Compression Spring Basic Features

A compression spring is an open-coil helical spring that offers resistance to a compressive force applied axially. Compression Springs are the most common metal spring configuration and are in fact one of the most efficient energy storage devices available. Other than the common cylindrical shape, many shapes are utilized, including conical, barrel and hourglass. Generally, these coil springs are either placed over a rod or fitted inside a hole. When you put a load on a compression coil spring, making it shorter, it pushes back against the load and tries to get back to its original length.

Compression springs are found in a wide variety of applications ranging from automotive engines and large stamping presses, e.g. die springs, to major appliances and lawn mowers to medical devices, cell phones, electronics and sensitive instrumentation devices. Cone shape metal springs are generally used in applications requiring low solid height and increased resistance to surging.

A coil spring can be wound in either a left hand or right hand direction, similar to a screw type thread. In applications such as one spring operating inside another, it is necessary to coil the springs so that the helices are in opposite directions, right and left.

Total number of coils is counted from tip to tip. Springs with closed ends or with closed and ground ends have one inactive coil at each end. Springs with open ends are considered to have virtually no inactive coil. Springs with open ends ground are considered to have about one-half inactive coil at each end.

"When you put a load on a compression coil spring, making it shorter, it pushes back against the load and tries to get back to its original length."

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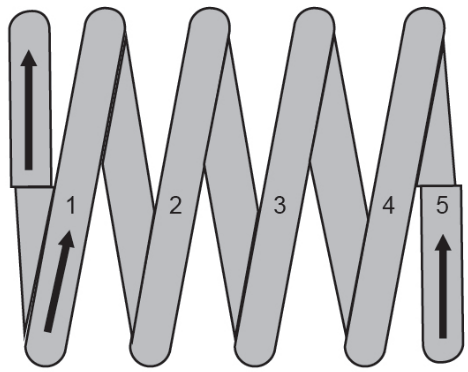
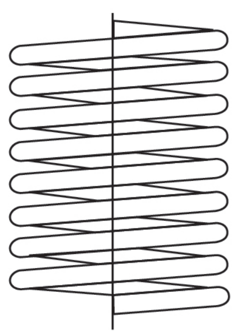
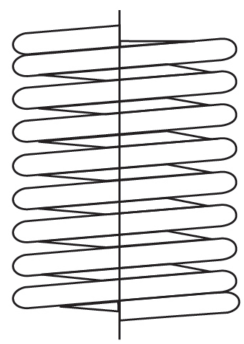
When designing a spring and specifying its dimensions, it is critical that the number of coils is counted correctly, as this can have a huge effect on the strength of the spring. It is a straightforward process - simply start at one end of the spring, where the wire has been cut, then follow the wire round – every time you go through 360° that counts as a full coil (180° = ½ coil; 90° = ¼ coil etc.) The compression spring pictured has five total coils (not six).



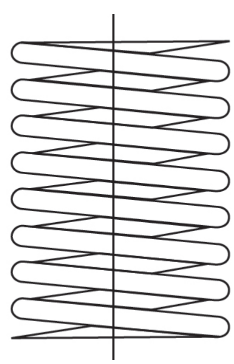
There are four basic types of compression spring ends, as shown. The type of ends specified affect the pitch, solid height, number of active and total coils, free length, and seating characteristics of the spring.



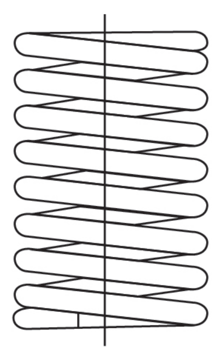
Open End: the coils are consistent with no pitch change through the end of the spring



Closed Ends, Not Ground: the end coils' pitch is reduced so the end coils touch



Open & Ground: last coil ground 'flat' in appearance and has a less parallel end



Closed, Squared & Ground: last coil not 'flat' in appearance and has a less parallel end

Spring squareness is the angular difference between the outermost limit of a spring diameter when compared to a straightedge at a right angle to a horizontal flat plate on which the spring is standing. This affects how the axial force produced by the spring can be transferred to adjacent parts in a mechanism. Open ends may be entirely suitable for some applications, however, when space allows, closed ends provide greater squareness and reduce the possibility of tangling with little increase in cost.
Compression springs with closed ends can often perform well without grinding, particularly in wire sizes smaller than .020 in. or spring indices exceeding 12.

Many applications require grinding the ends in order to provide greater control over squareness. Among these are applications in which:

1. High-duty springs are specified
2. Unusually close tolerances on load or rate are needed
3. solid height must be minimized,
4. accurate seating and uniform bearing pressures are required,
5. a tendency toward buckling must be reduced.

Since springs are flexible and external forces tend to tilt the ends, grinding to extreme squareness is difficult. A spring may be specified for grinding square in the unloaded condition or square under load, but not in both conditions with any degree of accuracy. When squareness at a specific load or height is required, it should be specified.

Compression Spring Shape Types

Compression springs can come in a variety of shapes. Custom designs may have any number of shapes depending on the application.

- Some common custom shapes include the **Cone** shape where the spring radius decreases, a common shape is a **Battery Springs**.
- An **Hour Glass** shape tapers tighter towards the center and the outer coils have a larger diameter.
- The **Barrel Shape** is reduced at the ends and wider in the center.
- The **Reduced Ends** spring is straight across the center coils and tapers only towards the end coils.

Conical

Hourglasses (Convex)

Barrel (Concave)

Reduced Ends

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Cone Compression Spring

Conical springs provide a commonly used solution for spring applications with constraints of reduced length or space. They can be used in many different mechanisms, such as contactors and switches in the electrical field. Indeed, they are often chosen for one special characteristic: their ability to telescope. They take up very little space at maximum compression while storing as much energy as cylindrical springs. Their load-length characteristics are usually nonlinear.