		0,115		3,950		0,124		18592	44832
FHE-0387	**-S02**	3,875	98,43	4,044		0,248		0,115		4,013		0,124		18900	45573
FHE-0393	**-S02**	3,937	100,00	4,114		0,248		0,115		4,075		0,124		19202	46302
FHE-0400	**-S02**	4,000	101,60	4,223	+0,050/-0,000	0,265		0,153	±0,004	4,158	+0,021/-0,000	0,163		22337	60283
FHE-0412	**-S02**	4,125	104,78	4,329		0,265		0,153		4,283		0,163		23035	62166
FHE-0425	**-S02**	4,250	107,95	4,452		0,265		0,153		4,408		0,163		23733	64050
FHE-0437	**-S02**	4,375	111,13	4,576		0,265		0,153		4,533		0,163		24431	65934
FHE-0450	**-S02**	4,500	114,30	4,703		0,265		0,153		4,658		0,163		25129	67818
FHE-0462	**-S02**	4,625	117,48	4,829		0,265		0,153		4,783		0,163		25827	69702
FHE-0475	**-S02**	4,750	120,65	4,945		0,265		0,153		4,908		0,163		26525	71585
FHE-0487	**-S02**	4,875	123,83	5,082		0,265		0,153		5,033		0,163		27223	73469
FHE-0500	**-S02**	5,000	127,00	5,207		0,265		0,153		5,158		0,163		27921	75353
FHE-0525	**-S02**	5,250	133,35	5,460		0,265		0,153		5,408		0,163		29317	79121
FHE-0550	**-S02**	5,500	139,70	5,719		0,265		0,153		5,658		0,163		30713	82888
FHE-0575	**-S02**	5,750	146,05	5,965		0,265		0,153		5,908		0,163		32109	86656
FHE-0600	**-S02**	6,000	152,40	6,256	+0,055/-0,000	0,316	±0,006	0,153		6,196	+0,024/-0,000	0,163		41563	90424
FHE-0625	**-S02**	6,250	158,75	6,508		0,316		0,153		6,446		0,163		43295	94191
FHE-0650	**-S02**	6,500	165,10	6,760		0,316		0,153		6,696		0,163		45027	97959
FHE-0675	**-S02**	6,750	171,45	7,013		0,316		0,153		6,946		0,163		46759	101727
FHE-0700	**-S02**	7,000	177,80	7,266		0,316		0,153		7,196		0,163		48490	105494
FHE-0725	**-S02**	7,250	184,15	7,541	+0,070/-0,000	0,316		0,153		7,446	+0,028/-0,000	0,163		50222	109262
FHE-0750	**-S02**	7,500	190,50	7,762		0,316		0,153		7,696		0,163		51954	113030
FHE-0775	**-S02**	7,750	196,85	8,023		0,316		0,153		7,946		0,163		53686	116797
FHE-0800	**-S02**	8,000	203,20	8,276		0,316		0,153		8,196		0,163		55418	120565
FHE-0825	**-S02**	8,250	209,55	8,580		0,373		0,192	±0,005	8,486		0,203		68813	147399
FHE-0850	**-S02**	8,500	215,90	8,821		0,373		0,192		8,736		0,203		70898	151866
FHE-0875	**-S02**	8,750	222,25	9,073		0,373		0,192		8,986		0,203		72983	156332
FHE-0900	**-S02**	9,000	228,60	9,326		0,373		0,192		9,236		0,203		75068	160799
FHE-0925	**-S02**	9,250	234,95	9,580		0,373		0,192		9,486		0,203		77154	165265
FHE-0950	**-S02**	9,500	241,30	9,831		0,373		0,192		9,736		0,203		79239	169732
FHE-0975	**-S02**	9,750	247,65	10,083		0,373		0,192		9,986		0,203		81324	174199
FHE-1000	**-S02**	10,000	254,00	10,414		0,435	±0,007	0,192		10,314	+0,031/-,000	0,203		110977	178665
FHE-1025	**-S02**	10,250	260,35	10,660		0,435		0,192		10,564		0,203		113751	183132
FHE-1050	**-S02**	10,500	266,70	10,919		0,435		0,192		10,814		0,203		116526	187599
FHE-1075	**-S02**	10,750	273,05	11,171		0,435		0,192		11,064		0,203		119300	192065
FHE-1100	**-S02**	11,000	279,40	11,440	+0,012/-0,000	0,435		0,192		11,314		0,203		122074	196532

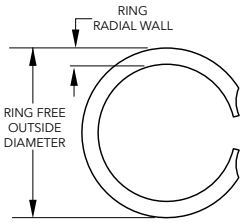
[1] Based on a groove material yield strength of 45000 psi and a safety factor of 2.
[2] Based on a safety factor of 3.
[3] Square edge wire.

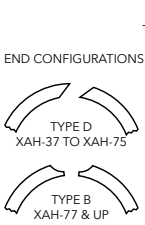
* Contact Smalley for details/information on how to order parts to be in compliance with this specification.

XAH Series

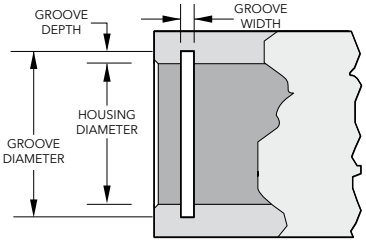
Constant Section Imperial Rings Internal











Product Dimensions: All dimensions in inches unless otherwise specified.

Smalley Part Number [3]		Housing Diameter		Ring			Groove		Thrust Capacity	
Carbon Steel	Add Suffix 302 SS	in	mm	Outside Diameter (in)	Radial Wall (in)	Thickness (in)	Diameter (in)	Width (in)	Groove Yield[1] (lb)	Ring Shear[2] (lb)
XAH-37	-S02	0,375	9,53	0,400 +0,020/-0,000	0,035	0,025	0,395	0,028	265	1174
XAH-43	-S02	0,438	11,13	0,467	0,035	0,025	0,462	0,028	372	1371
XAH-50	-S02	0,500	12,70	0,530	0,040	0,035	0,524	0,039	424	2073
XAH-51	-S02	0,512	13,00	0,542	0,040	0,035	0,536	0,039	434	2123
XAH-56	-S02	0,562	14,27	0,600	0,048	0,035	0,590	0,039	556	2331
XAH-62	-S02	0,625	15,88	0,670	0,048	0,035	0,657	0,039	707	2592
XAH-68	-S02	0,688	17,48	0,733	0,048	0,035	0,720	0,039	778	2853
XAH-75	-S02	0,750	19,05	0,799 +0,025/-0,000	0,048	0,035	0,786 ±0,003	0,039	954	3110
XAH-77	-S02	0,777	19,74	0,827	0,062	0,042	0,813	0,046	989	3906
XAH-81	-S02	0,812	20,62	0,867	0,062	0,042	0,852	0,046	1148	4082
XAH-87	-S02	0,875	22,23	0,934	0,062	0,042	0,919	0,046	1361	4398
XAH-90	-S02	0,901	22,89	0,961	0,078	0,042	0,945	0,046	1401	4529
XAH-93	-S02	0,938	23,83	1,003	0,078	0,042	0,986	0,046	1591	4715
XAH-100	-S02	1,000	25,40	1,070	0,078	0,042	1,052	0,046	1696	5027
XAH-102	-S02	1,023	25,98	1,094	0,093	0,042	1,075	0,046	1880	5142
XAH-106	-S02	1,062	26,97	1,134	0,093	0,050	1,114	0,056	1952	6272
XAH-112	-S02	1,125	28,58	1,202	0,093	0,050	1,181	0,056	2227	6644
XAH-118	-S02	1,188	30,18	1,270	0,093	0,050	1,248	0,056	2519	7017
XAH-125	-S02	1,250	31,75	1,337 +,031/-,000	0,109	0,050	1,314	0,056	2827	7383
XAH-131	-S02	1,312	33,32	1,404	0,109	0,050	1,380	0,056	3153	7749
XAH-137	-S02	1,375	34,93	1,472	0,109	0,050	1,447	0,056	3499	8121
XAH-143	-S02	1,438	36,53	1,535	0,125	0,050	1,510	0,056	3659	8493
XAH-145	-S02	1,456	36,98	1,557	0,125	0,050	1,532	0,056	3911	8599
XAH-150	-S02	1,500	38,10	1,607	0,125	0,050	1,576	0,056	4029	8859
XAH-156	-S02	1,562	39,67	1,668	0,125	0,062	1,642	0,068	4416	11002
XAH-162	-S02	1,625	41,28	1,736	0,141	0,062	1,709	0,068	4824	11446
XAH-165	-S02	1,653	41,99	1,765	0,141	0,062	1,737	0,068	4907	11643
XAH-168	-S02	1,688	42,88	1,804	0,156	0,062	1,776	0,068	5250	11889
XAH-175	-S02	1,750	44,45	1,870	0,156	0,062	1,842	0,068	5690	12326
XAH-181	-S02	1,812	46,02	1,933	0,156	0,062	1,904	0,068	5892	12763
XAH-185	-S02	1,850	46,99	1,975	0,156	0,062	1,946	0,068	6277	13030
XAH-187	-S02	1,875	47,63	2,000	0,156	0,062	1,971	0,068	6362	13206
XAH-193	-S02	1,938	49,23	2,068	0,156	0,062	2,038	0,068	6849	13650
XAH-196	-S02	1,968	49,99	2,098	0,156	0,062	2,068	0,068	6955	13862
XAH-200	-S02	2,000	50,80	2,131	0,156	0,062	2,100	0,068	7069	14087
XAH-206	-S02	2,062	52,37	2,197	0,156	0,078	2,166	0,086	7579	17491
XAH-212	-S02	2,125	53,98	2,260	0,156	0,078	2,229	0,086	7811	18025
XAH-218	-S02	2,188	55,58	2,331	0,171	0,078	2,296	0,086	8352	18559
XAH-225	-S02	2,250	57,15	2,393	0,171	0,078	2,358	0,086	8588	19085
XAH-231	-S02	2,312	58,72	2,459	0,171	0,078	2,424	0,086	9152	19611
XAH-237	-S02	2,375	60,33	2,523	0,171	0,078	2,487	0,086	9401	20145
XAH-244	-S02	2,440	61,98	2,592	0,187	0,078	2,556	0,086	10003	20697
XAH-250	-S02	2,500	63,50	2,653	0,187	0,078	2,616	0,086	10249	21206
XAH-253	-S02	2,531	64,29	2,688	0,187	0,078	2,651	0,086	10734	21469
XAH-256	-S02	2,562	65,07	2,726	0,187	0,093	2,686	0,103	11228	26078
XAH-262	-S02	2,625	66,68	2,790	0,187	0,093	2,750	0,103	11504	26719
XAH-268	-S02	2,688	68,28	2,856	0,187	0,093	2,816	0,103	11780	27361
XAH-271	-S02	2,717	69,01	2,882	0,187	0,093	2,842	0,103	12291	27656
XAH-275	-S02	2,750	69,85	2,918	0,187	0,093	2,878	0,103	12441	27992
XAH-281	-S02	2,813	71,45	2,985 +0,062/-0,000	0,187	0,093	2,945	0,103	13123	28633

[1] Based on a groove material yield strength of 45000 psi and a safety factor of 2.
[2] Based on a safety factor of 3.
[3] Square edge wire.

XAH Series

Constant Section Rings Imperial Internal Continued

Smalley Part Number [3]		Housing Diameter		Ring			Groove		Thrust Capacity	
Carbon Steel	Add Suffix 302 SS	in	mm	Outside Diameter (in)	Radial Wall (in)	Thickness (in)	Diameter (in)	Width (in)	Groove Yield[1] (lb)	Ring Shear[2] (lb)
XAH-283	**-S02**	2,834	71,98	3,006	0,187	0,093	2,966	0,103	13221	28847
XAH-287	**-S02**	2,875	73,03	3,056	0,187	0,093	3,011	0,103	13819	29264
XAH-300	**-S02**	3,000	76,20	3,181	0,187	0,093	3,136	0,103	14420	30536
XAH-306	**-S02**	3,062	77,77	3,247	0,218	0,109	3,202	0,120	15151	35009
XAH-312	**-S02**	3,125	79,38	3,311	0,218	0,109	3,265	0,120	15463	35729
XAH-315	**-S02**	3,156	80,16	3,342	0,218	0,109	3,296	0,120	15616	36084
XAH-325	**-S02**	3,250	82,55	3,442	0,218	0,109	3,394	0,120	16540	37158
XAH-334	**-S02**	3,346	84,99	3,539	0,218	0,109	3,490	0,120	17029	38256
XAH-346	**-S02**	3,469	88,11	3,663	0,218	0,109	3,613	0,120	17655	39662
XAH-350	**-S02**	3,500	88,90	3,700	0,250	0,109	3,648	0,120	18308	40017
XAH-354	**-S02**	3,543	89,99	3,745	0,250	0,109	3,691	0,120	18533	40508
XAH-356	**-S02**	3,562	90,47	3,766	0,250	0,109	3,710	0,120	18632	40725
XAH-362	**-S02**	3,625	92,08	3,831	0,250	0,109	3,773	0,120	18961	41446
XAH-375	**-S02**	3,750	95,25	3,962	0,250	0,109	3,902	0,120	20145	42875
XAH-387	**-S02**	3,875	98,43	4,089	0,250	0,109	4,027	0,120	20817	44304
XAH-393	**-S02**	3,938	100,03	4,156	0,250	0,109	4,094	0,120	21712	45024
XAH-400	**-S02**	4,000	101,60	4,221	0,250	0,109	4,156	0,120	22054	45733
XAH-412	**-S02**	4,125	104,78	4,355	0,250	0,109	4,285	0,120	23326	47162
XAH-425	**-S02**	4,250	107,95	4,485	0,250	0,109	4,410	0,120	24033	48592
XAH-433	**-S02**	4,330	109,98	4,565	0,250	0,109	4,490	0,120	24486	49506
XAH-443	**-S02**	4,436	112,67	4,670	0,250	0,109	4,596	0,120	25085	50718
XAH-450	**-S02**	4,500	114,30	4,744	0,250	0,109	4,664	0,120	26083	51450
XAH-462	**-S02**	4,625	117,48	4,875	0,250	0,109	4,795	0,120	27788	52879
XAH-475	**-S02**	4,750	120,65	5,011	0,281	0,109	4,926	0,120	29547	54308
XAH-500	**-S02**	5,000	127,00	5,265	0,281	0,109	5,180	0,120	31809	57167
XAH-525	**-S02**	5,250	133,35	5,530	0,312	0,125	5,435	0,139	34141	65732
XAH-537	**-S02**	5,375	136,53	5,660	0,312	0,125	5,565	0,139	36094	67297
XAH-550	**-S02**	5,500	139,70	5,796	0,312	0,125	5,696	0,139	38100	68862
XAH-575	**-S02**	5,750	146,05	6,050	0,312	0,125	5,950	0,139	40644	71992
XAH-600	**-S02**	6,000	152,40	6,309	0,312	0,125	6,204	0,139	43260	75122
XAH-625	**-S02**	6,250	158,75	6,568	0,343	0,156	6,458	0,174	45946	94130
XAH-650	**-S02**	6,500	165,10	6,832	0,343	0,156	6,712	0,174	48703	97895
XAH-662	**-S02**	6,625	168,28	6,975	0,343	0,156	6,845	0,174	51512	99778
XAH-675	**-S02**	6,750	171,45	7,100	0,343	0,156	6,970	0,174	52484	101660
XAH-700	**-S02**	7,000	177,80	7,350	0,343	0,156	7,220	0,174	54428	105426
XAH-725	**-S02**	7,250	184,15	7,630	0,375	0,187	7,500	0,209	64059	123654
XAH-750	**-S02**	7,500	190,50	7,890	0,375	0,187	7,750	0,209	66268	127918
XAH-800	**-S02**	8,000	203,20	8,400	0,375	0,187	8,250	0,209	70686	136446
XAH-825	**-S02**	8,250	209,55	8,665	0,437	0,187	8,540	0,209	84558	141478
XAH-850	**-S02**	8,500	215,90	8,915	0,437	0,187	8,790	0,209	87120	145766
XAH-875	**-S02**	8,750	222,25	9,205	0,500	0,187	9,080	0,209	102053	150053
XAH-900	**-S02**	9,000	228,60	9,455	0,500	0,187	9,330	0,209	104968	154340
XAH-905	**-S02**	9,055	230,00	9,509	0,500	0,187	9,384	0,209	105610	155283
XAH-950	**-S02**	9,500	241,30	9,955	0,500	0,187	9,830	0,209	110800	162915
XAH-984	**-S02**	9,840	249,94	10,295	0,500	0,187	10,170	0,209	114766	168745
XAH-1000	**-S02**	10,000	254,00	10,455	0,500	0,187	10,330	0,209	116632	171489

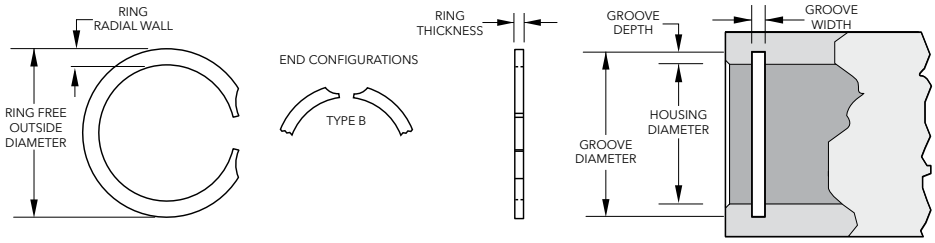
+0,062/-0,000 (Outside Diameter, XAH-283 through XAH-346)
+0,078/-0,000 (Outside Diameter, XAH-350 through XAH-387)
+0,093/-0,000 (Outside Diameter, XAH-393 through XAH-475)
+0,125/-0,000 (Outside Diameter, XAH-500 through XAH-600)
+0,156/-0,000 (Outside Diameter, XAH-625 through XAH-700)
+0,187/-0,000 (Outside Diameter, XAH-725 through XAH-1000)
±0,005 (Radial Wall)
±0,002 (Thickness)
±0,006 (Diameter, XAH-283 through XAH-387)
±0,007 (Diameter, XAH-393 through XAH-600)
±0,008 (Diameter, XAH-625 through XAH-1000)
+0,005/-0,000 (Width, XAH-283 through XAH-387)
+0,006/-0,000 (Width, XAH-393 through XAH-1000)

[1] Based on a groove material yield strength of 45000 psi and a safety factor of 2.
[2] Based on a safety factor of 3.
[3] Square edge wire.

XDH Series

Constant Section Imperial Rings Internal





Product Dimensions: All dimensions in inches unless otherwise specified.

Smalley Part Number[3]		Housing Diameter		Ring				Groove			Thrust Capacity	
Carbon Steel	Add Suffix 302 SS	in	mm	Outside Diameter (in)		Radial Wall (in)		Thickness (in)		Diameter (in)	Width (in)		Groove Yield[1] (lb)	Ring Shear[2] (lb)
XDH-112	**-S02**	1,125	28,58	1,196	+0,031/-0,000	0,093	±0,003	0,042	±0,002	1,181	0,046	+0,003/-0,000	2227	5655
XDH-125	**-S02**	1,250	31,75	1,330		0,093		0,042		1,310	0,046		2651	6283
XDH-137	**-S02**	1,375	34,93	1,460		0,093		0,042		1,435	0,046		2916	6912
XDH-150	**-S02**	1,500	38,10	1,600		0,125		0,042		1,580	0,046		4241	7540
XDH-162	**-S02**	1,625	41,28	1,725		0,125		0,042		1,705	0,046		4595	8168
XDH-175	**-S02**	1,750	44,45	1,855		0,125		0,042		1,830	0,046		4948	8796
XDH-187	**-S02**	1,875	47,63	1,990	+0,062/-0,000	0,156		0,042		1,965	0,046		5964	9425
XDH-200	**-S02**	2,000	50,80	2,115		0,156		0,042		2,090	0,046		6362	10053
XDH-206	**-S02**	2,062	52,37	2,177		0,156		0,042		2,152	0,046		6559	10365
XDH-218	**-S02**	2,187	55,55	2,302		0,156		0,042		2,277	0,046		6957	10993
XDH-231	**-S02**	2,312	58,72	2,432		0,156		0,042		2,402	0,046		7354	11621
XDH-243	**-S02**	2,437	61,90	2,557		0,156		0,042		2,527	0,046		7752	12250
XDH-256	**-S02**	2,562	65,07	2,682		0,156		0,042		2,652	0,046		8149	12878
XDH-300	**-S02**	3,000	76,20	3,154	+0,078/-0,000	0,187		0,062		3,124	0,068	+0,004/-0,000	13148	21130
XDH-325	**-S02**	3,250	82,55	3,404		0,187		0,062		3,374	0,068		14243	22891
XDH-350	**-S02**	3,500	88,90	3,654		0,187		0,062		3,624	0,068		15339	24652
XDH-375	**-S02**	3,750	95,25	3,904		0,187		0,062		3,874	0,068		16434	26413
XDH-400	**-S02**	4,000	101,60	4,155		0,187		0,062		4,125	0,068		17671	28174
XDH-425	**-S02**	4,250	107,95	4,429	+0,093/-0,000	0,218	±0,005	0,078		4,394	0,086	+0,005/-0,000	21630	36050
XDH-450	**-S02**	4,500	114,30	4,679		0,218		0,078		4,644	0,086		22902	38170
XDH-475	**-S02**	4,750	120,65	4,929		0,218		0,078		4,894	0,086		24175	40291
XDH-500	**-S02**	5,000	127,00	5,184		0,218		0,078		5,144	0,086		25447	42412
XDH-525	**-S02**	5,250	133,35	5,434		0,218		0,078		5,394	0,086		26719	44532
XDH-575	**-S02**	5,750	146,05	5,934		0,218		0,078		5,894	0,086		29264	48773
XDH-600	**-S02**	6,000	152,40	6,220	+0,125/-0,000	0,250		0,093		6,160	0,103		33929	61073
XDH-650	**-S02**	6,500	165,10	6,730		0,250		0,093		6,660	0,103		36757	66162
XDH-700	**-S02**	7,000	177,80	7,240		0,250		0,093		7,160	0,103		39584	71251
XDH-725	**-S02**	7,250	184,15	7,500	+0,187/-0,000	0,250		0,093		7,410	0,103		40998	73796
XDH-750	**-S02**	7,500	190,50	7,760		0,250		0,093		7,660	0,103		42412	76341
XDH-800	**-S02**	8,000	203,20	8,285		0,250		0,093		8,160	0,103		45239	81430

[1] Based on a groove material yield strength of 45000 psi and a safety factor of 2.
[2] Based on a safety factor of 3.
[3] Square edge wire.

Constant Section Rings Series End Configurations

Smalley offers four series of Eaton style snap rings from stock. Additional end types can be manufactured to meet your snap ring requirements. Contact one of our engineers to inquire about the following end types:

U-Notch	Double Scallop	Double Angle	Single Scallop
Type A-H 	Type B-H 	Type C-H 	Type E-H 
Type A-S 	Type B-S 	Type C-S 	Type E-S 

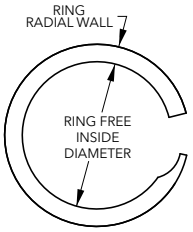
Single Angle	Pi-Cut	Flat Cut	Holes
Type D 	Type F 	Type G 	Type H 

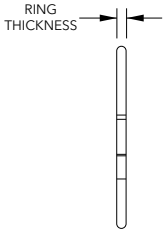
Material Hardness	
Thickness (mm)	Hardness (Rc) Min.
Up to 0,56	46,0
Over 0,56 - 1,27	44,0
Over 1,27 - 1,98	42,0
Over 1,98	40,0

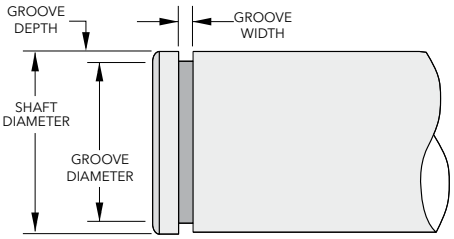
VSM Series

Spirolox® Light Duty Rings External









Product Dimensions: All dimensions in millimeters unless otherwise specified.

Smalley Part Number			Shaft Diameter		Ring			Groove		Thrust Capacity	
Carbon Steel	Add Suffix				Inside Diameter (mm)	Radial Wall (mm)	Thickness (mm)	Diameter (mm)	Width (mm)	Groove Yield[1] (N)	Ring Shear[2] (N)
	302 SS	316 SS	mm	in							
VSM-6[3,4]	**-S02**	**-S16**	6,00	0,236	5,65 +0,00/-0,25	0,51	0,30	5,70	0,38	439	1988
VSM-7[3,4]	**-S02**	**-S16**	7,00	0,276	6,58	0,51	0,30	6,64	0,38	614	2234
VSM-8[3,4]	**-S02**	**-S16**	8,00	0,315	7,52	0,64	0,38	7,60	0,46	780	3183
VSM-9[3,4]	**-S02**	**-S16**	9,00	0,354	8,42	0,76	0,38	8,50	0,46	1114	3580
VSM-10[3,4]	**-S02**	**-S16**	10,00	0,394	9,32 +0,00/-0,30	0,89	0,38	9,40	0,46	1462	3978
VSM-11[4]	**-S02**	**-S16**	11,00	0,433	10,32	0,89	0,38	10,40	0,46	1608	4376
VSM-12	**-S02**	**-S16**	12,00	0,472	11,22	1,14	0,46	11,34 ±0,05	0,56	1930	5779
VSM-13	**-S02**	**-S16**	13,00	0,512	12,15	1,14	0,46	12,28	0,56	2281	6261
VSM-14	**-S02**	**-S16**	14,00	0,551	13,15	1,14	0,46	13,28	0,56	2456	6742
VSM-15	**-S02**	**-S16**	15,00	0,591	14,14	1,14	0,46	14,28	0,56	2632	7224
VSM-16	**-S02**	**-S16**	16,00	0,630	15,13	1,14	0,46	15,28	0,56	2807	7705
VSM-17	**-S02**	**-S16**	17,00	0,669	16,13	1,14	0,46	16,28	0,56	2983	8187
VSM-18	**-S02**	**-S16**	18,00	0,709	17,12	1,14	0,46	17,28	0,56	3158	8669
VSM-19	**-S02**	**-S16**	19,00	0,748	18,11	1,14	0,46 ±0,04	18,28	0,56	3334	9150
VSM-20	**-S02**	**-S16**	20,00	0,787	19,10	1,14	0,46	19,28	0,56	3509	9632
VSM-21	**-S02**	**-S16**	21,00	0,827	19,74	1,65	0,53	19,94	0,66	5424	11652
VSM-22	**-S02**	**-S16**	22,00	0,866	20,73	1,65	0,53	20,94 ±0,08	0,66	5683	12207
VSM-24	**-S02**	**-S16**	24,00	0,945	22,72	1,65	0,53	22,94	0,66	6199	13317
VSM-25	**-S02**	**-S16**	25,00	0,984	23,71	1,65	0,53	23,94	0,66	6458	13872
VSM-26	**-S02**	**-S16**	26,00	1,024	24,63	2,24	0,64	24,88	0,79	7096	15138
VSM-28	**-S02**	**-S16**	28,00	1,102	26,62	2,24	0,64	26,88	0,79	7642	16303
VSM-29	**-S02**	**-S16**	29,00	1,142	27,61	2,24	0,64	27,88	0,79	7915	16885
VSM-30	**-S02**	**-S16**	30,00	1,181	28,59	2,24	0,64	28,88	0,79	8188	17467
VSM-32	**-S02**	**-S16**	32,00	1,260	30,57	2,24	0,64	30,88 ±0,10	0,79	8734	18632
VSM-34	**-S02**	**-S16**	34,00	1,339	32,56	2,24	0,64	32,88	0,79	9279	19796
VSM-35	**-S02**	**-S16**	35,00	1,378	33,55	2,24	0,64	33,88	0,79	9552	20378
VSM-36	**-S02**	**-S16**	36,00	1,417	34,54	2,24	0,64	34,88	0,79	9825	20960
VSM-38	**-S02**	**-S16**	38,00	1,496	36,52	2,24	0,64	36,88	0,79	10371	22125
VSM-40	**-S02**	**-S16**	40,00	1,575	38,09	3,00	0,79	38,52	0,99	14426	28748
VSM-42	**-S02**	**-S16**	42,00	1,654	40,07	3,00	0,79	40,52	0,99	15147	30185
VSM-45	**-S02**	**-S16**	45,00	1,772	43,04	3,00	0,79	43,52 ±0,13	0,99	16229	32341
VSM-48	**-S02**	**-S16**	48,00	1,890	46,01	3,00	0,79	46,52	0,99	17311	34497
VSM-50	**-S02**	**-S16**	50,00	1,969	47,99	3,00	0,79	48,52	0,99	18032	35935
VSM-52	**-S02**	**-S16**	52,00	2,047	49,48	4,01	0,79	50,06	0,99	24583	37372
VSM-55	**-S02**	**-S16**	55,00	2,165	52,46	4,01	0,79	53,06	0,99	26001	39528
VSM-56	**-S02**	**-S16**	56,00	2,205	53,44	4,01	0,79	54,06	0,99	26473	40247
VSM-58	**-S02**	**-S16**	58,00	2,283	55,42	4,01	0,79	56,06	0,99	27419	41684
VSM-60	**-S02**	**-S16**	60,00	2,362	57,40	4,01	0,79	58,06	0,99	28364	43122
VSM-62	**-S02**	**-S16**	62,00	2,441	59,37	4,01	0,79 ±0,05	60,06	0,99	29310	44559
VSM-63	**-S02**	**-S16**	63,00	2,480	60,35	4,01	0,79	61,06	0,99	29783	45278
VSM-65	**-S02**	**-S16**	65,00	2,559	62,33	4,01	0,79	63,06	0,99	30728	46715
VSM-68	**-S02**	**-S16**	68,00	2,677	65,31	4,01	0,79	66,06 ±0,15	0,99	32146	48871
VSM-70	**-S02**	**-S16**	70,00	2,756	67,29	4,01	0,79	68,06	0,99	33092	50309
VSM-72	**-S02**	**-S16**	72,00	2,835	69,27	4,01	0,79	70,06	0,99	34037	51746
VSM-75	**-S02**	**-S16**	75,00	2,953	72,25	4,01	0,79	73,06	0,99	35456	53902
VSM-78	**-S02**	**-S16**	78,00	3,071	74,85	4,78	0,99	75,66	1,12	44477	70250
VSM-80	**-S02**	**-S16**	80,00	3,150	76,82	4,78	0,99	77,66	1,12	45617	72052
VSM-82	**-S02**	**-S16**	82,00	3,228	78,79	4,78	0,99	79,66	1,12	46757	73853
VSM-85	**-S02**	**-S16**	85,00	3,346	81,76	4,78	0,99	82,66	1,12	48468	76555
VSM-88	**-S02**	**-S16**	88,00	3,465	84,73 +0,00/-0,76	4,78	0,99	85,66	1,12	50179	79257

[1] Based on a groove material yield strength of 310 N/mm² and a safety factor of 2.
[2] Based on a safety factor of 3.
[3] No removal notch.
[4] Square edge wire.

VSM Series

Spirolox® Light Duty Rings External Continued

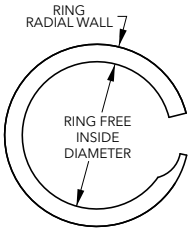
Smalley Part Number			Shaft Diameter		Ring			Groove		Thrust Capacity	
Carbon Steel	Add Suffix				Inside Diameter (mm)	Radial Wall (mm)	Thickness (mm)	Diameter (mm)	Width (mm)	Groove Yield[1] (N)	Ring Shear[2] (N)
	302 SS	316 SS	mm	in							
VSM-90	**-S02**	**-S16**	90,00	3,543	86,69 +0,00/-0,76	4,78 ±0,13	0,99 ±0,05	87,66 ±0,15	1,12 +0,08/-0,00	51319	81058
VSM-95	**-S02**	**-S16**	95,00	3,740	91,66 +0,00/-0,76	4,78 ±0,13	0,99 ±0,05	92,66 ±0,15	1,12 +0,08/-0,00	54170	85561
VSM-100	**-S02**	**-S16**	100,00	3,937	96,62 +0,00/-0,76	4,78 ±0,13	0,99 ±0,05	97,66 ±0,15	1,12 +0,08/-0,00	57021	90064
VSM-105	**-S02**	**-S16**	105,00	4,134	101,13 +0,00/-0,89	5,72 ±0,13	1,17 ±0,05	102,20 ±0,18	1,32 +0,10/-0,00	71642	106440
VSM-110	**-S02**	**-S16**	110,00	4,331	106,08 +0,00/-0,89	5,72 ±0,13	1,17 ±0,05	107,20 ±0,18	1,32 +0,10/-0,00	75054	111508
VSM-115	**-S02**	**-S16**	115,00	4,528	111,03 +0,00/-0,89	5,72 ±0,13	1,17 ±0,05	112,20 ±0,18	1,32 +0,10/-0,00	78465	116577
VSM-120	**-S02**	**-S16**	120,00	4,724	115,98 +0,00/-0,89	5,72 ±0,13	1,17 ±0,05	117,20 ±0,18	1,32 +0,10/-0,00	81877	121645
VSM-125	**-S02**	**-S16**	125,00	4,921	120,93 +0,00/-0,89	5,72 ±0,13	1,17 ±0,05	122,20 ±0,18	1,32 +0,10/-0,00	85288	126714
VSM-130	**-S02**	**-S16**	130,00	5,118	125,88 +0,00/-0,89	5,72 ±0,13	1,17 ±0,05	127,20 ±0,18	1,32 +0,10/-0,00	88700	131783
VSM-135	**-S02**	**-S16**	135,00	5,315	130,31 +0,00/-10,14	5,72 ±0,13	1,55 ±0,05	131,63 ±0,18	1,70 +0,10/-0,00	111027	181299
VSM-140	**-S02**	**-S16**	140,00	5,512	135,13 +0,00/-10,14	5,72 ±0,13	1,55 ±0,05	136,50 ±0,18	1,70 +0,10/-0,00	119404	188013
VSM-145	**-S02**	**-S16**	145,00	5,709	139,95 +0,00/-10,14	5,72 ±0,13	1,55 ±0,05	141,37 ±0,18	1,70 +0,10/-0,00	127974	194907
VSM-150	**-S02**	**-S16**	150,00	5,906	144,83 +0,00/-10,14	5,72 ±0,13	1,55 ±0,05	146,25 ±0,18	1,70 +0,10/-0,00	137070	201443
VSM-155	**-S02**	**-S16**	155,00	6,102	149,66 +0,00/-10,14	5,72 ±0,13	1,55 ±0,05	151,13 ±0,18	1,70 +0,10/-0,00	146361	208158
VSM-160	**-S02**	**-S16**	160,00	6,299	154,44 +0,00/-10,14	6,73 ±0,13	1,55 ±0,05	156,00 ±0,18	1,70 +0,10/-0,00	155956	214872
VSM-165	**-S02**	**-S16**	165,00	6,496	159,27 +0,00/-10,14	6,73 ±0,13	1,55 ±0,05	160,88 ±0,18	1,70 +0,10/-0,00	165855	221587
VSM-170	**-S02**	**-S16**	170,00	6,693	164,09 +0,00/-10,14	6,73 ±0,13	1,55 ±0,05	165,75 ±0,18	1,70 +0,10/-0,00	176059	228302
VSM-175	**-S02**	**-S16**	175,00	6,890	168,92 +0,00/-10,14	6,73 ±0,13	1,55 ±0,05	170,63 ±0,18	1,70 +0,10/-0,00	186568	235017
VSM-180	**-S02**	**-S16**	180,00	7,087	173,75 +0,00/-10,14	6,73 ±0,13	1,55 ±0,05	175,50 ±0,18	1,70 +0,10/-0,00	197381	241731
VSM-185	**-S02**	**-S16**	185,00	7,283	178,57 +0,00/-10,14	7,62 ±0,13	1,55 ±0,05	180,38 ±0,18	1,70 +0,10/-0,00	208499	248446
VSM-190	**-S02**	**-S16**	190,00	7,480	183,40 +0,00/-10,52	7,62 ±0,13	1,55 ±0,05	185,25 ±0,18	1,70 +0,10/-0,00	219922	255161
VSM-195	**-S02**	**-S16**	195,00	7,677	188,22 +0,00/-10,52	7,62 ±0,13	1,55 ±0,05	190,13 ±0,18	1,70 +0,10/-0,00	231649	261876
VSM-200	**-S02**	**-S16**	200,00	7,874	193,05 +0,00/-10,52	7,62 ±0,13	1,55 ±0,05	195,00 ±0,20	1,70 +0,10/-0,00	243681	268590
VSM-210	**-S02**	**-S16**	210,00	8,268	202,70 +0,00/-10,52	8,76 ±0,13	1,93 ±0,05	204,75 ±0,20	2,08 +0,13/-0,00	268658	351160
VSM-220	**-S02**	**-S16**	220,00	8,661	212,36 +0,00/-10,52	8,76 ±0,13	1,93 ±0,05	214,50 ±0,20	2,08 +0,13/-0,00	294854	367882
VSM-230	**-S02**	**-S16**	230,00	9,055	222,01 +0,00/-10,78	8,76 ±0,15	1,93 ±0,05	224,25 ±0,20	2,08 +0,13/-0,00	322268	384604
VSM-240	**-S02**	**-S16**	240,00	9,449	231,66 +0,00/-10,78	8,76 ±0,15	1,93 ±0,05	234,00 ±0,20	2,08 +0,13/-0,00	350900	401326
VSM-250	**-S02**	**-S16**	250,00	9,843	241,31 +0,00/-10,78	8,76 ±0,15	1,93 ±0,05	243,75 ±0,20	2,08 +0,13/-0,00	380751	418048
VSM-260	**-S02**	**-S16**	260,00	10,236	250,97 +0,00/-10,78	9,65 ±0,15	1,93 ±0,05	253,50 ±0,20	2,08 +0,13/-0,00	411821	434770
VSM-270	**-S02**	**-S16**	270,00	10,630	260,62 +0,00/-10,78	9,65 ±0,15	1,93 ±0,05	263,25 ±0,20	2,08 +0,13/-0,00	444108	451492
VSM-280	**-S02**	**-S16**	280,00	11,024	270,27 +0,00/-10,78	9,65 ±0,15	1,93 ±0,05	273,00 ±0,20	2,08 +0,13/-0,00	477614	468214
VSM-290	**-S02**	**-S16**	290,00	11,417	279,92 +0,00/-10,78	9,65 ±0,15	1,93 ±0,05	282,75 ±0,20	2,08 +0,13/-0,00	512339	484936
VSM-300	**-S02**	**-S16**	300,00	11,811	289,58 +0,00/-10,78	9,65 ±0,15	1,93 ±0,05	292,50 ±0,20	2,08 +0,13/-0,00	548282	501658

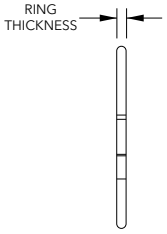
[1] Based on a groove material yield strength of 310 N/mm² and a safety factor of 2.
[2] Based on a safety factor of 3.

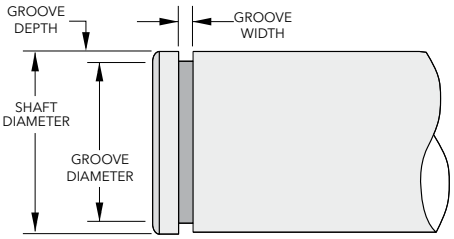
VS Series

Spirolox® Imperial Light Duty Rings External









Product Dimensions: All dimensions in inches unless otherwise specified.

Smalley Part Number			Shaft Diameter		Ring			Groove		Thrust Capacity	
Carbon Steel	Add Suffix				Inside Diameter (in)	Radial Wall (in)	Thickness (in)	Diameter (in)	Width (in)	Groove Yield[1] (lb)	Ring Shear[2] (lb)
	302 SS	316 SS	in	mm							
VS-25[3,4]	**-S02**	**-S16**	0,250	6,35	0,236 +0,000/-0,010	0,020	0,012	0,238	0,015	106	481
VS-31[3,4]	**-S02**	**-S16**	0,312	7,92	0,294	0,025	0,015	0,297	0,018	165	750
VS-37[3,4]	**-S02**	**-S16**	0,375	9,53	0,348	0,025	0,015	0,351	0,018	318	901
VS-43[4]	**-S02**	**-S16**	0,437	11,10	0,410 +0,000/-0,012	0,035	0,015	0,413 ±0,002	0,018	371	1050
VS-50	**-S02**	**-S16**	0,500	12,70	0,467	0,045	0,018	0,472	0,022	500	1300
VS-56	**-S02**	**-S16**	0,562	14,27	0,529	0,045	0,018	0,534	0,022	560	1460
VS-62	**-S02**	**-S16**	0,625	15,88	0,591	0,045	0,018	0,597	0,022	620	1630
VS-68	**-S02**	**-S16**	0,687	17,45	0,652	0,045	0,018	0,659	0,022	680	1790
VS-75	**-S02**	**-S16**	0,750	19,05	0,715	0,045	0,018	0,722	0,022	740	1950
VS-81	**-S02**	**-S16**	0,812	20,62	0,762	0,065	0,021	0,770	0,026	1210	2460
VS-87	**-S02**	**-S16**	0,875	22,23	0,825	0,065	0,021	0,833	0,026	1300	2660
VS-93	**-S02**	**-S16**	0,937	23,80	0,886	0,065	0,021	0,895	0,026	1390	2840
VS-100	**-S02**	**-S16**	1,000	25,40	0,949	0,065	0,021	0,958	0,026	1480	3040
VS-106	**-S02**	**-S16**	1,062	26,97	1,008	0,088	0,025	1,018	0,031	1650	3500
VS-112	**-S02**	**-S16**	1,125	28,58	1,071	0,088	0,025	1,081	0,031	1750	3710
VS-118	**-S02**	**-S16**	1,187	30,15	1,132	0,088	0,025	1,143	0,031	1850	3920
VS-125	**-S02**	**-S16**	1,250	31,75	1,194	0,088	0,025	1,206	0,031	1940	4120
VS-131	**-S02**	**-S16**	1,312	33,32	1,255	0,088	0,025	1,268	0,031	2040	4330
VS-137	**-S02**	**-S16**	1,375	34,93	1,318	0,088	0,025	1,331	0,031	2140	4540
VS-143	**-S02**	**-S16**	1,437	36,50	1,379	0,088	0,025	1,393	0,031	2240	4740
VS-150	**-S02**	**-S16**	1,500	38,10	1,442	0,088	0,025	1,456	0,031	2330	4950
VS-156	**-S02**	**-S16**	1,562	39,67	1,488	0,118	0,031	1,505	0,039	3200	6390
VS-162	**-S02**	**-S16**	1,625	41,28	1,550	0,118	0,031	1,568	0,039	3330	6650
VS-168	**-S02**	**-S16**	1,687	42,85	1,612	0,118	0,031	1,630	0,039	3460	6900
VS-175	**-S02**	**-S16**	1,750	44,45	1,674	0,118	0,031	1,693	0,039	3590	7160
VS-181	**-S02**	**-S16**	1,812	46,02	1,736	0,118	0,031	1,755	0,039	3710	7410
VS-187	**-S02**	**-S16**	1,875	47,63	1,798	0,118	0,031	1,818	0,039	3840	7670
VS-193	**-S02**	**-S16**	1,937	49,20	1,859	0,118	0,031	1,880	0,039	3970	7920
VS-200	**-S02**	**-S16**	2,000	50,80	1,922	0,118	0,031	1,943	0,039	4100	8180
VS-206	**-S02**	**-S16**	2,062	52,37	1,963	0,158	0,031	1,986	0,039	5540	8430
VS-212	**-S02**	**-S16**	2,125	53,98	2,026	0,158	0,031	2,049	0,039	5710	8690
VS-218	**-S02**	**-S16**	2,187	55,55	2,087	0,158	0,031	2,111	0,039	5870	8950
VS-225	**-S02**	**-S16**	2,250	57,15	2,149	0,158	0,031	2,174	0,039	6040	9200
VS-231	**-S02**	**-S16**	2,312	58,72	2,211	0,158	0,031	2,236	0,039	6210	9460
VS-237	**-S02**	**-S16**	2,375	60,33	2,273	0,158	0,031	2,299	0,039	6380	9720
VS-243	**-S02**	**-S16**	2,437	61,90	2,335	0,158	0,031	2,361	0,039	6550	9970
VS-250	**-S02**	**-S16**	2,500	63,50	2,397	0,158	0,031	2,424	0,039	6720	10230
VS-256	**-S02**	**-S16**	2,562	65,07	2,458	0,158	0,031	2,486	0,039	6880	10480
VS-262	**-S02**	**-S16**	2,625	66,68	2,521	0,158	0,031	2,549	0,039	7050	10740
VS-268	**-S02**	**-S16**	2,687	68,25	2,582	0,158	0,031	2,611	0,039	7220	10990
VS-275	**-S02**	**-S16**	2,750	69,85	2,644	0,158	0,031	2,674	0,039	7390	11250
VS-281	**-S02**	**-S16**	2,812	71,42	2,706	0,158	0,031	2,736	0,039	7550	11500
VS-287	**-S02**	**-S16**	2,875	73,03	2,768	0,158	0,031	2,799	0,039	7720	11760
VS-293	**-S02**	**-S16**	2,937	74,60	2,830	0,158	0,031	2,861	0,039	7890	12010
VS-300	**-S02**	**-S16**	3,000	76,20	2,892	0,158	0,031	2,924	0,039	8060	12270
VS-306	**-S02**	**-S16**	3,062	77,77	2,938	0,188	0,039	2,970	0,044	9960	15760
VS-312	**-S02**	**-S16**	3,125	79,38	3,001	0,188	0,039	3,033	0,044	10160	16080
VS-318	**-S02**	**-S16**	3,187	80,95	3,062	0,188	0,039	3,095	0,044	10360	16400
VS-325	**-S02**	**-S16**	3,250	82,55	3,125	0,188	0,039	3,158	0,044	10570	16720
VS-331	**-S02**	**-S16**	3,312	84,12	3,186	0,188	0,039	3,220	0,044	10770	17040

[1] Based on a groove material yield strength of 45000 psi and a safety factor of 2.
[2] Based on a safety factor of 3.
[3] No removal notch.
[4] Square edge wire.

