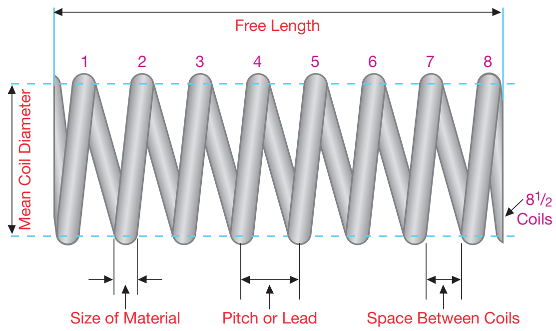
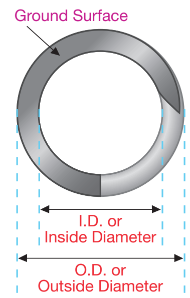
Compression Springs



A compression spring often functions within a set amount of space or functions over a tube or rod. In these situations, this space governs the dimensional limits of the spring, controlling the allowable solid height, the inside diameter and the outside diameter. These dimensional limits, together with a spring's load and deflection requirements, determine the stress level.



Rate is the change in load per unit deflection. To determine rate:

1) Deflect the spring to approximately 20% of the available deflection and measure the load (P_1) and the spring length (L_1).

2) Deflect the spring not more than 80% of the available deflection and measure the load (P_2) and the spring length (L_2). Be certain that no coils (other than the closed ends) are touching at L_2.

3) Calculate the rate (R) in lb./in. or N/mm

Rate (R)

$$R = \frac{(P_2 - P_1)}{(L_1 - L_2)}$$

Specifications

We manufacture using round wire, square wire, rectangular wire and special section wire. Our material size range for compression springs is from .004-inches to 2.0-inches in diameter.

Active coils (n_a) are the coils which are free to deflect under a load. To calculate mean coil diameter (D) subtract a spring's wire diameter (d) from its outside diameter $(O.D.)$.

Mean Coil Diameter (D)

$$D = O.D. - d$$

Formulas for Dimensional Characteristics

When applying the given data to solid height, one should remember that the formulas do not consider the fact that the actual solid height may not be the same as calculated, due to improper seating of the coils, variation in the grinding process, normal variation in wire size and electroplating.

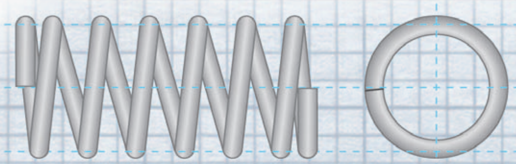
Spring Characteristic	Open	Open & Ground	Closed	Closed & Ground
Pitch (p)	$\frac{L - d}{n_a}$	$\frac{L}{n_a}$	$\frac{L - 3d}{n_a}$	$\frac{L - 2d}{n_a}$
Solid Height (H)	$d(N_t + 1)$	$d \times N_t$	$d(N_t + 1)$	$d \times N_t$
Total Coils (N_t)	n_a	$n_a + 1$	$n_a + 2$	$n_a + 2$
Free Length (L)	$(p \times n_a) + d$	$p \times n_a$	$(p \times n_a) + 3d$	$(p \times n_a) + 2d$

Design Notes

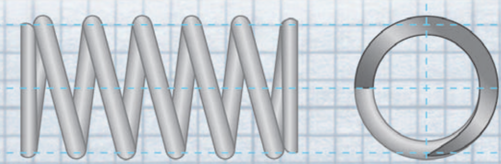
There are many issues related to the design of a compression spring that should be considered, as these relate directly to the spring's performance. Manufacturing tolerance requirements, squareness of ends and the slenderness ratio are often overlooked in the design process. Our sales and engineering staff will gladly review your compression spring specifications with you and recommend the best options to control your costs and ensure the spring functions to fit your needs.

The Importance of Deflection

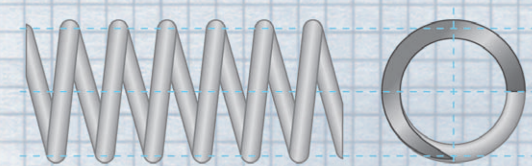
The spring rate over the central 60% of the deflection range is essentially linear for constant pitch springs. If possible, critical loads and rates should be specified within this range and can be increased to about 80% of total deflection using special production techniques.



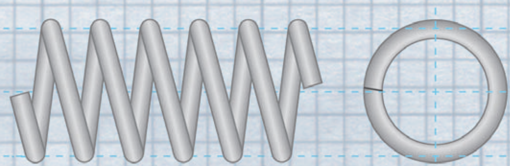
Closed Ends, Not Ground (left hand helix)



Closed and Ground Ends (right hand helix)



Open Ends, Ground (left hand helix)



Open Ends, Not Ground (right hand helix)