Innovation Every Day...

Since 1957, Rotor Clip has been the premier manufacturer of retaining rings, constant section rings, spiral rings and self-compensating hose clamps - incessantly updating equipment and improving processes along the way. And now, innovative engineering has lead Rotor Clip to the manufacture of wave springs. With the vast knowledge possessed in producing wire formed carbon spring and stainless steel parts, wave springs are a natural step in expanding our product line. Our dedication to continuous improvements, lean initiatives, and customer satisfaction is the driving force behind our initiatives, and Rotor Clip constantly strives to become the single source for large volume requirements of rings, clamps and wave springs.

The Wave Spring Advantage...

A wave spring is coiled flat wire with waves added to give it a spring effect. Wave springs are superior to coil springs in certain applications because they provide lower work heights with the same force. This not only provides for space savings, but also smaller assemblies that use less materials, hence lower production costs.

Wave springs can act as load bearing devices - compensating for accumulated tolerances in assemblies and providing end-play takeup. Wave springs exert a force, or "preload" on assemblies made to the low side of the tolerances "snugging" everything up. On the other end, they also "give" when parts are made to the high side of tolerances.

Coil Spring *Wave Spring*

Applications of Wave Springs...

STATIC: This type of application implies that a spring never really moves once it is installed. This type of spring generally holds a load at a given height for the life of the assembly - There is no cycling of the part.

DYNAMIC: This type of application indicates that a spring will constantly be moving up and down until the end of its life.This type of wave spring has 2 working heights, and hence, 2 loads. Fatigue is critical in this type of spring. Generally, the higher the cycle life, the stronger the spring needs to be.

Key Terminology...

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

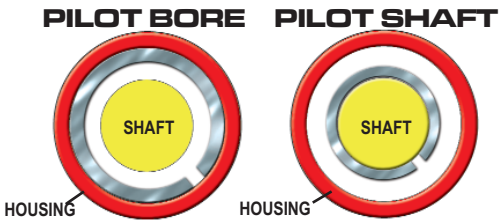
SPRING HEIGHTS - *(See figure, lower right)*

Free Height: The height of the wave spring when uncompressed.

Work Height: The height the spring is compressed to for delivering the desired force.

OPERATES IN BORE/CLEARS SHAFT - *(See figure, right)*

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



LOAD - The force the wave spring exerts when compressed.

Load requirement can be stated 3 ways:

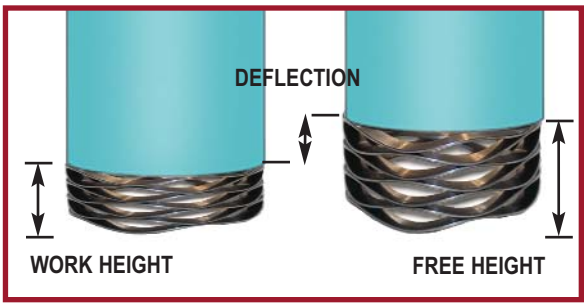
- A load requirement at a specific working height.
- The minimum load requirement at one working height, and a maximum load requirement at another working height.
- The specified spring rate between the minimum and maximum working heights.

SPRING RATE - The force per displacement (lbs./in. or Newtons/mm.) More accurate than stamped wave washers.

DEFLECTION - *(See figure, lower right)* How much the spring compresses.

DIAMETER EXPANSION - A wave spring will want to open outward during compression. This outward movement will increase the diameter.

FATIGUE - All springs suffer fatigue, the weakening or failure of a material resulting from prolonged stress. This can be compensated for with optimal materials and sizing.



Wave Spring Types...

Gap Single Turn/Overlap Single Turn **Standard Inch (SST) / Narrow Inch (NST) / Metric (MST)**

- Ideal for short deflection applications with low to medium forces.
- Offered in a number of waves and material thicknesses.
- Designed for a wide range of bore and rod diameters.
- Ideal for:
  - Narrow radial wall dimensions
  - Light duty applications
  - Low clearance applications
  - Ball or roller bearing applications

Multi-Turn Plain Ends **Light (WSL) / Medium (WSM) / Heavy (WSR)**

- Decreasing spring rate is proportional to the number of turns: More turns equals less force.
- Used for low force applications with large deflections.
- Utilizes nearly 1/2 the space as helical compression springs while producing the same force.

Choosing a Wave Spring...

There are 5 critical factors when considering a wave spring:

- The constraints of the application: Pilot bore/shaft, ID/OD, etc.
- The load (force).
- The working height at which the load is applied.
- The material desired.
- Whether it's dynamic or static.

Material Type

SAE 1070-1090 Carbon Steel

- This prehardened material is the standard material for wave springs.
- Less expensive option to Stainless Steel.

17-7 Stainless Steel

- Used for high stress and fatigue applications.
- Can withstand much higher temperatures than SAE 1070-1090 and not lose its spring qualities.
- Higher corrosion resistance than SAE 1070-1090.

TO HELP US DESIGN THE BEST WAVE SPRING FOR YOUR APPLICATION, COPY & FILL OUT THE CUSTOM WAVE SPRING DESIGN FORM ON THE BACK OF THIS BROCHURE AND FAX TO **732-805-6469**. THIS FORM CAN ALSO BE FOUND ON **WWW.ROTORCLIP.COM**

Certified to ISO/TS 16949:2002

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Rotor Clip
CUSTOM WAVE SPRING DESIGN FORM

CUSTOMER INFORMATION:

Name:_____ Title:_____ Date:____/____/____

Company:_____ Phone:_____ Fax:_____

Address:_____ E-Mail:_____

City:_____ State:_____ Zip:_____ Country:_____

APPLICATION CONSTRAINTS:

A bore diameter of _____ (☐ in. or ☐ mm) must be cleared.

An inside diameter of _____ (☐ in. or ☐ mm) must be cleared.

Should the diameter closely fit the ☐ shaft or ☐ bore?

LOAD REQUIREMENTS: (Fill out one section only.)

Values in: ☐ pounds & inches or ☐ Newtons & mm

SECTION 1:

Approximate Free Height:_____

Load_____@ height _____

Load_____@ height _____

SECTION 2:

Range of Free Height: _____ to _____

No. of Waves: _____ Material Thickness: _____

Ring Section: _____

LIFE CYCLE ESTIMATES:

☐ Static

☐ Less than 100,000 (10^5) cycles

☐ 100,000 (10^5) cycles

☐ 1,000,000 (10^6) cycles

☐ Greater than 1,000,000 (10^6) cycles

ENVIRONMENTAL CONSIDERATIONS:

Operating Temperature: _____ ☐ °F or ☐ °C

Is the Environment Corrosive? ☐ Yes ☐ No

If "yes", please explain: _____

SPRING MATERIAL:

☐ Carbon Steel

☐ Stainless Steel

SPRING FINISH:

☐ As Supplied

☐ Oil Dipped

☐ Degreased

☐ Phosphated

RANK IN ORDER OF PRIORITY (1-3):

_____ Price

_____ Load @ Height(s)

_____ Cycle Life

COMMENTS:

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