VS Series

Spirolox® Imperial Light Duty Rings External Continued

Smalley Part Number			Shaft Diameter		Ring			Groove		Thrust Capacity	
Carbon Steel	Add Suffix				Inside Diameter (in)	Radial Wall (in)	Thickness (in)	Diameter (in)	Width (in)	Groove Yield[1] (lb)	Ring Shear[2] (lb)
	302 SS	316 SS	in	mm							
VS-337	**-S02**	**-S16**	3,375	85,73	3,248	0,188	0,039	3,283	0,044	10970	17370
VS-343	**-S02**	**-S16**	3,437	87,30	3,310	0,188	0,039	3,345	0,044	11180	17690
VS-350	**-S02**	**-S16**	3,500	88,90	3,372	0,188	0,039	3,408	0,044	11380	18010
VS-356	**-S02**	**-S16**	3,562	90,47	3,433	0,188	0,039	3,470	0,044	11580	18330
VS-362	**-S02**	**-S16**	3,625	92,08	3,496	0,188	0,039	3,533	0,044	11790	18650
VS-368	**-S02**	**-S16**	3,687	93,65	3,557	0,188	0,039	3,595	0,044	11990	18970
VS-375	**-S02**	**-S16**	3,750	95,25	3,620	0,188	0,039	3,658	0,044	12190	19300
VS-381	**-S02**	**-S16**	3,812	96,82	3,681	0,188	0,039	3,720	0,044	12400	19620
VS-387	**-S02**	**-S16**	3,875	98,43	3,743	0,188	0,039	3,783	0,044	12600	19940
VS-393	**-S02**	**-S16**	3,937	100,00	3,805	0,188	0,039	3,845	0,044	12800	20260
VS-400	**-S02**	**-S16**	4,000	101,60	3,867	0,188	0,039	3,908	0,044	13010	20580
VS-412	**-S02**	**-S16**	4,125	104,78	3,973	0,225	0,046	4,015	0,052	16040	23850
VS-425	**-S02**	**-S16**	4,250	107,95	4,097	0,225	0,046	4,140	0,052	16520	24570
VS-437	**-S02**	**-S16**	4,375	111,13	4,221	0,225	0,046	4,265	0,052	17010	25290
VS-450	**-S02**	**-S16**	4,500	114,30	4,345	0,225	0,046	4,390	0,052	17500	26010
VS-462	**-S02**	**-S16**	4,625	117,48	4,468	0,225	0,046	4,515	0,052	17980	26740
VS-475	**-S02**	**-S16**	4,750	120,65	4,592	0,225	0,046	4,640	0,052	18470	27460
VS-487	**-S02**	**-S16**	4,875	123,83	4,715	0,225	0,046	4,765	0,052	18950	28180
VS-500	**-S02**	**-S16**	5,000	127,00	4,839	0,225	0,046	4,890	0,052	19440	28900
VS-525	**-S02**	**-S16**	5,250	133,35	5,067	0,225	0,061	5,119	0,067	24490	40240
VS-550	**-S02**	**-S16**	5,500	139,70	5,309	0,225	0,061	5,363	0,067	26830	42160
VS-575	**-S02**	**-S16**	5,750	146,05	5,550	0,225	0,061	5,606	0,067	29260	44080
VS-600	**-S02**	**-S16**	6,000	152,40	5,792	0,225	0,061	5,850	0,067	31810	45990
VS-625	**-S02**	**-S16**	6,250	158,75	6,033	0,265	0,061	6,094	0,067	34460	47910
VS-650	**-S02**	**-S16**	6,500	165,10	6,275	0,265	0,061	6,338	0,067	37220	49830
VS-675	**-S02**	**-S16**	6,750	171,45	6,515	0,265	0,061	6,581	0,067	40560	51740
VS-700	**-S02**	**-S16**	7,000	177,80	6,757	0,265	0,061	6,825	0,067	43540	53660
VS-725	**-S02**	**-S16**	7,250	184,15	6,998	0,300	0,061	7,069	0,067	46640	55580
VS-750	**-S02**	**-S16**	7,500	190,50	7,240	0,300	0,061	7,313	0,067	49830	57490
VS-775	**-S02**	**-S16**	7,750	196,85	7,480	0,300	0,061	7,556	0,067	53140	59410
VS-800	**-S02**	**-S16**	8,000	203,20	7,722	0,300	0,061	7,800	0,067	56550	61320
VS-825	**-S02**	**-S16**	8,250	209,55	7,964	0,345	0,076	8,044	0,082	60070	78790
VS-850	**-S02**	**-S16**	8,500	215,90	8,205	0,345	0,076	8,288	0,082	63690	81180
VS-875	**-S02**	**-S16**	8,750	222,25	8,446	0,345	0,076	8,531	0,082	68040	83570
VS-900	**-S02**	**-S16**	9,000	228,60	8,687	0,345	0,076	8,775	0,082	71890	85950
VS-925	**-S02**	**-S16**	9,250	234,95	8,929	0,345	0,076	9,019	0,082	75850	88340
VS-950	**-S02**	**-S16**	9,500	241,30	9,170	0,345	0,076	9,263	0,082	79910	90730
VS-975	**-S02**	**-S16**	9,750	247,65	9,411	0,345	0,076	9,506	0,082	84080	93120
VS-1000	**-S02**	**-S16**	10,000	254,00	9,653	0,345	0,076	9,750	0,082	88360	95500

+0,000/-0,030 | +0,000/-0,035 | +0,000/-0,045 | +0,000/-0,060 | +0,000/-0,070 | ±0,005 | +0,004/-0,008 | ±0,002 | ±0,006 | ±0,007 | ±0,008 | +0,003/-0,000 | +0,004/-0,000 | +0,005/-0,000

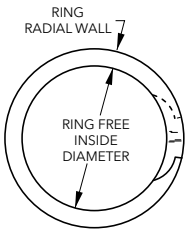
[1] Based on a groove material yield strength of 45000 psi and a safety factor of 2.
[2] Based on a safety factor of 3.

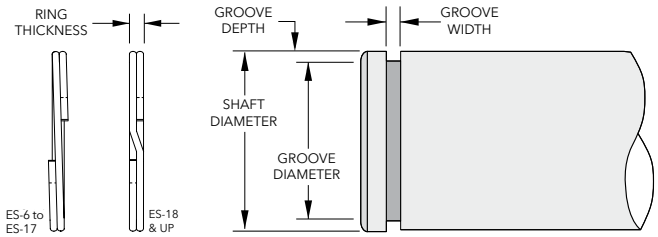
ES Series

Spirolox® Aerospace Rings External

**Compliance with MA 4016*







Product Dimensions: All dimensions in millimeters unless otherwise specified.

Smalley Part Number			Shaft Diameter		Ring			Groove		Thrust Capacity	
Carbon Steel	Add Suffix				Inside Diameter (mm)	Radial Wall (mm)	Thickness (mm)	Diameter (mm)	Width (mm)	Groove Yield[1] (N)	Ring Shear[2] (N)
	302 SS	316 SS	mm	in							
ES-6[3,4]	**-S02**	**-S16**	6,00	0,236	5,61	0,38 - 0,58	0,64	5,66	0,74	500	3160
ES-7[3,4]	**-S02**	**-S16**	7,00	0,276	6,53	0,51 - 0,71	0,64	6,58	0,74	720	3690
ES-8[3,4]	**-S02**	**-S16**	8,00	0,315	7,49	0,51 - 0,71	0,64	7,57	0,74	840	4210
ES-9[3,4]	**-S02**	**-S16**	9,00	0,354	8,41	0,64 - 0,84	0,64	8,48	0,74	1140	4740
ES-10[3,4]	**-S02**	**-S16**	10,00	0,394	9,40	0,64 - 0,84	0,64	9,50	0,74	1220	5270
ES-11[4]	**-S02**	**-S16**	11,00	0,433	10,39	0,76 - 0,96	0,64	10,46	0,74	1450	5790
ES-12	**-S02**	**-S16**	12,00	0,472	11,18	1,02 - 1,22	0,60	11,29	0,70	2100	7950
ES-13	**-S02**	**-S16**	13,00	0,512	12,13	1,14 - 1,35	0,89	12,24	1,00	2410	12100
ES-14	**-S02**	**-S16**	14,00	0,551	13,06	1,14 - 1,35	0,89	13,19	1,00	2800	13040
ES-15	**-S02**	**-S16**	15,00	0,591	13,98	1,14 - 1,35	0,89	14,09	1,00	3360	13970
ES-16	**-S02**	**-S16**	16,00	0,630	14,90	1,27 - 1,48	0,89	15,02	1,00	3820	14900
ES-17	**-S02**	**-S16**	17,00	0,669	15,82	1,27 - 1,48	0,89	16,02	1,00	4060	15830
ES-18	**-S02**	**-S16**	18,00	0,709	16,80	1,52 - 1,73	1,07	16,92	1,20	4730	20150
ES-19	**-S02**	**-S16**	19,00	0,748	17,73	1,52 - 1,73	1,07	17,87	1,20	5270	21270
ES-20	**-S02**	**-S16**	20,00	0,787	18,62	1,52 - 1,73	1,07	18,77	1,20	6040	22390
ES-21	**-S02**	**-S16**	21,00	0,827	19,57	1,52 - 1,73	1,07	19,72	1,20	6550	23510
ES-22	**-S02**	**-S16**	22,00	0,866	20,45	1,78 - 1,98	1,07	20,62	1,20	7390	24630
ES-23	**-S02**	**-S16**	23,00	0,906	21,39	1,78 - 1,98	1,07	21,57	1,20	8070	25750
ES-24	**-S02**	**-S16**	24,00	0,945	22,35	1,78 - 1,98	1,07	22,52	1,20	8650	26870
ES-25	**-S02**	**-S16**	25,00	0,984	23,25	2,03 - 2,24	1,07	23,42	1,20	9620	27990
ES-26	**-S02**	**-S16**	26,00	1,024	24,21	2,03 - 2,24	1,07	24,42	1,20	10000	29110
ES-27	**-S02**	**-S16**	27,00	1,063	25,04	2,49 - 2,69	1,27	25,35	1,40	10910	31170
ES-28	**-S02**	**-S16**	28,00	1,102	26,00	2,49 - 2,69	1,27	26,30	1,40	11590	32330
ES-29	**-S02**	**-S16**	29,00	1,142	26,95	2,49 - 2,69	1,27	27,27	1,40	12290	33480
ES-30	**-S02**	**-S16**	30,00	1,181	27,92	2,49 - 2,69	1,27	28,25	1,40	12860	34640
ES-31	**-S02**	**-S16**	31,00	1,220	28,84	2,49 - 2,69	1,27	29,17	1,40	13890	35790
ES-32	**-S02**	**-S16**	32,00	1,260	29,77	2,49 - 2,69	1,27	30,09	1,40	14960	36950
ES-34	**-S02**	**-S16**	34,00	1,339	31,54	2,87 - 3,07	1,27	31,90	1,40	17390	39260
ES-35	**-S02**	**-S16**	35,00	1,378	32,44	2,87 - 3,07	1,27	32,80	1,40	18750	40410
ES-36	**-S02**	**-S16**	36,00	1,417	33,40	2,87 - 3,07	1,27	33,75	1,40	19810	41560
ES-37	**-S02**	**-S16**	37,00	1,457	34,24	2,87 - 3,07	1,27	34,67	1,40	21080	42720
ES-38	**-S02**	**-S16**	38,00	1,496	35,18	2,87 - 3,07	1,27	35,66	1,40	21650	43870
ES-40	**-S02**	**-S16**	40,00	1,575	37,15	3,12 - 3,33	1,57	37,55	1,75	23960	57090
ES-42	**-S02**	**-S16**	42,00	1,654	39,02	3,12 - 3,33	1,57	39,45	1,75	26180	59990
ES-45	**-S02**	**-S16**	45,00	1,772	41,77	3,12 - 3,33	1,57	42,25	1,75	30240	64230
ES-46	**-S02**	**-S16**	46,00	1,811	42,67	3,12 - 3,33	1,57	43,15	1,75	32040	65660
ES-47	**-S02**	**-S16**	47,00	1,850	43,81	3,89 - 4,09	1,57	44,31	1,75	30900	67080
ES-48	**-S02**	**-S16**	48,00	1,890	44,48	3,89 - 4,09	1,57	45,05	1,75	34600	68510
ES-50	**-S02**	**-S16**	50,00	1,969	46,69	3,89 - 4,09	1,57	47,05	1,75	36040	71370
ES-52	**-S02**	**-S16**	52,00	2,047	49,62	3,12 - 3,33	1,25	50,15	1,42	23550	59090
ES-53	**-S02**	**-S16**	53,00	2,087	50,62	3,12 - 3,33	1,25	51,15	1,42	24000	60230
ES-54	**-S02**	**-S16**	54,00	2,126	51,62	3,12 - 3,33	1,25	52,15	1,42	24460	61370
ES-55	**-S02**	**-S16**	55,00	2,165	52,62	3,38 - 3,58	1,25	53,15	1,42	24910	62500
ES-56	**-S02**	**-S16**	56,00	2,205	53,62	3,38 - 3,58	1,25	54,15	1,42	25370	63640
ES-58	**-S02**	**-S16**	58,00	2,283	55,43	3,38 - 3,58	1,25	56,01	1,42	28250	65910
ES-59	**-S02**	**-S16**	59,00	2,323	56,43	3,38 - 3,58	1,25	57,01	1,42	28730	67050
ES-60	**-S02**	**-S16**	60,00	2,362	57,43	3,38 - 3,58	1,25	58,01	1,42	29220	68180
ES-61	**-S02**	**-S16**	61,00	2,402	58,36	3,38 - 3,58	1,25	58,91	1,42	31190	69320
ES-62	**-S02**	**-S16**	62,00	2,441	59,30	3,63 - 3,84	1,25	59,91	1,42	31710	70460
ES-63	**-S02**	**-S16**	63,00	2,480	60,30	3,63 - 3,84	1,25	60,91	1,42	32220	71590

[1] Based on a groove material yield strength of 310 N/mm² and a safety factor of 2.
[2] Based on a safety factor of 3.
[3] No removal notch.
[4] Square edge wire.
* Contact Smalley for details/information on how to order parts to be in compliance with this specification.

ES Series

Spirolox® Aerospace Rings External Continued

Smalley Part Number			Shaft Diameter		Ring				Groove				Thrust Capacity	
Carbon Steel	Add Suffix				Inside Diameter (mm)		Radial Wall (mm)	Thickness (mm)	Diameter (mm)		Width (mm)		Groove Yield[1] (N)	Ring Shear[2] (N)
	302 SS	316 SS	mm	in										
ES-64	**-S02**	**-S16**	64,00	2,520	61,25		3,63 - 3,84	1,25	61,91		1,42		32730	72730
ES-65	**-S02**	**-S16**	65,00	2,559	62,20	+,00/-,63	3,63 - 3,84	1,25	62,81		1,42		34820	73870
ES-66	**-S02**	**-S16**	66,00	2,598	63,16		3,63 - 3,84	1,25	63,79		1,42		35680	75000
ES-67	**-S02**	**-S16**	67,00	2,638	64,16		3,63 - 3,84	1,25	64,71		1,42		37530	76140
ES-68	**-S02**	**-S16**	68,00	2,677	65,08		3,89 - 4,09	1,25	65,71		1,42	+0,10/-0,00	38090	77270
ES-69	**-S02**	**-S16**	69,00	2,717	66,06		3,89 - 4,09	1,25	66,71		1,42		38650	78410
ES-70	**-S02**	**-S16**	70,00	2,756	67,08		3,89 - 4,09	1,25	67,71		1,42		39210	79550
ES-71	**-S02**	**-S16**	71,00	2,795	68,04		3,89 - 4,09	1,25	68,71		1,42		39770	80680
ES-72	**-S02**	**-S16**	72,00	2,835	69,00		4,11 - 4,37	1,25	69,65		1,42		41380	81820
ES-75	**-S02**	**-S16**	75,00	2,953	71,93		4,11 - 4,37	1,25	72,61		1,42		43830	85230
ES-78	**-S02**	**-S16**	78,00	3,071	74,84		4,11 - 4,37	1,55	75,55		1,73		46730	109910
ES-80	**-S02**	**-S16**	80,00	3,150	76,80	+,00/-,76	4,37 - 4,62	1,55	77,51		1,73		48700	112730
ES-82	**-S02**	**-S16**	82,00	3,228	78,72		4,37 - 4,62	1,55	79,45		1,73		51120	115550
ES-85	**-S02**	**-S16**	85,00	3,346	81,62		4,62 - 4,88	1,55	82,35		1,73		55060	119780
ES-88	**-S02**	**-S16**	88,00	3,465	84,53		4,62 - 4,88	1,55	85,31		1,73		57860	124000
ES-90	**-S02**	**-S16**	90,00	3,543	86,43		4,88 - 5,13	1,55	87,21		1,73		61370	126820
ES-95	**-S02**	**-S16**	95,00	3,740	91,37		4,88 - 5,13	1,55	92,15		1,73		66160	133870
ES-100	**-S02**	**-S16**	100,00	3,937	96,10		5,13 - 5,38	1,55	97,01		1,73		73050	140910
ES-105	**-S02**	**-S16**	105,00	4,134	100,94		5,38 - 5,64	1,55	101,85		1,73		80780	147960
ES-110	**-S02**	**-S16**	110,00	4,331	105,75		5,64 - 5,89	1,55	106,69		1,73		88930	155000
ES-115	**-S02**	**-S16**	115,00	4,528	110,59		5,89 - 6,15	1,55	111,55		1,73		96890	162050
ES-120	**-S02**	**-S16**	120,00	4,724	115,49	+,00/-1,00	6,20 - 6,45	1,83	116,45		2,00	+0,13/-0,00	104030	199640
ES-125	**-S02**	**-S16**	125,00	4,921	120,44		6,20 - 6,45	1,83	121,45		2,00		108360	207960
ES-130	**-S02**	**-S16**	130,00	5,118	125,34		6,20 - 6,45	1,83	126,35		2,00		115860	216280
ES-135	**-S02**	**-S16**	135,00	5,315	130,20		6,20 - 6,45	1,83	131,27		2,00		122950	224600
ES-140	**-S02**	**-S16**	140,00	5,512	135,14	+,00/-1,30	6,20 - 6,45	1,83	136,25	±,175	2,00		128190	232920
ES-145	**-S02**	**-S16**	145,00	5,709	140,00		6,20 - 6,45	1,83	141,17		2,00		135590	241230
ES-150	**-S02**	**-S16**	150,00	5,906	145,00		6,20 - 6,45	1,83	146,17		2,00		140260	249550
ES-155	**-S02**	**-S16**	155,00	6,102	149,33		7,72 - 8,03	2,18	150,60		2,40		166080	307190
ES-160	**-S02**	**-S16**	160,00	6,299	154,31		7,72 - 8,03	2,18	155,60		2,40		171430	317100
ES-165	**-S02**	**-S16**	165,00	6,496	159,23		7,72 - 8,03	2,18	160,60		2,40		176790	327010
ES-170	**-S02**	**-S16**	170,00	6,693	164,00		7,72 - 8,03	2,18	165,40		2,40		190430	336920
ES-175	**-S02**	**-S16**	175,00	6,890	169,00	+,00/-1,52	7,72 - 8,03	2,18	170,40		2,40		196030	346830
ES-180	**-S02**	**-S16**	180,00	7,087	173,78		7,72 - 8,03	2,18	175,20		2,40		210400	356740
ES-185	**-S02**	**-S16**	185,00	7,283	178,70		7,72 - 8,03	2,18	180,20		2,40		216240	366650
ES-190	**-S02**	**-S16**	190,00	7,480	183,70		7,72 - 8,03	2,18	185,20		2,40		220080	376560
ES-195	**-S02**	**-S16**	195,00	7,677	188,43		7,72 - 8,03	2,18	190,00	±,200	2,40		237420	386460
ES-200	**-S02**	**-S16**	200,00	7,874	193,43		7,72 - 8,03	2,18	195,00		2,40		243510	396370
ES-210	**-S02**	**-S16**	210,00	8,268	202,93		9,32 - 9,63	2,18	204,60		2,40		276140	416190
ES-220	**-S02**	**-S16**	220,00	8,661	212,65		9,32 - 9,63	2,18	214,40		2,40	+0,15/-0,00	300010	436010
ES-230	**-S02**	**-S16**	230,00	9,055	222,60		9,32 - 9,63	2,18	224,40		2,40		313640	455830
ES-240	**-S02**	**-S16**	240,00	9,449	232,32	+,00/-1,78	9,32 - 9,63	2,18	234,20		2,40		328970	475650
ES-250	**-S02**	**-S16**	250,00	9,843	241,83		9,32 - 9,63	2,18	243,80		2,40		377440	495470
ES-260	**-S02**	**-S16**	260,00	10,236	251,57		9,32 - 9,63	2,18	253,60		2,40		405210	515290
ES-270	**-S02**	**-S16**	270,00	10,630	261,30		9,32 - 9,63	2,18	263,40		2,40		433940	535100
ES-280	**-S02**	**-S16**	280,00	11,024	271,04		9,32 - 9,63	2,18	273,20		2,40		463650	554920

[1] Based on a groove material yield strength of 310 N/mm² and a safety factor of 2.
[2] Based on a safety factor of 3.

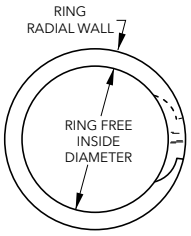
* Contact Smalley for details/information on how to order parts to be in compliance with this specification.

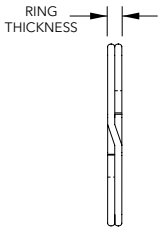
DNS Series

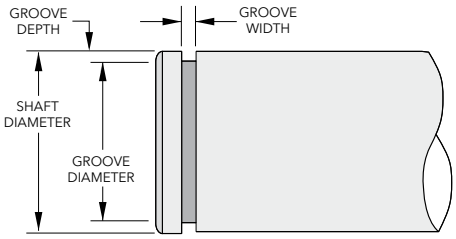
Spirolox® DIN Rings External

**Groove compatible with DIN 471*









Product Dimensions: All dimensions in millimeters unless otherwise specified.

Smalley Part Number			Shaft Diameter		Ring			Groove		Thrust Capacity	
Carbon Steel	Add Suffix				Inside Diameter (mm)	Radial Wall (mm)	Thickness (mm)	Diameter (mm)	Width (mm)	Groove Yield[1] (N)	Ring Shear[2] (N)
	302 SS	316 SS	mm	in							
DNS-13	**-S02**	**-S16**	13,00	0,512	12,27	1,40	0,99	12,40	1,10	1901	13474
DNS-14	**-S02**	**-S16**	14,00	0,551	13,26	1,40	0,99	13,40	1,10	2047	14510
DNS-15	**-S02**	**-S16**	15,00	0,591	14,15	1,40	0,99	14,30	1,10	2559	15547
DNS-16	**-S02**	**-S16**	16,00	0,630	15,04	1,65	0,99	15,20	1,10	3119	16583
DNS-17	**-S02**	**-S16**	17,00	0,669	16,04	1,65	0,99	16,20	1,10	3314	17620
DNS-18	**-S02**	**-S16**	18,00	0,709	16,83	1,91	1,14	17,00	1,30	4386	18668
DNS-19	**-S02**	**-S16**	19,00	0,748	17,83	1,91	1,14	18,00	1,30	4630	19705
DNS-20	**-S02**	**-S16**	20,00	0,787	18,82	1,91	1,14	19,00	1,30	4874	20742
DNS-21	**-S02**	**-S16**	21,00	0,827	19,79	1,91	1,14	20,00	1,30	5117	21779
DNS-22	**-S02**	**-S16**	22,00	0,866	20,78	1,91	1,14	21,00	1,30	5361	22816
DNS-23	**-S02**	**-S16**	23,00	0,906	21,77	1,91	1,14	22,00	1,30	5605	23853
DNS-24	**-S02**	**-S16**	24,00	0,945	22,66	2,18	1,14	22,90	1,30	6433	24891
DNS-25	**-S02**	**-S16**	25,00	0,984	23,65	2,18	1,14	23,90	1,30	6701	25928
DNS-26	**-S02**	**-S16**	26,00	1,024	24,64	2,18	1,14	24,90	1,30	6969	26965
DNS-27	**-S02**	**-S16**	27,00	1,063	25,34	2,18	1,14	25,60	1,30	9211	28002
DNS-28	**-S02**	**-S16**	28,00	1,102	26,34	2,39	1,44	26,60	1,60	9552	36681
DNS-29	**-S02**	**-S16**	29,00	1,142	27,33	2,39	1,44	27,60	1,60	9893	37991
DNS-30	**-S02**	**-S16**	30,00	1,181	28,32	2,39	1,44	28,60	1,60	10235	39301
DNS-32	**-S02**	**-S16**	32,00	1,260	30,00	3,25	1,44	30,30	1,60	13256	41921
DNS-33	**-S02**	**-S16**	33,00	1,299	30,99	3,25	1,44	31,30	1,60	13670	43231
DNS-34	**-S02**	**-S16**	34,00	1,339	31,98	3,25	1,44	32,30	1,60	14085	44541
DNS-35	**-S02**	**-S16**	35,00	1,378	32,66	3,25	1,44	33,00	1,60	17058	45851
DNS-36	**-S02**	**-S16**	36,00	1,417	33,65	4,01	1,69	34,00	1,85	17545	55349
DNS-38	**-S02**	**-S16**	38,00	1,496	35,64	4,01	1,69	36,00	1,85	18520	58424
DNS-40	**-S02**	**-S16**	40,00	1,575	37,11	4,01	1,69	37,50	1,85	24368	61498
DNS-42	**-S02**	**-S16**	42,00	1,654	39,09	4,01	1,69	39,50	1,85	25586	64573
DNS-45	**-S02**	**-S16**	45,00	1,772	42,06	4,01	1,69	42,50	1,85	27414	69186
DNS-46	**-S02**	**-S16**	46,00	1,811	43,05	4,01	1,69	43,50	1,85	28023	70723
DNS-47	**-S02**	**-S16**	47,00	1,850	44,04	4,01	1,69	44,50	1,85	28633	72261
DNS-48	**-S02**	**-S16**	48,00	1,890	45,03	4,01	1,69	45,50	1,85	29242	73798
DNS-50	**-S02**	**-S16**	50,00	1,969	46,53	5,08	1,93	47,00	2,15	36552	87790
DNS-52	**-S02**	**-S16**	52,00	2,047	48,51	5,08	1,93	49,00	2,15	38014	91302
DNS-54	**-S02**	**-S16**	54,00	2,126	50,50	5,08	1,93	51,00	2,15	39476	94813
DNS-55	**-S02**	**-S16**	55,00	2,165	51,49	5,08	1,93	52,00	2,15	40207	96569
DNS-56	**-S02**	**-S16**	56,00	2,205	52,48	5,08	1,93	53,00	2,15	40938	98325
DNS-58	**-S02**	**-S16**	58,00	2,283	54,43	5,08	1,93	55,00	2,15	42400	101836
DNS-60	**-S02**	**-S16**	60,00	2,362	56,42	5,08	1,93	57,00	2,15	43863	105348
DNS-62	**-S02**	**-S16**	62,00	2,441	58,42	5,08	1,93	59,00	2,15	45325	108860
DNS-63	**-S02**	**-S16**	63,00	2,480	59,39	5,08	1,93	60,00	2,15	46056	110615
DNS-65	**-S02**	**-S16**	65,00	2,559	61,39	5,08	2,41	62,00	2,65	47518	135725
DNS-67	**-S02**	**-S16**	67,00	2,638	63,37	5,08	2,41	64,00	2,65	48980	139901
DNS-68	**-S02**	**-S16**	68,00	2,677	64,34	5,08	2,41	65,00	2,65	49711	141989
DNS-70	**-S02**	**-S16**	70,00	2,756	66,34	5,08	2,41	67,00	2,65	51173	146165
DNS-72	**-S02**	**-S16**	72,00	2,835	68,33	5,08	2,41	69,00	2,65	52635	150341
DNS-75	**-S02**	**-S16**	75,00	2,953	71,33	5,08	2,41	72,00	2,65	54828	156605
DNS-77	**-S02**	**-S16**	77,00	3,031	73,33	5,08	2,41	74,00	2,65	56290	160782
DNS-78	**-S02**	**-S16**	78,00	3,071	74,33	5,08	2,41	75,00	2,65	57021	162870
DNS-80	**-S02**	**-S16**	80,00	3,150	75,81	6,02	2,41	76,50	2,65	68231	167046
DNS-82	**-S02**	**-S16**	82,00	3,228	77,81	6,02	2,41	78,50	2,65	69936	171222
DNS-85	**-S02**	**-S16**	85,00	3,346	80,80	6,27	2,91	81,50	3,15	72495	214309

+0,00/-0,33 (Inside Diameter) · ±0,10 (Radial Wall) · ±0,05 (Thickness) · +0,00/-0,11 (Diameter) · +0,00/-0,13 (Diameter) · +0,00/-0,21 (Diameter) · +0,00/-0,25 (Diameter) · +0,14/-0,00 (Width)

+0,00/-0,38 (Inside Diameter) · +0,00/-0,51 (Inside Diameter) · +0,00/-0,63 (Inside Diameter) · ±0,12 (Radial Wall) · ±0,08 (Thickness) · +0,00/-0,30 (Diameter)

+0,00/-0,76 (Inside Diameter) · ±0,13 (Radial Wall) · +0,00/-0,35 (Diameter) · +0,18/-0,00 (Width)

[1] Based on a groove material yield strength of 310 N/mm² and a safety factor of 2.
[2] Based on a safety factor of 3.

* Contact Smalley for details/information on how to order parts to be in compliance with this specification.

DNS Series

Spirolox® DIN Rings External Continued

Smalley Part Number			Shaft Diameter		Ring			Groove		Thrust Capacity	
Carbon Steel	Add Suffix				Inside Diameter (mm)	Radial Wall (mm)	Thickness (mm)	Diameter (mm)	Width (mm)	Groove Yield[1] (N)	Ring Shear[2] (N)
	302 SS	316 SS	mm	in							
DNS-88	**-S02**	**-S16**	88,00	3,465	83,80 +0,00/-0,89	6,27 ±0,13	2,91 ±0,08	84,50 +0,00/-0,35	3,15	75054	221873
DNS-90	**-S02**	**-S16**	90,00	3,543	85,80 +0,00/-0,89	6,27 ±0,13	2,91 ±0,08	86,50 +0,00/-0,35	3,15	76759	226915
DNS-95	**-S02**	**-S16**	95,00	3,740	90,80 +0,00/-0,89	6,27 ±0,13	2,91 ±0,08	91,50 +0,00/-0,35	3,15	81024	239522
DNS-98	**-S02**	**-S16**	98,00	3,858	93,79 +0,00/-0,89	6,27 ±0,13	2,91 ±0,08	94,50 +0,00/-0,35	3,15	83583	247086
DNS-100	**-S02**	**-S16**	100,00	3,937	95,79 +0,00/-0,89	6,27 ±0,13	2,91 ±0,08	96,50 +0,00/-0,35	3,15	85288	252128
DNS-102	**-S02**	**-S16**	102,00	4,016	97,29 +0,00/-1,03	6,73 ±0,13	3,89 ±0,10	98,00 +0,00/-0,54	4,15	99422	343778
DNS-105	**-S02**	**-S16**	105,00	4,134	100,28 +0,00/-1,03	6,73 ±0,13	3,89 ±0,10	101,00 +0,00/-0,54	4,15	102346	353889
DNS-108	**-S02**	**-S16**	108,00	4,252	103,25 +0,00/-1,03	6,73 ±0,13	3,89 ±0,10	104,00 +0,00/-0,54	4,15	105270	364000
DNS-110	**-S02**	**-S16**	110,00	4,331	105,23 +0,00/-1,03	6,73 ±0,13	3,89 ±0,10	106,00 +0,00/-0,54	4,15	107220	370741
DNS-115	**-S02**	**-S16**	115,00	4,528	110,19 +0,00/-1,03	6,73 ±0,13	3,89 ±0,10	111,00 +0,00/-0,54	4,15	112093	387593
DNS-120	**-S02**	**-S16**	120,00	4,724	115,16 +0,00/-1,03	6,73 ±0,13	3,89 ±0,10	116,00 +0,00/-0,54	4,15	116967	404445
DNS-125	**-S02**	**-S16**	125,00	4,921	120,12 +0,00/-1,03	6,73 ±0,13	3,89 ±0,10	121,00 +0,00/-0,63	4,15	121840	421297
DNS-130	**-S02**	**-S16**	130,00	5,118	125,07 +0,00/-1,03	6,73 ±0,13	3,89 ±0,10	126,00 +0,00/-0,63	4,15	126714	438149
DNS-135	**-S02**	**-S16**	135,00	5,315	130,02 +0,00/-1,03	6,73 ±0,13	3,89 ±0,10	131,00 +0,00/-0,63	4,15	131588	455001
DNS-140	**-S02**	**-S16**	140,00	5,512	134,98 +0,00/-1,03	6,73 ±0,13	3,89 ±0,10	136,00 +0,00/-0,63	4,15	136461	471852
DNS-145	**-S02**	**-S16**	145,00	5,709	139,93 +0,00/-1,03	6,73 ±0,13	3,89 ±0,10	141,00 +0,00/-0,63	4,15	141335	488704
DNS-150	**-S02**	**-S16**	150,00	5,906	143,91 +0,00/-1,03	7,92 ±0,15	3,89 ±0,10	145,00 +0,00/-0,63	4,15	182761	505556
DNS-155	**-S02**	**-S16**	155,00	6,102	148,89 +0,00/-1,03	7,92 ±0,15	3,89 ±0,10	150,00 +0,00/-0,63	4,15	188853	522408
DNS-160	**-S02**	**-S16**	160,00	6,299	153,85 +0,00/-1,03	7,92 ±0,15	3,89 ±0,10	155,00 +0,00/-0,63	4,15	194945	539260
DNS-165	**-S02**	**-S16**	165,00	6,496	158,80 +0,00/-1,03	7,92 ±0,15	3,89 ±0,10	160,00 +0,00/-0,63	4,15	201037	556112
DNS-170	**-S02**	**-S16**	170,00	6,693	163,75 +0,00/-1,03	7,92 ±0,15	3,89 ±0,10	165,00 +0,00/-0,63	4,15	207129	572964
DNS-175	**-S02**	**-S16**	175,00	6,890	168,73 +0,00/-1,03	7,92 ±0,15	3,89 ±0,10	170,00 +0,00/-0,63	4,15	213221	589815
DNS-180	**-S02**	**-S16**	180,00	7,087	173,69 +0,00/-1,03	7,92 ±0,15	3,89 ±0,10	175,00 +0,00/-0,63	4,15	219313	606667
DNS-185	**-S02**	**-S16**	185,00	7,283	178,66 +0,00/-1,03	7,92 ±0,15	3,89 ±0,10	180,00 +0,00/-0,63	4,15	225405	623519
DNS-190	**-S02**	**-S16**	190,00	7,480	183,59 +0,00/-1,03	7,92 ±0,15	3,89 ±0,10	185,00 +0,00/-0,72	4,15	231497	640371
DNS-195	**-S02**	**-S16**	195,00	7,677	188,54 +0,00/-1,03	7,92 ±0,15	3,89 ±0,10	190,00 +0,00/-0,72	4,15	237589	657223
DNS-200	**-S02**	**-S16**	200,00	7,874	193,54 +0,00/-1,03	7,92 ±0,15	3,89 ±0,10	195,00 +0,00/-0,72	4,15	243681	674075
DNS-205	**-S02**	**-S16**	205,00	8,071	197,54 +0,00/-1,03	11,05 ±0,15	4,86 ±0,13	199,00 +0,00/-0,72	5,15	299727	863214
DNS-210	**-S02**	**-S16**	210,00	8,268	202,54 +0,00/-1,03	11,05 ±0,15	4,86 ±0,13	204,00 +0,00/-0,72	5,15	307038	884268
DNS-220	**-S02**	**-S16**	220,00	8,661	212,47 +0,00/-1,03	11,05 ±0,15	4,86 ±0,13	214,00 +0,00/-0,72	5,15	321659	926376
DNS-230	**-S02**	**-S16**	230,00	9,055	222,40 +0,00/-1,03	11,05 ±0,15	4,86 ±0,13	224,00 +0,00/-0,72	5,15	336280	968484
DNS-240	**-S02**	**-S16**	240,00	9,449	232,33 +0,00/-1,03	11,05 ±0,15	4,86 ±0,13	234,00 +0,00/-0,72	5,15	350900	1010592
DNS-250	**-S02**	**-S16**	250,00	9,843	242,24 +0,00/-1,03	11,05 ±0,15	4,86 ±0,13	244,00 +0,00/-0,72	5,15	365521	1052700
DNS-260	**-S02**	**-S16**	260,00	10,236	250,19 +0,00/-1,30	12,70 ±0,19	4,86 ±0,13	252,00 +0,00/-0,81	5,15	506856	1094808
DNS-270	**-S02**	**-S16**	270,00	10,630	260,15 +0,00/-1,30	12,70 ±0,19	4,86 ±0,13	262,00 +0,00/-0,81	5,15	526351	1136916
DNS-280	**-S02**	**-S16**	280,00	11,024	270,08 +0,00/-1,30	12,70 ±0,19	4,86 ±0,13	272,00 +0,00/-0,81	5,15	545845	1179024
DNS-290	**-S02**	**-S16**	290,00	11,417	279,98 +0,00/-1,30	12,70 ±0,19	4,86 ±0,13	282,00 +0,00/-0,81	5,15	565340	1221132
DNS-300	**-S02**	**-S16**	300,00	11,811	289,92 +0,00/-1,30	12,70 ±0,19	4,86 ±0,13	292,00 +0,00/-0,81	5,15	584834	1263241
DNS-310	**-S02**	**-S16**	310,00	12,205	297,84 +0,00/-1,30	15,81 ±0,19	5,87 ±0,13	300,00 +0,00/-0,89	6,20	755411	1576625
DNS-320	**-S02**	**-S16**	320,00	12,598	307,84 +0,00/-1,30	15,81 ±0,19	5,87 ±0,13	310,00 +0,00/-0,89	6,20	779779	1627484
DNS-330	**-S02**	**-S16**	330,00	12,992	317,75 +0,00/-1,30	15,81 ±0,19	5,87 ±0,13	320,00 +0,00/-0,89	6,20	804147	1678342
DNS-340	**-S02**	**-S16**	340,00	13,386	327,69 +0,00/-1,30	15,81 ±0,19	5,87 ±0,13	330,00 +0,00/-0,89	6,20	828515	1729201
DNS-350	**-S02**	**-S16**	350,00	13,780	337,64 +0,00/-1,30	15,81 ±0,19	5,87 ±0,13	340,00 +0,00/-0,89	6,20	852883	1780060
DNS-360	**-S02**	**-S16**	360,00	14,173	347,57 +0,00/-1,30	15,81 ±0,19	5,87 ±0,13	350,00 +0,00/-0,89	6,20	877251	1830919
DNS-370	**-S02**	**-S16**	370,00	14,567	357,48 +0,00/-1,30	15,81 ±0,19	5,87 ±0,13	360,00 +0,00/-0,89	6,20	901619	1881778
DNS-380	**-S02**	**-S16**	380,00	14,961	367,41 +0,00/-1,30	15,81 ±0,19	5,87 ±0,13	370,00 +0,00/-0,89	6,20	925987	1932637
DNS-390	**-S02**	**-S16**	390,00	15,354	377,34 +0,00/-1,30	15,81 ±0,19	5,87 ±0,13	380,00 +0,00/-0,89	6,20	950355	1983496
DNS-400	**-S02**	**-S16**	400,00	15,748	387,25 +0,00/-1,30	15,81 ±0,19	5,87 ±0,13	390,00 +0,00/-0,89	6,20	974723	2034354

[1] Based on a groove material yield strength of 310 N/mm² and a safety factor of 2.
[2] Based on a safety factor of 3.

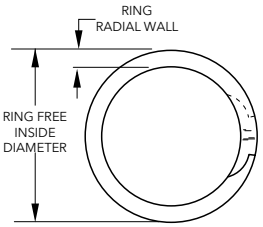
* Contact Smalley for details/information on how to order parts to be in compliance with this specification.

