

ENTER THE WORLD OF MACHINED SPRINGS



**The spring
for the
21st century**

 **HELICAL**
PRODUCTS COMPANY, INC.

Enter the world of MACHINED SPRINGS



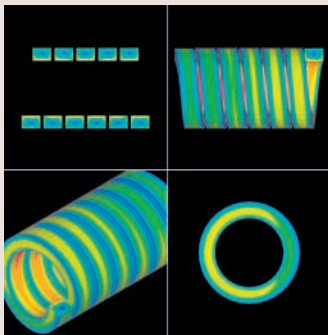
Cover picture:
International Space
Station spring

The spring for the 21st century

Here's why:

■ Advanced machined spring technology

- ★ Finite element stress analysis (FEA) with Ansys
- ★ Modal analysis
- ★ Accommodates a wide variety of integrated attachments
- ★ Includes pure spring reactions for torsional applications
- ★ Incorporates multiple start configurations to eliminate extraneous reaction forces and moments, (buckling)
- ★ Provides unlimited variations
- ★ Offers multi-functionality expertise



Testing for stress areas

■ The HELI-CAL® Flexure

The HELI-CAL Flexure is a flexible helix (curved beam) machined into a unique configuration that incorporates special design requirements, performance features and/or characteristics. The material used is basically unlimited.

When used as a spring, the multi-functional flexure provides desired and predictable elastic performance in compression, extension, torsion, lateral bending and lateral translation modes.

The HELI-CAL® Flexure



...as a spring

One huge advantage of this technology—it enables customer specified end-attachments, such as tangs, clamps, flanges or threaded ends, to be integrated into a single multi-functional component.

■ Materials

- ★ High strength corrosion resistant materials such as stainless steel
- ★ High strength aluminum
- ★ High strength titanium
- ★ All machinable alloys
- ★ Machinable plastics

Materials most used: Stainless steel 17-4PH, 15-5PH, 303, 316, 416, 18-8, Custom 455 maraging, C300 and C250, 718, 4340, H-11, Beta C Titanium, Delrin 150, Aluminum 7075-T6.

■ Capabilities/Services

- ★ Over 40 years of manufacturing and engineering excellence
- ★ Complete in-house engineering design and manufacturing
- ★ Quality assurance
- ★ Precise spring rates
- ★ Prototypes and short runs to high volume production quantities
- ★ Fast turnaround and delivery
- ★ Unmatched dedication to quality and customer satisfaction

- ★ “Multi-start” flexure construction (more than one spring coil set) provides a broad range of spring rates and functionality within a given envelope. Provides a redundant coil to resolve lateral forces.
- ★ Precision machining of complex, multi-featured configurations

■ Wire-wound vs HELI-CAL machined springs

Differences in coil geometry enable *machined* springs to provide more precise performance, features and functions than can other, more traditional types of springs. There are big differences in performance, reliability, versatility, integrity, and cost effectiveness. See example below.



Before

Wire-wound spring.
Three pieces.



After

Helical *machined*
spring. Single piece.
Integrated parts-
functions.

■ The bottom line — machined springs:

- ★ Offer more functions in a single spring than other more traditional springs, such as wire-wound.
- ★ Add value, in terms of multi-part integration, time saved in handling, reliability, rates being linear, and dimensions being very precise.
- ★ Reduce and/or control costs
- ★ Raise overall productivity, i.e., add more, do more, save more dollars.

■ Comparison Data — are machined springs right for your application?

Consideration	Wire-wound springs	Machined springs	Comments
★ Perform basic elastic modes	Yes	Yes	Machined springs have distinct multi-functional advantages.
★ Relatively inexpensive	Can be	Depends	Both types can be expensive or inexpensive.
★ Available in different materials	Limited	Yes	Machined springs can be produced from any machinable material.
★ Multi-function - feature capability	Limited	Yes	Machined springs can contain many dimensional features.
★ No stress to overcome before deflection	Some	Yes	Machined springs have a more precise force-deflection relation.
★ Can reduce assembly costs	Doubtful	Yes	Incorporating multiple features into a single part design makes assembly easier & cost effective.
★ Can contain redundant elastic elements (multiple starts)	No	Yes	Machined spring rates are linear.
★ Quality - reliability	Depends on manufacturer	Yes	Dimensional variances are typically smaller in machined springs.
★ Precision elasticity	Difficult	Yes	Variation rates in machined springs are typically low.
★ Integration with other products	Difficult	Yes	Design it into your system, not around it.
★ Reduction of system complexity	Difficult	Yes	Simplify your system by incorporating multiple capabilities into a single part.
★ Custom-end configurations added to spring	With difficulty	Yes	One of the major advantages of machined springs.
★ Longevity achievable?	Yes	Yes	Machined spring's long life can benefit from multi-start configurations (double and triple starts).
★ Can be configured as:			
Extension spring	Yes	Yes	} Machining lends itself to custom end attachments. With machined springs, <u>all coils</u> deflect under load.
Compression spring	Yes	Yes	
Torsion spring	Yes	Yes	
Lateral bending spring	?	Yes	
Lateral translation spring	?	Yes	



Applications utilizing the HELI-CAL® Flexure range from missiles to medical apparatus to oil wells

■ Integrated attachment examples of Helical machined springs

Threaded ID and OD



Hubble telescope

Integrated flange



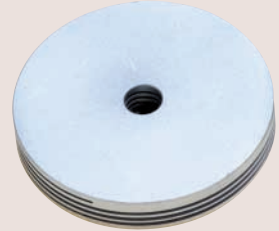
Aerospace application

Double start flexure



Cryogenic cooler application

Heat dissipating spring



Used with lasers

Material: Beta C Titanium



240° torsional spring

Right and left handed flexure



Triple start, torsional spring

Threaded ends



Mars Rover

Capacitor terminal



Aircraft electronics

Formerly four pieces



Now one piece with Helical wrap spring clutch

Tapered flange



Single start, compression spring

Beefed up radius on tangs



One piece, wrap spring clutch

Four elastic rates incorporated



Medical application
Five start spring

Constant pivot and rotary



Medical application
Torsion spring

Material: 17-4PH



Industrial knife application

Integrated end attachments



Machine tool application

.125" Flexure OD



Commercial lateral spring



■ Springs in photo range from .090 to 5.0 inches (OD)