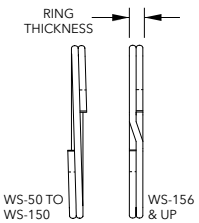
WS Series

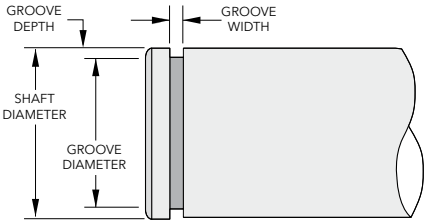
Spirolox® Imperial Medium Duty Rings External

**Compliance with AS3218, AS4299, MIL-DTL-27426/1*









Product Dimensions: All dimensions in inches unless otherwise specified.

Smalley Part Number			Shaft Diameter		Ring			Groove		Thrust Capacity	
Carbon Steel	Add Suffix				Inside Diameter (in)	Radial Wall (in)	Thickness (in)	Diameter (in)	Width (in)	Groove Yield[1] (lb)	Ring Shear[2] (lb)
	302 SS	316 SS	in	mm							
WS-50	**-S02**	**-S16**	0,500	12,70	0,467	0,045	0,025	0,474	0,030	460	2000
WS-53	**-S02**	**-S16**	0,531	13,49	0,498	0,045	0,025	0,505	0,030	490	2130
WS-55	**-S02**	**-S16**	0,551	14,00	0,518	0,045	0,025	0,525	0,030	510	2210
WS-56	**-S02**	**-S16**	0,562	14,27	0,529	0,045	0,025	0,536	0,030	520	2250
WS-59	**-S02**	**-S16**	0,594	15,09	0,561	0,045	0,025	0,569	0,030	550	2380
WS-62	**-S02**	**-S16**	0,625	15,88	0,585	0,055	0,025	0,594	0,030	710	2500
WS-65	**-S02**	**-S16**	0,656	16,66	0,617	0,055	0,025	0,625	0,030	740	2630
WS-66	**-S02**	**-S16**	0,669	16,99	0,629	0,055	0,025	0,638	0,030	760	2680
WS-68	**-S02**	**-S16**	0,687	17,45	0,647	0,055	0,025	0,656	0,030	780	2750
WS-71	**-S02**	**-S16**	0,718	18,24	0,679	0,055	0,025	0,687	0,030	810	2880
WS-75	**-S02**	**-S16**	0,750	19,05	0,710	0,065	0,031	0,719	0,036	850	3360
WS-78	**-S02**	**-S16**	0,781	19,84	0,741	0,065	0,031	0,750	0,036	880	3500
WS-81	**-S02**	**-S16**	0,812	20,62	0,771	0,065	0,031	0,781	0,036	920	3640
WS-84	**-S02**	**-S16**	0,843	21,41	0,803	0,065	0,031	0,812	0,036	950	3780
WS-87	**-S02**	**-S16**	0,875	22,23	0,828	0,065	0,031	0,838	0,036	1180	3920
WS-90	**-S02**	**-S16**	0,906	23,01	0,860	0,065	0,031	0,869	0,036	1220	4060
WS-93	**-S02**	**-S16**	0,937	23,80	0,889	0,065	0,031	0,900	0,036	1260	4200
WS-96	**-S02**	**-S16**	0,968	24,59	0,916	0,075	0,037	0,925	0,042	1440	5180
WS-98	**-S02**	**-S16**	0,984	24,99	0,930	0,075	0,037	0,941	0,042	1460	5260
WS-100	**-S02**	**-S16**	1,000	25,40	0,946	0,075	0,037	0,957	0,042	1480	5350
WS-102	**-S02**	**-S16**	1,023	25,98	0,968	0,075	0,037	0,980	0,042	1520	5470
WS-103	**-S02**	**-S16**	1,031	26,19	0,978	0,075	0,037	0,988	0,042	1530	5510
WS-106	**-S02**	**-S16**	1,062	26,97	1,007	0,075	0,037	1,020	0,042	1580	5680
WS-109	**-S02**	**-S16**	1,093	27,76	1,040	0,075	0,037	1,051	0,042	1620	5840
WS-112	**-S02**	**-S16**	1,125	28,58	1,070	0,075	0,037	1,083	0,042	1670	6020
WS-115	**-S02**	**-S16**	1,156	29,36	1,102	0,075	0,037	1,114	0,042	1720	6180
WS-118	**-S02**	**-S16**	1,188	30,18	1,127	0,085	0,043	1,140	0,048	2020	7380
WS-121	**-S02**	**-S16**	1,218	30,94	1,159	0,085	0,043	1,170	0,048	2070	7570
WS-125	**-S02**	**-S16**	1,250	31,75	1,188	0,085	0,043	1,202	0,048	2120	7770
WS-128	**-S02**	**-S16**	1,281	32,54	1,221	0,085	0,043	1,233	0,048	2170	7960
WS-131	**-S02**	**-S16**	1,312	33,32	1,251	0,095	0,043	1,264	0,048	2230	8150
WS-134	**-S02**	**-S16**	1,343	34,11	1,282	0,095	0,043	1,295	0,048	2280	8350
WS-137	**-S02**	**-S16**	1,375	34,93	1,308	0,095	0,043	1,323	0,048	2530	8540
WS-140	**-S02**	**-S16**	1,406	35,71	1,340	0,095	0,043	1,354	0,048	2580	8740
WS-143	**-S02**	**-S16**	1,437	36,50	1,370	0,095	0,043	1,385	0,048	2640	8930
WS-146	**-S02**	**-S16**	1,468	37,29	1,402	0,095	0,043	1,416	0,048	2700	9120
WS-150	**-S02**	**-S16**	1,500	38,10	1,433	0,095	0,043	1,448	0,048	2760	9320
WS-156	**-S02**	**-S16**	1,562	39,67	1,490	0,108	0,049	1,507	0,056	3090	10100
WS-157	**-S02**	**-S16**	1,575	40,01	1,503	0,108	0,049	1,520	0,056	3120	10190
WS-162	**-S02**	**-S16**	1,625	41,28	1,549	0,108	0,049	1,566	0,056	3450	10510
WS-168	**-S02**	**-S16**	1,687	42,85	1,610	0,118	0,049	1,628	0,056	3580	10910
WS-175	**-S02**	**-S16**	1,750	44,45	1,673	0,118	0,049	1,691	0,056	3710	11310
WS-177	**-S02**	**-S16**	1,771	44,98	1,690	0,118	0,049	1,708	0,056	4010	11450
WS-181	**-S02**	**-S16**	1,813	46,05	1,730	0,118	0,049	1,749	0,056	4100	11720
WS-187	**-S02**	**-S16**	1,875	47,63	1,789	0,128	0,049	1,808	0,056	4510	12120
WS-193	**-S02**	**-S16**	1,938	49,23	1,844	0,128	0,049	1,861	0,056	4660	12530
WS-196	**-S02**	**-S16**	1,969	50,01	1,882	0,128	0,049	1,902	0,056	4730	12730
WS-200	**-S02**	**-S16**	2,000	50,80	1,909	0,128	0,049	1,929	0,056	4950	12930
WS-206	**-S02**	**-S16**	2,062	52,37	1,971	0,128	0,049	1,992	0,056	5100	13330
WS-212	**-S02**	**-S16**	2,125	53,98	2,029	0,128	0,049	2,051	0,056	5560	13740

Inside Diameter (in): +0,000/-0,013 (WS-50 to WS-103); +0,000/-0,015 (WS-106 to WS-150); +0,000/-0,020 (WS-156 to WS-212)

Radial Wall (in): +0,003/-0,005 (WS-50 to WS-150); +0,004/-0,006 (WS-156 to WS-212)

Thickness (in): ±0,002 (WS-50 to WS-103); ±0,003 (WS-106 to WS-212)

Diameter (in): ±0,002 (WS-50 to WS-56); ±0,003 (WS-59 to WS-103); ±0,004 (WS-106 to WS-150); ±0,005 (WS-156 to WS-175); ±0,006 (WS-177 to WS-212)

Width (in): +0,003/-0,000 (WS-50 to WS-103); +0,004/-0,000 (WS-106 to WS-212)

[1] Based on a groove material yield strength of 45000 psi and a safety factor of 2.
[2] Based on a safety factor of 3.

* Contact Smalley for details/information on how to order parts to be in compliance with this specification.

WS Series

Spirolox® Imperial Medium Duty Rings External Continued

Smalley Part Number			Shaft Diameter		Ring			Groove		Thrust Capacity	
Carbon Steel	Add Suffix				Inside Diameter (in)	Radial Wall (in)	Thickness (in)	Diameter (in)	Width (in)	Groove Yield[1] (lb)	Ring Shear[2] (lb)
	302 SS	316 SS	in	mm							
WS-215	**-S02**	**-S16**	2,156	54,76	2,060	0,138	0,049	2,082	0,056	5640	13940
WS-216	**-S02**	**-S16**	2,165	54,99	2,070	0,138	0,049	2,091	0,056	5660	14000
WS-218	**-S02**	**-S16**	2,188	55,58	2,092	0,138	0,049	2,113	0,056	5720	14150
WS-225	**-S02**	**-S16**	2,250	57,15	2,153	0,138	0,049	2,176	0,056	5890	14550
WS-231	**-S02**	**-S16**	2,312	58,72	2,211	0,138	0,049	2,234	0,056	6370	14950
WS-236	**-S02**	**-S16**	2,362	59,99	2,261	0,138	0,049	2,284	0,056	6510	15270
WS-237	**-S02**	**-S16**	2,375	60,33	2,273	0,138	0,049	2,297	0,056	6550	15360
WS-243	**-S02**	**-S16**	2,437	61,90	2,331	0,148	0,049	2,355	0,056	7060	15760
WS-250	**-S02**	**-S16**	2,500	63,50	2,394	0,148	0,049	2,418	0,056	7250	16160
WS-255	**-S02**	**-S16**	2,559	65,00	2,449	0,148	0,049	2,473	0,056	7780	16550
WS-256	**-S02**	**-S16**	2,562	65,07	2,452	0,148	0,049	2,476	0,056	7790	16560
WS-262	**-S02**	**-S16**	2,625	66,68	2,514	0,148	0,049	2,539	0,056	7980	16970
WS-268	**-S02**	**-S16**	2,688	68,28	2,572	0,158	0,049	2,597	0,056	8550	17380
WS-275	**-S02**	**-S16**	2,750	69,85	2,635	0,158	0,049	2,660	0,056	8750	17780
WS-281	**-S02**	**-S16**	2,813	71,45	2,696	0,168	0,049	2,722	0,056	8950	18190
WS-287	**-S02**	**-S16**	2,875	73,03	2,755	0,168	0,049	2,781	0,056	9550	18590
WS-293	**-S02**	**-S16**	2,937	74,60	2,817	0,168	0,049	2,843	0,056	9760	18990
WS-295	**-S02**	**-S16**	2,952	74,98	2,831	0,168	0,049	2,858	0,056	9810	19090
WS-300	**-S02**	**-S16**	3,000	76,20	2,877	0,168	0,061	2,904	0,068	10180	24150
WS-306	**-S02**	**-S16**	3,062	77,77	2,938	0,168	0,061	2,966	0,068	10390	24650
WS-312	**-S02**	**-S16**	3,125	79,38	3,000	0,178	0,061	3,027	0,068	10820	25150
WS-314	**-S02**	**-S16**	3,149	79,98	3,023	0,178	0,061	3,051	0,068	10910	25350
WS-318	**-S02**	**-S16**	3,187	80,95	3,061	0,178	0,061	3,089	0,068	11040	25650
WS-325	**-S02**	**-S16**	3,250	82,55	3,121	0,178	0,061	3,150	0,068	11490	26160
WS-331	**-S02**	**-S16**	3,312	84,12	3,180	0,188	0,061	3,208	0,068	12170	26660
WS-334	**-S02**	**-S16**	3,343	84,91	3,210	0,188	0,061	3,239	0,068	12290	26910
WS-337	**-S02**	**-S16**	3,375	85,73	3,242	0,188	0,061	3,271	0,068	12410	27170
WS-343	**-S02**	**-S16**	3,437	87,30	3,301	0,188	0,061	3,331	0,068	12880	27660
WS-350	**-S02**	**-S16**	3,500	88,90	3,363	0,188	0,061	3,394	0,068	13110	28170
WS-354	**-S02**	**-S16**	3,543	89,99	3,402	0,198	0,061	3,433	0,068	13770	28520
WS-356	**-S02**	**-S16**	3,562	90,47	3,422	0,198	0,061	3,452	0,068	13850	28670
WS-362	**-S02**	**-S16**	3,625	92,08	3,483	0,198	0,061	3,515	0,068	14090	29180
WS-368	**-S02**	**-S16**	3,687	93,65	3,543	0,198	0,061	3,575	0,068	14600	29680
WS-374	**-S02**	**-S16**	3,740	95,00	3,597	0,198	0,061	3,628	0,068	14800	30100
WS-375	**-S02**	**-S16**	3,750	95,25	3,606	0,198	0,061	3,638	0,068	14840	30180
WS-381	**-S02**	**-S16**	3,812	96,82	3,668	0,198	0,061	3,700	0,068	15090	30680
WS-387	**-S02**	**-S16**	3,875	98,43	3,724	0,208	0,061	3,757	0,068	16160	31190
WS-393	**-S02**	**-S16**	3,938	100,03	3,784	0,208	0,061	3,820	0,068	16420	31700
WS-400	**-S02**	**-S16**	4,000	101,60	3,842	0,218	0,061	3,876	0,068	17530	32200
WS-406	**-S02**	**-S16**	4,063	103,20	3,906	0,218	0,061	3,939	0,068	17810	32700
WS-412	**-S02**	**-S16**	4,125	104,78	3,967	0,218	0,061	4,000	0,068	18080	33200
WS-413	**-S02**	**-S16**	4,134	105,00	3,975	0,218	0,061	4,010	0,068	18120	33270
WS-418	**-S02**	**-S16**	4,188	106,38	4,030	0,218	0,061	4,058	0,068	19240	33710
WS-425	**-S02**	**-S16**	4,250	107,95	4,084	0,228	0,061	4,120	0,068	19530	34210
WS-431	**-S02**	**-S16**	4,312	109,52	4,147	0,228	0,061	4,182	0,068	19810	34710
WS-433	**-S02**	**-S16**	4,331	110,01	4,164	0,228	0,061	4,200	0,068	19900	34860
WS-437	**-S02**	**-S16**	4,375	111,13	4,208	0,228	0,061	4,245	0,068	20100	35210
WS-443	**-S02**	**-S16**	4,437	112,70	4,271	0,228	0,061	4,307	0,068	20390	35710
WS-450	**-S02**	**-S16**	4,500	114,30	4,326	0,238	0,061	4,364	0,068	21630	36220
WS-456	**-S02**	**-S16**	4,562	115,87	4,384	0,250	0,072	4,422	0,079	22570	43340
WS-462	**-S02**	**-S16**	4,625	117,48	4,447	0,250	0,072	4,485	0,079	22890	43940
WS-468	**-S02**	**-S16**	4,687	119,05	4,508	0,250	0,072	4,547	0,079	23190	44530
WS-472	**-S02**	**-S16**	4,724	119,99	4,546	0,250	0,072	4,584	0,079	23370	44880
WS-475	**-S02**	**-S16**	4,750	120,65	4,571	0,250	0,072	4,610	0,079	23500	45130
WS-481	**-S02**	**-S16**	4,812	122,22	4,633	0,250	0,072	4,672	0,079	23810	45720
WS-487	**-S02**	**-S16**	4,875	123,83	4,695	0,250	0,072	4,735	0,079	24120	46310
WS-493	**-S02**	**-S16**	4,937	125,40	4,757	0,250	0,072	4,797	0,079	24430	46900
WS-500	**-S02**	**-S16**	5,000	127,00	4,820	0,250	0,072	4,856	0,079	25450	47500
WS-511	**-S02**	**-S16**	5,118	130,00	4,934	0,250	0,072	4,974	0,079	26050	48620
WS-512	**-S02**	**-S16**	5,125	130,18	4,939	0,250	0,072	4,981	0,079	26080	48690
WS-525	**-S02**	**-S16**	5,250	133,35	5,064	0,250	0,072	5,107	0,079	26720	49880
WS-537	**-S02**	**-S16**	5,375	136,53	5,187	0,250	0,072	5,228	0,079	28120	51060
WS-550	**-S02**	**-S16**	5,500	139,70	5,308	0,250	0,072	5,353	0,079	28770	52250
WS-551	**-S02**	**-S16**	5,511	139,98	5,320	0,250	0,072	5,364	0,079	28830	52360
WS-562	**-S02**	**-S16**	5,625	142,88	5,433	0,250	0,072	5,478	0,079	29420	53440
WS-575	**-S02**	**-S16**	5,750	146,05	5,550	0,250	0,072	5,597	0,079	31300	54630

+0,000/-0,025 (Inside Diameter)
+0,003/-0,005 (Radial Wall)
±0,003 (Thickness)
+0,000/-0,030 (Inside Diameter)
+0,004/-0,006 (Radial Wall)
±0,003 (Thickness)
+0,000/-0,040 (Inside Diameter)
±0,004 (Thickness)
+0,000/-0,050 (Inside Diameter)
±0,004 (Thickness)
±0,006 (Diameter)
±0,007 (Diameter)
+0,004/-0,000 (Width)
+0,005/-0,000 (Width)

[1] Based on a groove material yield strength of 45000 psi and a safety factor of 2.
[2] Based on a safety factor of 3.

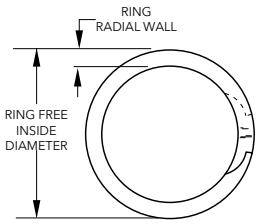
* Contact Smalley for details/information on how to order parts to be in compliance with this specification.

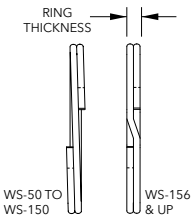
WS Series

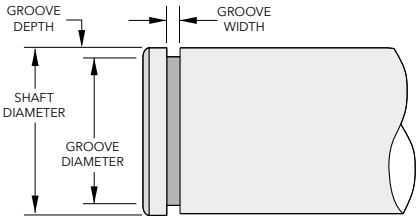
Spirolox® Imperial Medium Duty Rings External

**Compliance with AS3218, AS4299, MIL-DTL-27426/1*









Product Dimensions: All dimensions in inches unless otherwise specified.

Smalley Part Number			Shaft Diameter		Ring			Groove		Thrust Capacity	
Carbon Steel	Add Suffix				Inside Diameter (in)	Radial Wall (in)	Thickness (in)	Diameter (in)	Width (in)	Groove Yield[1] (lb)	Ring Shear[2] (lb)
	302 SS	316 SS	in	mm							
WS-587	**-S02**	**-S16**	5,875	149,23	5,674 +0,000/-0,050	0,250 +0,004/-0,006	0,072	5,722 ±0,007	0,079 +0,005/-0,000	31980	55810
WS-590	**-S02**	**-S16**	5,905	149,99	5,705	0,250	0,072	5,752	0,079	32140	56100
WS-600	**-S02**	**-S16**	6,000	152,40	5,798	0,250	0,072	5,847	0,079	32660	57000
WS-612	**-S02**	**-S16**	6,125	155,58	5,903	0,312	0,086	5,953	0,094	37230	69500
WS-625	**-S02**	**-S16**	6,250	158,75	6,026	0,312	0,086	6,078	0,094	37990	70920
WS-629	**-S02**	**-S16**	6,299	159,99	6,076	0,312	0,086	6,127	0,094	38290	71480
WS-637	**-S02**	**-S16**	6,375	161,93	6,152	0,312	0,086	6,203	0,094	38750	72340
WS-650	**-S02**	**-S16**	6,500	165,10	6,274	0,312	0,086	6,328	0,094	39510	73760
WS-662	**-S02**	**-S16**	6,625	168,28	6,390	0,312	0,086	6,443	0,094	42620	75180
WS-675	**-S02**	**-S16**	6,750	171,45	6,513	0,312	0,086	6,568	0,094	43420	76600
WS-687	**-S02**	**-S16**	6,875	174,63	6,638	0,312	0,086	6,693	0,094	44220	78010
WS-700	**-S02**	**-S16**	7,000	177,80	6,761	0,312	0,086	6,818	0,094	45030	79430
WS-712	**-S02**	**-S16**	7,125	180,98	6,877	0,312	0,086	6,933	0,094	48350	80850
WS-725	**-S02**	**-S16**	7,250	184,15	6,999	0,312	0,086	7,058	0,094	49200	82270
WS-737	**-S02**	**-S16**	7,375	187,33	7,125	0,312	0,086	7,183	0,094	50050	83690
WS-750	**-S02**	**-S16**	7,500	190,50	7,250	0,312	0,086	7,308	0,094	50890	85110
WS-762	**-S02**	**-S16**	7,625	193,68	7,363	0,312	0,086	7,423	0,094	54440	86520
WS-775	**-S02**	**-S16**	7,750	196,85	7,486	0,312	0,086	7,548	0,094	55330	87940
WS-787	**-S02**	**-S16**	7,875	200,03	7,611	0,312	0,086	7,673	0,094	56220	89360
WS-800	**-S02**	**-S16**	8,000	203,20	7,734	0,312	0,086	7,798	0,094	57110	90780
WS-825	**-S02**	**-S16**	8,250	209,55	7,972	0,375	0,086	8,038	0,094	61820	93620
WS-850	**-S02**	**-S16**	8,500	215,90	8,220	0,375	0,086	8,288	0,094	63690	96450
WS-875	**-S02**	**-S16**	8,750	222,25	8,459	0,375	0,086	8,528	0,094	68650	99290
WS-900	**-S02**	**-S16**	9,000	228,60	8,707	0,375	0,086	8,778	0,094	70620	102130
WS-925	**-S02**	**-S16**	9,250	234,95	8,945	0,375	0,086	9,018	0,094	75850	104960
WS-950	**-S02**	**-S16**	9,500	241,30	9,194	0,375	0,086	9,268	0,094	77900	107800
WS-975	**-S02**	**-S16**	9,750	247,65	9,432	0,375	0,086	9,508	0,094	83390	110640
WS-1000	**-S02**	**-S16**	10,000	254,00	9,680	0,375	0,086	9,758	0,094	85530	113470
WS-1025	**-S02**	**-S16**	10,250	260,35	9,918	0,375	0,086	9,998	0,094	91290	116310
WS-1050	**-S02**	**-S16**	10,500	266,70	10,166	0,375	0,086	10,248	0,094	93520	119150
WS-1075	**-S02**	**-S16**	10,750	273,05	10,405	0,375	0,086	10,488	0,094	99540	121990
WS-1100	**-S02**	**-S16**	11,000	279,40	10,653	0,375	0,086	10,738	0,094	101860	124820

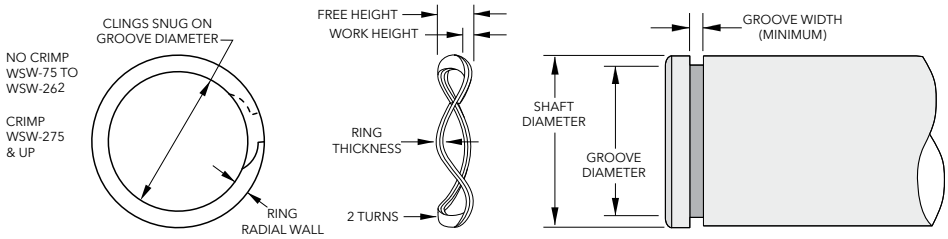
[1] Based on a groove material yield strength of 45000 psi and a safety factor of 2.
[2] Based on a safety factor of 3.

* Contact Smalley for details/information on how to order parts to be in compliance with this specification.

WSW Series

WaveRing® Imperial External





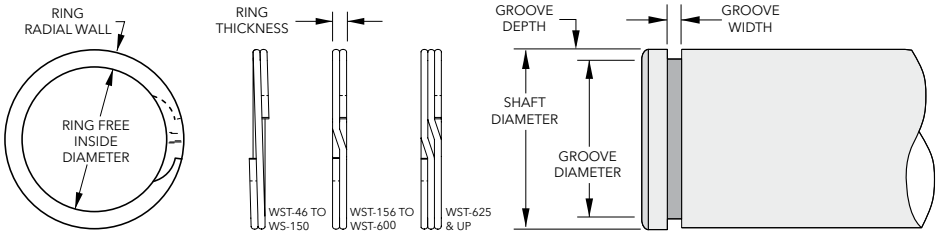
Product Dimensions: All dimensions in inches unless otherwise specified.

Smalley Part Number		Housing Diameter		Ring		Groove		Load (lb) @ Work Height	Max Free Height (in)	Number of Waves
Carbon Steel	Add Suffix 17-7	in	mm	Thickness (in)	Radial Wall (in)	Diameter (in)	Width (in)			
WSW-75	**-S17**	0,750	19,05	0,042	0,065	0,704	0,120	25 @ 0,085	0,115	3
WSW-87	**-S17**	0,875	22,23	0,042	0,075	0,821	0,136	30 @ 0,085	0,131	3
WSW-100	**-S17**	1,000	25,40	0,042	0,085	0,940	0,134	34 @ 0,085	0,129	3
WSW-112	**-S17**	1,125	28,58	0,050	0,128	1,059	0,142	38 @ 0,100	0,137	3
WSW-125	**-S17**	1,250	31,75	0,050	0,128	1,176	0,150	40 @ 0,100	0,145	3
WSW-137	**-S17**	1,375	34,93	0,050	0,128	1,291	0,135	45 @ 0,100	0,130	4
WSW-150	**-S17**	1,500	38,10	0,050	0,128	1,406	0,131	50 @ 0,100	0,126	4
WSW-162	**-S17**	1,625	41,28	0,062	0,158	1,529	0,143	55 @ 0,110	0,138	4
WSW-175	**-S17**	1,750	44,45	0,062	0,158	1,650	0,142	60 @ 0,110	0,137	4
WSW-187	**-S17**	1,875	47,63	0,062	0,158	1,769	0,145	63 @ 0,110	0,140	4
WSW-200	**-S17**	2,000	50,80	0,062	0,158	1,886	0,150	65 @ 0,110	0,145	4
WSW-212	**-S17**	2,125	53,98	0,078	0,188	2,003	0,175	70 @ 0,130	0,170	4
WSW-225	**-S17**	2,250	57,15	0,078	0,188	2,120	0,180	75 @ 0,130	0,175	4
WSW-237	**-S17**	2,375	60,33	0,078	0,188	2,239	0,180	80 @ 0,130	0,175	4
WSW-250	**-S17**	2,500	63,50	0,078	0,188	2,360	0,176	84 @ 0,130	0,171	4
WSW-262	**-S17**	2,625	66,68	0,078	0,188	2,481	0,190	88 @ 0,130	0,181	4
WSW-275	**-S17**	2,750	69,85	0,093	0,225	2,602	0,222	94 @ 0,170	0,217	4
WSW-287	**-S17**	2,875	73,03	0,093	0,225	2,721	0,222	97 @ 0,170	0,217	4
WSW-300	**-S17**	3,000	76,20	0,093	0,225	2,838	0,230	100 @ 0,170	0,225	4
WSW-312	**-S17**	3,125	79,38	0,093	0,225	2,957	0,235	103 @ 0,170	0,230	4
WSW-325	**-S17**	3,250	82,55	0,093	0,225	3,076	0,230	106 @ 0,170	0,225	4
WSW-350	**-S17**	3,500	88,90	0,111	0,281	3,316	0,250	115 @ 0,185	0,245	4
WSW-362	**-S17**	3,625	92,08	0,111	0,281	3,435	0,255	117 @ 0,185	0,250	4
WSW-375	**-S17**	3,750	95,25	0,111	0,281	3,552	0,263	121 @ 0,185	0,258	4
WSW-387	**-S17**	3,875	98,43	0,111	0,281	3,673	0,260	126 @ 0,185	0,255	4
WSW-400	**-S17**	4,000	101,60	0,111	0,281	3,792	0,273	130 @ 0,185	0,268	4
WSW-412	**-S17**	4,125	104,78	0,111	0,281	3,919	0,268	134 @ 0,185	0,263	4
WSW-425	**-S17**	4,250	107,95	0,111	0,281	4,065	0,253	140 @ 0,185	0,248	5
WSW-450	**-S17**	4,500	114,30	0,111	0,281	4,310	0,261	150 @ 0,185	0,256	5
WSW-475	**-S17**	4,750	120,65	0,111	0,281	4,550	0,258	160 @ 0,185	0,253	5
WSW-500	**-S17**	5,000	127,00	0,111	0,281	4,790	0,264	170 @ 0,185	0,259	5

WST Series

Spirolox® Imperial Medium/Heavy Duty Rings External





Product Dimensions: All dimensions in inches unless otherwise specified.

Smalley Part Number			Shaft Diameter		Ring			Groove		Thrust Capacity	
Carbon Steel	Add Suffix				Inside Diameter (in)	Radial Wall (in)	Thickness (in)	Diameter (in)	Width (in)	Groove Yield[1] (lb)	Ring Shear[2] (lb)
	302 SS	316 SS	in	mm							
Two-Turn											
WST-46	**-S02**	**-S16**	0,469	11,91	0,436	0,045	0,025	0,443	0,029	430	1800
WST-50	**-S02**	**-S16**	0,500	12,70	0,469	0,045	0,035	0,474	0,039	460	2530
WST-55	**-S02**	**-S16**	0,551	14,00	0,518	0,045	0,035	0,524	0,039	550	2790
WST-56	**-S02**	**-S16**	0,562	14,27	0,529	0,045	0,035	0,535	0,039	560	2840
WST-59	**-S02**	**-S16**	0,594	15,09	0,559	0,045	0,035	0,565	0,039	630	3000
WST-62	**-S02**	**-S16**	0,625	15,88	0,590	0,055	0,035	0,596	0,039	660	3160
WST-66	**-S02**	**-S16**	0,669	16,99	0,630	0,055	0,035	0,638	0,039	760	3380
WST-68	**-S02**	**-S16**	0,688	17,48	0,648	0,065	0,042	0,655	0,046	830	4180
WST-75	**-S02**	**-S16**	0,750	19,05	0,708	0,065	0,042	0,715	0,046	950	4550
WST-78	**-S02**	**-S16**	0,781	19,84	0,738	0,065	0,042	0,745	0,046	990	4740
WST-81	**-S02**	**-S16**	0,812	20,62	0,768	0,065	0,042	0,776	0,046	1030	4930
WST-87	**-S02**	**-S16**	0,875	22,23	0,827	0,075	0,042	0,835	0,046	1240	5310
WST-93	**-S02**	**-S16**	0,938	23,83	0,886	0,075	0,042	0,894	0,046	1460	5690
WST-98	**-S02**	**-S16**	0,984	24,99	0,934	0,075	0,042	0,940	0,046	1530	5970
WST-100	**-S02**	**-S16**	1,000	25,40	0,947	0,075	0,042	0,955	0,046	1630	6070
WST-102	**-S02**	**-S16**	1,023	25,98	0,969	0,075	0,042	0,977	0,046	1660	6210
WST-106	**-S02**	**-S16**	1,062	26,97	1,005	0,088	0,050	1,015	0,056	1800	7010
WST-112	**-S02**	**-S16**	1,125	28,58	1,064	0,088	0,050	1,075	0,056	1990	7420
WST-118	**-S02**	**-S16**	1,188	30,18	1,126	0,088	0,050	1,135	0,056	2270	7370
WST-125	**-S02**	**-S16**	1,250	31,75	1,184	0,093	0,050	1,195	0,056	2470	8250
WST-131	**-S02**	**-S16**	1,312	33,32	1,240	0,098	0,050	1,250	0,056	2880	8660
WST-137	**-S02**	**-S16**	1,375	34,93	1,298	0,103	0,050	1,310	0,056	3210	9070
WST-143	**-S02**	**-S16**	1,438	36,53	1,359	0,103	0,050	1,370	0,056	3460	9490
WST-150	**-S02**	**-S16**	1,500	38,10	1,419	0,103	0,050	1,430	0,056	3710	9900
WST-156	**-S02**	**-S16**	1,562	39,67	1,476	0,113	0,062	1,490	0,068	3980	12780
WST-162	**-S02**	**-S16**	1,625	41,28	1,537	0,118	0,062	1,550	0,068	4370	13290
WST-168	**-S02**	**-S16**	1,687	42,85	1,598	0,118	0,062	1,610	0,068	4650	13800
WST-175	**-S02**	**-S16**	1,750	44,45	1,657	0,118	0,062	1,670	0,068	4950	14320
WST-177	**-S02**	**-S16**	1,771	44,98	1,676	0,123	0,062	1,689	0,068	5130	14490
WST-181	**-S02**	**-S16**	1,812	46,02	1,714	0,123	0,062	1,730	0,068	5250	14820
WST-187	**-S02**	**-S16**	1,875	47,63	1,774	0,123	0,062	1,790	0,068	5700	15340
WST-196	**-S02**	**-S16**	1,969	50,01	1,864	0,123	0,062	1,879	0,068	6260	16110
WST-200	**-S02**	**-S16**	2,000	50,80	1,894	0,128	0,062	1,910	0,068	6360	16360
WST-206	**-S02**	**-S16**	2,062	52,37	1,955	0,141	0,078	1,970	0,086	6710	21220
WST-212	**-S02**	**-S16**	2,125	53,98	2,012	0,141	0,078	2,027	0,086	7360	21870
WST-215	**-S02**	**-S16**	2,156	54,76	2,041	0,141	0,078	2,057	0,086	7620	22190
WST-225	**-S02**	**-S16**	2,250	57,15	2,129	0,141	0,078	2,145	0,086	8430	23160
WST-231	**-S02**	**-S16**	2,312	58,72	2,188	0,141	0,078	2,205	0,086	8830	23800
WST-237	**-S02**	**-S16**	2,375	60,33	2,248	0,141	0,078	2,265	0,086	9230	24440
WST-243	**-S02**	**-S16**	2,437	61,90	2,307	0,141	0,078	2,325	0,086	9650	25080
WST-250	**-S02**	**-S16**	2,500	63,50	2,366	0,188	0,078	2,385	0,086	10250	25730
WST-255	**-S02**	**-S16**	2,559	65,00	2,424	0,188	0,078	2,443	0,086	10490	26340
WST-262	**-S02**	**-S16**	2,625	66,68	2,485	0,188	0,078	2,505	0,086	11130	27020
WST-268	**-S02**	**-S16**	2,687	68,25	2,545	0,188	0,078	2,565	0,086	11590	27660
WST-275	**-S02**	**-S16**	2,750	69,85	2,604	0,188	0,093	2,625	0,103	12250	32140
WST-287	**-S02**	**-S16**	2,875	73,03	2,722	0,188	0,093	2,742	0,103	13620	33600
WST-293	**-S02**	**-S16**	2,937	74,60	2,780	0,188	0,093	2,801	0,103	14120	34320
WST-300	**-S02**	**-S16**	3,000	76,20	2,838	0,188	0,093	2,860	0,103	14840	35060
WST-306	**-S02**	**-S16**	3,062	77,77	2,897	0,188	0,093	2,920	0,103	15370	35790

+0,000/-0,013 (Inside Diameter) · ±0,004 (Radial Wall) · ±0,002 (Thickness) · ±0,002 (Diameter) · ±0,003 (Width) · +0,003/-0,000 (Groove Yield)

+0,000/-0,015 (Inside Diameter) · ±0,004 (Radial Wall) · ±0,002 (Thickness) · ±0,004 (Diameter) · ±0,004 (Width) · +0,004/-0,000 (Groove Yield)

+0,000/-0,020 (Inside Diameter) · ±0,004 (Radial Wall) · ±0,002 (Thickness) · ±0,005 (Diameter) · ±0,005 (Width) · +0,004/-0,000 (Groove Yield)

+0,000/-0,025 (Inside Diameter) · ±0,004 (Radial Wall) · ±0,003 (Thickness) · ±0,005 (Diameter) · ±0,006 (Width) · +0,005/-0,000 (Groove Yield)

+0,000/-0,030 (Inside Diameter) · ±0,005 (Radial Wall) · ±0,003 (Thickness) · ±0,005 (Diameter) · ±0,006 (Width) · +0,005/-0,000 (Groove Yield)

[1] Based on a groove material yield strength of 45000 psi and a safety factor of 2.
[2] Based on a safety factor of 3.

WST Series

Spirolox® Imperial Medium/Heavy Duty Rings External Continued

Smalley Part Number			Shaft Diameter		Ring			Groove		Thrust Capacity	
Carbon Steel	Add Suffix				Inside Diameter (in)	Radial Wall (in)	Thickness (in)	Diameter (in)	Width (in)	Groove Yield[1] (lb)	Ring Shear[2] (lb)
	302 SS	316 SS	in	mm							
WST-312	**-S02**	**-S16**	3,125	79,38	2,957 +0,000/-0,030	0,188 ±0,005	0,093 ±0,003	2,980 ±0,006	0,103 +0,005/-0,000	16130	36520
WST-315	**-S02**	**-S16**	3,156	80,16	2,986	0,188	0,093	3,010	0,103	16290	36880
WST-325	**-S02**	**-S16**	3,250	82,55	3,075	0,188	0,093	3,100	0,103	17230	37980
WST-334	**-S02**	**-S16**	3,344	84,94	3,164	0,188	0,093	3,190	0,103	18200	39080
WST-343	**-S02**	**-S16**	3,437	87,30	3,254	0,188	0,093	3,280	0,103	19190	40170
WST-350	**-S02**	**-S16**	3,500	88,90	3,315	0,250	0,111	3,340	0,120	19790	48820
WST-354	**-S02**	**-S16**	3,543	89,99	3,356	0,250	0,111	3,381	0,120	20290	49420
WST-362	**-S02**	**-S16**	3,625	92,08	3,433	0,250	0,111	3,458	0,120	21520	50560
WST-368	**-S02**	**-S16**	3,687	93,65	3,490	0,250	0,111	3,517	0,120	22150	51430
WST-375	**-S02**	**-S16**	3,750	95,25	3,550	0,250	0,111	3,577	0,120	23060	52310
WST-387	**-S02**	**-S16**	3,875	98,43	3,670	0,250	0,111	3,696	0,120	24650	54050
WST-393	**-S02**	**-S16**	3,938	100,03	3,730	0,250	0,111	3,756	0,120	25330	54930
WST-400	**-S02**	**-S16**	4,000	101,60	3,787	0,250	0,111	3,815	0,120	26300	55800
WST-425	**-S02**	**-S16**	4,250	107,95	4,032	0,250	0,111	4,065	0,120	27940	59280
WST-437	**-S02**	**-S16**	4,375	111,13	4,162	0,250	0,111	4,190	0,120	28760	61030
WST-450	**-S02**	**-S16**	4,500	114,30	4,280	0,250	0,111	4,310	0,120	30220	62770
WST-475	**-S02**	**-S16**	4,750	120,65	4,515	0,250	0,111	4,550	0,120	33580	66260
WST-500	**-S02**	**-S16**	5,000	127,00	4,755 +0,000/-0,040	0,250	0,111	4,790	0,120	37110	69740
WST-525	**-S02**	**-S16**	5,250	133,35	4,995	0,375 ±0,006	0,127 ±0,004	5,030 ±0,007	0,139 +0,006/-0,000	40820	83790
WST-550	**-S02**	**-S16**	5,500	139,70	5,229 +0,000/-0,050	0,375	0,127	5,265	0,139	45880	87780
WST-575	**-S02**	**-S16**	5,750	146,05	5,466	0,375	0,127	5,505	0,139	49990	91770
WST-600	**-S02**	**-S16**	6,000	152,40	5,705	0,375	0,127	5,745	0,139	54290	95760
						Three-Turn					
WST-625	**-S02**	**-S16**	6,250	158,75	5,942 +0,000/-0,060	0,312 ±0,006	0,165 ±0,005	5,985 ±0,008	0,174 +0,008/-0,000	58760	129590
WST-650	**-S02**	**-S16**	6,500	165,10	6,182	0,312	0,165	6,225	0,174	63410	134780
WST-675	**-S02**	**-S16**	6,750	171,45	6,420	0,312	0,165	6,465	0,174	68230	139960
WST-700	**-S02**	**-S16**	7,000	177,80	6,658	0,312	0,165	6,705	0,174	73230	145140
WST-725	**-S02**	**-S16**	7,250	184,15	6,894 +0,000/-0,070	0,312	0,165	6,942	0,174	78290	172190
WST-750	**-S02**	**-S16**	7,500	190,50	7,130	0,375	0,189	7,180	0,209	84820	178130
WST-775	**-S02**	**-S16**	7,750	196,85	7,368	0,375	0,189	7,420	0,209	90390	184070
WST-800	**-S02**	**-S16**	8,000	203,20	7,607	0,375	0,189	7,660	0,209	96130	190000
WST-825	**-S02**	**-S16**	8,250	209,55	7,845	0,375	0,189	7,900	0,209	102050	195940
WST-850	**-S02**	**-S16**	8,500	215,90	8,083	0,375	0,189	8,140	0,209	108150	201880
WST-875	**-S02**	**-S16**	8,750	222,25	8,321	0,375	0,189	8,383	0,209	113800	207820
WST-900	**-S02**	**-S16**	9,000	228,60	8,560	0,375	0,189	8,620	0,209	120870	213750
WST-925	**-S02**	**-S16**	9,250	234,95	8,798	0,375	0,189	8,860	0,209	127500	219690
WST-950	**-S02**	**-S16**	9,500	241,30	9,036	0,375	0,189	9,100	0,209	134300	225630
WST-975	**-S02**	**-S16**	9,750	247,65	9,273	0,375	0,189	9,338	0,209	141970	231570
WST-1000	**-S02**	**-S16**	10,000	254,00	9,508	0,375	0,189	9,575	0,209	150560	237500

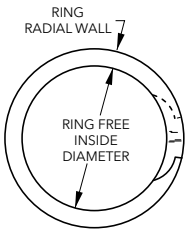
[1] Based on a groove material yield strength of 45000 psi and a safety factor of 2.
[2] Based on a safety factor of 3.

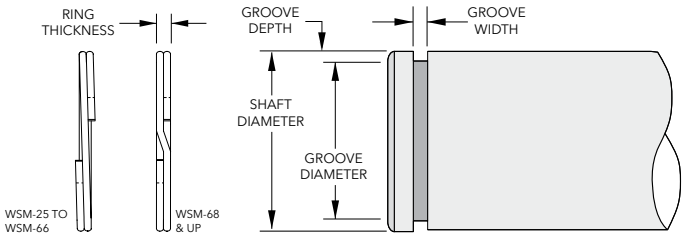
WSM Series

Spirolox® Imperial Heavy Duty Rings External

**Compliance with AS3216, AS4299, MIL-DTL-27426/2*







Product Dimensions: All dimensions in inches unless otherwise specified.

Smalley Part Number			Shaft Diameter		Ring			Groove		Thrust Capacity	
Carbon Steel	Add Suffix				Inside Diameter (in)	Radial Wall (in)	Thickness (in)	Diameter (in)	Width (in)	Groove Yield[1] (lb)	Ring Shear[2] (lb)
	302 SS	316 SS	in	mm							
WSM-25[3,4]	**-S02**	**-S16**	0,250	6,35	0,228	0,020	0,025	0,230	0,029	177	961
WSM-31[3,4]	**-S02**	**-S16**	0,312	7,92	0,287	0,025	0,025	0,290	0,029	243	1200
WSM-37[3,4]	**-S02**	**-S16**	0,375	9,53	0,349	0,030	0,025	0,352	0,029	305	1442
WSM-43[4]	**-S02**	**-S16**	0,437	11,10	0,409	0,035	0,025	0,412	0,029	386	1680
WSM-46	**-S02**	**-S16**	0,469	11,91	0,439	0,045	0,025	0,443	0,029	430	1880
WSM-50	**-S02**	**-S16**	0,500	12,70	0,464	0,050	0,035	0,468	0,039	570	2530
WSM-55	**-S02**	**-S16**	0,551	14,00	0,514	0,050	0,035	0,519	0,039	620	2790
WSM-56	**-S02**	**-S16**	0,562	14,27	0,525	0,050	0,035	0,530	0,039	640	2840
WSM-59	**-S02**	**-S16**	0,594	15,09	0,554	0,050	0,035	0,559	0,039	760	3000
WSM-62	**-S02**	**-S16**	0,625	15,88	0,583	0,055	0,035	0,588	0,039	840	3160
WSM-66	**-S02**	**-S16**	0,669	16,99	0,623	0,055	0,035	0,629	0,039	950	3380
WSM-68	**-S02**	**-S16**	0,688	17,48	0,641	0,065	0,042	0,646	0,046	1020	4180
WSM-75	**-S02**	**-S16**	0,750	19,05	0,698	0,065	0,042	0,704	0,046	1220	4550
WSM-78	**-S02**	**-S16**	0,781	19,84	0,727	0,065	0,042	0,733	0,046	1330	4740
WSM-81	**-S02**	**-S16**	0,812	20,62	0,756	0,065	0,042	0,762	0,046	1440	4930
WSM-87	**-S02**	**-S16**	0,875	22,23	0,814	0,075	0,042	0,821	0,046	1670	5310
WSM-93	**-S02**	**-S16**	0,938	23,83	0,875	0,075	0,042	0,882	0,046	1860	5690
WSM-98	**-S02**	**-S16**	0,984	24,99	0,919	0,085	0,042	0,926	0,046	2020	5970
WSM-100	**-S02**	**-S16**	1,000	25,40	0,932	0,085	0,042	0,940	0,046	2120	6070
WSM-102	**-S02**	**-S16**	1,023	25,98	0,953	0,085	0,042	0,961	0,046	2240	6210
WSM-106	**-S02**	**-S16**	1,062	26,97	0,986	0,103	0,050	0,998	0,056	2400	7010
WSM-112	**-S02**	**-S16**	1,125	28,58	1,047	0,103	0,050	1,059	0,056	2620	7420
WSM-118	**-S02**	**-S16**	1,188	30,18	1,105	0,103	0,050	1,118	0,056	2940	7840
WSM-125	**-S02**	**-S16**	1,250	31,75	1,163	0,103	0,050	1,176	0,056	3270	8250
WSM-131	**-S02**	**-S16**	1,312	33,32	1,218	0,118	0,050	1,232	0,056	3710	8660
WSM-137	**-S02**	**-S16**	1,375	34,93	1,277	0,118	0,050	1,291	0,056	4080	9070
WSM-143	**-S02**	**-S16**	1,438	36,53	1,336	0,118	0,050	1,350	0,056	4470	9490
WSM-150	**-S02**	**-S16**	1,500	38,10	1,385	0,118	0,050	1,406	0,056	4980	9900
WSM-156	**-S02**	**-S16**	1,562	39,67	1,453	0,128	0,062	1,468	0,068	5190	12780
WSM-162	**-S02**	**-S16**	1,625	41,28	1,513	0,128	0,062	1,529	0,068	5510	13290
WSM-168	**-S02**	**-S16**	1,687	42,85	1,573	0,128	0,062	1,589	0,068	5840	13800
WSM-175	**-S02**	**-S16**	1,750	44,45	1,633	0,128	0,062	1,650	0,068	6190	14320
WSM-177	**-S02**	**-S16**	1,771	44,98	1,651	0,128	0,062	1,669	0,068	6380	14490
WSM-181	**-S02**	**-S16**	1,812	46,02	1,690	0,128	0,062	1,708	0,068	6660	14820
WSM-187	**-S02**	**-S16**	1,875	47,63	1,751	0,158	0,062	1,769	0,068	7020	15340
WSM-196	**-S02**	**-S16**	1,969	50,01	1,838	0,158	0,062	1,857	0,068	7790	16110
WSM-200	**-S02**	**-S16**	2,000	50,80	1,867	0,158	0,062	1,886	0,068	8060	16360
WSM-206	**-S02**	**-S16**	2,062	52,37	1,932	0,168	0,078	1,946	0,086	8450	21220
WSM-212	**-S02**	**-S16**	2,125	53,98	1,989	0,168	0,078	2,003	0,086	9160	21870
WSM-215	**-S02**	**-S16**	2,156	54,76	2,018	0,168	0,078	2,032	0,086	9450	22190
WSM-225	**-S02**	**-S16**	2,250	57,15	2,105	0,168	0,078	2,120	0,086	10340	23160
WSM-231	**-S02**	**-S16**	2,312	58,72	2,163	0,168	0,078	2,178	0,086	10950	23800
WSM-237	**-S02**	**-S16**	2,375	60,33	2,223	0,200	0,078	2,239	0,086	11420	24440
WSM-243	**-S02**	**-S16**	2,437	61,90	2,283	0,200	0,078	2,299	0,086	11890	25080
WSM-250	**-S02**	**-S16**	2,500	63,50	2,343	0,200	0,078	2,360	0,086	12370	25730
WSM-255	**-S02**	**-S16**	2,559	65,00	2,402	0,200	0,078	2,419	0,086	12660	26340
WSM-262	**-S02**	**-S16**	2,625	66,68	2,464	0,200	0,078	2,481	0,086	13360	27020
WSM-268	**-S02**	**-S16**	2,687	68,25	2,523	0,200	0,078	2,541	0,086	13870	27660
WSM-275	**-S02**	**-S16**	2,750	69,85	2,584	0,225	0,093	2,602	0,103	14390	32140
WSM-287	**-S02**	**-S16**	2,875	73,03	2,702	0,225	0,093	2,721	0,103	15650	33600

[1] Based on a groove material yield strength of 45000 psi and a safety factor of 2.
[2] Based on a safety factor of 3.
[3] No removal notch.
[4] Square edge wire.
* Contact Smalley for details/information on how to order parts to be in compliance with this specification.

WSM Series

Spirolox® Imperial Heavy Duty Rings External Continued

Smalley Part Number			Shaft Diameter		Ring			Groove		Thrust Capacity	
Carbon Steel	Add Suffix				Inside Diameter (in)	Radial Wall (in)	Thickness (in)	Diameter (in)	Width (in)	Groove Yield[1] (lb)	Ring Shear[2] (lb)
	302 SS	316 SS	in	mm							
WSM-293	**-S02**	**-S16**	2,937	74,60	2,760	0,225	0,093	2,779	0,103	16400	34320
WSM-300	**-S02**	**-S16**	3,000	76,20	2,818	0,225	0,093	2,838	0,103	17180	35060
WSM-306	**-S02**	**-S16**	3,062	77,77	2,878	0,225	0,093	2,898	0,103	17750	35790
WSM-312	**-S02**	**-S16**	3,125	79,38	2,936	0,225	0,093	2,957	0,103	18560	36520
WSM-315	**-S02**	**-S16**	3,156	80,16	2,965	0,225	0,093	2,986	0,103	18960	36880
WSM-325	**-S02**	**-S16**	3,250	82,55	3,054	0,225	0,093	3,076	0,103	19990	37980
WSM-334	**-S02**	**-S16**	3,344	84,94	3,144	0,225	0,093	3,166	0,103	21040	39080
WSM-343	**-S02**	**-S16**	3,437	87,30	3,234	0,225	0,093	3,257	0,103	21870	40170
WSM-350	**-S02**	**-S16**	3,500	88,90	3,293	0,270	0,111	3,316	0,120	22760	48820
WSM-354	**-S02**	**-S16**	3,543	89,99	3,333	0,270	0,111	3,357	0,120	23290	49420
WSM-362	**-S02**	**-S16**	3,625	92,08	3,411	0,270	0,111	3,435	0,120	24340	50560
WSM-368	**-S02**	**-S16**	3,687	93,65	3,469	0,270	0,111	3,493	0,120	25280	51430
WSM-375	**-S02**	**-S16**	3,750	95,25	3,527	0,270	0,111	3,552	0,120	26240	52310
WSM-387	**-S02**	**-S16**	3,875	98,43	3,647	0,270	0,111	3,673	0,120	27670	54050
WSM-393	**-S02**	**-S16**	3,938	100,03	3,708	0,270	0,111	3,734	0,120	28390	54930
WSM-400	**-S02**	**-S16**	4,000	101,60	3,765	0,270	0,111	3,792	0,120	29410	55800
WSM-425	**-S02**	**-S16**	4,250	107,95	4,037	0,270	0,111	4,065	0,120	27940	59280
WSM-437	**-S02**	**-S16**	4,375	111,13	4,161	0,270	0,111	4,190	0,120	28760	61030
WSM-450	**-S02**	**-S16**	4,500	114,30	4,280	0,270	0,111	4,310	0,120	30220	62770
WSM-475	**-S02**	**-S16**	4,750	120,65	4,518	0,270	0,111	4,550	0,120	36930	66260
WSM-500	**-S02**	**-S16**	5,000	127,00	4,756	0,270	0,111	4,790	0,120	37110	69740
WSM-525	**-S02**	**-S16**	5,250	133,35	4,995	0,350	0,127	5,030	0,139	40820	83790
WSM-550	**-S02**	**-S16**	5,500	139,70	5,228	0,350	0,127	5,265	0,139	45880	87780
WSM-575	**-S02**	**-S16**	5,750	146,05	5,466	0,350	0,127	5,505	0,139	49990	91770
WSM-600	**-S02**	**-S16**	6,000	152,40	5,705	0,350	0,127	5,745	0,139	54290	95760
WSM-625	**-S02**	**-S16**	6,250	158,75	5,938	0,418	0,156	5,985	0,174	58760	122520
WSM-650	**-S02**	**-S16**	6,500	165,10	6,181	0,418	0,156	6,225	0,174	63410	127420
WSM-675	**-S02**	**-S16**	6,750	171,45	6,410	0,418	0,156	6,465	0,174	68230	132330
WSM-700	**-S02**	**-S16**	7,000	177,80	6,648	0,418	0,156	6,705	0,174	73230	137230
WSM-725	**-S02**	**-S16**	7,250	184,15	6,891	0,418	0,156	6,942	0,174	78920	142130
WSM-750	**-S02**	**-S16**	7,500	190,50	7,130	0,437	0,187	7,180	0,209	84820	176240
WSM-775	**-S02**	**-S16**	7,750	196,85	7,368	0,437	0,187	7,420	0,209	90390	182120
WSM-800	**-S02**	**-S16**	8,000	203,20	7,606	0,437	0,187	7,660	0,209	96130	187990
WSM-825	**-S02**	**-S16**	8,250	209,55	7,845	0,437	0,187	7,900	0,209	102050	193870
WSM-850	**-S02**	**-S16**	8,500	215,90	8,083	0,437	0,187	8,140	0,209	108150	199740
WSM-875	**-S02**	**-S16**	8,750	222,25	8,324	0,437	0,187	8,383	0,209	113800	205620
WSM-900	**-S02**	**-S16**	9,000	228,60	8,560	0,500	0,187	8,620	0,209	120870	211490
WSM-925	**-S02**	**-S16**	9,250	234,95	8,798	0,500	0,187	8,860	0,209	127500	217370
WSM-950	**-S02**	**-S16**	9,500	241,30	9,036	0,500	0,187	9,100	0,209	134300	223240
WSM-975	**-S02**	**-S16**	9,750	247,65	9,275	0,500	0,187	9,338	0,209	141970	229120
WSM-1000	**-S02**	**-S16**	10,000	254,00	9,508	0,500	0,187	9,575	0,209	150560	234990
WSM-1025	**-S02**	**-S16**	10,250	260,35	9,745	0,500	0,187	9,814	0,209	157950	240870
WSM-1050	**-S02**	**-S16**	10,500	266,70	9,984	0,500	0,187	10,054	0,209	165510	246740
WSM-1075	**-S02**	**-S16**	10,750	273,05	10,221	0,500	0,187	10,293	0,209	174010	252620
WSM-1100	**-S02**	**-S16**	11,000	279,40	10,459	0,500	0,187	10,533	0,209	181950	258490
WSM-1125	**-S02**	**-S16**	11,250	285,75	10,692	0,500	0,187	10,772	0,209	190060	264360
WSM-1150	**-S02**	**-S16**	11,500	292,10	10,934	0,562	0,187	11,011	0,209	199160	270240
WSM-1175	**-S02**	**-S16**	11,750	298,45	11,171	0,562	0,187	11,250	0,209	207640	276120
WSM-1200	**-S02**	**-S16**	12,000	304,80	11,410	0,562	0,187	11,490	0,209	216300	281990
WSM-1225	**-S02**	**-S16**	12,250	311,15	11,647	0,562	0,187	11,729	0,209	226000	287860
WSM-1250	**-S02**	**-S16**	12,500	317,50	11,885	0,562	0,187	11,969	0,209	235030	293740
WSM-1275	**-S02**	**-S16**	12,750	323,85	12,124	0,562	0,187	12,208	0,209	244240	299610
WSM-1300	**-S02**	**-S16**	13,000	330,20	12,361	0,662	0,187	12,448	0,209	253620	305490
WSM-1325	**-S02**	**-S16**	13,250	336,55	12,598	0,662	0,187	12,687	0,209	264120	311360
WSM-1350	**-S02**	**-S16**	13,500	342,90	12,837	0,662	0,187	12,927	0,209	273870	317240
WSM-1375	**-S02**	**-S16**	13,750	349,25	13,074	0,662	0,187	13,166	0,209	283800	323110
WSM-1400	**-S02**	**-S16**	14,000	355,60	13,311	0,662	0,187	13,405	0,209	294900	328990
WSM-1425	**-S02**	**-S16**	14,250	361,95	13,548	0,662	0,187	13,644	0,209	305200	334860
WSM-1450	**-S02**	**-S16**	14,500	368,30	13,787	0,750	0,187	13,884	0,209	315680	340740
WSM-1475	**-S02**	**-S16**	14,750	374,65	14,024	0,750	0,187	14,123	0,209	327380	346610
WSM-1500	**-S02**	**-S16**	15,000	381,00	14,262	0,750	0,187	14,363	0,209	338230	352490

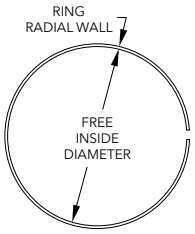
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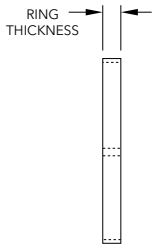
[1] Based on a groove material yield strength of 45000 psi and a safety factor of 2.
[2] Based on a safety factor of 3.

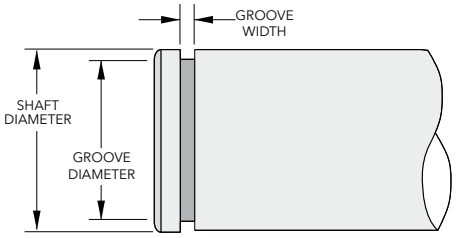
* Contact Smalley for details/information on how to order parts to be in compliance with this specification.

HSM Series
Hoopster® Rings External









Product Dimensions: All dimensions in millimeters unless otherwise specified.

Smalley Part Number[3]		Shaft Diameter		Ring				Groove				Thrust
Carbon Steel	Add Suffix 302 SS	mm	in	Inside Diameter (mm)		Radial Wall (mm)		Thickness (mm)		Diameter[2] (mm)		Width (mm)		Groove Yield[1] (N)
HSM-10	-S02	10,00	0,394	9,37	+0,00/-0,30	0,43	±0,04	1,14	±0,10	9,57	±0,05	1,27	+0,08/-0,00	1051
HSM-11	-S02	11,00	0,433	10,35		0,43		1,14		10,57		1,27		1156
HSM-12	-S02	12,00	0,472	11,33		0,43		1,14		11,57		1,27		1262
HSM-13	-S02	13,00	0,512	12,21		0,53		1,65		12,47		1,78		1688
HSM-14	-S02	14,00	0,551	13,19	+0,00/-0,38	0,53		1,65		13,47		1,78		1818
HSM-15	-S02	15,00	0,591	14,17		0,53		1,65		14,47		1,78		1948
HSM-16	-S02	16,00	0,630	15,15		0,53		1,65		15,47		1,78		2078
HSM-17	-S02	17,00	0,669	16,13		0,53		1,65		16,47		1,78		2208
HSM-18	-S02	18,00	0,709	17,03		0,61		2,24		17,39		2,36		2672
HSM-19	-S02	19,00	0,748	18,01		0,61		2,24		18,39		2,36		2820
HSM-20	-S02	20,00	0,787	18,99	+0,00/-0,46	0,61		2,24		19,39	±0,08	2,36		2968
HSM-21	-S02	21,00	0,827	19,97		0,61		2,24		20,39		2,36		3117
HSM-22	-S02	22,00	0,866	20,95		0,61		2,24		21,39		2,36		3265
HSM-23	-S02	23,00	0,906	21,93		0,61		2,24		22,39		2,36		3414
HSM-24	-S02	24,00	0,945	22,91		0,61		2,24		23,39		2,36		3562
HSM-25	-S02	25,00	0,984	23,89		0,61		2,24		24,39		2,36		3711
HSM-26	-S02	26,00	1,024	24,72	+0,00/-0,51	0,76		3,00		25,24		3,12		4824
HSM-27	-S02	27,00	1,063	25,70		0,76		3,00		26,24		3,12		5009
HSM-28	-S02	28,00	1,102	26,68		0,76		3,00		27,24		3,12		5195
HSM-29	-S02	29,00	1,142	27,66		0,76		3,00		28,24		3,12		5380
HSM-30	-S02	30,00	1,181	28,64		0,76		3,00		29,24		3,12		5566
HSM-31	-S02	31,00	1,220	29,62		0,76		3,00		30,24		3,12		5751
HSM-32	-S02	32,00	1,260	30,60		0,76		3,00		31,24		3,12		5937
HSM-33	-S02	33,00	1,299	31,48		0,86		3,81		32,14	±0,10	3,94		6939
HSM-34	-S02	34,00	1,339	32,46		0,86		3,81		33,14		3,94		7149
HSM-35	-S02	35,00	1,378	33,44		0,86		3,81		34,14		3,94		7359
HSM-36	-S02	36,00	1,417	34,42		0,86		3,81		35,14		3,94		7569
HSM-37	-S02	37,00	1,457	35,40		0,86		3,81		36,14		3,94		7780
HSM-38	-S02	38,00	1,496	36,38		0,86		3,81		37,14		3,94		7990
HSM-40	-S02	40,00	1,575	38,34		0,86		3,81		39,14		3,94		8411
HSM-41	-S02	41,00	1,614	39,32	+0,00/-0,61	0,86		3,81		40,14		3,94		8621
HSM-42	-S02	42,00	1,654	40,30		0,86		3,81		41,14		3,94		8831
HSM-45	-S02	45,00	1,772	43,13		0,97	±0,05	4,75	±0,13	44,03	±0,13	4,88	+0,10/-0,00	10575
HSM-47	-S02	47,00	1,850	45,09		0,97		4,75		46,03		4,88		11045
HSM-48	-S02	48,00	1,890	46,07		0,97		4,75		47,03		4,88		11280
HSM-50	-S02	50,00	1,969	48,03		0,97		4,75		49,03		4,88		11750
HSM-51	-S02	51,00	2,008	49,01		0,97		4,75		50,03		4,88		11985
HSM-52	-S02	52,00	2,047	49,99		0,97		4,75		51,03		4,88		12220
HSM-55	-S02	55,00	2,165	52,93		0,97		4,75		54,03		4,90		12925
HSM-56	-S02	56,00	2,205	53,91		0,97		4,75		55,03		4,90		13160
HSM-57	-S02	57,00	2,244	54,89		0,97		4,75		56,03		4,90		13395
HSM-58	-S02	58,00	2,283	55,87		0,97		4,75		57,03		4,90		13630
HSM-60	-S02	60,00	2,362	57,83		0,97		4,75		59,03		4,90		14100
HSM-62	-S02	62,00	2,441	59,62	+0,00/-0,76	1,14		5,72		60,86	±0,15	5,87	+0,13/-0,00	17254
HSM-63	-S02	63,00	2,480	60,60		1,14		5,72		61,86		5,87		17532
HSM-64	-S02	64,00	2,520	61,58		1,14		5,72		62,86		5,87		17811
HSM-65	-S02	65,00	2,559	62,56		1,14		5,72		63,86		5,87		18089
HSM-67	-S02	67,00	2,638	64,52		1,14		5,72		65,86		5,87		18645
HSM-68	-S02	68,00	2,677	65,50		1,14		5,72		66,86		5,87		18924
HSM-70	-S02	70,00	2,756	67,46		1,14		5,72		68,86		5,87		19480

[1] Based on a groove material yield strength of 310 N/mm² and a safety factor of 2.
[2] Sharp corners on the groove required.
[3] Square edge wire.

HSM Series

Hoopster® Rings External Continued

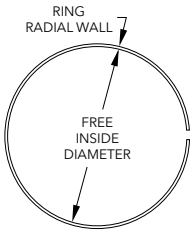
Smalley Part Number[3]		Shaft Diameter		Ring						Groove						Thrust
Carbon Steel	Add Suffix			Inside Diameter (mm)		Radial Wall (mm)		Thickness (mm)		Diameter[2] (mm)		Width (mm)				Groove Yield[1] (N)
	302 SS	mm	in													
HSM-72	**-S02**	72,00	2,835	69,42	+0,00/ -0,76	1,14	±0,05	5,72	±0,13	70,86	±0,15	5,87	+0,13/ -0,00			20037
HSM-75	**-S02**	75,00	2,953	72,36	+0,00/ -0,76	1,14	±0,05	5,72	±0,13	73,86	±0,15	5,87	+0,13/ -0,00			20872
HSM-76	**-S02**	76,00	2,992	73,34	+0,00/ -0,76	1,14	±0,05	5,72	±0,13	74,86	±0,15	5,87	+0,13/ -0,00			21150

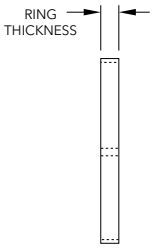
[1] Based on a groove material yield strength of 310 N/mm² and a safety factor of 2.
[2] Sharp corners on the groove required.
[3] Square edge wire.

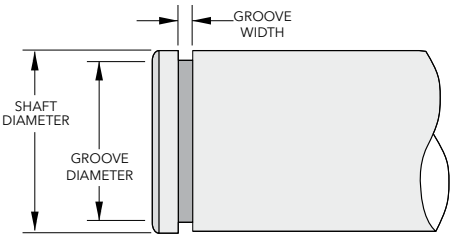
HS Series

Hoopster® Imperial Rings External









Product Dimensions: All dimensions in inches unless otherwise specified.

Smalley Part Number[3]		Shaft Diameter		Ring				Groove			Thrust
Carbon Steel	Add Suffix 302 SS	in	mm	Inside Diameter (in)		Radial Wall (in)		Thickness (in)		Diameter[2] (in)	Width (in)		Groove Yield[1] (lb)
HS-37	**-S02**	0,375	9,53	0,351	+0,000/-0,012	0,017	±0,0015	0,045	±0,004	0,358	0,050	+0,003/-0,000	225
HS-43	**-S02**	0,437	11,10	0,411		0,017		0,045		0,420	0,050		263
HS-46	**-S02**	0,469	11,91	0,443		0,017		0,045		0,452	0,050		282
HS-50	**-S02**	0,500	12,70	0,469	+0,000/-0,015	0,021		0,065		0,479	0,070		371
HS-53	**-S02**	0,531	13,49	0,499		0,021		0,065		0,510	0,070		394
HS-56	**-S02**	0,562	14,27	0,530		0,021		0,065		0,541	0,070		417
HS-59	**-S02**	0,594	15,09	0,561		0,021		0,065		0,573	0,070		441
HS-62	**-S02**	0,625	15,88	0,592		0,021		0,065		0,604	0,070		464
HS-65	**-S02**	0,656	16,66	0,622		0,021		0,065		0,635	0,070		487
HS-68	**-S02**	0,688	17,48	0,653		0,021		0,065		0,667	0,070		511
HS-71	**-S02**	0,718	18,24	0,680		0,024		0,088		0,694	0,093		609
HS-75	**-S02**	0,750	19,05	0,711		0,024		0,088		0,726	0,093		636
HS-78	**-S02**	0,781	19,84	0,741	+0,000/-0,018	0,024		0,088		0,757	0,093		662
HS-81	**-S02**	0,812	20,62	0,772		0,024		0,088		0,788	0,093		689
HS-84	**-S02**	0,843	21,41	0,802		0,024		0,088		0,819	0,093		715
HS-87	**-S02**	0,875	22,23	0,834		0,024		0,088		0,851	0,093		742
HS-90	**-S02**	0,906	23,01	0,864		0,024		0,088		0,882	0,093		768
HS-93	**-S02**	0,938	23,83	0,895		0,024		0,088		0,914	0,093		796
HS-96	**-S02**	0,968	24,59	0,925		0,024		0,088		0,944	0,093		821
HS-100	**-S02**	1,000	25,40	0,956	+0,000/-0,020	0,024		0,088		0,976	0,093		848
HS-103	**-S02**	1,031	26,19	0,980		0,030	±0,002	0,118		1,001	0,123	+0,004/-0,000	1093
HS-106	**-S02**	1,062	26,97	1,011		0,030		0,118		1,032	0,123		1126
HS-109	**-S02**	1,093	27,76	1,041		0,030		0,118		1,063	0,123		1159
HS-112	**-S02**	1,125	28,58	1,073		0,030		0,118		1,095	0,123		1193
HS-115	**-S02**	1,156	29,36	1,103		0,030		0,118		1,126	0,123		1226
HS-118	**-S02**	1,188	30,18	1,134		0,030		0,118		1,158	0,123		1260
HS-121	**-S02**	1,218	30,94	1,164		0,030		0,118		1,188	0,123		1291
HS-125	**-S02**	1,250	31,75	1,195		0,030		0,118		1,220	0,123		1325
HS-128	**-S02**	1,281	32,54	1,225		0,030		0,118		1,251	0,123		1358
HS-131	**-S02**	1,312	33,32	1,252		0,034		0,150		1,278	0,155		1577
HS-134	**-S02**	1,343	34,11	1,282		0,034		0,150		1,309	0,155		1614
HS-137	**-S02**	1,375	34,93	1,314		0,034		0,150		1,341	0,155		1652
HS-140	**-S02**	1,406	35,71	1,344		0,034		0,150		1,372	0,155		1690
HS-143	**-S02**	1,437	36,50	1,374		0,034		0,150		1,403	0,155		1727
HS-146	**-S02**	1,468	37,29	1,405		0,034		0,150		1,434	0,155		1765
HS-150	**-S02**	1,500	38,10	1,436		0,034		0,150		1,466	0,155		1802
HS-156	**-S02**	1,562	39,67	1,497		0,034		0,150		1,528	0,155		1877
HS-162	**-S02**	1,625	41,28	1,559	+0,000/-0,024	0,034		0,150		1,591	0,155		1953
HS-168	**-S02**	1,688	42,88	1,619		0,034		0,150		1,653	0,155		2028
HS-175	**-S02**	1,750	44,45	1,677		0,038		0,187	±0,005	1,712	0,193		2350
HS-181	**-S02**	1,812	46,02	1,739		0,038		0,187		1,775	0,193		2434
HS-187	**-S02**	1,875	47,63	1,800		0,038		0,187		1,837	0,193		2518
HS-193	**-S02**	1,938	49,23	1,861		0,038		0,187		1,900	0,193		2603
HS-200	**-S02**	2,000	50,80	1,922		0,038		0,187		1,962	0,193		2686
HS-206	**-S02**	2,062	52,37	1,983		0,038		0,187		2,024	0,193		2769
HS-212	**-S02**	2,125	53,98	2,045		0,038		0,187		2,087	0,193		2854
HS-218	**-S02**	2,188	55,58	2,106		0,038		0,187		2,150	0,193		2939
HS-225	**-S02**	2,250	57,15	2,167		0,038		0,187		2,212	0,193		3022
HS-231	**-S02**	2,312	58,72	2,228		0,038		0,187		2,274	0,193		3105
HS-237	**-S02**	2,375	60,33	2,290		0,038		0,187		2,337	0,193		3190

[1] Based on a groove material yield strength of 45000 psi and a safety factor of 2.
[2] Sharp corners on the groove required.
[3] Square edge wire.

HS Series

Hoopster® Imperial Rings External Continued

Smalley Part Number[3]		Shaft Diameter		Ring						Groove				Thrust
Carbon Steel	Add Suffix 302 SS	in	mm	Inside Diameter (in)		Radial Wall (in)		Thickness (in)		Diameter[2] (in)		Width (in)		Groove Yield[1] (lb)
HS-243	**-S02**	2,437	61,90	2,343	+0,000/-0,030	0,045	±0,002	0,225	±0,005	2,392	±0,006	0,232	+0,005/-0,000	3876
HS-250	**-S02**	2,500	63,50	2,405		0,045		0,225		2,455		0,232		3976
HS-256	**-S02**	2,562	65,07	2,466		0,045		0,225		2,517		0,232		4075
HS-262	**-S02**	2,625	66,68	2,528		0,045		0,225		2,580		0,232		4175
HS-268	**-S02**	2,688	68,28	2,589		0,045		0,225		2,643		0,232		4275
HS-275	**-S02**	2,750	69,85	2,650		0,045		0,225		2,705		0,232		4374
HS-281	**-S02**	2,812	71,42	2,712		0,045		0,225		2,768		0,232		4472
HS-287	**-S02**	2,875	73,03	2,773		0,045		0,225		2,830		0,232		4572
HS-293	**-S02**	2,938	74,63	2,833		0,045		0,225		2,892		0,232		4673
HS-300	**-S02**	3,000	76,20	2,895		0,045		0,225		2,955		0,232		4771

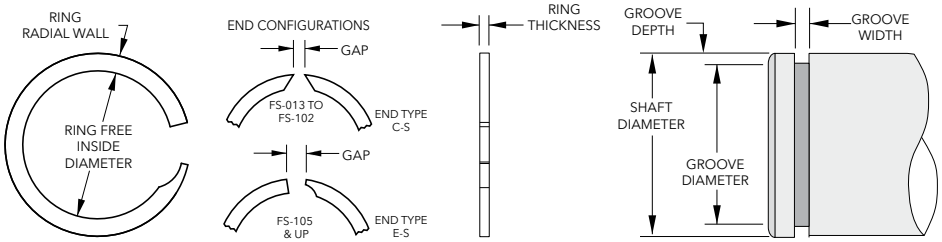
[1] Based on a groove material yield strength of 45000 psi and a safety factor of 2.
[2] Sharp corners on the groove required.
[3] Square edge wire.

FS Series

Constant Section Rings External

**Groove compatible with DIN 471*





Product Dimensions: All dimensions in millimeters unless otherwise specified.

Smalley Part Number[3]		Shaft Diameter		Ring			Groove		Thrust Capacity	
Carbon Steel	Add Suffix 302 SS	mm	in	Inside Diameter (mm)	Radial Wall (mm)	Thickness (mm)	Diameter (mm)	Width (mm)	Groove Yield[1] (N)	Ring Shear[2] (N)
FS-013	**-S02**	13,00	0,512	12,27	1,40	0,94	12,40	1,10	1931	10591
FS-014	**-S02**	14,00	0,551	13,31	1,40	0,94	13,40	1,10	2077	11396
FS-015	**-S02**	15,00	0,591	14,15	1,40	0,94	14,30	1,10	2602	12224
FS-016	**-S02**	16,00	0,630	14,98	1,65	0,94	15,20	1,10	3172	13029
FS-017	**-S02**	17,00	0,669	16,06	1,65	0,94	16,20	1,10	3367	13838
FS-018	**-S02**	18,00	0,709	16,82	1,90	1,15	17,00	1,30	4457	17953
FS-019	**-S02**	19,00	0,748	17,81	1,90	1,15	18,00	1,30	4702	18941
FS-020	**-S02**	20,00	0,787	18,80	1,90	1,15	19,00	1,30	4951	19928
FS-021	**-S02**	21,00	0,827	19,79	1,90	1,15	20,00	1,30	5200	20942
FS-022	**-S02**	22,00	0,866	20,83	1,90	1,15	21,00	1,30	5445	21930
FS-023	**-S02**	23,00	0,906	21,77	1,90	1,15	22,00	1,30	5698	22939
FS-024	**-S02**	24,00	0,945	22,50	2,15	1,15	22,90	1,30	6539	23927
FS-025	**-S02**	25,00	0,984	23,70	2,15	1,15	23,90	1,30	6806	24914
FS-026	**-S02**	26,00	1,024	24,64	2,15	1,15	24,90	1,30	7082	25929
FS-027	**-S02**	27,00	1,063	25,50	2,15	1,15	25,90	1,30	7353	26916
FS-028	**-S02**	28,00	1,102	26,32	3,25	1,44	26,60	1,60	9702	33179
FS-029	**-S02**	29,00	1,142	27,15	3,25	1,44	27,60	1,60	10053	34385
FS-030	**-S02**	30,00	1,181	28,35	3,25	1,44	28,60	1,60	10395	35559
FS-032	**-S02**	32,00	1,260	29,87	3,25	1,44	30,30	1,60	13073	37939
FS-033	**-S02**	33,00	1,299	31,07	3,25	1,44	31,30	1,60	13478	39113
FS-034	**-S02**	34,00	1,339	31,96	3,25	1,44	32,30	1,60	13892	40319
FS-035	**-S02**	35,00	1,378	32,57	3,25	1,44	33,00	1,60	16899	41493
FS-036	**-S02**	36,00	1,417	33,64	4,01	1,69	34,00	1,85	17375	50038
FS-038	**-S02**	38,00	1,496	35,62	4,01	1,69	36,00	1,85	18344	52827
FS-040	**-S02**	40,00	1,575	37,02	4,01	1,69	37,50	1,85	24265	55621
FS-042	**-S02**	42,00	1,654	39,08	4,01	1,69	39,50	1,85	25484	58410
FS-045	**-S02**	45,00	1,772	42,05	4,01	1,69	42,50	1,85	27303	62578
FS-046	**-S02**	46,00	1,811	43,10	4,01	1,69	43,50	1,85	27904	63952
FS-047	**-S02**	47,00	1,850	44,03	4,01	1,69	44,50	1,85	28504	65331
FS-048	**-S02**	48,00	1,890	44,89	4,01	1,69	45,50	1,85	29118	66741
FS-050	**-S02**	50,00	1,969	46,50	5,08	1,93	47,00	2,15	36529	75282
FS-052	**-S02**	52,00	2,047	48,48	5,08	1,93	49,00	2,15	37974	78266
FS-054	**-S02**	54,00	2,126	50,46	5,08	1,93	51,00	2,15	39438	81287
FS-055	**-S02**	55,00	2,165	51,45	5,08	1,93	52,00	2,15	40163	82777
FS-056	**-S02**	56,00	2,205	52,44	5,08	1,93	53,00	2,15	40906	84307
FS-058	**-S02**	58,00	2,283	54,42	5,08	1,93	55,00	2,15	42352	87287
FS-060	**-S02**	60,00	2,362	56,55	5,08	1,93	57,00	2,15	43819	90308
FS-062	**-S02**	62,00	2,441	58,32	5,08	1,93	59,00	2,15	45283	93328
FS-063	**-S02**	63,00	2,480	59,37	5,08	1,93	60,00	2,15	46008	94823
FS-065	**-S02**	65,00	2,559	61,35	5,08	2,41	62,00	2,65	47471	116641
FS-067	**-S02**	67,00	2,638	63,35	5,08	2,41	64,00	2,65	48939	120240
FS-068	**-S02**	68,00	2,677	64,45	5,08	2,41	65,00	2,65	49660	122019
FS-070	**-S02**	70,00	2,756	66,22	5,08	2,41	67,00	2,65	51128	125618
FS-072	**-S02**	72,00	2,835	68,28	5,08	2,41	69,00	2,65	52591	129221
FS-075	**-S02**	75,00	2,953	71,25	5,08	2,41	72,00	2,65	54780	134599
FS-077	**-S02**	77,00	3,031	73,23	5,08	2,41	74,00	2,65	56230	138153
FS-078	**-S02**	78,00	3,071	74,06	5,08	2,41	75,00	2,65	56968	139977
FS-080	**-S02**	80,00	3,150	75,70	6,02	2,41	76,50	2,65	68342	143575
FS-082	**-S02**	82,00	3,228	77,68	6,02	2,41	78,50	2,65	70033	147134
FS-085	**-S02**	85,00	3,346	80,65	6,30	2,91	81,50	3,15	72595	175656

+0,00/-0,33 (Inside Diameter) · +0,00/-0,38 · +0,00/-0,51 · +0,00/-0,63 · +0,00/-0,76

±0,10 (Radial Wall) · ±0,13

±0,05 (Thickness) · ±0,08

+0,00/-0,11 (Diameter) · +0,00/-0,13 · +0,00/-0,21 · +0,00/-0,25 · +0,00/-0,30 · +0,00/-0,35

+0,14/-0,00 (Width) · +,18/-0,00

[1] Based on a groove material yield strength of 310 N/mm² and a safety factor of 2.
[2] Based on a safety factor of 3.
[3] Square edge wire.

* Contact Smalley for details/information on how to order parts to be in compliance with this specification.
- See page 90 for different End Types.

FS Series

Constant Section Rings External Continued

Smalley Part Number[3]		Shaft Diameter		Ring			Groove		Thrust Capacity	
Carbon Steel	Add Suffix 302 SS	mm	in	Inside Diameter (mm)	Radial Wall (mm)	Thickness (mm)	Diameter (mm)	Width (mm)	Groove Yield[1] (N)	Ring Shear[2] (N)
FS-088	**-S02**	88,00	3,465	83,60 +0,00/-0,89	6,30	2,91 ±0,08	84,50 +0,00/-0,35	3,15	75175	181906
FS-090	**-S02**	90,00	3,543	85,80 +0,00/-0,89	6,30	2,91 ±0,08	86,50 +0,00/-0,35	3,15	76865	185998
FS-095	**-S02**	95,00	3,740	90,68 +0,00/-0,89	6,30	2,91 ±0,08	91,50 +0,00/-0,35	3,15	81140	196340
FS-098	**-S02**	98,00	3,858	93,70 +0,00/-0,89	6,30	2,91 ±0,08	94,50 +0,00/-0,35	3,15	83702	202536
FS-100	**-S02**	100,00	3,937	95,50 +0,00/-0,89	6,30	2,91 ±0,08	96,50 +0,00/-0,35	3,15	85415	206682
FS-102	**-S02**	102,00	4,016	97,23 +0,00/-1,30	6,30	2,91 ±0,08	98,50 +0,00/-0,54	3,15	87127	210828
FS-105	**-S02**	105,00	4,134	99,83 +0,00/-1,30	6,73 ±0,13	3,89 ±0,10	101,00 +0,00/-0,54	4,15	102687	276951
FS-108	**-S02**	108,00	4,252	102,87 +0,00/-1,30	6,73 ±0,13	3,89 ±0,10	104,00 +0,00/-0,54	4,15	105619	284855
FS-110	**-S02**	110,00	4,331	104,90 +0,00/-1,30	6,73 ±0,13	3,89 ±0,10	106,00 +0,00/-0,54	4,15	107580	290149
FS-115	**-S02**	115,00	4,528	109,85 +0,00/-1,30	6,73 ±0,13	3,89 ±0,10	111,00 +0,00/-0,54	4,15	112473	303346
FS-120	**-S02**	120,00	4,724	115,06 +0,00/-1,30	6,73 ±0,13	3,89 ±0,10	116,00 +0,00/-0,54	4,15	117344	316478
FS-125	**-S02**	125,00	4,921	119,75 +0,00/-1,30	6,73 ±0,13	3,89 ±0,10	121,00 +0,00/-0,63	4,15	122237	329676
FS-130	**-S02**	130,00	5,118	124,70 +0,00/-1,30	6,73 ±0,13	3,89 ±0,10	126,00 +0,00/-0,63	4,15	127130	342873
FS-135	**-S02**	135,00	5,315	129,65 +0,00/-1,30	6,73 ±0,13	3,89 ±0,10	131,00 +0,00/-0,63	4,15	132023	356071
FS-140	**-S02**	140,00	5,512	134,42 +0,00/-1,30	6,73 ±0,13	3,89 ±0,10	136,00 +0,00/-0,63	4,15	136916	369269
FS-145	**-S02**	145,00	5,709	139,55 +0,00/-1,30	6,73 ±0,13	3,89 ±0,10	141,00 +0,00/-0,63	4,15	141809	382467
FS-150	**-S02**	150,00	5,906	143,50 +0,00/-1,52	8,03 ±0,15	3,89 ±0,10	145,00 +0,00/-0,63	4,15	181986	395665
FS-155	**-S02**	155,00	6,102	148,45 +0,00/-1,52	8,03 ±0,15	3,89 ±0,10	150,00 +0,00/-0,63	4,15	188026	408796
FS-160	**-S02**	160,00	6,299	153,40 +0,00/-1,52	8,03 ±0,15	3,89 ±0,10	155,00 +0,00/-0,63	4,15	194094	421994
FS-165	**-S02**	165,00	6,496	158,40 +0,00/-1,52	8,03 ±0,15	3,89 ±0,10	160,00 +0,00/-0,63	4,15	200166	435192
FS-170	**-S02**	170,00	6,693	163,30 +0,00/-1,52	8,03 ±0,15	3,89 ±0,10	165,00 +0,00/-0,63	4,15	206237	448683
FS-175	**-S02**	175,00	6,890	168,25 +0,00/-1,52	8,03 ±0,15	3,89 ±0,10	170,00 +0,00/-0,63	4,15	212305	461890
FS-180	**-S02**	180,00	7,087	173,20 +0,00/-1,52	8,03 ±0,15	3,89 ±0,10	175,00 +0,00/-0,63	4,15	218377	475097
FS-185	**-S02**	185,00	7,283	177,62 +0,00/-1,78	8,03 ±0,15	3,89 ±0,10	180,00 +0,00/-0,63	4,15	224417	488232
FS-190	**-S02**	190,00	7,480	183,35 +0,00/-1,78	8,03 ±0,15	3,89 ±0,10	185,00 +0,00/-0,72	4,15	230489	501439
FS-195	**-S02**	195,00	7,677	188,05 +0,00/-1,78	8,03 ±0,15	3,89 ±0,10	190,00 +0,00/-0,72	4,15	236556	514646
FS-200	**-S02**	200,00	7,874	193,00 +0,00/-1,78	8,03 ±0,15	3,89 ±0,10	195,00 +0,00/-0,72	4,15	242628	527853
FS-205	**-S02**	205,00	8,071	196,95 +0,00/-1,78	11,05 ±0,18	4,87 ±0,13	199,00 +0,00/-0,72	5,15	299454	641438
FS-210	**-S02**	210,00	8,268	201,67 +0,00/-1,78	11,05 ±0,18	4,87 ±0,13	204,00 +0,00/-0,72	5,15	306763	657096
FS-220	**-S02**	220,00	8,661	211,80 +0,00/-1,78	11,05 ±0,18	4,87 ±0,13	214,00 +0,00/-0,72	5,15	321344	688327
FS-230	**-S02**	230,00	9,055	221,70 +0,00/-1,78	11,05 ±0,18	4,87 ±0,13	224,00 +0,00/-0,72	5,15	335961	719638
FS-240	**-S02**	240,00	9,449	231,89 +0,00/-1,78	11,05 ±0,18	4,87 ±0,13	234,00 +0,00/-0,72	5,15	350578	750953
FS-250	**-S02**	250,00	9,843	241,50 +0,00/-2,30	11,05 ±0,18	4,87 ±0,13	244,00 +0,00/-0,81	5,15	365199	782264
FS-260	**-S02**	260,00	10,236	249,59 +0,00/-2,30	12,70 ±0,18	4,87 ±0,13	252,00 +0,00/-0,81	5,15	505300	813500
FS-270	**-S02**	270,00	10,630	259,30 +0,00/-2,30	12,70 ±0,18	4,87 ±0,13	262,00 +0,00/-0,81	5,15	524748	844811
FS-280	**-S02**	280,00	11,024	268,83 +0,00/-2,30	12,70 ±0,18	4,87 ±0,13	272,00 +0,00/-0,81	5,15	544200	876126
FS-290	**-S02**	290,00	11,417	279,10 +0,00/-2,30	12,70 ±0,18	4,87 ±0,13	282,00 +0,00/-0,81	5,15	563599	907357
FS-300	**-S02**	300,00	11,811	289,00 +0,00/-2,30	12,70 ±0,18	4,87 ±0,13	292,00 +0,00/-0,81	5,15	583051	938673

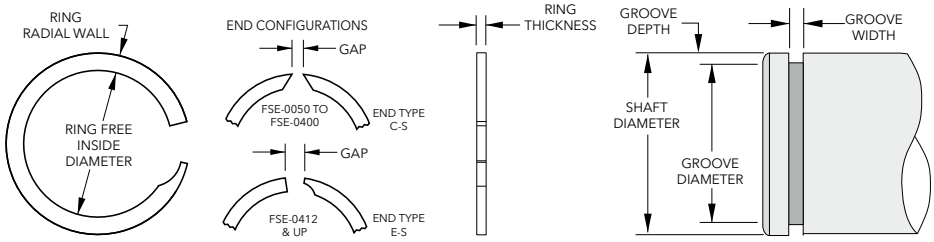
[1] Based on a groove material yield strength of 310 N/mm² and a safety factor of 2.
[2] Based on a safety factor of 3.
[3] Square edge wire.

* Contact Smalley for details/information on how to order parts to be in compliance with this specification.
- *See page 90 for different End Types.*

FSE Series

Constant Section Imperial Rings External





Product Dimensions: All dimensions in inches unless otherwise specified.

Smalley Part Number[3]		Shaft Diameter		Ring			Groove		Thrust Capacity	
Carbon Steel	Add Suffix 302 SS	in	mm	Inside Diameter (in)	Radial Wall (in)	Thickness (in)	Diameter (in)	Width (in)	Groove Yield[1] (lb)	Ring Shear[2] (lb)
FSE-0050	**-S02**	0,500	12,70	0,471 +0,000/-0,013	0,055	0,037	0,476 +0,000/-0,004	0,043	424	2325
FSE-0056	**-S02**	0,562	14,27	0,524	0,055	0,037	0,532	0,043	596	2613
FSE-0062	**-S02**	0,625	15,88	0,590	0,065	0,037	0,595	0,043	663	2906
FSE-0068	**-S02**	0,687	17,45	0,649	0,065	0,037	0,655	0,043	777	3194
FSE-0075	**-S02**	0,750	19,05	0,701	0,075	0,045	0,710	0,051	1060	4241
FSE-0081	**-S02**	0,812	20,62	0,764	0,075	0,045	0,772 +0,000/-0,005	0,051	1148	4592
FSE-0087	**-S02**	0,875	22,23	0,820	0,075	0,045	0,831	0,051	1361	4948
FSE-0093	**-S02**	0,937	23,80	0,886	0,085	0,045	0,893 +0,000/-0,008	0,051	1457	5334
FSE-0100	**-S02**	1,000	25,40	0,933	0,085	0,045	0,952	0,051	1696	5693
FSE-0106	**-S02**	1,062	26,97	1,004	0,085	0,045	1,014	0,051	1802	6045
FSE-0112	**-S02**	1,125	28,58	1,069	0,128 ±0,004	0,057 ±0,002	1,077	0,063	1909	7615
FSE-0118	**-S02**	1,187	30,15	1,116 +0,000/-0,015	0,128	0,057	1,131 +0,000/-0,008	0,063	2349	8035
FSE-0125	**-S02**	1,250	31,75	1,176	0,128	0,057	1,188	0,063	2739	8461
FSE-0131	**-S02**	1,312	33,32	1,223	0,128	0,057	1,242	0,063	3246	8881
FSE-0137	**-S02**	1,375	34,93	1,282	0,128	0,057	1,297	0,063	3791	9307
FSE-0143	**-S02**	1,437	36,50	1,344	0,158	0,067	1,359	0,073	3961	11408
FSE-0150	**-S02**	1,500	38,10	1,402	0,158	0,067	1,422	0,073	4135	11908
FSE-0156	**-S02**	1,562	39,67	1,457 +0,000/-0,020	0,158	0,067	1,470 +0,000/-0,010	0,073	5079	12400
FSE-0162	**-S02**	1,625	41,28	1,517	0,158	0,067	1,533	0,073	5284	12901
FSE-0168	**-S02**	1,687	42,85	1,578	0,158	0,067	1,595	0,073	5485	13393
FSE-0175	**-S02**	1,750	44,45	1,640	0,158	0,067	1,658	0,073	5690	13893
FSE-0181	**-S02**	1,812	46,02	1,697	0,158	0,067	1,720	0,073	5892	14385
FSE-0187	**-S02**	1,875	47,63	1,767	0,158	0,067	1,783	0,073	6097	14885
FSE-0193	**-S02**	1,937	49,20	1,800	0,200	0,076	1,819	0,085	8078	16649
FSE-0200	**-S02**	2,000	50,80	1,862	0,200	0,076	1,882	0,085	8341	17191
FSE-0206	**-S02**	2,062	52,37	1,924	0,200	0,076	1,944	0,085	8599	17724
FSE-0212	**-S02**	2,125	53,98	1,987	0,200	0,076	2,007	0,085	8862	18265
FSE-0218	**-S02**	2,187	55,55	2,048	0,200	0,076	2,069	0,085	9121	18798
FSE-0225	**-S02**	2,250	57,15	2,110	0,200	0,076	2,132	0,085	9384	19340
FSE-0231	**-S02**	2,312	58,72	2,171	0,200	0,076	2,194	0,085	9642	19873
FSE-0237	**-S02**	2,375	60,33	2,226	0,200	0,076	2,257	0,085	9905	20414
FSE-0243	**-S02**	2,437	61,90	2,296	0,200	0,076	2,319	0,085	10163	20947
FSE-0250	**-S02**	2,500	63,50	2,357 +0,000/-0,025	0,200	0,076	2,382	0,085	10426	21488
FSE-0256	**-S02**	2,562	65,07	2,415	0,200	0,095	2,444	0,104	10685	26252
FSE-0262	**-S02**	2,625	66,68	2,486	0,200	0,095	2,507	0,104	10947	26898
FSE-0268	**-S02**	2,687	68,25	2,537	0,200 ±0,005	0,095 ±0,003	2,569	0,104	11206	27533
FSE-0275	**-S02**	2,750	69,85	2,607	0,200	0,095	2,632 +0,000/-0,012	0,104	11469	28179
FSE-0281	**-S02**	2,812	71,42	2,665	0,200	0,095	2,694	0,104	11727	28814
FSE-0287	**-S02**	2,875	73,03	2,727	0,200	0,095	2,757	0,104	11990	29460
FSE-0293	**-S02**	2,937	74,60	2,789	0,200	0,095	2,819	0,104	12249	30095
FSE-0300	**-S02**	3,000	76,20	2,852 +0,000/-0,030	0,200	0,095	2,882	0,104	12511	30740
FSE-0306	**-S02**	3,062	77,77	2,916	0,200	0,095	2,944	0,104	12770	31376
FSE-0312	**-S02**	3,125	79,38	2,955	0,237	0,095	2,987	0,104	15242	32021
FSE-0318	**-S02**	3,187	80,95	3,016	0,237	0,095	3,049	0,104	15544	32657
FSE-0325	**-S02**	3,250	82,55	3,079	0,237	0,095	3,112	0,104	15851	33302
FSE-0331	**-S02**	3,312	84,12	3,140	0,248	0,115	3,174 +0,000/-0,014	0,124	16154	39088
FSE-0337	**-S02**	3,375	85,73	3,203 +0,000/-0,035	0,248	0,115	3,237	0,124	16461	39831
FSE-0343	**-S02**	3,437	87,30	3,264	0,248	0,115	3,299	0,124	16763	40563
FSE-0350	**-S02**	3,500	88,90	3,326	0,248	0,115	3,362	0,124	17071	41307
FSE-0356	**-S02**	3,562	90,47	3,378	0,248	0,115	3,424	0,124	17373	42038

[1] Based on a groove material yield strength of 45000 psi and a safety factor of 2.
[2] Based on a safety factor of 3.
[3] Square edge wire.
** See page 90 for different End Types.*

FSE Series

Constant Section Imperial Rings External Continued

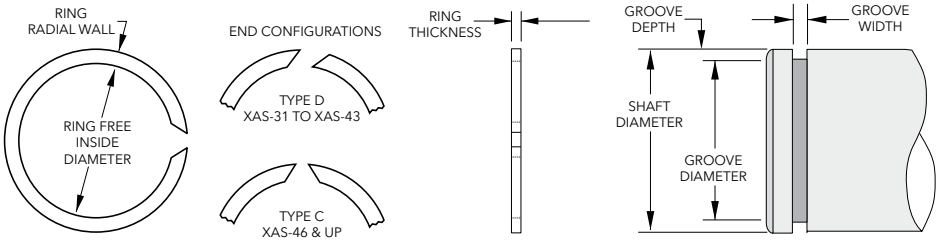
Smalley Part Number[3]		Shaft Diameter		Ring			Groove		Thrust Capacity	
Carbon Steel	Add Suffix 302 SS	in	mm	Inside Diameter (in)	Radial Wall (in)	Thickness (in)	Diameter (in)	Width (in)	Groove Yield[1] (lb)	Ring Shear[2] (lb)
FSE-0362	**-S02**	3,625	92,08	3,451 +0,000/-0,035	0,248	0,115 ±0,003	3,487 +0,000/-0,014	0,124	17680	42782
FSE-0368	**-S02**	3,687	93,65	3,512	0,248	0,115	3,549	0,124	17983	43514
FSE-0375	**-S02**	3,750	95,25	3,570	0,248	0,115	3,612	0,124	18290	44257
FSE-0381	**-S02**	3,812	96,82	3,636	0,248	0,115	3,674	0,124	18592	44989
FSE-0387	**-S02**	3,875	98,43	3,689	0,248	0,115	3,737	0,124	18900	45732
FSE-0393	**-S02**	3,937	100,00	3,760	0,248	0,115	3,799	0,124	19202	46464
FSE-0400	**-S02**	4,000	101,60	3,828	0,248	0,115	3,862	0,124	19509	47208
FSE-0412	**-S02**	4,125	104,78	3,930	0,265	0,153 ±0,004	3,967 +0,000/-0,021	0,163	23035	62126
FSE-0425	**-S02**	4,250	107,95	4,050	0,265	0,153	4,092	0,163	23733	64008
FSE-0437	**-S02**	4,375	111,13	4,174	0,265	0,153	4,217	0,163	24431	65891
FSE-0450	**-S02**	4,500	114,30	4,297 +0,000/-0,051	0,265 ±0,005	0,153	4,342	0,163	25129	67774
FSE-0462	**-S02**	4,625	117,48	4,421	0,265	0,153	4,467	0,163	25827	69656
FSE-0475	**-S02**	4,750	120,65	4,530	0,265	0,153	4,592	0,163	26525	71539
FSE-0487	**-S02**	4,875	123,83	4,668	0,265	0,153	4,717	0,163	27223	73421
FSE-0500	**-S02**	5,000	127,00	4,792	0,265	0,153	4,842	0,163	27921	75304
FSE-0525	**-S02**	5,250	133,35	5,039	0,265	0,153	5,092	0,163	29317	79069
FSE-0550	**-S02**	5,500	139,70	5,292	0,265	0,153	5,342	0,163	30713	82834
FSE-0575	**-S02**	5,750	146,05	5,535	0,265	0,153	5,592	0,163	32109	86599
FSE-0600	**-S02**	6,000	152,40	5,744 +0,000/-0,060	0,316	0,153	5,804 +0,000/-0,024	0,163	41563	90365
FSE-0625	**-S02**	6,250	158,75	5,992	0,316	0,153	6,054	0,163	43295	94130
FSE-0650	**-S02**	6,500	165,10	6,236	0,316	0,153	6,304	0,163	45027	97895
FSE-0675	**-S02**	6,750	171,45	6,486	0,316 ±0,006	0,153	6,554	0,163	46759	101727
FSE-0700	**-S02**	7,000	177,80	6,734	0,316	0,153	6,804	0,163	48490	105494
FSE-0725	**-S02**	7,250	184,15	6,993	0,316	0,153	7,054	0,163	50222	109262
FSE-0750	**-S02**	7,500	190,50	7,219	0,316	0,153	7,304	0,163	51954	113030
FSE-0775	**-S02**	7,750	196,85	7,477 +0,000/-0,070	0,316	0,153	7,554	0,163	53686	116797
FSE-0800	**-S02**	8,000	203,20	7,683	0,435	0,192	7,764 +0,000/-0,028	0,203	66727	142932
FSE-0825	**-S02**	8,250	209,55	7,940	0,435	0,192	8,014	0,203	68813	147399
FSE-0850	**-S02**	8,500	215,90	8,179	0,435	0,192	8,264	0,203	70898	151866
FSE-0875	**-S02**	8,750	222,25	8,427	0,435	0,192	8,514	0,203	72983	156332
FSE-0900	**-S02**	9,000	228,60	8,673	0,435	0,192	8,764	0,203	75068	160799
FSE-0925	**-S02**	9,250	234,95	8,922	0,435	0,192	9,014	0,203	77154	165265
FSE-0950	**-S02**	9,500	241,30	9,130	0,435 ±0,007	0,192 ±0,005	9,240	0,203	87297	169732
FSE-0975	**-S02**	9,750	247,65	9,393	0,435	0,192	9,490	0,203	89594	174199
FSE-1000	**-S02**	10,000	254,00	9,586 +0,000/-0,091	0,500	0,192	9,686	0,203	110977	178665
FSE-1025	**-S02**	10,250	260,35	9,826	0,500	0,192	9,936	0,203	113751	183132
FSE-1050	**-S02**	10,500	266,70	10,081	0,500	0,192	10,186	0,203	116526	187599
FSE-1075	**-S02**	10,750	273,05	10,329	0,500	0,192	10,436	0,203	119300	192065
FSE-1100	**-S02**	11,000	279,40	10,584	0,500	0,192	10,686 +0,000/-0,031	0,203 +0,007/-0,000	122074	196532

[1] Based on a groove material yield strength of 45000 psi and a safety factor of 2.
[2] Based on a safety factor of 3.
[3] Square edge wire.
** See page 90 for different End Types.*

XAS Series

Constant Section Imperial Rings External





Product Dimensions: All dimensions in inches unless otherwise specified.

Smalley Part Number[3]		Shaft Diameter		Ring				Groove		Thrust Capacity	
Carbon Steel	Add Suffix 302 SS	in	mm	Inside Diameter (in)	Radial Wall (in)	Thickness (in)		Diameter (in)	Width (in)	Groove Yield[1] (lb)	Ring Shear[2] (lb)
XAS-31	**-S02**	0,312	7,92	0,281 +0,000/-0,020	0,040 +0,000/-0,015	0,025 ±0,003	±0,002	0,290 ±0,002	0,028 +,003/-,000	243	977
XAS-34	**-S02**	0,344	8,74	0,312	0,040	0,025		0,322	0,028	267	1077
XAS-35	**-S02**	0,354	8,99	0,320	0,040	0,025		0,330	0,028	300	1108
XAS-37	**-S02**	0,375	9,53	0,341	0,040	0,025		0,351	0,028	318	1174
XAS-39	**-S02**	0,393	9,98	0,359	0,040	0,025		0,369	0,028	333	1231
XAS-40	**-S02**	0,406	10,31	0,372	0,040	0,025		0,382	0,028	344	1271
XAS-43	**-S02**	0,438	11,13	0,402	0,040	0,025		0,412	0,028	402	1371
XAS-46	**-S02**	0,469	11,91	0,433	0,040	0,025		0,443	0,028	431	1468
XAS-50	**-S02**	0,500	12,70	0,464	0,048	0,035		0,474	0,039	459	2073
XAS-55	**-S02**	0,551	14,00	0,514	0,048	0,035		0,524	0,039	526	2285
XAS-56	**-S02**	0,562	14,27	0,524	0,048	0,035		0,534	0,039	556	2331
XAS-59	**-S02**	0,594	15,09	0,555	0,048	0,035		0,566	0,039	588	2463
XAS-62	**-S02**	0,625	15,88	0,586 +0,000/-0,025	0,062	0,035		0,597	0,039	619	2592
XAS-66	**-S02**	0,669	16,99	0,630	0,062	0,035		0,640	0,039	686	2774
XAS-68	**-S02**	0,688	17,48	0,644	0,062	0,042		0,656	0,046	778	3458
XAS-75	**-S02**	0,750	19,05	0,703	0,062	0,042		0,716	0,046	901	3770
XAS-78	**-S02**	0,781	19,84	0,733	0,062	0,042		0,745	0,046	994	3926
XAS-81	**-S02**	0,812	20,62	0,764	0,062	0,042		0,776	0,046	1033	4082
XAS-87	**-S02**	0,875	22,23	0,820	0,078	0,042		0,835	0,046	1237	4398
XAS-93	**-S02**	0,938	23,83	0,881	0,078	0,042		0,896	0,046	1392	4715
XAS-98	**-S02**	0,984	24,99	0,925	0,078	0,042		0,940	0,046	1530	4946
XAS-100	**-S02**	1,000	25,40	0,941	0,093	0,042		0,956 ±0,003	0,046	1555	5027
XAS-102	**-S02**	1,023	25,98	0,962 +0,000/-0,031	0,093	0,042		0,977	0,046	1663	5142
XAS-106	**-S02**	1,062	26,97	1,000	0,093	0,050		1,016	0,056	1727	6272
XAS-112	**-S02**	1,125	28,58	1,060	0,093	0,050	±0,002	1,075	0,056	1988	6644
XAS-118	**-S02**	1,188	30,18	1,121	0,093	0,050		1,136	0,056	2183	7017
XAS-125	**-S02**	1,250	31,75	1,179	0,093	0,050		1,194	0,056	2474	7383
XAS-131	**-S02**	1,312	33,32	1,232	0,093	0,050		1,250	0,056	2875	7749
XAS-137	**-S02**	1,375	34,93	1,291	0,109	0,050		1,309	0,056	3207	8121
XAS-143	**-S02**	1,438	36,53	1,351	0,109	0,050		1,370	0,056	3456	8493
XAS-150	**-S02**	1,500	38,10	1,408	0,109	0,050		1,430 ±0,004	0,056	3711	8859
XAS-156	**-S02**	1,562	39,67	1,467	0,125	0,062		1,490	0,068	3975	11002
XAS-162	**-S02**	1,625	41,28	1,527	0,125	0,062		1,551	0,068	4250	11446
XAS-168	**-S02**	1,687	42,85	1,581	0,125	0,062		1,611	0,068	4531	11882
XAS-175	**-S02**	1,750	44,45	1,640	0,125	0,062		1,670	0,068	4948	12326
XAS-177	**-S02**	1,771	44,98	1,657	0,141	0,062		1,687	0,068	5258	12474
XAS-181	**-S02**	1,812	46,02	1,698	0,141	0,062		1,728	0,068	5379	12763
XAS-187	**-S02**	1,875	47,63	1,759	0,156	0,062		1,789	0,068	5699	13206
XAS-196	**-S02**	1,969	50,01	1,849	0,156	0,062		1,879	0,068	6263	13869
XAS-200	**-S02**	2,000	50,80	1,880 +0,000/-0,046	0,156	0,062		1,910	0,068	6362	14087
XAS-206	**-S02**	2,062	52,37	1,936	0,156	0,078	±0,005	1,966	0,086	6996	17491
XAS-212	**-S02**	2,125	53,98	1,997	0,156	0,078		2,027	0,086	7360	18025
XAS-215	**-S02**	2,156	54,76	2,026	0,156	0,078		2,056	0,086	7620	18288
XAS-225	**-S02**	2,250	57,15	2,116	0,156	0,078		2,146 ±0,006	0,086	8270	19085
XAS-231	**-S02**	2,312	58,72	2,174	0,187	0,078		2,204	0,086	8825	19611
XAS-237	**-S02**	2,375	60,33	2,235	0,187	0,078		2,265	0,086	9233	20145
XAS-243	**-S02**	2,437	61,90	2,295	0,187	0,078		2,325	0,086	9647	20671
XAS-250	**-S02**	2,500	63,50	2,356	0,187	0,078		2,386	0,086	10073	21206
XAS-255	**-S02**	2,559	65,00	2,413	0,187	0,078		2,443	0,086	10491	21706
XAS-262	**-S02**	2,625	66,68	2,475	0,187	0,078		2,505	0,086	11133	22266

[1] Based on a groove material yield strength of 45000 psi and a safety factor of 2.
[2] Based on a safety factor of 3.
[3] Square edge wire.
** See page 90 for different End Types.*

XAS Series

Constant Section Imperial Rings External Continued

Smalley Part Number[3]		Shaft Diameter		Ring			Groove		Thrust Capacity	
Carbon Steel	Add Suffix 302 SS	in	mm	Inside Diameter (in)	Radial Wall (in)	Thickness (in)	Diameter (in)	Width (in)	Groove Yield[1] (lb)	Ring Shear[2] (lb)
XAS-268	**-S02**	2,687	68,25	2,535 0,000/-0,046	0,187	0,078	2,565	0,086	11586	22792
XAS-275	**-S02**	2,750	69,85	2,594	0,187	0,093	2,624	0,103	12246	27992
XAS-287	**-S02**	2,875	73,03	2,713	0,187	0,093	2,743	0,103	13413	29264
XAS-293	**-S02**	2,937	74,60	2,771	0,187	0,093	2,801	0,103	14117	29895
XAS-300	**-S02**	3,000	76,20	2,830	0,218	0,093	2,860	0,103	14844	30536
XAS-306	**-S02**	3,062	77,77	2,890	0,218	0,093	2,920	0,103	15367	31167
XAS-312	**-S02**	3,125	79,38	2,951	0,218	0,093	2,981	0,103	15904	31809
XAS-315	**-S02**	3,156	80,16	2,980	0,218	0,093	3,010	0,103	16285	32124
XAS-325	**-S02**	3,250	82,55	3,070	0,250	0,093	3,100	0,103	17230	33081
XAS-334	**-S02**	3,344	84,94	3,160	0,250	0,093	3,190	0,103	18201	34038
XAS-343	**-S02**	3,437	87,30	3,251	0,250	0,093	3,281	0,103	18950	34984
XAS-350	**-S02**	3,500	88,90	3,305	0,250	0,109	3,340	0,120	19792	40017
XAS-354	**-S02**	3,543	89,99	3,346	0,250	0,109	3,381	0,120	20286	40508
XAS-362	**-S02**	3,625	92,08	3,423	0,250	0,109	3,458	0,120	21396	41446
XAS-368	**-S02**	3,687	93,65	3,482	0,250	0,109	3,517	0,120	22153	42155
XAS-375	**-S02**	3,750	95,25	3,541	0,250	0,109	3,576	0,120	23061	42875
XAS-387	**-S02**	3,875	98,43	3,657	0,281	0,109	3,697	0,120	24378	44304
XAS-393	**-S02**	3,938	100,03	3,713	0,281	0,109	3,758	0,120	25052	45024
XAS-400	**-S02**	4,000	101,60	3,771	0,281	0,109	3,816	0,120	26012	45733
XAS-425	**-S02**	4,250	107,95	4,016	0,281	0,109	4,066	0,120	27638	48592
XAS-437	**-S02**	4,375	111,13	4,141	0,281	0,109	4,191	0,120	28451	50021
XAS-450	**-S02**	4,500	114,30	4,255	0,312	0,109	4,310	0,120	30218	51450
XAS-475	**-S02**	4,750	120,65	4,495	0,312	0,109	4,550	0,120	33576	54308
XAS-500	**-S02**	5,000	127,00	4,730	0,312	0,109	4,790	0,120	37110	57167
XAS-525	**-S02**	5,250	133,35	4,970	0,375	0,125	5,030	0,139	40821	65732
XAS-550	**-S02**	5,500	139,70	5,206	0,375	0,125	5,266	0,139	45486	68862
XAS-575	**-S02**	5,750	146,05	5,446	0,375	0,125	5,506	0,139	49586	71992
XAS-590	**-S02**	5,900	149,86	5,600	0,375	0,125	5,656	0,139	50880	73870
XAS-600	**-S02**	6,000	152,40	5,687	0,375	0,125	5,746	0,139	53863	75122
XAS-625	**-S02**	6,250	158,75	5,916	0,437	0,156	5,986	0,174	58316	94130
XAS-650	**-S02**	6,500	165,10	6,151	0,437	0,156	6,226	0,174	62946	97895
XAS-675	**-S02**	6,750	171,45	6,386	0,437	0,156	6,466	0,174	67752	101660
XAS-700	**-S02**	7,000	177,80	6,621	0,437	0,156	6,706	0,174	72736	105426
XAS-725	**-S02**	7,250	184,15	6,840	0,500	0,187	6,930	0,209	81996	124330
XAS-750	**-S02**	7,500	190,50	7,090	0,500	0,187	7,180	0,209	84823	128617
XAS-800	**-S02**	8,000	203,20	7,560	0,500	0,187	7,660	0,209	96133	137191
XAS-850	**-S02**	8,500	215,90	8,050	0,500	0,187	8,160	0,209	102141	145766
XAS-900	**-S02**	9,000	228,60	8,545	0,500	0,187	8,660	0,209	108149	154340
XAS-925	**-S02**	9,250	234,95	8,800	0,500	0,187	8,910	0,209	111153	158627
XAS-950	**-S02**	9,500	241,30	9,040	0,500	0,187	9,160	0,209	114158	162915
XAS-1000	**-S02**	10,000	254,00	9,535	0,500	0,187	9,660	0,209	120166	171489

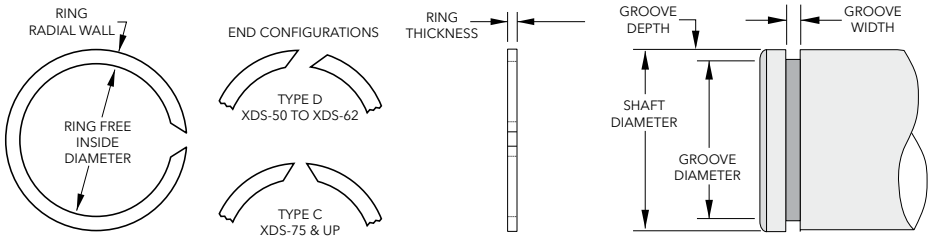
+0,000/-0,062 (Inside Diameter)
+0,000/-0,078
+0,000/-0,093
+0,000/-0,125
+0,000/-0,156
±0,005 (Radial Wall)
±0,002 (Thickness)
±0,006 (Diameter)
±0,008 (Diameter)
+0,005/-0,000 (Width)
+0,006/-0,000 (Groove Yield)
+0,008/-0,000 (Ring Shear)

[1] Based on a groove material yield strength of 45000 psi and a safety factor of 2.
[2] Based on a safety factor of 3.
[3] Square edge wire.
** See page 90 for different End Types.*

XDS Series

Constant Section Imperial Rings External





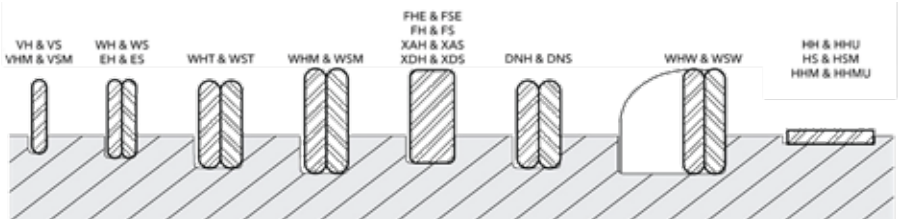
Product Dimensions: All dimensions in inches unless otherwise specified.

Smalley Part Number[3]		Shaft Diameter		Ring			Groove		Thrust Capacity	
Carbon Steel	Add Suffix 302 SS	mm	in	Inside Diameter (in)	Radial Wall (in)	Thickness (in)	Diameter (in)	Width (in)	Groove Yield[1] (lb)	Ring Shear[2] (lb)
XDS-50	**-S02**	12,70	0,500	0,465 +0,000/-0,025	0,048	0,035	0,474 ±0,002	0,039	459	2073
XDS-62	**-S02**	15,88	0,625	0,587 +0,000/-0,025	0,062 ±0,003	0,035	0,597 ±0,002	0,039	619	2592
XDS-75	**-S02**	19,05	0,750	0,704 +0,000/-0,025	0,078 ±0,003	0,042	0,716 ±0,002	0,046	901	3770
XDS-87	**-S02**	22,23	0,875	0,823 +0,000/-0,031	0,093 ±0,003	0,042	0,833 ±0,003	0,046	1299	4398
XDS-100	**-S02**	25,40	1,000	0,944 +0,000/-0,031	0,094 ±0,003	0,042	0,954 ±0,003	0,046	1626	5027
XDS-112	**-S02**	28,58	1,125	1,065 +0,000/-0,031	0,125 ±0,003	0,042	1,077 ±0,003	0,046	1909	5655
XDS-118	**-S02**	30,15	1,187	1,120 +0,000/-0,031	0,125 ±0,003	0,042	1,135 ±0,003	0,046	2182	5967
XDS-125	**-S02**	31,75	1,250	1,179 +0,000/-0,031	0,125 ±0,003	0,042	1,194 ±0,003	0,046	2474	6283
XDS-131	**-S02**	33,32	1,312	1,232 +0,000/-0,031	0,125 ±0,003	0,042	1,252 ±0,004	0,046	2782	6595
XDS-137	**-S02**	34,93	1,375	1,289 +0,000/-0,031	0,125 ±0,003	0,042	1,309 ±0,004	0,046	3207	6912
XDS-143	**-S02**	36,50	1,437	1,349 +0,000/-0,031	0,125 ±0,003	0,042	1,369 ±0,004	0,046	3454	7223
XDS-150	**-S02**	38,10	1,500	1,410 +0,000/-0,031	0,125 ±0,003	0,042	1,430 ±0,004	0,046	3711	7540
XDS-162	**-S02**	41,28	1,625	1,520 +0,000/-0,062	0,156 ±0,003	0,042	1,545 ±0,004	0,046	4595	8168
XDS-168	**-S02**	42,85	1,687	1,582 +0,000/-0,062	0,156 ±0,003	0,042	1,607 ±0,004	0,046	4770	8480
XDS-175	**-S02**	44,45	1,750	1,645 +0,000/-0,062	0,156 ±0,003	0,042	1,670 ±0,004	0,046	4948	8796
XDS-193	**-S02**	49,20	1,937	1,832 +0,000/-0,062	0,156 ±0,003	0,042	1,857 ±0,004	0,046	5477	9736
XDS-200	**-S02**	50,80	2,000	1,895 +0,000/-0,062	0,156 ±0,003	0,042	1,920 ±0,004	0,046	5655	10053
XDS-218	**-S02**	55,55	2,187	2,082 +0,000/-0,062	0,156 ±0,003	0,042	2,107 ±0,004	0,046	6184	10993
XDS-225	**-S02**	57,15	2,250	2,145 +0,000/-0,062	0,156 ±0,003	0,042	2,170 ±0,004	0,046	6362	11310
XDS-237	**-S02**	60,33	2,375	2,270 +0,000/-0,062	0,156 ±0,003	0,042	2,295 ±0,004	0,046	6715	11938
XDS-250	**-S02**	63,50	2,500	2,390 +0,000/-0,062	0,156 ±0,003	0,042	2,420 ±0,004	0,046	7069	12566
XDS-275	**-S02**	69,85	2,750	2,596 +0,000/-0,093	0,187 ±0,005	0,062 ±0,002	2,626 ±0,006	0,068 +0,004/-0,000	12052	19369
XDS-293	**-S02**	74,60	2,937	2,783 +0,000/-0,093	0,187 ±0,005	0,062 ±0,002	2,813 ±0,006	0,068 +0,004/-0,000	12871	20687
XDS-300	**-S02**	76,20	3,000	2,846 +0,000/-0,093	0,187 ±0,005	0,062 ±0,002	2,876 ±0,006	0,068 +0,004/-0,000	13148	21130
XDS-312	**-S02**	79,38	3,125	2,965 +0,000/-0,093	0,187 ±0,005	0,062 ±0,002	3,000 ±0,006	0,068 +0,004/-0,000	13806	22011
XDS-325	**-S02**	82,55	3,250	3,090 +0,000/-0,093	0,187 ±0,005	0,062 ±0,002	3,125 ±0,006	0,068 +0,004/-0,000	14358	22891
XDS-337	**-S02**	85,73	3,375	3,215 +0,000/-0,093	0,187 ±0,005	0,062 ±0,002	3,250 ±0,006	0,068 +0,004/-0,000	14910	23772
XDS-350	**-S02**	88,90	3,500	3,340 +0,000/-0,093	0,187 ±0,005	0,062 ±0,002	3,375 ±0,006	0,068 +0,004/-0,000	15463	24652
XDS-375	**-S02**	95,25	3,750	3,570 +0,000/-0,078	0,218 ±0,005	0,078 ±0,002	3,610 ±0,006	0,086 +0,005/-0,000	18555	31809
XDS-400	**-S02**	101,60	4,000	3,820 +0,000/-0,078	0,218 ±0,005	0,078 ±0,002	3,860 ±0,006	0,086 +0,005/-0,000	19792	33929
XDS-425	**-S02**	107,95	4,250	4,070 +0,000/-0,078	0,218 ±0,005	0,078 ±0,002	4,110 ±0,006	0,086 +0,005/-0,000	21029	36050
XDS-450	**-S02**	114,30	4,500	4,320 +0,000/-0,078	0,218 ±0,005	0,078 ±0,002	4,360 ±0,006	0,086 +0,005/-0,000	22266	38170
XDS-475	**-S02**	120,65	4,750	4,560 +0,000/-0,078	0,218 ±0,005	0,078 ±0,002	4,610 ±0,006	0,086 +0,005/-0,000	23503	40291
XDS-500	**-S02**	127,00	5,000	4,800 +0,000/-0,078	0,218 ±0,005	0,078 ±0,002	4,860 ±0,006	0,086 +0,005/-0,000	24740	42412
XDS-550	**-S02**	139,70	5,500	5,280 +0,000/-0,125	0,250 ±0,005	0,093 ±0,002	5,340 ±0,006	0,103 +0,005/-0,000	31102	55983
XDS-600	**-S02**	152,40	6,000	5,775 +0,000/-0,125	0,250 ±0,005	0,093 ±0,002	5,840 ±0,008	0,103 +0,005/-0,000	33929	61073
XDS-650	**-S02**	165,10	6,500	6,270 +0,000/-0,125	0,250 ±0,005	0,093 ±0,002	6,340 ±0,008	0,103 +0,005/-0,000	36757	66162
XDS-700	**-S02**	177,80	7,000	6,765 +0,000/-0,125	0,250 ±0,005	0,093 ±0,002	6,840 ±0,008	0,103 +0,005/-0,000	39584	71251
XDS-750	**-S02**	190,50	7,500	7,245 +0,000/-0,156	0,281 ±0,005	0,109 ±0,002	7,320 ±0,008	0,120 +0,005/-0,000	47713	85750
XDS-800	**-S02**	203,20	8,000	7,740 +0,000/-0,156	0,281 ±0,005	0,109 ±0,002	7,820 ±0,008	0,120 +0,005/-0,000	50894	91466

[1] Based on a groove material yield strength of 45000 psi and a safety factor of 2.
[2] Based on a safety factor of 3.
[3] Square edge wire.
** See page 90 for different End Types.*

Relative proportions of rings in grooves

A cross-section of each Spirolox Retaining Ring configuration is illustrated below, comparing groove and ring sections in the same diameter bore or shaft. The heavier retaining ring cross-sections are in deeper and wider grooves, to provide significantly greater thrust capacity.



Interchange Listing

Smalley retaining rings are interchangeable with both imperial and metric retaining ring grooves. Smalley offers free samples of all stock retaining rings to test in your application. Cross reference a standard stamped or snap ring to find the appropriate Smalley retaining ring to fit your application.

SMALLEY®	SPIROLOX® SERIES	MILITARY MIL-DTL-27426	AEROSPACE AS3219	METRIC AEROSPACE MA 4035	EUROPEAN SPECIFICATION DIN	WALDES TRUARC	EATON	INDUSTRIAL RETAINING RING	OTHER RINGS	ANDERTON
VH	UR	---	---	---	**Groove Interchange Only** Use a Smalley retaining ring to fit into the same groove of these stamped retaining rings (circlips).					
VS	US	---	---	---						
WH	RR	/3	AS4299 AS3217	---						
WS	RS	/1	AS4299 AS3218	---						
WHT	RRT	---	---	---	---	---	NAN	---	UHB	---
WST	RST	---	---	---	---	---	XAN	---	USC	---
WHM	RRN	/4	AS4299 AS3215	---	---	N5000 5008	IN	3000 4000	HO HOI UHO	N1300
WSM	RSN	/2	AS4299 AS3216	---	---	5100 5108	EN	3100 4100	SH SHI USH	N1400
DNH	---	---	---	---	DIN 472	---	---	---	DHO	D1300
DNS	---	---	---	---	DIN 471	---	---	---	DSH	D1400
EH	---	---	---	MA 4017	---	---	---	---	---	---
ES	---	---	---	MA 4016	---	---	---	---	---	---
FH	---	---	---	---	DIN 472	---	---	---	DHO	D1300
FS	---	---	---	---	DIN 471	---	---	---	DSH	D1400
XAH	---	---	---	---	---	---	NAN	---	UHB	---
XAS	---	---	---	---	---	---	XAN	---	USC	---
XDH	---	---	---	---	---	---	ND	---	HN	---
XDS	---	---	---	---	---	---	XD	---	SNL	---
XNH	---	---	---	---	---	---	IN	---	UHO	---
XNS	---	---	---	---	---	---	EN	---	USH	---

Laminar Seal Rings Introduction

Laminar Seals

Smalley's laminar seals are flat wire ring sets that, together, form labyrinth seals used to protect an assembly from damaging environments. Their arrangement and orientation is dictated by the application. Standard materials for our laminar seals are carbon and 302 stainless steel, unlike traditional rubber seals. This makes them much more durable in applications that operate at high speeds, at higher temperatures, or in corrosive environments.

Standard Laminar Seal Sets Available:

- Single-Turn, Three Ring Sets
- Single-Turn, Five Ring Sets
- Two-Turn, Two Ring Sets
- Two-Turn, Three Ring Sets



Custom Laminar Seals

Smalley Engineers are available to help design custom laminar seals if one of our standard sets do not fit your exact needs. Because all of our products are edgewound (coiled, not stamped), there is no new tooling required for custom configurations. This means that we can produce prototypes quickly and economically for high or low volume orders, and easily make adjustments to designs throughout the No-Tooling-Charges™ production process.

Customizable features include:

- Diameter
- Material
- Tolerance
- Radial wall
- Wire thickness
- Number of turns
- Number of rings in a set

Interchange Listing	
Smalley	Fey
QH	AS (FK3)
QHK	ASK (FK3)
QS	IS (FK3)
QSK	ISK (FK3)
QHD	ASD (FK6)
QHKD	ASKD (FK6)
QSD	ISD (FK6)
QSKD	ISKD (FK6)
CONSULT SMALLEY ENGINEERING	FK5



Laminar Seal Ring Types

Standard Laminar Ring Sets Available

Laminar Seals
Single-Turn Ring Sets

Single-Turn laminar seals consist of three single-turn rings stacked parallel to each other, all clinging to the bore or shaft. This configuration is used to seal applications from light contamination and/or slightly higher temperatures while retaining grease or lubricant. Single-turn, five ring sets will be configured with rings that cling in an alternating pattern to both the bore and shaft. These are used for applications in environments with more contamination and/or high temperatures that would make grease or lubricant less viscous.

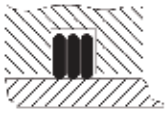




YH Series
QH Series
Internal- Light Duty
1 Set= 3 individual rings
(rings rotate with bore only)



YHK Series
QHK Series
Internal- Medium Duty
1 Set= 5 individual rings
(3 rings rotate with bore & 2 rings rotate with shaft)



YS Series
QS Series
External- Light Duty
1 Set= 3 individual rings
(rings rotate with shaft only)



YSK Series
QSK Series
External- Medium Duty
1 Set= 5 individual rings
(3 rings rotate with shaft & 2 rings rotate with bore)

Laminar Seals
Two-Turn Ring Sets

Laminar seals are also made in sets of two-turn retaining rings. These seals are ideal for applications set in environments with high contamination risk. Sets of two-turn rings provide the highest level of protection against corrosive contaminants, dirt, extensive water splashing, and high temperatures. Two-turn ring sets with alternate cling provide the most application protection.

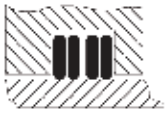




YHD Series
QHD Series
Internal- Medium/Heavy Duty
1 Set= 2 individual rings
(rings rotate with bore only)



YHKD Series
QHKD Series
Internal- Heavy Duty
1 Set= 3 individual rings
(2 rings rotate with bore & 1 ring rotates with shaft)

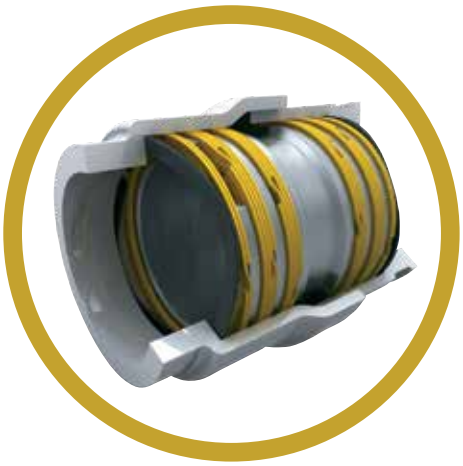


YSD Series
QSD Series
External- Medium/Heavy Duty
1 Set= 2 individual rings
(rings rotate with shaft only)



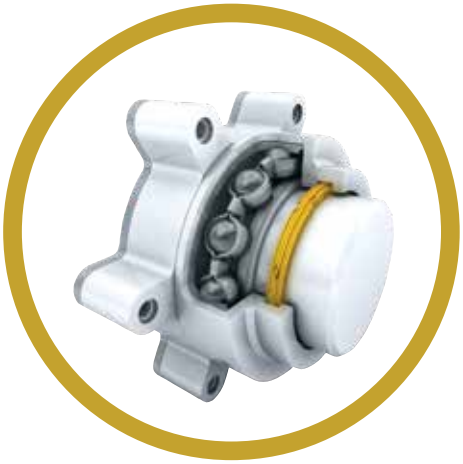
YSKD Series
QSKD Series
External- Heavy Duty
1 Set= 3 individual rings
(2 rings rotate with shaft & 1 ring rotates with bore)

Laminar Seal Ring Applications



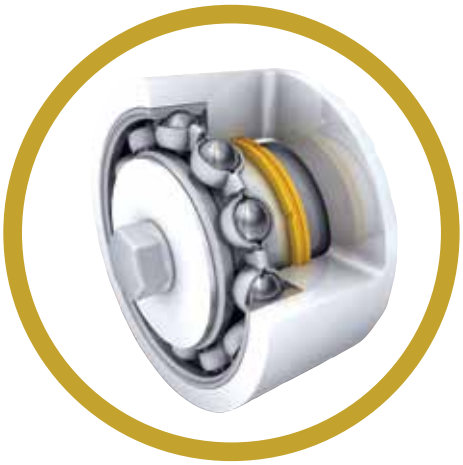
Coupling

The custom seal arrangement was designed for optimum protection against contamination. Gases build up pressure in a center cavity as seals on either side prevent contaminants from entering.



Bearing Protection

A three ring laminar seal set retains grease/lubricant and prevents contaminants such as dirt or water from penetrating into critical assembly components.



Pulley Idler

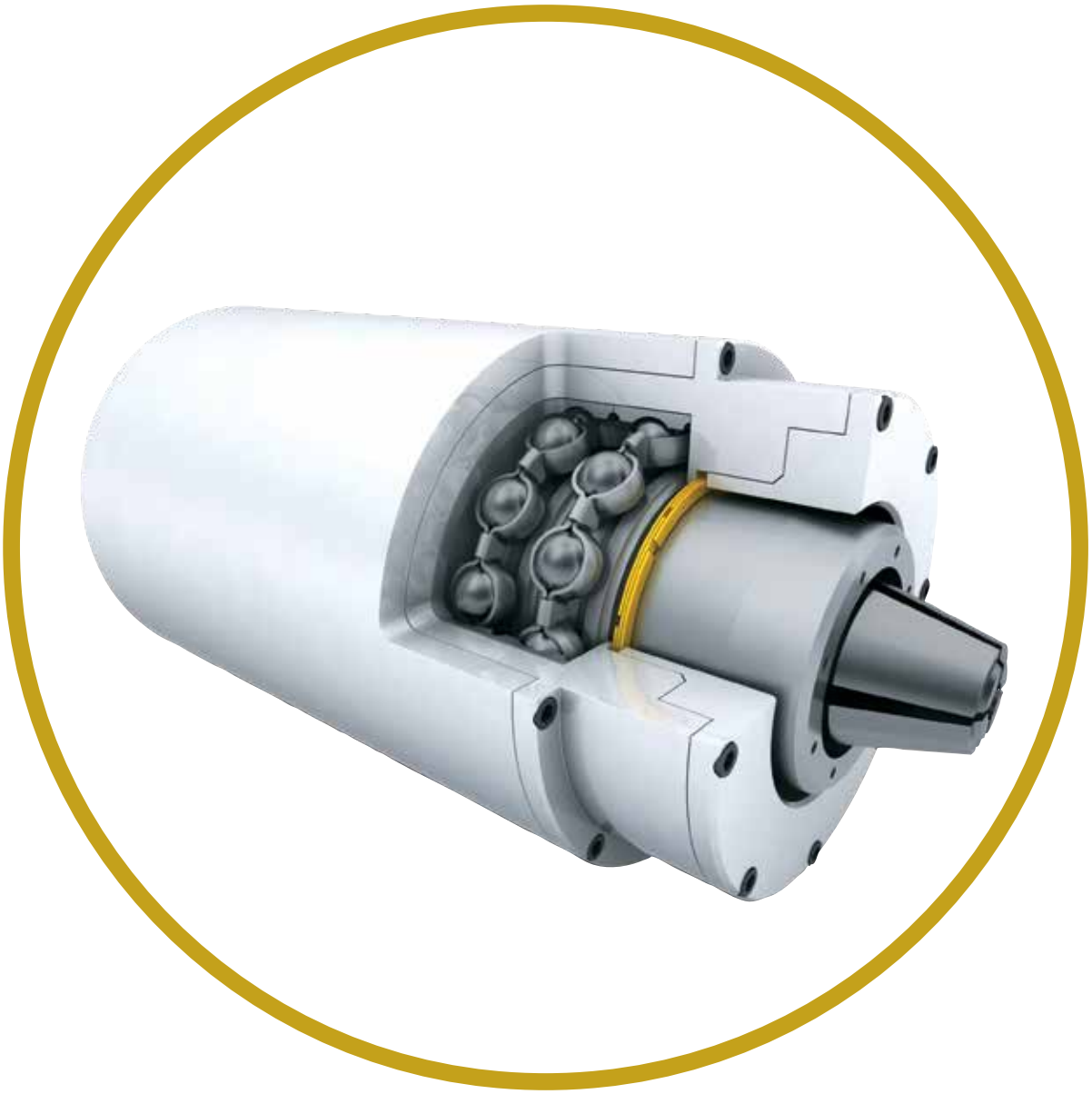
The custom ring set extends the ball bearing lifespan by limiting contaminants from penetrating precision bearing surfaces. When the shaft rotates, only the groove ring rotates while the housing ring remain stationary.

Laminar Seal Ring
Application Spotlight

High Speed Spindle

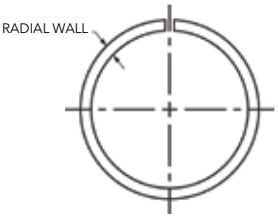
This high-speed spindle consists of two tandem bearings, reducing friction between the moving parts of the assembly which is rotating at high speeds. This particular application is set in a harsh environment exposed to corrosive elements. The ball bearings need to be protected from such elements in order to operate correctly.

A single-turn, three ring seal set was designed into the spindle to protect the bearings from any contaminants. The rings in the set cling to the shaft due to the high rotational speeds of the spindle. The laminar seal is manufactured from steel, making it more durable than a typical rubber seal. While the laminar seal is not the primary seal, it is the final outer seal that protects the bearing.



QH, QHK, QS and QSK Series
Single-Turn Ring Sets





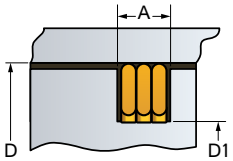


Product Dimensions: All dimensions in millimeters unless otherwise specified.

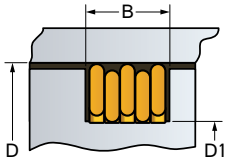
Bore Shaft[1]			Groove[2] Width			Ring Dimensions				Groove Diameter			Groove Diameter		
D			A		B	RW		T		D2			D1		
15	-	24,9	2,2	+0,10/-0,00	3,6	1,0	±0,10	0,65	+0,04/-0,02	(D)	+ 2,6	+0,20/-0,00	(D)	- 2,6	+0,00/-0,20
25	-	29,9	2,2		3,6	1,2		0,65			+ 3,0			- 3,0	
30	-	35,9	2,2		3,6	1,5		0,65			+ 3,6			- 3,6	
36	-	42,9	2,2		3,6	1,8		0,65			+ 4,2			- 4,2	
43	-	48,9	2,4		4,0	2,2		0,72			+ 5,0			- 5,0	
49	-	51,9	2,4		4,0	2,4		0,72			+ 5,4			- 5,4	
52	-	59,9	2,4		4,0	2,6		0,72			+ 5,8			- 5,8	
60	-	69,9	2,7		4,5	2,8		0,82			+ 6,2			- 6,2	
70	-	74,9	2,7		4,5	3,1		0,82			+ 6,8			- 6,8	
75	-	79,9	2,7		4,5	3,3		0,82			+ 7,2			- 7,2	
80	-	89,9	2,7		4,5	3,5		0,82			+ 7,6			- 7,6	
90	-	99,9	2,7		4,5	3,8		0,82			+ 8,2			- 8,2	
100	-	104,9	2,7		4,5	4,1		0,82			+ 8,8			- 8,8	
105	-	109,9	3,3	+0,15/-0,00	5,5	4,3	+0,10/-0,20	0,98	+0,05/-0,03		+ 9,2	+0,25/-0,00		- 9,2	+0,00/-0,25
110	-	119,9	3,3		5,5	4,6		0,98			+ 9,8			- 9,8	
120	-	129,9	3,3		5,5	5,0		0,98			+10,8			-10,8	
130	-	149,9	3,3		5,5	5,5		0,98			+11,8			-11,8	
150	-	170,9	3,4	+0,20/-0,00	5,6	6,0	+0,15/-0,30	1,00	+0,06/-0,04		+13,0	+0,30/-0,00		-13,0	+0,00/-0,30
150[3]	-	170,9	5,1		8,2	6,0		1,50			+13,0			-13,0	
171	-	199,9	3,4		5,6	7,0		1,00			+15,0			-15,0	
171[3]	-	199,9	5,1		8,2	7,0		1,50			+15,0			-15,0	
200	-	259,9	4,1		6,6	8,0		1,20			+18,0			-18,0	
200[3]	-	259,9	5,1		8,2	8,0		1,50			+18,0			-18,0	
260	-	319,9	5,1		8,2	9,0		1,50			+20,0			-20,0	
320	-	399,9	5,2		8,3	10,0		1,50			+22,0			-22,0	
400	-	439,9	5,2		8,3	11,0		1,50			+24,0			-24,0	
440	-	600,9	5,2	+0,25/-0,00	8,3	12,0	+0,20/-0,40	1,50	+0,07/-0,05		+26,0	+0,40/-0,00		-26,0	+0,00/-0,40
440[3]	-	600,0	8,3		13,5	12,0		2,50			+26,0			-26,0	
601	-	699,9	8,3		13,5	14,0		2,50			+32,0			-32,0	
700	-	799,9	8,3		13,5	16,0		2,50			+36,0			-36,0	
800	-	899,9	8,3		13,5	18,0		2,50			+40,0			-40,0	
900	-	999,9	8,3		13,5	20,0		2,50			+44,0			-44,0	
1000	-	1300,0	8,4		13,6	22,0		2,50			+48,0			-48,0	

Contact Smalley Engineering for assistance.

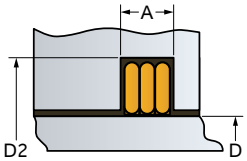
QH



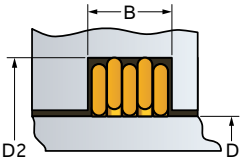
QHK



QS



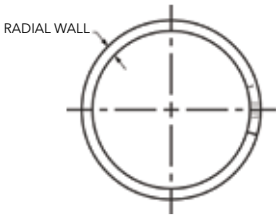
QSK



[1] Standard raw materials are carbon steel and 302 stainless steel.
[2] If axial movement occurs during operation, an increase to Groove Width may be necessary to avoid friction between Rings and Groove.
[3] Increased cross-section.

QHD, QHKD, QSD and QSKD Series
Double-Turn Ring Sets







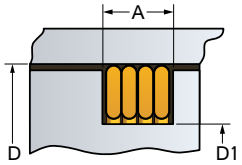
Product Dimensions: All dimensions in millimeters unless otherwise specified.

Bore Shaft[1]	Groove[2] Width		Ring Dimensions		Groove Diameter	Groove Diameter
D	A	B	RW	T	D2	D1
15 - 24,9	2,9	4,3	1,0	1,30	(D) + 2,6	(D) - 2,6
25 - 29,9	2,9	4,3	1,2	1,30	+ 3,0	- 3,0
30 - 35,9	2,9	4,3	1,5	1,30	+ 3,6	- 3,6
36 - 42,9	2,9	4,3	1,8	1,30	+ 4,2	- 4,2
43 - 48,9	3,2	4,8	2,2	1,45	+ 5,0	- 5,0
49 - 51,9	3,2	4,8	2,4	1,45	+ 5,4	- 5,4
52 - 59,9	3,2	4,8	2,6	1,45	+ 5,8	- 5,8
60 - 69,9	3,6	5,4	2,8	1,65	+ 6,2	- 6,2
70 - 74,9	3,6	5,4	3,1	1,65	+ 6,8	- 6,8
75 - 79,9	3,6	5,4	3,3	1,65	+ 7,2	- 7,2
80 - 89,9	3,6	5,4	3,5	1,65	+ 7,6	- 7,6
90 - 99,9	3,6	5,4	3,8	1,65	+ 8,2	- 8,2
100 - 104,9	3,6	5,4	4,1	1,65	+ 8,8	- 8,8
105 - 109,9	4,3	6,4	4,3	1,96	+ 9,2	- 9,2
110 - 119,9	4,3	6,4	4,6	1,96	+ 9,8	- 9,8
120 - 129,9	4,3	6,4	5,0	1,96	+10,8	-10,8
130 - 149,9	4,3	6,4	5,5	1,96	+11,8	-11,8
150 - 170,9	4,4	6,5	6,0	2,00	+13,0	-13,0
150[3] - 170,9	6,5	9,6	6,0	3,00	+13,0	-13,0
171 - 199,9	4,4	6,5	7,0	2,00	+15,0	-15,0
171[3] - 199,9	6,5	9,6	7,0	3,00	+15,0	-15,0
200 - 259,9	5,3	7,8	8,0	2,40	+18,0	-18,0
200[3] - 259,9	6,5	9,6	8,0	3,00	+18,0	-18,0
260 - 319,9	6,5	9,6	9,0	3,00	+20,0	-20,0
320 - 399,9	6,6	9,8	10,0	3,00	+22,0	-22,0
400 - 439,9	6,6	9,8	11,0	3,00	+24,0	-24,0
440 - 600,9	6,6	9,8	12,0	3,00	+26,0	-26,0
440[3] - 600,9	10,6	15,9	12,0	5,00	+26,0	-26,0
601 - 699,9	10,8	16,2	14,0	5,00	+32,0	-32,0
700 - 799,9	10,8	16,2	16,0	5,00	+36,0	-36,0
800 - 899,9	11,0	16,5	18,0	5,00	+40,0	-40,0
900 - 999,9	11,0	16,5	20,0	5,00	+44,0	-44,0
1000 - 1300,0	11,0	16,5	22,0	5,00	+48,0	-48,0

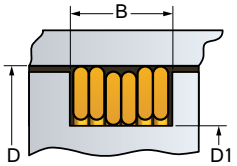
Groove Width A	Groove Width B	Ring T	Groove Diameter D2	Groove Diameter D1
+0,10/-0,00	+0,10/-0,00	±0,10	+0,08/-0,04	+0,20/-0,00	+0,00/-0,20
+0,15/-0,00	+0,15/-0,00	+0,10/-0,20	+0,10/-0,06	+0,25/-0,00	+0,00/-0,25
+0,20/-0,00	+0,20/-0,00	+0,15/-0,30	+0,12/-0,08	+0,30/-0,00	+0,00/-0,30
+0,25/-0,00	+0,25/-0,00	+0,20/-0,40	+0,14/-0,10	+0,40/-0,00	+0,00/-0,40

Contact Smalley Engineering for assistance.

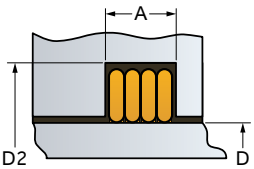
QHD



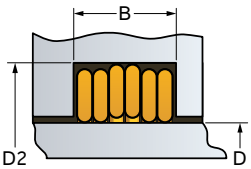
QHKD



QSD



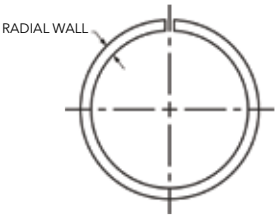
QSKD



[1] Standard raw materials are carbon steel and 302 stainless steel.
[2] If axial movement occurs during operation, an increase to Groove Width may be necessary to avoid friction between Rings and Groove.
[3] Increased cross-section.

YH, YHK, YS and YSK Series
Imperial Single-Turn Ring Sets



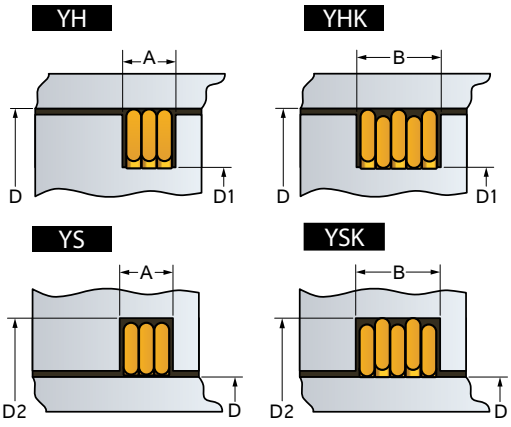




Product Dimensions: All dimensions in inches unless otherwise specified.

Bore Shaft[1]	Groove[2] Width		Ring Dimensions		Groove Diameter	Groove Diameter
D	A	B	RW	T	D2	D1
0,625 - 1,249	0,072 +0,004/-0,000	0,119 +0,004/-0,000	0,055 ±0,004	0,021 ±0,002	(D) +0,134 +0,008/-0,000	(D) -0,134 +0,000/-0,008
1,250 - 1,499	0,072	0,119	0,065	0,021	+0,154	-0,154
1,500 - 1,749	0,084	0,139	0,078	0,025	+0,180	-0,180
1,750 - 2,249	0,102	0,170	0,095	0,031	+0,214	-0,214
2,250 - 2,749	0,102	0,170	0,113	0,031	+0,250	-0,250
2,750 - 2,999	0,102	0,170	0,123	0,031	+0,270	-0,270
3,000 - 3,249	0,102	0,170	0,128	0,031	+0,280	-0,280
3,250 - 3,499	0,102	0,170	0,138	0,031	+0,300	-0,300
3,500 - 3,999	0,102	0,170	0,158	0,031	+0,340	-0,340
4,000 - 4,499	0,102	0,170	0,168	0,031	+0,360	-0,360
4,500 - 4,999	0,131 +0,008/-0,000	0,215 +0,008/-0,000	0,188 ±0,006	0,039 ±0,003	+0,408 +0,012/-0,000	-0,408 +0,000/-0,012
5,000 - 5,499	0,131	0,215	0,200	0,039	+0,432	-0,432
5,500 - 6,249	0,158	0,254	0,225	0,046	+0,490	-0,490
6,250 - 7,749	0,187	0,301	0,250	0,055	+0,540	-0,540
7,750 - 9,999	0,187	0,301	0,312	0,055	+0,702	-0,702
10,000 - 12,499	0,217 +0,010/-0,000	0,346 +0,010/-0,000	0,350 ±0,007	0,063 ±0,004	+0,778	-0,778
12,500 - 14,999	0,217	0,346	0,375	0,063	+0,828	-0,828
15,000 - 19,999	0,307	0,496	0,437	0,093	+0,952	-0,952
20,000 - 24,999	0,310	0,504	0,500 +0,015/-0,010	0,093 ±0,005	+1,158 +0,016/-0,000	-1,158 +0,000/-0,016
25,000 - 29,999	0,310	0,504	0,567	0,093	+1,292	-1,292
30,000 - 50,000	0,310	0,504	0,750	0,093	+1,658	-1,658

Contact Smalley Engineering for assistance.



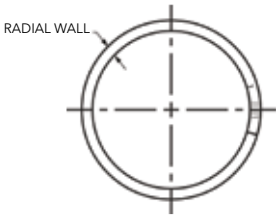
[1] Standard raw materials are carbon steel and 302 stainless steel.

[2] If axial movement occurs during operation, an increase to Groove Width may be necessary to avoid friction between Rings and Groove.

YHD, YHKD, YSD and YSKD Series

Imperial Double-Turn Ring Sets



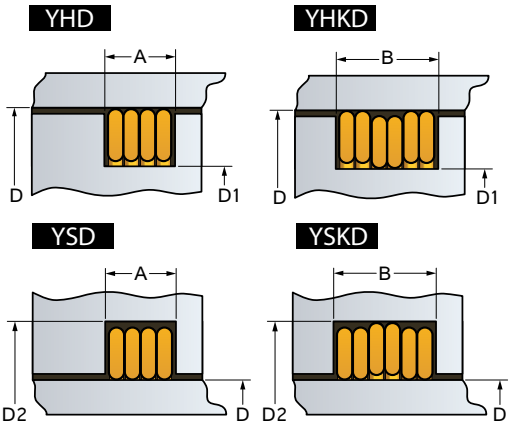




Product Dimensions: All dimensions in inches unless otherwise specified.

Bore Shaft[1]			Groove[2] Width				Ring Dimensions				Groove Diameter		Groove Diameter	
D			A		B		RW		T		D2		D1	
0,625	-	1,249	0,098	+0,004/-0,000	0,145	+0,004/-0,000	0,055	±0,004	0,043	±0,0025	(D) +0,134	+0,008/-0,000	(D) -0,134	+0,000/-0,008
1,250	-	1,499	0,098		0,145		0,065		0,043		+0,154		-0,154	
1,500	-	1,749	0,112		0,166		0,078		0,050		+0,180		-0,180	
1,750	-	2,249	0,136		0,204		0,095		0,062		+0,214		-0,214	
2,250	-	2,749	0,136		0,204		0,113		0,062		+0,250		-0,250	
2,750	-	2,999	0,136		0,204		0,123		0,062		+0,270		-0,270	
3,000	-	3,249	0,136		0,204		0,128		0,062		+0,280		-0,280	
3,250	-	3,499	0,136		0,204		0,138		0,062		+0,300		-0,300	
3,500	-	3,999	0,136		0,204		0,158		0,062		+0,340		-0,340	
4,000	-	4,499	0,136		0,206		0,168		0,062		+0,360		-0,360	
4,500	-	4,999	0,172	+0,008/-0,000	0,254	+0,008/-0,000	0,188	±0,006	0,078	±0,003	+0,408	+0,012/-0,000	-0,408	+0,000/-0,012
5,000	-	5,499	0,172		0,254		0,200		0,078		+0,432		-0,432	
5,500	-	6,249	0,202		0,299		0,225		0,093		+0,490		-0,490	
6,250	-	7,749	0,238		0,353		0,250		0,111		+0,540		-0,540	
7,750	-	9,999	0,242		0,357		0,312		0,111		+0,702		-0,702	
10,000	-	12,499	0,274	+0,010/-0,000	0,405	+0,010/-0,000	0,350	±0,007	0,127	±0,004	+0,778	+0,016/-0,000	-0,778	+0,000/-0,016
12,500	-	14,999	0,278		0,412		0,375		0,127		+0,828		-0,828	
15,000	-	19,999	0,398		0,592		0,437		0,187		+0,952		-0,952	
20,000	-	24,999	0,398		0,596		0,500	+0,015/-0,010	0,187	±0,005	+1,158		-1,158	
25,000	-	29,999	0,405		0,608		0,567		0,187		+1,292		-1,292	
30,000	-	50,000	0,413		0,620		0,750		0,187		+1,658		-1,658	

Contact Smalley Engineering for assistance.



[1] Standard raw materials are carbon steel and 302 stainless steel.

[2] If axial movement occurs during operation, an increase to Groove Width may be necessary to avoid friction between Rings and Groove.

Spring and Cycle Testers

Spring Tester

A compression spring tester is used to inspect load(s) at work height(s).

Smalley designs and builds its own spring testers.

The accuracy of the spring tester relies on:

1. Parallel Plates and Spring Positioning:
   Upper and lower plates must be parallel and spring must be centered.
2. Surface Cleanliness:
   Plates must be free of cracks, scratches, or other physical imperfections. Our surfaces are polished for a smooth, mirror-like finish.
3. Precision Linear Gauges and Load Cells:
   Linear gauges are used to measure the height of the spring while calibrated load cells precisely output the load at a given spring height.



Spring Tester

Cycle Tester

Cycle testing provides a more accurate prediction of cycle life in comparison to our theoretical cycle life equations.

We recommend cycle testing if cycle life is critical in your application, or when calculations show little margin over the cycle requirement.

Ideally, springs should be cycle tested in the actual assembly. When this is not feasible, Smalley offers testing on high-speed cycle testing machinery. The cycle tester can be adjusted to various work heights and stroke lengths to simulate the application.



Cycle Tester

Materials Table

Material	Material Thickness (mm)	Minimum Tensile Strength (N/mm²)	Shear Strength (N/mm²)	Maximum Recommended Operating Temp (°C)	Modulus of Elasticity (N/mm²)	Chemical	AFNOR	Number-DIN
Carbon Steel								
Oil Tempered SAE 1070 – 1090	0,152 - 0,356	1855	1055	121	20,7 x 10⁴	Carbon Steel XC67 to XC75	N/A	1,1231-1,1248[1]
	0,357 - 0,533	1758	1000					
	0,534 - 1,092	1524	869					
	1,093 & larger	1455	827					
Hard Drawn SAE 1060 - 1075	0,152 - 0,762	1586	896					
	0,763 - 2,794	1248	710					
	2,795 - 5,588	1076	614					
Stainless Steel								
AISI 302 AMS-5866	0,051 - 0,559	1448	820	204	19,3 x 10⁴	X10 CrNi 18-8	N/A	1,4310
	0,560 - 1,194	1379	786					
	1,195 - 1,575	1276	724					
	1,576 - 1,880	1207	689					
	1,881 - 2,261	1138	648					
	2,262 & larger	1069	607					
AISI 316 ASTM A313[1]	0,051 - 0,584	1344	765			X 5 CrNiMo 17-12-2	Z 7 CND 17-12-2	1,4401
	0,585 - 1,219	1310	745					
	1,220 - 1,549	1207	683					
	1,550 & larger	1172	669					
17-7 PH/CH900 Condition CH900 AMS-5529		1655[2]	945[2]	343	20,3 x 10⁴	X 7 CrNiAl 17-7	Z 9 CNA 17-07	1,4568
Exotic Alloys								
A-286 AMS-5810		1276[2]	724[2]	538	21,4 x 10⁴	X 6 NiCrTi-MoVB 25-15-2	Z6NCT-DV25-15	1,4980
INCONEL® Alloy X-750 Spring Temper AMS-5699[3]		1517[2]	862[2]	371		NiCr 15 Fe 7 TiAl	NC 15 Fe 7 TA	2,4669
INCONEL® Alloy X-750 No. 1 TEMPER "Rc 35 Maximum" AMS-5699[1,3]		938 REF	531					
INCONEL® Alloy X-750 No. 1 TEMPER AMS-5698		1069[2]	607[2]	538				
INCONEL® Alloy 718 AMS-5596[1]		1241[2]	703[2]	704	20,4 x 10⁴	NiCr 19 NbMo	NC 19 FeNb	2,4668
ELGILOY® AMS-5876[1,3]	≤ 0,102	2068[2]	1179[2]	427	20,7 x 10⁴	CoCr20 Ni16 Mo7	N/A	N/A
	0,103 - 0,483	1999[2]	1138[2]					
	0,484 - 0,635	1931[2]	1096[2]					
	0,636 - 2,540	1862[2]	1062[2]					
BERYLLIUM COPPER TEMPER TH02 ASTM B197[1]		1276[2]	883[2]	204	12,8 x 10⁴	CuBe2	N/A	2,1247
MP35N® AMS 5758[1]		1655	1034	316	23,5 X 10⁴	N/A	N/A	2,4999
Hastelloy® C-276 ASTM B 74[1]	< 0,406	1586	903	399	20,5 x 10⁴	NiMo 16Cr15W	N/A	2,4819
	0,406 - 0,813	1448	820					
	0,813 - 1,372	1379	786					
	1,372 & larger	1310	745					
Monel® K-500 QQ-N-286[1]		1172	669	288	17,9 x 10⁴	NiCu30Al	N/A	2,4375

Note: Additional materials available include Phosphor Bronze, 410 Stainless Steel, MONEL® 400, Waspaloy®, Duplex Stainless and others. Please consult Smalley Engineering for further details.

[1] Referenced for chemical composition only.
[2] Values obtained after precipitation hardening.
[3] Conforms to NACE Standard MR0175.
[4] Exceeding these temperatures will cause relaxation. Consult Smalley Engineering for High Temperature Applications.

ELGILOY is a registered trademark of Combined Metals of Chicago. INCONEL and MONEL are registered trademarks of Special Metals Corporation. HASTELLOY is a registered trademark of Haynes International. WASPALOY is a registered trademark of United Technologies Corp. MP35N is a registered trademark of SPS Technologies Inc.

Material Types

Selecting Material Types

Selecting the appropriate material for your ring or spring is essential for avoiding additional cost and failure in operation. Smalley stocks many raw materials for various operating conditions including extreme temperatures and corrosive environments.

Carbon Steel

Smalley offers two standard carbon steel materials for retaining rings and wave springs. Carbon steel is cost effective and durable, but has low corrosion resistance. It is highly magnetic and can be a variety of colors such as blue, gray, or black. Smalley's carbon steel products are oil-dipped for protection during shipment and shelf storage.

SAE 1070-1090

SAE 1070-1090 high carbon spring steels are oil tempered and are Smalley's most commonly used carbon steels. Tensile and yield strength are maximized because of the oil tempered martensitic structure.

SAE 1060-1075

SAE 1060-1075 high carbon cold drawn spring steels receive their strength from cold rolling.

In either temper, carbon steel is suited for use in a protected environment, as it corrodes if not oiled and sealed from the elements. Additional corrosion protection can be achieved with special finishes.



Stainless Steel

Smalley offers three stainless steel materials for retaining rings and wave springs. 302 and 316 are standard materials for retaining rings and 17-7 PH is the standard material for wave springs. Stainless steel, although more costly than carbon steel, is more corrosion resistant and able to withstand higher temperature limits. It is slightly magnetic and can be a variety of colors such as blue, brown, and silver. Smalley's stainless steel products usually undergo ultrasonic cleaning and vapor degrease finishing processes.

302

302 is specified because of its combination of corrosion resistance and physical properties. 302 stainless steel gains spring temper condition by cold working. Although it is categorized as a nonmagnetic stainless, 302 becomes slightly magnetic because of the cold working. It cannot be hardened by heat treatment.

316

316 is nearly identical in physical properties and heat resistance to 302. It provides more corrosion resistance because of the addition of molybdenum, particularly against pitting. As with 302, the magnetism of 316 increases as the wire is cold reduced. It cannot be hardened by heat treatment.

17-7 PH Condition CH900

17-7 PH Condition CH900 is similar in corrosion resistance to 302 and offers both high tensile and yield strength. In fatigue and high stress applications, 17-7 outperforms even the finest grade of carbon steel. Spring properties are achieved by precipitation hardening Condition C to Condition CH900. As a result, the material may be subjected to a temperature of 343° C without a loss of spring properties. Its magnetism is similar to carbon steel. After precipitation hardening, 17-7 has a blue, brown, or silver color; atmosphere-controlled heat treatment provides a brighter color.

Super Alloy

Smalley offers super alloys when carbon and stainless steels do not meet an application's unique requirements. Super alloys maintain material properties in extreme operating conditions. These materials exhibit no magnetism and can be blue, brown, or silver in color.

Materials may be heat treated in open-air or in an atmosphere-controlled furnace. Open-air heat treatment may produce scale, which often results in a dark residue. An atmosphere-controlled environment eliminates scale and produces a part with a brighter finish.

Inconel®[1] X-750

Inconel X-750 is a nickel-chromium alloy and precipitation heat treated to a spring temper condition. In this state, it has temperature resistance up to 371˚ C. Additional temper methods are available to achieve slightly different physical properties. Smalley also offers NACE (The National Association of Corrosion Engineers) approved materials to meet your requirements.

A286 Alloy

A286 is a nickel-iron-based alloy that exhibits similar properties to Inconel X-750, but with additional heat resistance of up to 538˚ C. Its spring temper condition is obtained by precipitation hardening.

Elgiloy®[2]

Elgiloy is a cobalt-based alloy known for its high strength and excellent corrosion resistance. It can be used in environments up to 427˚ C. Elgiloy shows improved resistance to sulfide stress cracking over other NACE approved materials.

MP35N®[3]

MP35N is a nickel-cobalt-based alloy known for its high strength and corrosion resistance. It can be used in environments up to 316˚ C. It is often specified for oil and gas applications.

Hastelloy®[4] C-276

Commonly used in chemical processing industries, Hastelloy C-276 is a nickel-based alloy with a proven performance in corrosive applications. Similar to other nickel-based alloys, it is ductile, easy to form, and has excellent resistance to stress corrosion cracking in chloride solutions. It can be used in environments up to 399˚ C.

Monel®[1] K-500

Monel K-500 is a nickel-copper-based alloy known for its excellent corrosion resistance, strength, and hardness properties. It can be used in environments up to 288˚ C.

[1]INCONEL X-750 and MONEL are registered trademarks of Special Metals Corporation.
[2]ELGILOY is a registered trademark of Combined Metals of Chicago.
[3]MP35N is a registered trademark of SPS Technologies Inc.
[4]HASTELLOY is a registered trademark of Haynes International.

Material Types

Copper

When magnetism or conductivity are important to your application, Smalley offers a range of copper materials. Smalley offers two major types of copper alloys as custom materials.

Beryllium Copper Alloy #25

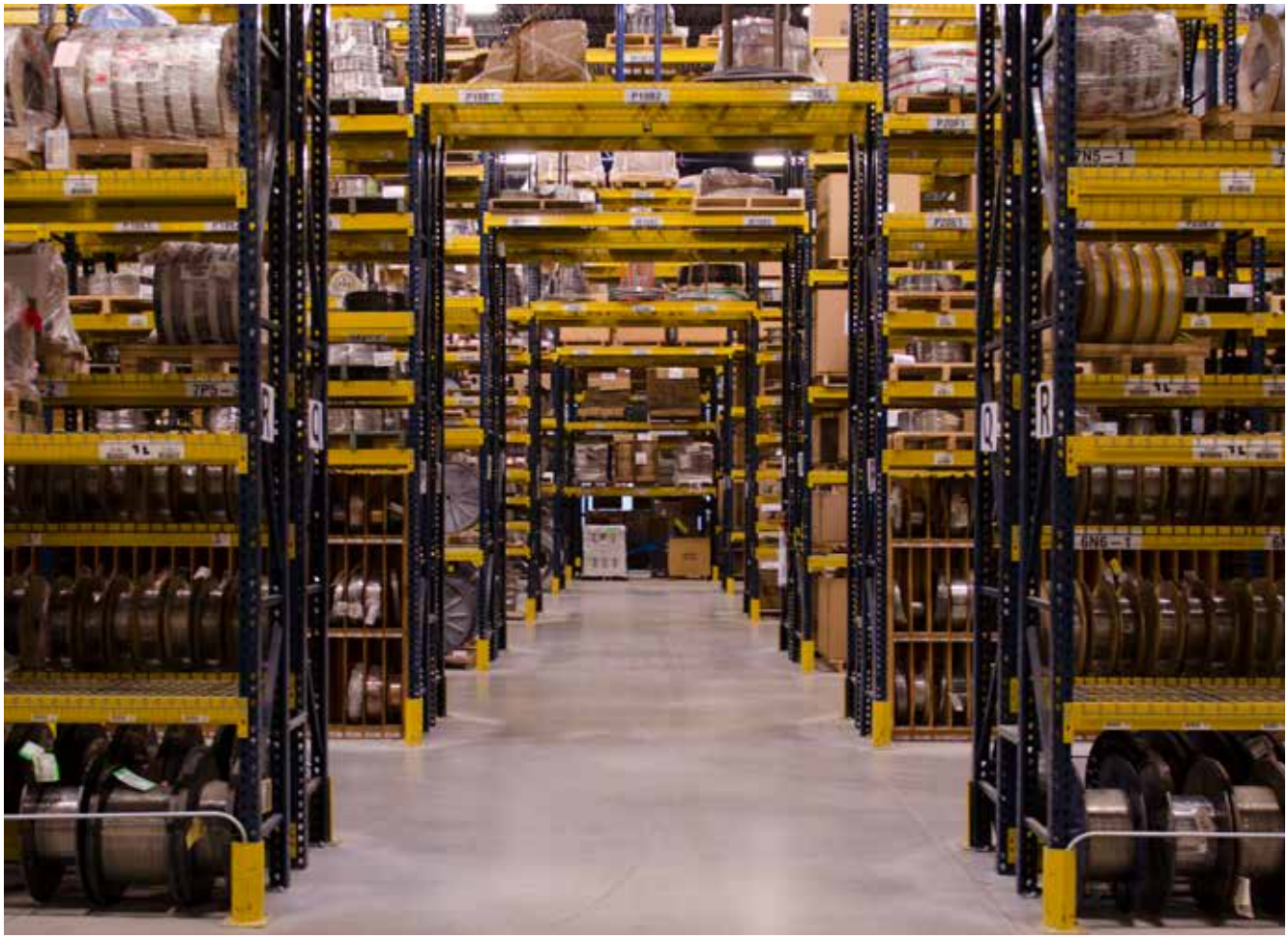
Beryllium copper is nonmagnetic and one of the most electrically conductive materials offered by Smalley. Normally specified in a hard temper, it has a combination of low modulus of elasticity and high ultimate tensile strength. The alloy gains its physical properties by precipitation hardening. In contrast to other copper alloys, beryllium copper has the highest strength and is suitable to use at temperatures up to 204˚ C.

Phosphor Bronze, Grade A

Phosphor bronze is a nonmagnetic alloy with fair electrical conductivity. It is purchased in a spring temper condition to maximize spring characteristics and can be hardened only by cold working. Phosphor bronze exhibits fair spring properties and is rated a step below beryllium copper in performance.

Additional Materials

In addition to the materials listed above, Smalley offers Hastelloy C-276, 410 Stainless Steel, Waspaloy and others. If you have questions on these materials or do not see your desired material listed, please contact Smalley Engineering for further details.



Finishes, Plating & Coating

After selecting the appropriate material for your application, adding a finish, plating or coating may be necessary to meet your application requirements. These additional processes can improve the function, look, and performance of the part.

Black Oxide

MIL-DTL-13924, Class 1

This finish provides a flat black appearance that is generally used to alter cosmetic appearance instead of an improvement in corrosion resistance.

Oil Dip

This is the standard finish for all Smalley products produced from carbon steel. The oil provides resistance to corrosion in transport and normal storage. The oil dip finish should not be considered a permanent finish.

Passivation

AMS 2700, Method 1, Type 2, Class 3

Passivation is an optional cleaning operation for stainless steel. It provides a bright finish and increased corrosion resistance. Passivation dissolves iron particles and other substances that have become embedded in the surface of the stainless steel during production. If not dissolved, these foreign particles could promote corrosion, discoloration, or pitting.

Vapor Degrease/Ultrasonic Clean

This is the standard cleaning and finish for all products manufactured in stainless steel. The process removes oil and other organic compounds from the material surface by use of a degreasing solvent, which is forced between the turns of the part with ultrasonic waves.

Vibratory Deburr/Hand Deburr

Although all circumferential surfaces and edges of Smalley products are smooth, sharp corners can be present on the gap ends due to the cut-off operation. To break the sharp corners and achieve a smooth surface finish, parts may be either vibratory or hand deburred to meet your specifications.

Zinc Phosphate

MIL-DTL-16232, Type Z, Class 2

Sometimes referred to as "Parkerizing", zinc phosphate appears gray-black in color. The corrosion resistance of phosphate is superior to black oxide but inferior to stainless steel. Zinc phosphate cannot be applied to stainless steel.

Zinc Plating

Zinc Plate, ASTM B633, Type V, Fe/Zn 5, SC1 (Colorless)

Zinc Plate, ASTM B633, Type VI, Fe/Zn 5, SC1 (Colored Chromate)

Zinc plating is used on carbon steel to increase the corrosion resistance of the product. It is sometimes used as a more cost effective alternative to other plating options or stainless steel. Smalley's standard zinc platings, Type V and Type VI, are RoHS compliant. The thickness level of the plating is controlled by the service condition number (SC Number), which should be designated by the customer. Zinc plating does not guarantee coverage between the turns of multiple turn rings and springs. (The process does subject the part to the possibility of hydrogen embrittlement. We offer stainless steel as a preferable alternative.)

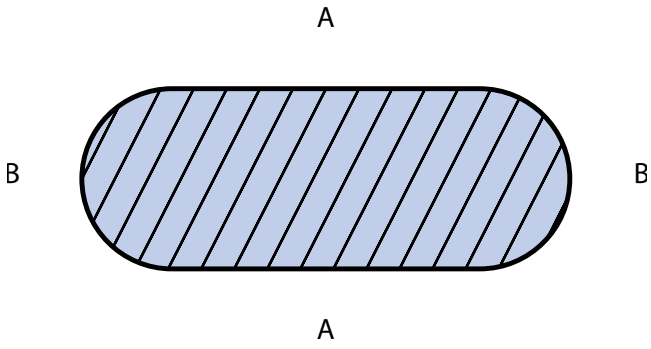
Technical Requirements

Specifications

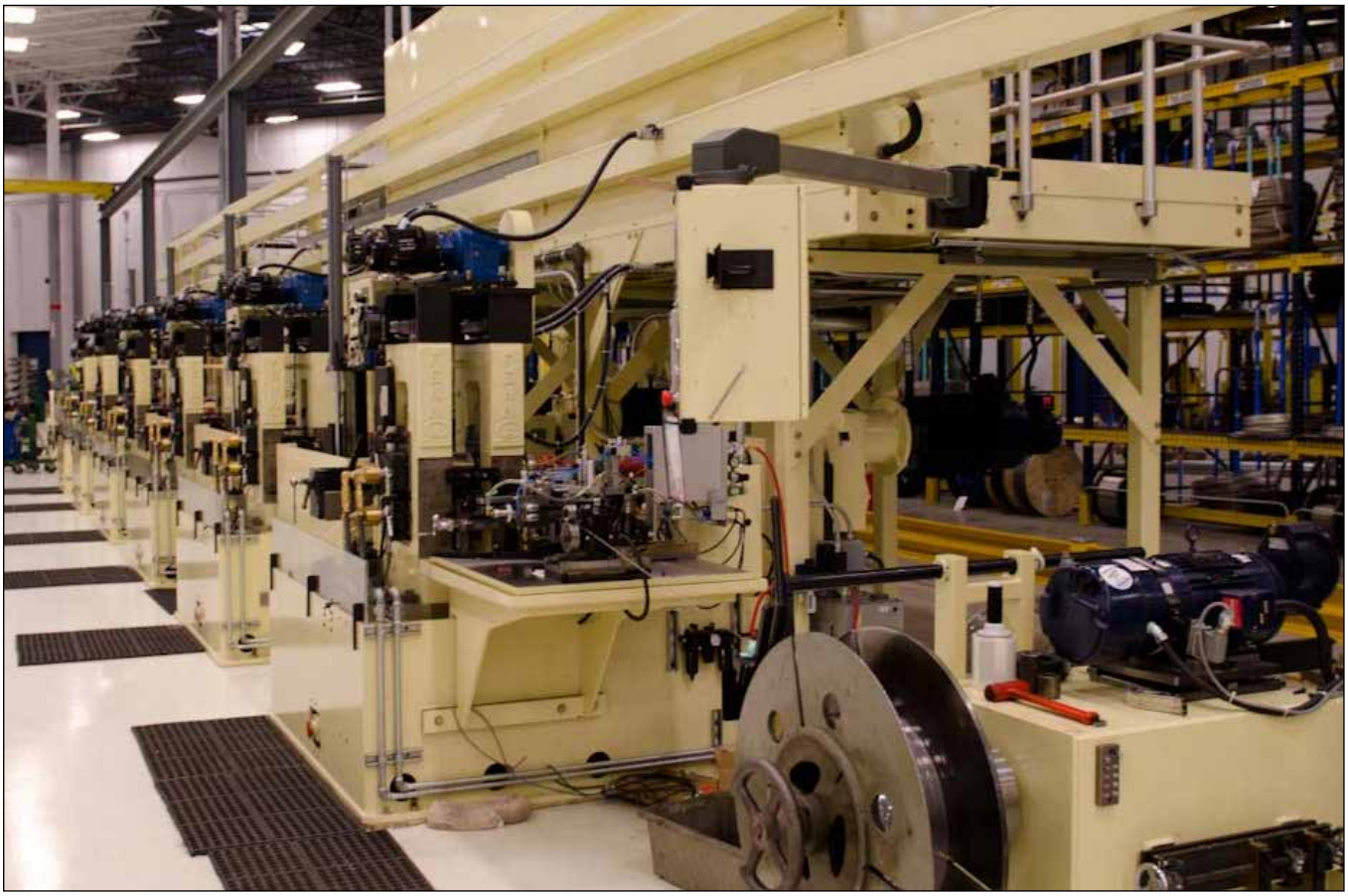
Although there are industry and government specifications that specify properties for flat wire, there are not many. In many cases, Smalley procures and/or rolls its material to internal specifications that are appropriate for the products they are used for. In addition to controlling tensile strength, thickness, and width, strict inspection procedures have been established to check for details such as edge contour, camber, coil set, and other physical imperfections.

Ultimate Tensile Strength

Tensile strength, rather than hardness, is used to measure the strength of our wire. This test method is preferred over hardness testing because flat wire may have different hardness values at various test points. As a result of cold rolling, the top and bottom surfaces ("A") become harder as they are cold worked over multiple passes. The round edge areas ("B") are not compressed in the same manner, resulting in a different hardness. Tensile tests are more consistent as they evaluate the entire cross-section, not just a single point as in a hardness test.



The below photo shows one of Smalley's rolling mills.
For more information on Edgewinding and our manufacturing process, please visit page VI.



Spring Design Considerations

Defining the Spring Requirements

Although wave spring applications are extremely diverse, there is a basic set of rules for defining spring requirements. These guidelines will help determine if a standard spring or a custom design is needed for your application.

Working Cavity

The working cavity usually consists of a bore that a spring operates in and/or a shaft the spring clears. The spring stays positioned by piloting the bore or the shaft. The distance between the loading surfaces defines the axial working cavity or work height of the spring.

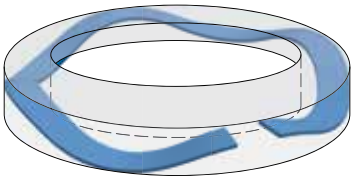


Figure 1

Diameter and Expansion

When wave springs are compressed, the waveform flattens out and the diameter expands. This must be considered in the wave spring design to ensure it performs accurately in the application. The spring diameter is developed to provide proper operation between the bore and the shaft. Two methods of specifying diameters are Bore Pilot and Shaft Pilot.

Bore Pilot

For springs piloting the bore as shown in Figure 2a below, the bore and shaft diameters should be included in the spring specifications. Commonly used requirements would read:

"Spring must pilot and operate in a minimum bore diameter."

"Spring must clear a maximum shaft diameter."

The actual spring diameter is then developed at time of manufacture to provide the best fit and prevent binding due to expansion.

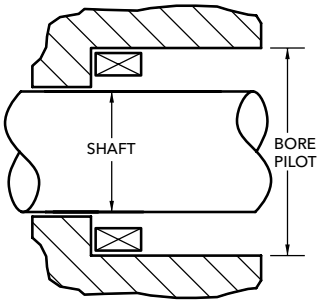


Figure 2a

Shaft Pilot

For springs piloting a shaft as shown in Figure 2b below, the inside diameter can be toleranced to provide a minimum clearance from the shaft. Since wave springs expand during compression, interference with the shaft is generally not a concern.

To ensure proper operation, include shaft and bore diameters in the spring specifications. Commonly used requirements would read:

"Spring pilots over and clears a maximum shaft diameter."

"Spring operates in a minimum bore diameter."

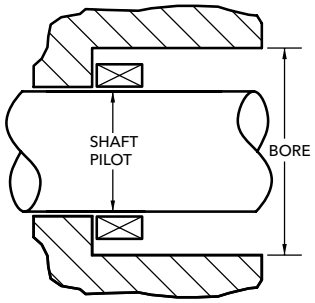


Figure 2b

Material Cross-Section

The material cross-section for flat wire is defined as the thickness by the width. The material cross-section of the spring is an important consideration in preventing misalignment between adjacent layers for multiple turn Crest-to-Crest Wave Springs and Nested Wave Springs. For springs with narrow radial walls, radial misalignment can occur during handling or operation if the spring is not contained or closely piloted.

As a basic guideline, use our standard 'SSR' Wave Spring series for cross-section and diameter relationships. Lighter material cross-sections are usually acceptable, while heavier cross-sections for a given diameter may be incorporated using the following information:

Special wave spring design criteria for selecting material cross-sections:
Maximum material thickness = standard ('SSR-') thickness * 2
Maximum radial wall = material thickness (any value) * 10
Minimum radial wall = material thickness (any value) * 3

Table 1

Spring Design Considerations

Spring Rate
Spring rate is the proportion of how much force it takes to compress a spring a certain distance. It is measured in lb/in or N/mm and can be calculated by manipulating the deflection equations. See formulas in the Spring Calculations section on page 137.

Free Height
Free height is the natural height of the spring with no load applied, denoted as H in Figure 3 below.

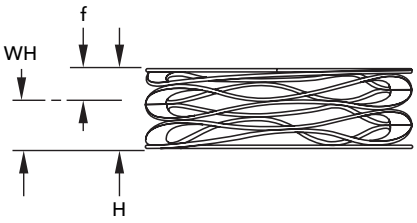


Figure 3

Work Height
Work height is the height that a spring is compressed to in order to achieve a specified load, denoted as WH in Figure 3 above. Compressing a wave spring below the design work height may overstress it.

Deflection
Deflection, also known as travel, is the difference between a spring's free height and its work height. It is denoted as f in Figure 3 above. See formula in the Spring Calculations section on page 137.

Load Requirement
The load requirement is defined as the amount of axial force the spring must output at work height, depicted in Figure 4 below.

Some applications require multiple working heights, where loads at two or more operating heights are critical and must be considered in the design. Often in these applications, minimum and/or maximum loads are satisfactory solutions, particularly where tolerance stack-ups are a concern.

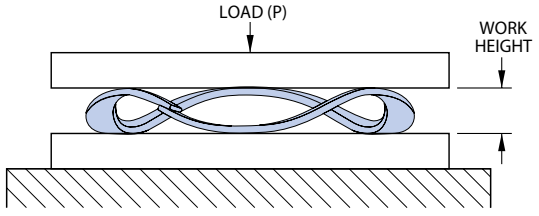


Figure 4

Load/Deflection
A comparison of the actual spring rate to the theoretical (calculated) spring rate provides practical limits for the working range of the spring. Spring rate is defined as the load generated over a distance of deflection. See deflection formula in the Spring Calculations section on page 137.

Figure 5 below shows a graph of theoretical versus tested spring rate. As a general rule, spring rate is linear through the first 80% of available deflection and for work heights down to two times the solid height. Although the spring can operate beyond this "linear" range, measured loads will be much higher than calculated.

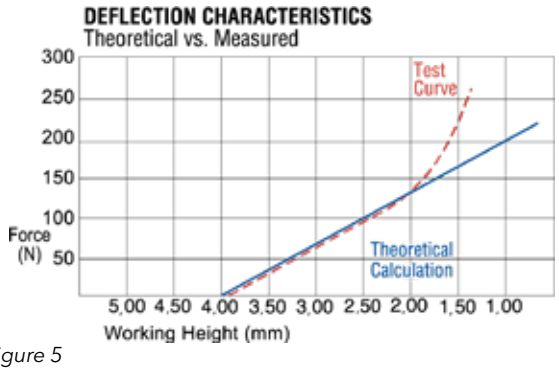


Figure 5

Hysteresis
Wave springs exert a greater force upon loading and a lower force unloading. This effect is known as hysteresis. In Figure 6, the curves show the down-going and upcoming loads. The shaded area represents the difference or the amount of hysteresis.

This difference between the down-going and upcoming loads is a result of friction caused by the circumferential and radial movement of the turns of the spring when it is compressed. Lubricating the wave spring will help to reduce the amount of hysteresis, but the amount of hysteresis will also depend on the type of wave spring, turns, waves, thickness and radial wall.

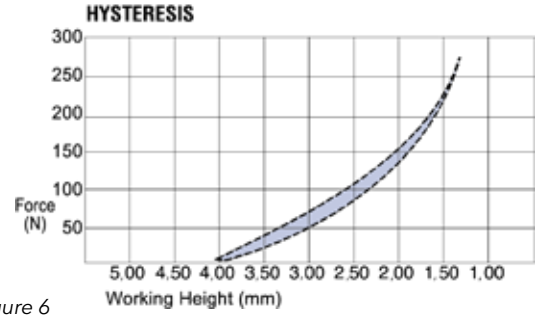


Figure 6

Operating Environment

There are a several key factors to consider when it comes to choosing the right material for your application. One of the factors is defining the operating environment. Extreme temperatures, corrosive substances, dynamic loading (fatigue), stress, and other operating conditions must be considered for optimal spring performance.

Stress

Operating Stress

Compressing a wave spring creates bending stresses similar to a simple beam in bending. These compressive and tensile stresses limit the amount a spring can be compressed before it yields or "takes a set". Although spring set is sometimes not acceptable, load and deflection requirements will often drive the design to accept some set or "relaxation" over time.

Maximum Design Stress

Smalley utilizes the minimum tensile strength value (found in our Materials Table on page 128) to approximate yield strength due to minimal elongation of hardened flat wire used.

Static Operating Stress

In static applications, the calculated operating stress should be no greater than 100% of minimum tensile strength. This can vary based on the acceptability of permanent set, relaxation, loss of load, and/or loss of free height.

Dynamic Operating Stress

In dynamic applications, the calculated operating stress should not exceed 80% of minimum tensile strength. Refer to the "Cycle Life and Fatigue" section to the right and Table 2 for further fatigue guidelines.

Residual Stress/Pre-Setting

Increasing the load capacity and/or fatigue life can be achieved by compressing a spring beyond its yield point, known as "presetting". Preset springs are manufactured to a higher than needed free height and load, and then compressed beyond the stress limit of the material. Both the free height and load are reduced, and the material surfaces now exhibit residual stresses, which enhances spring performance.

Cycle Life and Fatigue

Cycle life or fatigue cycling is the number of strokes a spring can withstand before permanent deformation or breakage. Fatigue cycling is an important consideration in wave spring design. An analysis should include whether the spring deflects full stroke each cycle, only some fraction of a full stroke, or possibly a combination of both due to part wear and or/temperature changes, for example.

The fatigue guidelines in Table 2 provide a conservative approach to calculate cycle life between two work heights. Although these methods of fatigue analysis have proven to be a good approximation, testing in the application is recommended whenever cycle life is critical.

Formula:

$$\text{Fatigue Stress Ratio} = X = \frac{(\sigma - S_1)}{(\sigma - S_2)}$$

Where: σ = Material tensile strength

S_1 = Calculated operating stress at lower work height (must be less than σ)

S_2 = Calculated operating stress at upper work height

Fatigue Guidelines	
X	Estimated Cycle Life
< 0,40	Under 30000
0,40 - 0,49	30000 – 50000
0,50 - 0,55	50000 – 75000
0,56 - 0,60	75000 – 100000
0,61 - 0,67	100000 – 200000
0,68 - 0,70	200000 – 1000000
> 0,70	Over 1000000

Table 2

Spring Design Calculations

Nomenclature

b	Radial width of material (mm) = (OD - ID) / 2
D_m	Mean diameter (mm) = (OD + ID) / 2
E	Modulus of elasticity (N/mm²)
f	Deflection (mm)
H	Free height (mm) = WH + f
ID	Inside diameter (mm)
K	Multiple wave factor, see Table 1
L	Length, overall linear (mm)
N	Number of waves (per turn)
OD	Outside diameter (mm)
P	Load (N)
S	Operating stress (N/mm²)
S_1	Operating stress at lower WH (Must be less than σ)
S_2	Operating stress at upper WH
t	Thickness of material (mm)
WH	Work Height (mm) = H - f
Z	Number of turns
σ	Material tensile strength

Multiple Wave Factor (K)				
N	2,0-4,0	4,5-6,5	7,0-9,5	10,0 & Over
K	3,88	2,90	2,30	2,13

Table 1

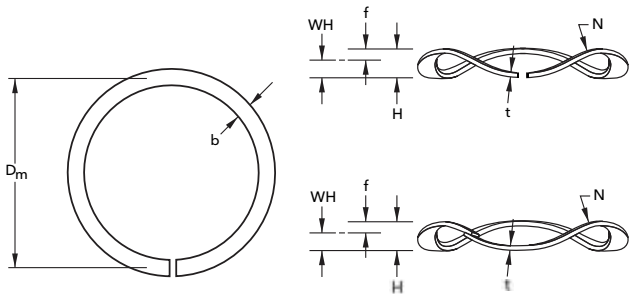
Single-Turn Gap-Type or Overlap-Type

N must be a whole number

Formulas:

$$\text{Deflection}=f=\frac{PKD_m^3}{Ebt^3N^4}*\frac{ID}{OD}$$

$$\text{Operating Stress}=S=\frac{3\pi PD_m}{4bt^2N^2}$$



Example: Smalley Part Number SSR-0200

Calculate free height and operating stress for Smalley part number SSR-0200 (Gap-Type, Single-Turn, Carbon Spring Temper Steel).

Where:

- P = 151,2 N
- t = 0,61 mm
- b = 3,81 mm
- OD = 50,42 mm
- ID = 42,80 mm
- D_m = 46,61 mm
- N = 4
- E = 20.7x10⁴ N/mm²
- K = 3.88
- WH = 2,36 mm

$$\text{Deflection}=f=\frac{(151,2)(3.88)(46,61)^3}{(20.7x10^4)(3,81)(0,61)^3(4)^4}*\frac{42,80}{50,42}=1,10\text{ mm}$$

* Free Height= H = (WH +f)=2,36+1,10= 3,46 mm

$$\text{Operating Stress}=S=\frac{(3)(\pi)(151,2)(46,61)}{(4)(3,81)(0,61)^2(4)^2}=732,2\text{ N/mm}^2$$

*Calculated free height may vary from manufactured spring height due to variations in raw material and manufacturing process.

Spring Design Considerations

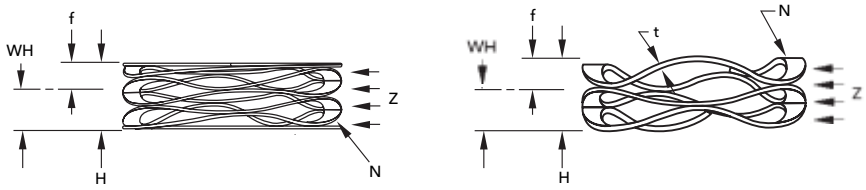
Crest-to-Crest

N must be 1/2 wave increments
Z=number of active turns

Formulas:

$$\text{Deflection}=f=\frac{PKD_m{}^3Z}{Ebt^3N^4}*\frac{ID}{OD}$$

$$\text{Operating Stress}=S=\frac{3\pi PD_m}{4bt^2N^2}$$



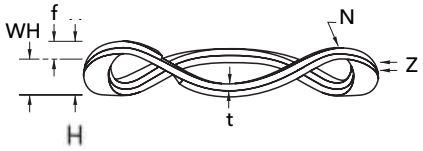
Nested Spirawave

N must be a whole number
Z=number of active turns

Formulas:

$$\text{Deflection}=f=\frac{PKD_m{}^3}{Ebt^3N^4Z}*\frac{ID}{OD}$$

$$\text{Operating Stress}=S=\frac{3\pi PD_m}{4bt^2N^2Z}$$



Linear

N must be a whole number

Formula 1:
Single wave linear spring where N=1

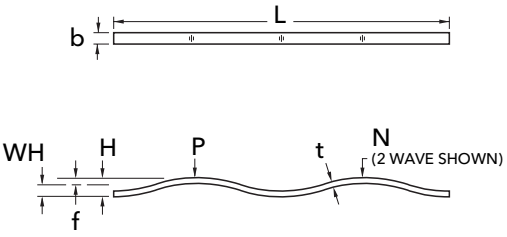
$$\text{Deflection}=f=\frac{PL^3}{4Ebt^3}$$

$$\text{Operating Stress}=S=\frac{3PL}{2bt^2}$$

Formula 2:
2 or more wave linear springs where N>1

$$\text{Deflection}=f=\frac{PL^3}{16Ebt^3N^4}$$

$$\text{Operating Stress}=S=\frac{3PL}{4bt^2N^2}$$

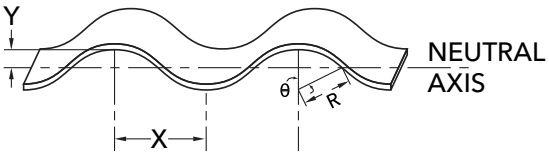


Diameter Expansion

Formula:
Maximum outside diameter at 100% deflection (solid height) = (0,02222 * R * N * ϴ) + b

Where:

- R = Wave radius = $(4Y^2+X^2)/(8Y)$
- ϴ = Angle, degrees = ArcSin(X / (2R))
- X = 1/2 Wave frequency = πDm / (2N)
- Y = 1/2 Mean free height = H_{PT} / 2-t
- H_{PT} = Per-turn free height = H / Z
- N = Number of Waves
- b = Radial Wall



Engineering Support

Engineering Design

Retaining Rings

Spirolox® Retaining Ring and Constant Section Ring applications, although diverse, can be analyzed with a straight-forward set of design calculations. There are four main areas that should be considered in most applications.

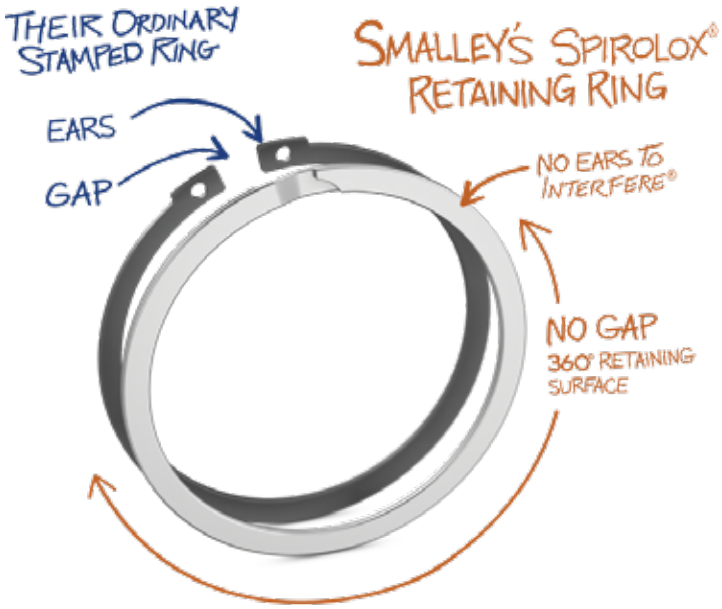
1. Material Selection
2. Load Capacity
3. Rotational Capacity
4. Installation Stress

Smalley Engineers are available to provide technical and application assistance.

The following pages of Ring Design Considerations for Spirolox and Constant Section Rings have been developed from over 100 years of extensive testing and research into the various applications of retaining rings. The formulas are provided for the preliminary analysis of a ring application and the design of a Spirolox Retaining Ring.

Design engineers commonly associate the word "retaining ring" to a basic style or type of retaining device. In reality, retaining rings are nearly as diverse as their applications. Spirolox Retaining Rings offer a distinct alternative, and in many instances, an advantage over the ordinary stamped circlips. The major distinctions are outlined below.

Spirolox® Retaining Ring Advantages



No Ears to Interfere®
No undesired interference with components

No Lugs
Ideal for tight radial applications

No Gap
Secure 360° retaining surface for even load distribution

Coiled, not Stamped
Economic material options due to reduced scrap costs

Easy Customization
Design around your application with no new tooling required

Improved Aesthetic Appearance
Smoothly blend into your application

Safe and Easy Installation
Requires no special tools

Groove Interchangeable
Easy to replace stamped rings

Defining the Ring Requirements

Although retaining ring applications are extremely diverse, there is a basic set of rules for defining ring requirements. These guidelines will determine if a standard ring or a custom design is needed in your application.

Nomenclature

A	Cross-sectional area (mm^2) = t * b – .12 * t^2
b	Radial wall (mm) = (OD – ID) / 2
d	Groove depth (mm)
D	Shaft or housing diameter (mm)
D_G	Groove diameter (mm)
D_H	Housing diameter (mm)
D_I	Free inside diameter, minimum (mm)
D_O	Free outside diameter, maximum (mm)
D_S	Shaft diameter (mm)
E	Modulus of elasticity (N/mm^2)
I	Moment of inertia (mm^4)
ID	Inner diameter (mm)
K	Safety factor
N	Maximum allowable RPM (rpm)
n	Number of turns
OD	Outer diameter (mm)
P	Load (N)
P_G	Allowable thrust load, groove yield (N)
P_R	Allowable thrust load, ring shear (N)
R_M	Mean free radius (mm) = (D_I + b) / 2
S_C	Stress due to compression (N/mm^2)
S_E	Stress due to expansion (N/mm^2)
S_S	Shear strength of ring material (N/mm^2)
S_Y	Yield strength of groove material (N/mm^2), [See table 1]
t	Material thickness (mm)
T	Ring thickness (mm)
V	Cling/2 (mm)
Y	Multiple turn factor, [See table 2]
z	Edge margin (mm)

Typical Groove material yield strengths	
Hardened Steel 8620	750 N/mm^2
Cold Drawn Steel 1018	500 N/mm^2
Hot Rolled Steel 1018	310 N/mm^2
Aluminum 2017	275 N/mm^2
Cast Iron	70 - 275 N/mm^2

Table 1

Ring Design Considerations

Thrust Capacity

Understanding the thrust (or load) capacity of a retaining ring assembly requires calculations for both groove deformation and ring shear. Assuming the groove geometry meets our recommended standards, the design limitation is the lesser of the two calculations.

The load capacity formulas do not take into account any extreme operating conditions and/or dynamic loading. If the ring is subjected to this type of environment or loading, the proper safety factor should be applied and product testing conducted.

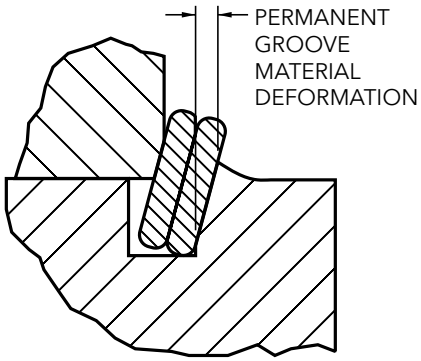
Groove Deformation (Yield)

Groove deformation is by far the most common design limitation of retaining rings. When the groove material yields, it causes the ring to dish and roll out of the groove, potentially leading to failure.

A safety factor of K=2 is recommended

Formula:

$$P_G = \frac{DdS_Y\pi}{K}$$



Example: Smalley Part Number EH-20-S02

Where:

S_Y = 310 N/mm²
K = 2
D = 20,0 mm
d = 0,61 mm

$$\text{Groove Yield} = P_G = \frac{20{,}0\ (0{,}61)\ 310\ (\pi)}{2} = 5941\ \text{N}$$

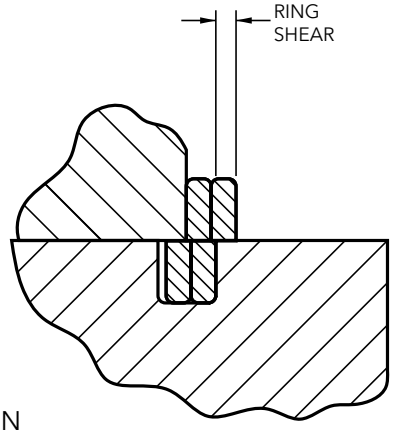
Ring Shear

Although not commonly associated as a typical failure of retaining rings, ring shear can be a design limitation when hardened steel is used as a groove material. Ring thrust load capacities based on ring shear are provided in the product tables for standard rings.

A safety factor of K=3 is recommended

Formula:

$$P_R = \frac{DTS_S\pi}{K}$$



Example: Smalley Part Number EH-20-S02

Where:

D = 20,0 mm
T = 0,89 mm
S_S = 786 N/mm²
K = 3

$$\text{Ring Shear} = P_R = \frac{20{,}0\ (0{,}89)\ 786\ (\pi)}{3} = 14651\ \text{N}$$

Groove Geometry

Groove geometry covers the groove size, shape, and position on both the retained and retaining components. Following all of the associated guidelines below will better ensure optimal ring performance.

Groove Radius

To assure maximum load capacity, it is essential to have square corners on the groove and retained components. Additionally, components must always be square to the ring groove in order to maintain a uniform, concentric load. The radius on the groove bottom should not exceed the values in Table 3.

Shaft or Housing Diameter	Maximum Radius on Groove Bottom
25 mm and under	0,10 max
Over 25 mm	0,25 max

Table 3

Hoopster Rings

A Hoopster's groove radius has a slightly different recommended groove geometry because it is essential to have sharp corners on every edge of the groove. The maximum radius on the groove bottom of a Hoopster application should be no greater than 10% of the ring's radial wall.

Maximum Radius on Groove Bottom for Hoopster Retaining Rings	
All sizes	0,10b

Table 4 b = radial wall

Retained Component

The retained part ideally has a square corner and contacts the ring as close as possible to the housing or shaft. For the maximum recommended radius or chamfer allowable on the retained part, see formula below.

Formulas:

Maximum Chamfer = 0,375 (b-d)
(on retained component)

Maximum Radius = 0,5 (b-d)
(on retained component)

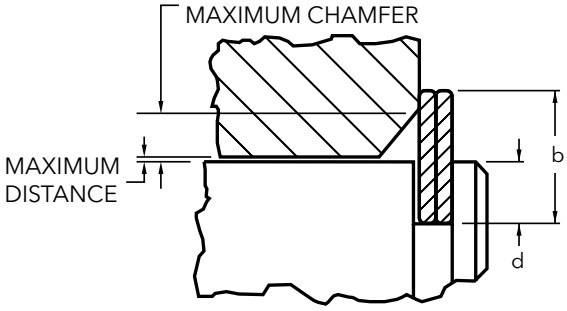
Example: Smalley Part Number DNS-100

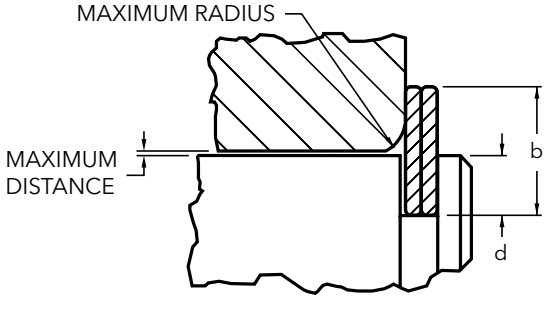
Where:

b = 6,27 mm
d = 1,75 mm

Maximum Chamfer= 0,375 (6,27 - 1,75) = 1,70 mm

Maximum Radius= 0,5 (6,27 - 1,75) = 2,26 mm





Ring Design Considerations

Edge Margin

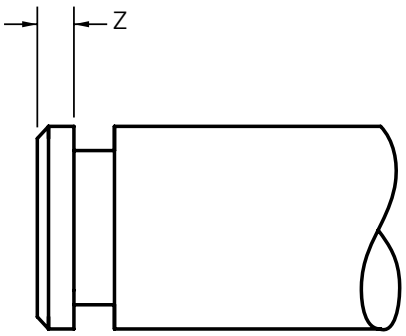
Ring grooves that are located near the end of a shaft or housing should have an adequate edge margin to maximize strength. As a rule, the minimum edge margin may be approximated by a value of 3 times the groove depth. Edge margin for both shear and bending should be calculated and the larger value selected. See formula below.

A safety factor of K=3 is recommended

Formulas:

$$\text{Shear} \quad z = \frac{K3P}{S_Y D_G \pi}$$

$$\text{Bending} \quad z = \left[\frac{K6dP}{S_Y D_G \pi} \right]^{1/2}$$



Example: Smalley Part Number FS-040

Where:

$P = 5000$ N

$D_G = 37{,}50$ mm

$S_Y = 310$ N/mm^2

$d = 1{,}25$ mm

$K = 3$

$$\text{Shear} = z = \frac{3\,(3)\,5000}{310\,(37{,}5)\,\pi} = 1{,}23 \text{ mm}$$

$$\text{Bending} = z = \left[\frac{3\,(6)\,1{,}25\,(5000)}{310\,(37{,}5)\,\pi} \right]^{½} = 1{,}76 \text{ mm}$$

Therefore the minimum edge margin that should be used is 1,76 mm.

Rotational Capacity

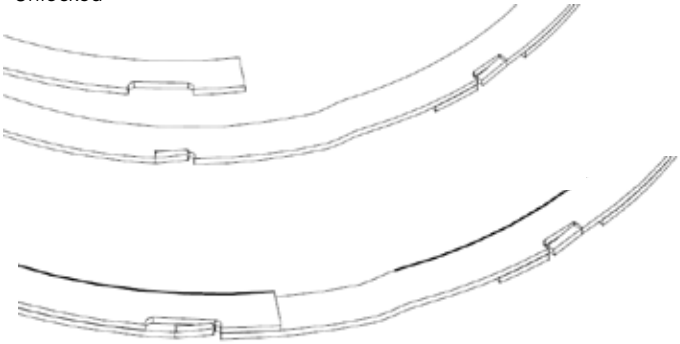
Any retaining ring operating on a rotating shaft is limited by centrifugal forces, including Smalley Retaining Rings. Failure occurs when these centrifugal forces are great enough to expand and shift the retaining ring from the groove. With more applications requiring higher rotational capacities, Smalley is invested in ongoing research and development in this area. If rotational capacity is critical in your application, please contact Smalley engineering for more information. A custom retaining ring, or possibly a self-locking ring, may be an option if your application requirements exceed the recommended rotational capacity of our standard parts.

Self-Locking

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

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

Unlocked



Locked

Ring Design Considerations

Installation Stress Analysis

Installation stress analysis is used to check that the elastic stress limit of the ring material is not exceeded during installation. Standard parts that are assembled manually in the recommended shaft/bore and groove diameters do not require stress analysis. Custom rings assembled with special tooling may require analysis.

To select a safe stress value, it is necessary to estimate the elastic limit of the raw material. The minimum tensile strength, as shown in the Materials Table on page 128, can be used as a suitable estimate. A closer analysis of the actual application may reveal that these stress values can be exceeded. However, particular consideration must be made to functional characteristics such as installation method, the number of times the ring will be installed and removed, thrust load and/or rotational capacity.

After forming, a ring's natural tendency is to return to its original state. For a ring being installed over a shaft, this places the inner edge of the radial wall in residual tension and the outer edge in residual compression. To account for the residual stress in the ring when expansion is taking place, only 80% of the minimum tensile strength should be used to compare to the installation stress, as noted in Table 5 below.

In custom designs where the installation stress exceeds the material's elastic limit, rings can be produced to diameters that will yield an acceptable amount during assembly. Once installed, the ring will have the proper cling (grip) on the groove.

Installation Stress

Formulas:

External Rings $S_E = \dfrac{Eb\,(D_S - D_I)}{(D_I + b)(D_S + b)}$

Internal Rings $S_C = \dfrac{Eb\,(D_O - D_H)}{(D_O - b)(D_H - b)}$

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

Table 5

Example: Smalley Part Number ES-20-S02 and EH-20-S02

Where:

- S_E = Stress due to expansion (N/mm²)
- S_C = Stress due to compression (N/mm²)
- E = 193053 N/mm²
- b = 1,65 mm
- D_S = 20,00 mm
- D_H = 20,00 mm
- D_I = 18,62 mm
- D_O = 21,51 mm

$$S_E = \frac{193053\,(1{,}65)\,(20{,}00 - 18{,}62)}{(18{,}62 + 1{,}65)(20{,}00 + 1{,}65)} = 1002\ \text{N/mm}^2$$

$$S_C = \frac{193053\,(1{,}65)\,(21{,}51 - 20{,}00)}{(21{,}51 - 1{,}65)\,(20{,}00 - 1{,}65)} = 1320\ \text{N/mm}^2$$

ES-20-S02

Minimum tensile strength of the ring material: 1448 N/mm²
80% (Table 5) of 1448 N/mm² = 1158 N/mm²

1002 N/mm² < 1158 N/mm²

Since the installation stress is less than 80% of the minimum tensile strength, permanent set is not expected.

EH-20-S02

Minimum tensile strength of the ring material: 1448 N/mm²
100% (Table 5) of 1448 N/mm² = 1448 N/mm²

1320 N/mm² < 1448 N/mm²

Since the installation stress is less than 100% of the minimum tensile strength, permanent set is not expected.

Spring Checklist

APPLICATION CHECKLIST

CUSTOM ORDERS...OUR SPECIALTY

SMALLEY WAVE SPRINGS

Email to: info@smalley.com
Or fill out online.

Name _____ Title _____ Date _____

Company _____

Address _____

City/State/Zip Code _____ Country _____

Phone _____ Fax _____

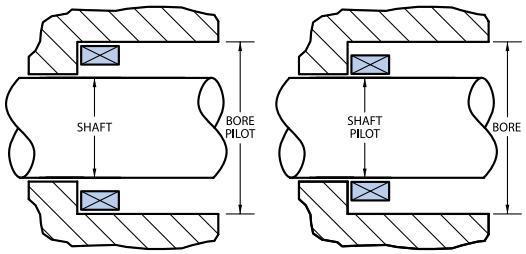
Email _____

DIMENSIONS IN: ( ) Metric Units ( ) Imperial Units

Operates in _____ bore diameter

Inside diameter clears _____ shaft

Specify which diameter the spring should pilot closest to: ( ) Bore ( ) Shaft



LOAD DEFLECTION (SELECT ONE)

Group A

_____ (Min - Max Load) @ _____ (Work Height) ( ) N @ mm ( ) lb @ in

Free Height _____ Approximate

Group B

_____ (Min - Max Load) @ _____ (Work Height) ( ) N @ mm ( ) lb @ in

_____ (Min - Max Load) @ _____ (Work Height) ( ) N @ mm ( ) lb @ in

Free Height _____ Approximate

Group C

Free Height _____ (min) – _____ (max)

# of Waves _____ Material Thickness _____

Radial Wall _____

MATERIAL

Consider the environment:
Temperature _____ °
( ) C ( ) F
Corrosive Media _____

*Carbon Steel ( )
*17-7 PH/CH900 Stainless ( )
302 Stainless Steel ( )
316 Stainless Steel ( )
Inconel X-750 ( )
Other _____ ( )

FINISH

* Oil dipped (Carbon Steel) ( )
* Vapor degreased and ultrasonic cleaned (Stainless Steel) ( )
Passivate ( )
Black Oxide ( )
Phosphate Coat ( )
Vibratory Deburr ( )
Other _____ ( )

SKETCH

FATIGUE: Specify estimated cycle life

( ) Static Application
( ) Under 10^5 Cycle Life
( ) 10^5 Cycle Life
( ) 10^6 Cycle Life
( ) Over 10^6 Cycle Life

QUANTITY:

Prototype _____
Production _____

APPLICATION: (Description)

_____

_____

* Denotes standard material or finish

If you need a part to include added inspections or other quality requirements, please contact one of our engineers.

APPLICATION CHECKLIST

CUSTOM ORDERS...OUR SPECIALTY

SMALLEY RETAINING RINGS

Email to: info@smalley.com
Or fill out online.

Name _____ Title _____ Date _____

Company _____

Address _____

City/State/Zip Code _____ Country _____

Phone _____ Fax _____

Email _____

DIMENSIONS IN: ( ) Metric Units ( ) Imperial Units

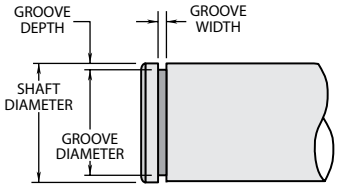
Housing Diameter _____

Shaft Diameter _____

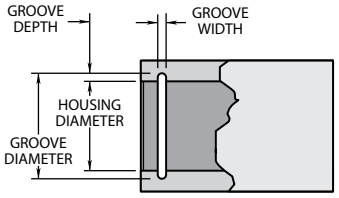
Groove Diameter _____

Groove Width _____

RPM _____



Ring Radial Wall _____



Ring Thickness _____

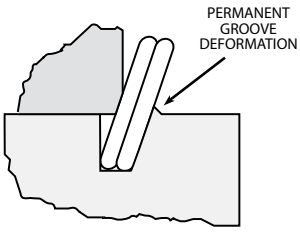
THRUST CAPACITY

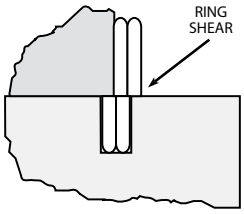
1) Groove Deformation

Occurs when maximum capacity is limited by the groove material (groove material is soft)

2) Ring Shear

Occurs when maximum capacity is limited by the retaining ring (groove material is hardened)





If thrust is a consideration specify:

Groove Material _____

Load Capacity _____ ( ) N ( ) lb

MATERIAL

Consider the environment:
Temperature _____ °
( ) F ( ) C
Corrosive Media _____

*Carbon Steel	( )
*17-7 PH/CH900 Stainless	( )
*302 Stainless Steel	( )
*316 Stainless Steel	( )
Inconel X-750	( )
Other _____	( )

FINISH

* Oil dipped (Carbon Steel)	( )
* Vapor degreased and ultrasonic cleaned (Stainless Steel)	( )
Passivate	( )
Black Oxide	( )
Phosphate Coat	( )
Vibratory Deburr	( )
Other _____	( )

SKETCH

QUANTITY:

Prototype _____
Production _____

APPLICATION: (Description)

_____

_____

* Denotes standard material or finish

If you need a part to include added inspections or other quality requirements, please contact one of our engineers.

Laminar Ring Checklist

APPLICATION CHECKLIST

CUSTOM ORDERS...OUR SPECIALTY

SMALLEY LAMINAR RINGS

Email to: info@smalley.com
Or fill out online.

Name _____ Title _____ Date _____

Company _____

Address _____

City/State/Zip Code _____ Country _____

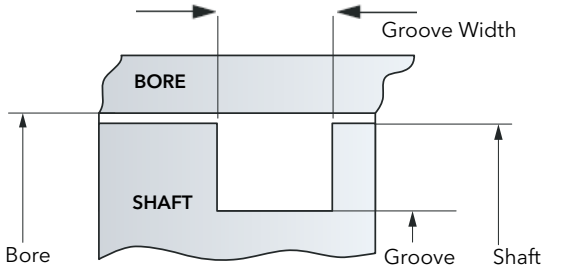
Phone _____ Fax _____

Email _____

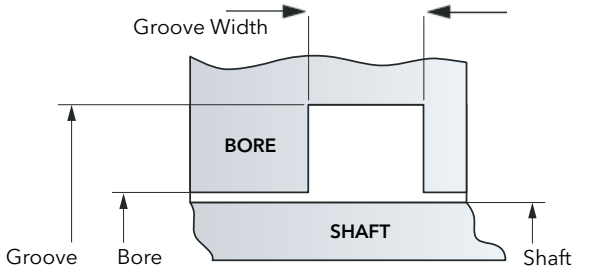
DIMENSIONS IN: ( ) Metric Units ( ) Imperial Units

Bore Diameter _____ Shaft Diameter _____

Groove Diameter _____ Groove Width _____



GROOVE IN SHAFT
(Seal Rings fit tight in Bore)



GROOVE IN BORE
(Seal Rings fit tight on Shaft)

MATERIAL

Standard	*Maximum Recommended Operating Temperature		
	°C	°F	
Carbon Steel (SAE 1070-1090)	120	250	( )
302 Stainless Steel	200	400	( )

Special	*Maximum Recommended Operating Temperature	
	°C	°F
17-7 PH/CH900 Stainless Steel	343	650
A286 Alloy	538	1000
316 Stainless Steel	204	400
Inconel X-750	370-700	700-1300
Elgiloy	427	800
Other		

SERIES

A. Single-Turn Ring Sets

(Metric - QH, QHK, QS or QSK) ( )

(English - YH, YHK, YS or YSK) ( )

B. Double-Turn Ring Sets

(Metric - QHD, QHKD, QSD or QSKD) ( )

(English - YHD, YHKD, YSD or YSKD) ( )

QUANTITY:

Prototype _____

Production _____

APPLICATION: (Description)

_____

_____

_____

SKETCH

Sample Request Form

SAMPLE REQUEST

Smalley offers free samples to test in your application.

SMALLEY WAVE SPRINGS, RETAINING RINGS AND LAMINAR RINGS

Email to: info@smalley.com
Or fill out online.

Name _____ Title _____ Date _____

Company _____

Address _____

City/State/Zip Code _____ Country _____

Phone (*REQUIRED*) _____ Fax _____

Email _____

SHIPPING METHOD:
All samples are sent out by FedEx (Ground). For expedited delivery, please provide a valid UPS or FedEx account number and specify the service to bill.

Please call Smalley at +1 847.719.5900 to request other delivery methods.

☐ **FedEx Ground:** ***(FREE)***

☐ UPS Account number for charges ***(REQUIRED)*** _____

☐ Ground ☐ Overnight ☐ 2nd Day

☐ FedEx Account number for charges ***(REQUIRED)*** _____

☐ Overnight ☐ 2nd Day

SPECIFIC SAMPLE:

Please provide us with the part number you would like to test and mark the requested material:

Smalley Part Number: _____ ☐ Carbon Steel ☐ Stainless Steel

Smalley Part Number: _____ ☐ Carbon Steel ☐ Stainless Steel

ASSORTED SAMPLES:

☐ Please send me a sample bag of assorted Smalley Retaining Rings and Wave Springs.

Smalley reserves the right to authorize all sample requests.

How To Order

Specifying Smalley Part Numbers

Smalley ring and spring part numbers consist of three steps. Please use the following guide to correctly identify your part number:

WHT-50-PA-S02

Material: Specifies type of material (see Table 3)

Finish: Specifies the type of finish to be applied on the material (see Table 2)

Base Part Number: Specifies series and housing/shaft diameter (see Tables 1a and 1b)

Step 1: Base Part Numbers

Select Series from TABLE 1a or 1b

TABLE 1a: Retaining Ring Series

Series	Number of Turns	Internal	External
Light Duty	1	VHM	VSM
Light Duty Imperial	1	VH	VS
Medium Duty Imperial	2	WH	WS
Medium Heavy Duty Imperial	2 or 3	WHT	WST
Heavy Duty Imperial	2	WHM	WSM
Constant Section Imperial	1	FHE	FSE
Constant Section Imperial (Eaton Style)	1	XAH	XAS
Constant Section Imperial (Eaton Style)	1	XDH	XDS
Aerospace	2	EH	ES
DIN Series	2	DNH	DNS
DIN Series Constant Section	1	FH	FS
Hoopster	1	HHM/HHMU	HSM
Hoopster Imperial	1	HH/HHU	HS
WaveRing Imperial	2	WHW	WSW

TABLE 1b: Wave Spring Series

Series	Prefix
Bearing Preload	SSB
Single-Turn Imperial	SSR
Narrow Section Single-Turn Imperial	SSR-N
Shim Imperial	SSRS
Crest-to-Crest	CM
Crest-to-Crest with Shim End	CMS
Crest-to-Crest Imperial	C
Crest-to-Crest with Shim End Imperial	CS
Wavo Imperial	RW
Nested Spirawave	NSSB
Nested Spirawave Imperial	NSSR

Then Specify Part Diameter

See the product tables for a complete listing of available diameters in stock. Below are some base part number examples:

Part Number Examples	
VHM-10	10 mm Light Duty Internal Ring
FS-050	50 mm DIN Series Constant Section External Ring
CM15-M1	15 mm Crest-to-Crest Wave Spring
CMS08-L1	8 mm Crest-to-Crest Wave Spring w/ Shim Ends
SSB-0087	22 mm Bearing Preload Spring

How To Order

Step 2: Finish

To prevent corrosion, carbon steel has an oil dip finish. Stainless steel parts are vapor degreased and go through an ultrasonic cleaning process. To specify a special finish on retaining rings or wave springs, add the appropriate suffix to the part number preceding the material suffix. For standard materials, there is no designation necessary.

TABLE 2: Finish

Standard	
Finish	**Designation**
Carbon Steel- Oil Dip	None
Stainless Steel-Vapor Degrease & Ultrasonic Clean	None

Special	
Finish	**Designation**
Passivation	PA
Black Oxide	BA
Phosphate Coat	PS
Cadmium Plate	CD
Vibratory Deburr	DV

Example: VHM-100-**PA**-S02 100 mm Light Duty Internal Ring, with **passivation** in 302 stainless steel

Step 3: Material

To specify the material, add the appropriate designation below to the end of the part number.

TABLE 3: Material

Standard	
Material	**Designation**
Carbon Steel SAE 1070-1090	None
302 Stainless Steel (Retaining Rings)	S02
316 Stainless Steel (Retaining Rings)	S16
17-7 PH Stainless Steel (Wave Springs)	S17

Special	
Material	**Designation**
Inconel X-750	INX
A286 Stainless Steel	A86
Beryllium Copper	BEC
Phosphor Bronze	PHB
Elgiloy	LGY

Examples:
VHM-50 — 50 mm Light Duty Internal Ring in **Carbon Steel**
VSM-100-**S02** — 100 mm Light Duty External Ring in **302 Stainless Steel**
CM150-M5-**INX** — 15 mm Crest-to-Crest Wave Spring in **Inconel X-750**

Note: Custom wave springs can be manufactured in 302 & 316 stainless steel, retaining rings can be manufactured in 17-7 PH condition CH900 stainless steel upon request. If you need a part to include added inspections or other quality requirements, please contact one of our engineers.

Packaging

Smalley has the flexibility to package retaining rings and wave springs using a variety of methods to simplify your assembly process. Standard packaging is based on the diameter. As a general rule for both retaining rings and wave springs:

- 23,8 mm and under diameters are bulk packaged
- 41,3 mm and over diameters are tube (coin) packaged in lengths from 250 to 450 mm

Smalley can accommodate custom packaging requests to make your assembly process easier. Contact us for more information.

Placing an Order

Smalley Customer Service representatives are ready to assist you with pricing, ordering, and delivery options.
Contact Smalley Customer Service at:

+1 847.719.5920 **+1 847.719.5999** **sales@smalley.com**

Glossary

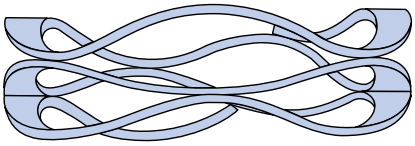
Bore Diameter: (See *Housing Diameter*).

Centrifugal Capacity (N): A mathematical expression for determining the speed (in revolutions per minute, RPM) at which a retaining ring will lose cling on the groove.

Cling: A value that signifies the amount of "interference fit" between a retaining ring and its groove.

Cold Working: Shaping or forming wire without heating.

Crest-To-Crest: Term used to identify a Smalley Flat Wire Compression spring in a "Series" configuration, having a sinusoidal waveform. The wave contour in each 360˚ turn provides a peak to valley relationship that decreases spring rate proportionally to the number of turns.

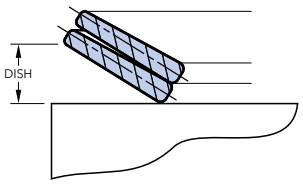


Cycle Life: (See *Fatigue Life*).

Deflection: Also referred to as *Stroke*. The distance a wave spring is displaced under a load. Not to be confused with work height.



Dish: This ring dimension is the height difference in the ring cross section's axis of symmetry between OD and ID as illustrated below:



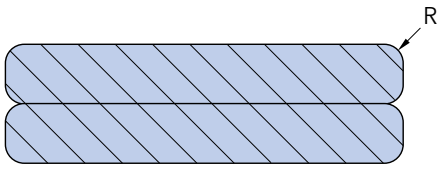
Dynamic Application: An application that moves resulting in repeated spring deflection.

Dynamic Loading: When a spring regularly cycles between different heights.

Eccentric Loading: Loading on a ring or spring that is lateral to or not symmetric with the central axis.

Edge Contour: The shape of the side surfaces of the wire.

Edge Radius: The size of the rounded corner of the wire cross-section.



Edgewinding: Smalley's manufacturing method of circle coiling rectangular section flat wire on edge.

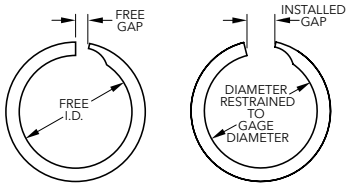
Elastic Limit: The maximum stress that can be applied to a material without causing permanent deformation.

External Ring: A type of retaining ring that is installed typically into a groove on a shaft.



Fatigue Life: Also referred to as *Cycle Life*. The number of cycles a spring can withstand before failing.

Free Gap: The distance between the "Free Ends" of a ring or spring as it rests in its free state.



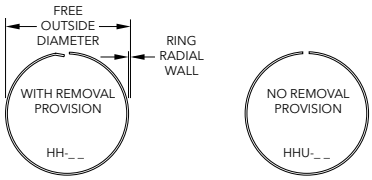
Glossary

Gap in Gage: (See *Installed Gap*).

Hardness: The resistance of a material to plastic deformation, usually by indentation.

Helix: (See *Pitch*).

Hoopster: Term used to identify the style of retaining ring with minimal radial projection and shallow groove depth.



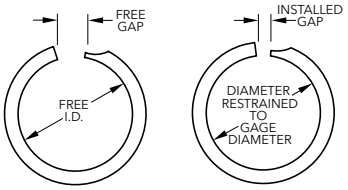
Housing Diameter (DH): Also referred to as *Bore Diameter*. This dimension represents the inside diameter of the assembly where an internal retaining ring is installed.

Hydrogen Embrittlement: A condition where hydrogen is absorbed within the internal grain structure of metal tending to make it susceptible to cracking and failure, particularly under sustained loads. Environments such as hydrogen sulfide (H_2S) or processes such as electroplating or pickling can induce hydrogen embrittlement.

Impact Loading: Sudden force applied to a spring or ring.

Installation Stress (SC) or (SE): Mathematical expression based on a radial strain. Useful in determining how far a Spirolox or Constant Section Retaining Ring can be expanded or contracted during installation.

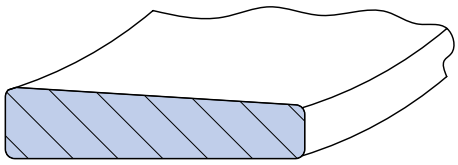
Installed Gap: Also referred to as *Gap in Gage*. This ring dimension is the distance between the ring ends while the ring is restrained at a specific gage diameter. Recommended as a more precise method of control over a free gap.



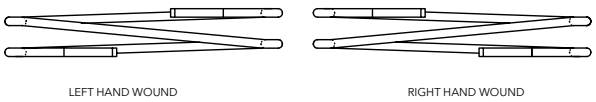
Internal Ring: A type of retaining of ring that is installed typically into a groove in a housing.



Keystone: Derived from the definition of a "wedge" shaped stone. This term, illustrated below, refers to the "wedge" shaped cross section as a result of edgewinding flat wire.



Left Hand Wound: Also referred to as *Reverse Wound*. Design term signifying the counter-clockwise winding direction of a coil.

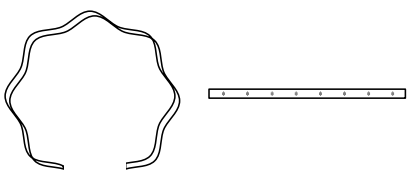


Linear Spring: Term used to identify a straight length of flat wire having a sinusoidal waveform. Used as a compression spring in both axial and radial applications.

Load/Deflection Curve: Graph of force vs travel of a spring as it is compressed. See page 135.

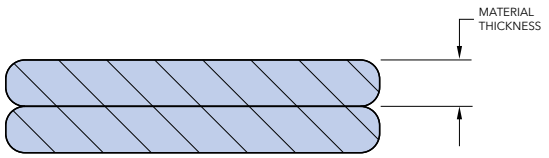
Load Capacity: Also referred to as *Thrust Capacity*. The maximum force that can be applied to a retaining ring without failure.

Marcel Spring: Also known as *Marcel Expander*. A single-turn wave spring used to provide radial force. A Marcel expander is defined by a bore and a shaft. A Marcel expander is coiled in a circular shape such that the ID clings to a shaft and the OD clings in a bore.

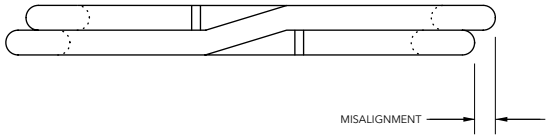


Glossary

Material Thickness (t): Also referred to as *Wire Thickness*. This dimension, illustrated below, is also used in determining the overall ring thickness.

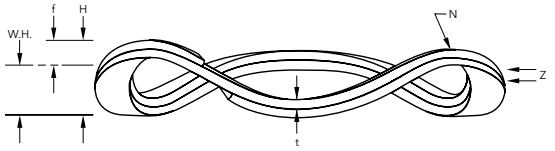


Misalignment: Also referred to as *Skew*. This ring dimension is the radial variance of a multiple turn retaining ring.



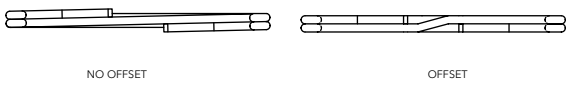
Modulus of elasticity (E): A measure of the rigidity of a material.

Nested: Term used to identify a Smalley Flat Wire Compression Spring in a "Parallel" configuration, having a sinusoidal waveform. The wave contour in each 360˚ turn matches (nests), increasing the spring rate proportionally to the number of turns.

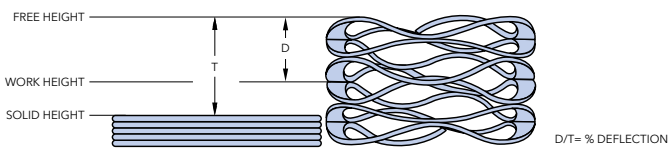


Notch Radius: (See *Removal Notch*).

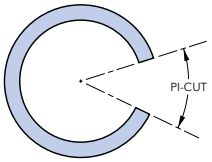
Offset: As illustrated below, this design feature is a bend in the material at the gap. This provides flat and parallel surfaces for ease of installation and more even loading.



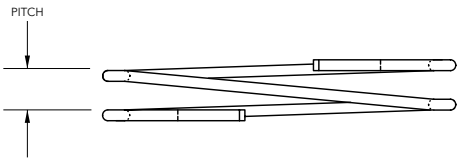
Percent Deflection: Ratio of actual displacement (D) to total available displacement (T) of a spring.



Pi-Cut Ends: Term signifying a particular ring design where the ends have been cut in an angular direction from the center of the ring as illustrated below.



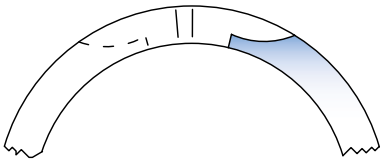
Pitch: Also referred to as *Helix*, this ring dimension is the distance between two adjacent layers of the retaining ring.



Precipitation Hardening: The process of strengthening certain alloys by a heat treatment or aging method.

Radial Wall (b): Width of a retaining ring when measured from inside to outside edge.

Removal Notch: Also referred to as a *Notch Radius* or *Scallop*. This standard Spirolox Retaining Ring design feature is used to facilitate removal of the ring from its groove by means of a screwdriver or similar type tool.



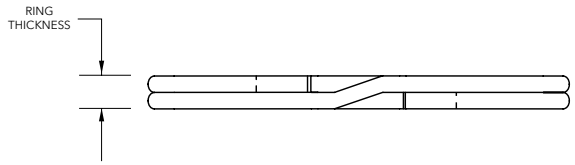
Residual Stress: Internal stresses that are introduced as a result of the cold forming (coiling) process.

Reverse Wound: (See *Left Hand Wound*)

Right Hand Wound: (See also *Left Hand Wound*) Design term signifying the clockwise winding direction of a coil.

Glossary

Ring Thickness (T): The total thickness of an edgewound retaining ring, which is determined by multiplying material thickness by the number of turns, and accounting for keystone.



Rod Diameter: (See *Shaft Diameter*)

Rotational Capacity: The maximum speed at which a retaining ring can rotate before failing.

Safety Factor (K): Mathematical constant used in many design formulas to account for theoretical inaccuracies.

Scallop: (See *Removal Notch*)

Set (Permanent): The point at which the elastic properties of the material have been exceeded, and the shape of the ring or spring does not return to its original state.

Shaft Diameter (DS): Also referred to as *Rod Diameter*. This dimension represents the outside diameter of the assembly where an external retaining ring is installed.

Shear Strength (SS): An index of the quality of a material through a mathematical expression which divides the force required to shear a material by its cross-sectional area.

Skew: (See *Misalignment*).

Static Application: A spring application that does not have any motion resulting in spring deflection.

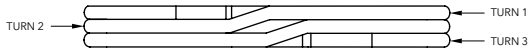
Stress Relieve: Low temperature heat treatment for removing any residual stresses induced by edgewinding and/or forming.

Stroke: Also referred to as *Deflection*. The distance a wave spring is displaced under a load.

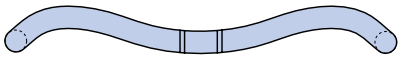
Tensile Strength: An index of the quality of a material through a mathematical expression which divides the material's load capacity in tension by its original cross-sectional area. Particularly accurate for spring steels, as there is only a small difference between ultimate tensile strength and yield strength.

Thrust Load Capacity (PG) or (PR): Also referred to as *Load Capacity*. Overall capacity of an assembly to withstand a given value of thrust load in pounds. The limitation being the lesser of two mathematical calculations: ring thrust load capacity (PR) or groove thrust load capacity (PG).

Turns (Number of): The number of 360° turns of flat wire formed in a retaining ring or wave spring.



WAVO: Single turn round wire wave spring.



Wire Thickness: (See *Material Thickness*).

Yield Strength (Sy): The stress at which a material exhibits initial plastic deformation.

Terms and Conditions of Sale

All Quotations, Purchase Orders, Order Confirmations, Order Acknowledgements, Invoices or any other form (in any media) for placing orders for goods or services from Smalley Steel Ring Co. ("Order") are expressly subject to the terms and conditions ("Terms and Conditions") set forth herein. Smalley Steel Ring Co. is hereafter referred to as "Seller", and the original purchaser of the products or services of Seller (collectively, "Goods") is hereafter referred to as "Buyer".

1. OFFER AND ACCEPTANCE – THIS ORDER EXPRESSLY LIMITS ACCEPTANCE TO THE TERMS AND CONDITIONS SET FORTH HEREIN, AND ANY ADDITIONAL OR DIFFERENT TERMS ARE REJECTED UNLESS EXPRESSLY AGREED IN WRITING SIGNED BY AN OFFICER OF SELLER, NOTWITHSTANDING ANY PRIOR TRANSACTIONS OR COURSE OF DEALING BETWEEN BUYER AND SELLER. No Order of any kind between Buyer and Seller shall be binding on Seller unless and until it is accepted by Seller. Acceptance of Buyer's Order is upon these Terms and Conditions; provided, however, if Buyer's Order or offer is expressly conditioned upon Seller's acceptance of Buyer's terms and conditions, and the terms of quantity, price and the description of the Goods of Seller in Buyer's offer are the same as set forth in Seller's acceptance, then all other contrary or different terms in Buyer's offer are expressly rejected and Seller's acceptance shall create an agreement between Buyer and Seller to the extent of all consistent terms between Buyer's offer and Seller's acceptance, subject to and conditioned upon Buyer's consent to any of these Terms and Conditions which may constitute terms additional to or different from those terms contained in Buyer's offer. Buyer shall be deemed to have so consented by notifying Seller in writing or electronically, by accepting delivery of the Goods, or by using or selling the Goods. Acceptance by Seller of Buyer's Order shall take place upon acknowledgement either electronically or in writing of Buyer's Order, or by delivery to Buyer or Buyer's carrier of all or any part of the Goods.

2. PRICE – All prices for Goods are quoted and payable in United States currency, unless otherwise agreed by Seller in writing. All prices are F.O.B. Seller's factory in Lake Zurich, Illinois, United States of America ("Seller's Factory"), unless otherwise agreed by Seller in writing. Seller shall have the right to correct any obvious errors in price.

3. TAXES – Prices do not include any taxes. Any taxes which, under any existing or future law, Seller may be required to pay or collect with respect to the sale, purchase, delivery, storage, processing, use, consumption or transportation of any of the Goods shall be paid by Buyer to Seller on Seller's demand.

4. DELIVERY – Delivery dates for any Goods are approximate, are done for the convenience of Buyer, and shall not be binding upon Seller or considered material to the performance of these Terms and Conditions. Shipping schedules and shipping commitments are based upon current production capabilities, material availability and inventory, and may be changed by Seller at Seller's option as conditions may require. The Goods shall be sold and delivered F.O.B. Seller's Factory, and delivery of Goods to Buyer shall be deemed to have taken place upon tender of Goods to Buyer or the shipping carrier. Seller reserves title to the Goods until paid for in full to Seller. Seller reserves the right to ship plus or minus 10% on the quantity ordered, and the Order will be deemed complete when shipped within such 10% range. Shipments in installments shall be permitted.

5. RISK OF LOSS - Buyer agrees to assume all risk for loss of, or damage or injury to, the Goods from the time they are tendered for delivery to the shipping carrier and for all risk of loss arising out of any delay in shipment of the Goods after they are tendered for delivery to the shipping carrier, or if shipment is deferred by an act or omission of Buyer, from the time the Goods are completed and ready for shipment, and Buyer shall be liable for the full purchase price whether or not the Goods are lost, stolen, damaged or destroyed.

6. INSPECTION, ACCEPTANCE AND RETURN OF GOODS – Buyer shall have thirty (30) days from the date of delivery of the Goods to inspect the Goods to determine whether the Goods: (a) conform to this Order, or other shipping document, as applicable, or, (b) are damaged, visibly defective or otherwise nonconforming. Buyer must assert any claim for the foregoing within such thirty-day period by furnishing Seller with detailed written information of such damage, nonconformance, defect or shortage. In the event inspection and notice of rejection are not made within such thirty-day period, Buyer shall be deemed to have accepted the Goods. No returns can be made without the prior authorization of Seller and a pre-assigned return authorization number issued by Seller. All returns are subject to inspection and acceptances by Seller. When returns are accepted, they are subject to a handling and re-inspecting charge to be determined by Seller. All returns shall be in accordance with Seller's specific shipping instructions.

7. PAYMENTS - All invoices shall be due and payable in full, without set-off or reduction, within thirty (30) days from the invoice date, unless payment for the Goods is due in full upon delivery or in advance. Extensions of credit may be changed or withdrawn at any time. Buyer shall pay an interest charge of one and one-half percent (1 ½%) per month or part thereof, or the highest rate permitted by law, whichever is less, on any amount past due and owing by Buyer to Seller on any invoice until paid in full to Seller. Buyer shall bear and promptly pay to Seller any and all costs, expenses and fees, including, without limitation, reasonable attorneys' fees and costs, incurred by Seller in enforcing any of Seller's rights under this Order or to receive or collect any amounts owing from Buyer.

8. LIMITED WARRANTY - Seller warrants that (a) Seller has the right to convey good title to the Goods sold hereunder and, upon Buyer's payment in full therefor, Buyer shall have good title in and to such Goods, and (b) the Goods manufactured by Seller and sold hereunder to original Buyer are free from defects in material and workmanship occurring under normal use and conform, as applicable, to (i) Seller's specifications for stocked Goods, or (ii) Buyer's specifications for the Goods if provided by Buyer to Seller and/or the specifications as indicated on the applicable Smalley drawing. Seller's warranty is limited to a period of one year from the date of shipment from Seller's factory or the expected life of the goods, whichever is shorter. The Goods shall be subject to tolerances and variations consistent with usual industry practices or with Seller's current parts/engineering catalogs where applicable. Smalley assumes no liability for specifications agreed upon, reviewed or provided by Buyer. This limited warranty does not apply to any Goods misused, abused, altered or used other than as approved in writing by Seller, as determined by Seller's inspection of the non-conforming goods. If any defect in material or workmanship occurs during the applicable warranty period in any of the Goods, as determined by Seller's inspection of the non-conforming Goods, Buyer's sole and exclusive remedy shall be as set forth in Section 10 of these Terms and Conditions.

9. WARRANTY DISCLAIMER – OTHER THAN THE LIMITED WARRANTY SET FORTH IN SECTION 8 OF THESE TERMS AND CONDITIONS ABOVE, SELLER MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, OF ANY KIND, WITH RESPECT TO THE GOODS, INCLUDING, WITHOUT LIMITATION, ANY WARRANTIES AS TO ACCURACY, FUNCTIONALITY, PERFORMANCE OR MERCHANTABILITY. SELLER EXPRESSLY DISCLAIMS ALL OTHER WARRANTIES, EXPRESS, IMPLIED OR STATUTORY WITH RESPECT TO THE GOODS, INCLUDING, WITHOUT LIMITATION, THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE AND ANY WARRANTIES ARISING FROM TRADE USAGE, COURSE OF DEALING OR COURSE OF PERFORMANCE. ANY PERFORMANCE ESTIMATES DESCRIBED IN THIS ORDER, OR IN ANY OF SELLER'S WRITTEN OR ELECTRONIC OR MAGNETIC MEDIA PROPOSALS OR QUOTATIONS, ARE ONLY ESTIMATES AND ARE NOT INTENDED AS AN EXPRESS WARRANTY. ANY SAMPLES SUBMITTED BY SELLER TO BUYER, AND ANY DESCRIPTIONS, ILLUSTRATIONS, OR FORECASTS IN TRADE LITERATURE, BROCHURES, OR OTHER DOCUMENTATION OR ELECTRONIC OR MAGNETIC MEDIA SHALL NOT BE CONSTRUED AS WARRANTIES AS TO SUBSTANCE, PERFORMANCE, QUALITY, WEIGHT OR DIMENSION, AND ANY FAILURE TO CONFORM WITH SUCH SAMPLES, DESCRIPTIONS, FORECASTS OR ILLUSTRATIONS SHALL NOT CONSTITUTE ANY BREACH OF THIS ORDER OR THESE TERMS AND CONDITIONS. NO SALES PERSONNEL, EMPLOYEES, AGENTS OR REPRESENTATIVES OF SELLER OR ANY THIRD PARTY ARE AUTHORIZED TO MAKE ANY REPRESENTATION, WARRANTY OR COVENANT, WHETHER IN WRITING OR ORALLY, ON BEHALF OF SELLER, OTHER THAN THE LIMITED WARRANTY IN SECTION 8 ABOVE.

10. BUYER'S SOLE AND EXCLUSIVE REMEDY; LIMITATIONS ON LIABILITY – Except with respect to infringement of any United States patent or United States copyright by the Goods, Seller's sole obligation and liability to Buyer, and Buyer's sole and exclusive remedy with respect to defective or otherwise nonconforming Goods is limited, in Seller's discretion, to: (a) replacement (not including labor) of the non-conforming Goods and delivery to Buyer free of charge to the same location of original shipment; (b) repair (not including labor) of the non-conforming Goods and delivery to Buyer free of charge to the same location of original shipment; or (c) refund of Buyer's purchase price for the non-conforming Goods (without interest). If requested by Seller and at Seller's expense, Buyer shall return to Seller any Goods which are replaced or for which Buyer receives a refund, provided that in any such event, Buyer has complied with Seller's return policies and procedures. BUYER WAIVES ANY RIGHT TO ANY REMEDIES FOR NONCONFORMING GOODS OTHERWISE AVAILABLE AT LAW OR STATUTE OTHER THAN THOSE EXPRESSLY STATED IN THIS SECTION 10. OTHER THAN AS EXPRESSLY SET FORTH IN THIS SECTION 10 AND SECTION 13, SELLER SHALL NOT BE LIABLE TO BUYER FOR ANY DIRECT, INCIDENTAL, INDIRECT, SPECIAL, PUNITIVE, EXEMPLARY, TORT OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO ANY DAMAGES FOR BUSINESS INTERRUPTION, LOSS OF REVENUES, PROFITS OR SAVINGS, LOSS OF DATA, PROCUREMENT, PRODUCT RECALL, PRODUCT REMOVAL OR REINSTALLATION, INCREASED OVERHEAD, INJURY TO REPUTATION OR LOSS OF CUSTOMERS, INDEMNITY OR REIMBURSEMENT FOR ANY CLAIMS ASSERTED AGAINST BUYER BY A THIRD PARTY ARISING DIRECTLY OR INDIRECTLY FROM THE MANUFACTURE, DELIVERY, SALE, USE, INSTALLATION, ASSEMBLY, DISASSEMBLY OR RECALL OF THE GOODS, REGARDLESS OF CAUSE OR FORM OF ACTION ASSERTED BY BUYER, WHETHER IN CONTRACT, TORT, STRICT LIABILITY, STATUTORY LIABILITY OR OTHERWISE, AND WHETHER OR NOT SUCH DAMAGES WERE FORESEEN, UNFORESEEN OR FORESEEABLE, EVEN IF SELLER HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. NOTWITHSTANDING THE FOREGOING, IN THE EVENT THE TERMS OF THIS SECTION, OR ANY PART THEREOF, SHALL BE HELD INVALID OR UNENFORCEABLE BY A COURT OF COMPETENT JURISDICTION, SELLER'S TOTAL AGGREGATE LIABILITY TO BUYER UNDER THIS ORDER AND THESE TERMS AND CONDITIONS SHALL NOT EXCEED THE PURCHASE PRICE OF THE GOODS GIVING RISE TO THE CLAIM. IF NOT PERMITTED BY APPLICABLE LAW, THIS SECTION SHALL NOT RELIEVE SELLER FROM LIABILITY FOR DAMAGES THAT RESULT FROM ANY GROSS NEGLIGENCE OR WILLFUL OR TORTIOUS ACTS OF SELLER.

11. TECHNOLOGICAL CHANGES OR IMPROVEMENTS - Notwithstanding any other provision hereof, Seller reserves the right, without prior notice, at any time and from time to time, to make changes in: (a) any formula, data, tables, dimensions, materials and/or processes used in the manufacture of the Goods; or (b) to make changes in the design, specifications and capacities of any of the Goods; or (c) to discontinue manufacturing or supplying any of the Goods.

12. SUSPENSION OF PERFORMANCE; SET-OFF – If, in Seller's judgment, reasonable doubt exists as to Buyer's financial responsibility, or if Buyer is past due in payment of any amount owing to Seller, Seller reserves the right, without liability and without prejudice to any other remedies, to suspend performance, decline to ship, or stop any material or the Goods in transit, until Seller receives payment of all amounts owing to Seller, whether or not due or adequate assurance of such payment has been made by Buyer to Seller.

13. INTELLECTUAL PROPERTY INDEMNITY – Notwithstanding anything to the contrary contained in these Terms and Conditions, as Buyer's sole and exclusive remedy with respect to infringement of any United States patent or United States copyright by the Goods, Seller shall indemnify, defend and hold harmless Buyer from and against any and all costs and damages awarded against Buyer in any lawsuit, arbitration or similar proceeding with respect to any actual violation or infringement by the Goods manufactured by Seller of any United States patent or United States copyright of any third party ("Claim"), provided that Buyer provides to Seller prompt written notice and complete support, including, without limitation, documentation and witnesses as requested by Seller, but only if the alleged infringement is solely related to Seller's design, processes or methods and not Buyer's designs, specifications or instructions to Seller, in which event Section 16 shall apply. Seller shall have the right to control the defense of any such Claim, including, without limitation, authority to settle any such Claim and select counsel. As part of Buyer's sole and exclusive remedy with respect to infringement of any United States patent or United States copyright by the Goods, Seller shall, at its option, (a) obtain a license or right for Buyer to continue to use and sell the Goods, (b) redesign the Goods subject to the Claim to make them non-infringing, (c) deliver non-infringing products to Buyer, or (d) refund the purchase price of the infringing Goods upon return of said products to Seller as specified by Seller. This represents Seller's entire and exclusive obligation, and Buyer's sole and exclusive remedy, with respect to any such Claim regarding the Goods.

14. INDEMNIFICATION OF SELLER – Buyer shall indemnify, defend and hold harmless Seller and its officers, directors, employees, agents, shareholders, affiliated companies and their respective successors and assigns from and against any and all claims relating to, in connection with or arising from: (a) any breach by Buyer of any provisions of these Terms and Conditions; (b) any claim or suit for actual or alleged violation or infringement of any United States patent or United States copyright of any third party arising from Buyer's designs, specifications or instructions to Seller; (c) any unauthorized modification, alteration, adaptation or use of the Goods; and (d) any claim or suit for damages arising from acts, representations or omissions of Buyer related to Buyer's sale of the Goods, use of the Goods or incorporation of the Goods into a product or part thereof. Seller shall have the right to control the defense of any such claim, including, without limitation, authority to settle any such claim and seek reimbursement from Buyer and select counsel.

15. TOOLS, DIES, FIXTURES AND TECHNICAL DATA - Unless otherwise required by applicable law, any tools, dies, fixtures or technical data that Seller may develop for use in production of the Goods shall remain the sole property of Seller and shall be subject to the confidentiality provisions set forth herein. Where Seller furnishes Buyer technical data that will be used under a contract with the United States Government, Buyer shall affix the following legend upon such technical data: Technical Data contained herein are proprietary to Smalley Steel Ring Co. and may not be used, disclosed, reproduced, modified or displayed without the prior written approval of Smalley Steel Ring Co. U. S. Government license rights are limited to those mandatory rights identified in DFARS 252.7015(b) and/or to the rights identified in Smalley's commercial license agreement.

16. CONFIDENTIALITY; NO LICENSE - Buyer shall not use, disclose, sell, license, publish, reproduce or otherwise make available Seller's Confidential Information (as defined below), and Buyer shall secure and protect Seller's Confidential Information in a manner at least as robust as the maintenance of Buyer's confidential and proprietary rights, but in no event using less than reasonable efforts. "Confidential Information" means information not generally known by personnel who are not employees of Buyer or Seller, respectively, which is used by either Buyer or Seller, and is proprietary to Seller. Buyer acknowledges and agrees that disclosure of Seller's Confidential Information would be detrimental to Seller. Buyer further agrees that no license, express or implied, under any copyright, patents, trade secrets or know how ("Know How") of Seller is granted to Buyer by this Order or by any disclosure of Confidential Information or proprietary information hereunder. Seller shall retain all of its property rights in any such Know How which it possessed prior to the effective date of this Order and the property rights to any new Know How developed by Seller during the performance of its obligations hereunder shall, subject to any restrictions imposed by the Federal Acquisition Regulation ("FAR") (48 C.F.R. Parts 1-52) or imposed by the applicable terms of any higher tiered prime contract with an executive agency of the United States Government, vest in Seller. Subject to the property rights of the Buyer in respect of pre-existing or developed Know How, if any, Seller shall be entitled to a perpetual, fully paid-up or no-cost license to use, to copy, to modify and to exploit Buyer's Know How disclosed to Seller for the purpose of performing Seller's obligations under this Order. Buyer agrees that in the event of a breach of this confidentiality provision, Seller shall be entitled to obtain injunctive relief against Buyer, without bond but upon due notice, in addition to such other relief as may appertain at law or in equity, and shall be entitled to all costs of suit, including reasonable attorney's fees, related to enforcement of this Section 16.

17. LIMITATION ON ACTION – Any action or suit against Seller arising in any way from or with respect to these Terms and Conditions, this Order or the Goods must be commenced not later than one (1) year after the cause of action has occurred.

18. GOVERNMENT CONTRACTS - Buyer shall notify Seller if Buyer's requirement for Seller's Goods derives from a contract with the United States Government, or a lower-tiered subcontract under a United States Government contract. In that case, Buyer shall provide Seller with a complete listing of all FAR clauses or related agency FAR clause supplements that are deemed "flowed down" from the prime contract to be incorporated by reference into this Order. Such clauses shall apply to Seller in such a manner as necessary to reflect the position of Seller as a subcontractor to Buyer's prime contract, and these clauses shall be deemed to be the obligations of Seller to Buyer to the extent required by applicable law. However, wherever the clauses include a requirement for the settlement of disputes between the parties in accordance with the "Disputes" clause, the dispute shall be handled in accordance with the disputes provisions of this Order and not the prime contract. Unless the specific FAR clause(s) furnished by Buyer is mandatory by law, statue, or regulation, in cases of inconsistency between the provisions of this Order and the referenced clauses, the provisions of this Order shall have precedence.

19. EXPORTS - All sales, shipments, and sharing of technical data, both domestically and internationally, by Seller, its divisions, and subsidiaries, are done so in accordance with all applicable United States laws and regulations, including, but not limited to, the Export Administration Regulations ("EAR"), International Traffic in Arms Regulations ("ITAR"), Iranian Transaction Regulations ("ITR") and the International Emergency Economic Powers Act ("IEEPA") and any controls thereunder, and/or amendments thereof. By entering into this Order and/or accepting the Goods, Buyer confirms that it is not located in (or a national resident of) any country under United States or United Nations embargo or sanction, not identified on any United States Department of Commerce Denied Persons List, Entity List, United States Department of State Debarred Parties List, and/or the United States Department of the Treasury's Specially Designated Nationals list, and not directly or indirectly involved in the financing, commission or support of terrorist activities or in the development or production of nuclear, chemical, biological weapons or in missile technology programs as specified in the EAR. Upon request, Buyer agrees to provide Seller with all information pertaining to the actual routing of Goods to be exported and the intended use thereof. Any routing and/or use of the Goods contrary to the laws and regulations of the United States or country in which they are being used is prohibited.

20. FORCE MAJEURE - Seller shall not be liable for any failure to perform in accordance with this Order, including, without limitation, failure to deliver the Goods, caused for any reason, in whole or in part, beyond Seller's reasonable control, including, but not limited to, production schedules of Seller's suppliers, unavailability of materials, labor disturbances, acts of God, fire, flood, weather, terrorism or transportation difficulties.

21. CANCELLATION – Except as set forth in this Section 21, this Order may be cancelled or modified only by written agreement between Buyer and Seller. Buyer's insistence upon canceling or suspending fabrication or shipment, or Buyer's failure to furnish specifications when required, may be treated by Seller as a breach of contract by Buyer, and Seller may cancel any unshipped balance of Goods without prejudice to any other remedies Seller may have.

22. ENTIRE AGREEMENT - These Terms and Conditions, together with the other documents expressly referred to herein constituting this Order, constitute the entire agreement under which Seller is supplying the Goods for sale to Buyer. No other terms, condition, or understanding, whether oral or written, shall be binding upon Seller, unless concurrently herewith or hereafter made in writing and signed by Seller's authorized representative.

23. NO WAIVER – No waiver of any term, provision, covenant or condition of these Terms and Conditions by Seller, whether by conduct or otherwise, in any one or more instances, shall be deemed or construed as a further or continuing waiver of any such term, provision, covenant or condition or as a waiver of any other term, provision, covenant or condition hereof.

24. SUCCESSORS AND ASSIGNS – The rights, duties, agreements and obligations hereunder, or any portion thereof, shall be binding upon and inure to the benefit of Seller and Buyer and their respective successors and assigns.

25. GOVERNING LAW; U.N. CONVENTION ON THE SALE OF GOODS; JURISDICTION – This Order, which has been made and entered into the State of Illinois, United States of America, and all the rights and duties of the parties arising from or relating in any way to the subject matter of this Order or the transaction(s) contemplated by it, shall be governed by, construed and enforced in accordance with the laws of the State of Illinois and the United States of America without regard to any conflict of laws rules, except to the extent of provisions included herein by virtue of the requirements applicable to Federal Government procurement, which provisions shall be construed and interpreted according to the Federal common law of government contracts as enunciated and applied by Federal judicial bodies, boards of contract appeals and quasi-judicial agencies of the Federal Government. The rights and obligations of Buyer and Seller shall not be governed by the provisions of the United Nations Convention on Contracts for the International Sale of Goods. Any suit or proceeding relating to this Order or the Goods may be brought in the courts, state or federal, located in Chicago, Cook County, Illinois. BUYER HEREBY CONSENTS TO THE PERSONAL JURISDICTION AND VENUE OF THE COURTS, STATE AND FEDERAL, LOCATED IN CHICAGO, COOK COUNTY, ILLINOIS. TCS-06

Please see our website for updated Terms and Conditions: ***smalley.com/terms-and-conditions***

Notes

Notes

NO ORDINARY MANUFACTURING COMPANY

Every Smalley retaining ring and wave spring is backed by our legendary customer support. Don't just take our word for it – see what our customers are saying.

"Great customer service, love how easy it is to get samples for our prototypes. Everyone at Smalley is very courteous and knowledgeable. Love using Smalley on all of our new designs. Thanks so much!"

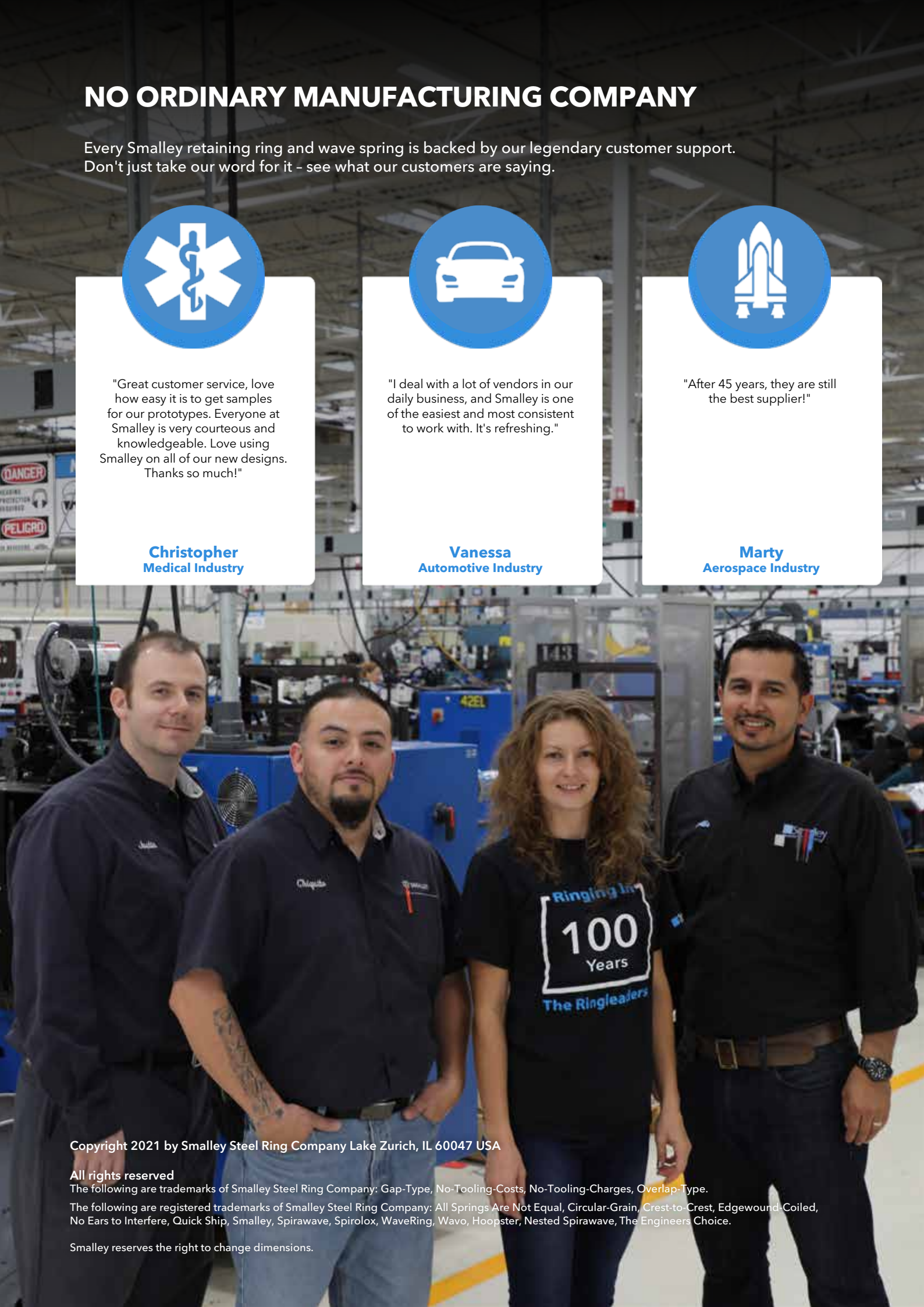
Christopher
Medical Industry

"I deal with a lot of vendors in our daily business, and Smalley is one of the easiest and most consistent to work with. It's refreshing."

Vanessa
Automotive Industry

"After 45 years, they are still the best supplier!"

Marty
Aerospace Industry



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Smalley reserves the right to change dimensions.

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- SINGLE-TURN
- WAVO®
- LINEAR
- NESTED SPIRAWAVE®

RETAINING RINGS
- SPIROLOX®
- CONSTANT SECTION
- HOOPSTER®
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