Spring Definition & Glossary of Terminology

Active Coils (n) - Those active coils which are free to deflect under load.

Arbor - A round, hardened rod or shaft upon which springs are wound., Also called a "mandrel"

Blue - A thin blue film of oxide on ferrous alloys, sometimes used to indicate that the material has been stress relieved.

Buckling - Bowing or lateral deflection of compression springs when compressed, related to the slenderness ratio (L/D)

Closed Ends - Ends of compression springs, where pitch of the end coils is reduced so that the end coils touch.

Closed and ground ends - As with closed ends, except that the end is ground to provide a flat plane.

Close-wound - Coiled with adjacent coils touching

Deflection (F) - Motion of spring ends or arms under the application or removal of an external load (P)

Elastic limit - Maximum stress to which a material may be subjected without permanent set.

Endurance limit - Maximum stress at which any given material will operate indefinitely without failure for a given minimum stress.

Free Angle - Angle between the arms of a torsion spring when the spring is not loaded

Free Length (L) - The overall length of a spring in the unloaded position.

Helix - The spiral form (open or closed) of compression, extension, and torsion springs.

Hooks - Open loops / ends of extension springs.

Hydrogen embrittlement - Hydrogen absorbed in electroplating or pickling of carbon steels, tending to make the spring material brittle and susceptible to cracking and failure, particularly under sustained loads.

Initial Tension (P) - The force that tends to keep the coils of an extension spring closed and which must be overcome before the coils start to open.

Load (P) - The force applied to a spring that caused a deflection (F).

Loops - Coil-like wire shapes at the ends of extension springs that provide for attachment and force application.

Mean coil diameter (D) - Outside spring diameter (O.D.) minus one wire diameter (d)

Modulus in shear or torsion (G) **-** Coefficient of stiffness for extension and compression springs.

Modulus in tension or bending (E) - Coefficient of stiffness used for torsion and flat springs (Young's Modulus).

Open ends, not ground - End of a compression spring with a constant pitch for each coil.

Open ends ground - "Open ends, not ground" followed by an end grinding operation

Passivating - Acid treatment of stainless steel to remove contaminants and improve corrosion resistance.

Permanent set - A material that is deflected so far that its elastic properties have been exceeded and it does not return to its original condition upon release of load is said to have taken a "permanent set".

Pitch (p) - The distance from center to center of the wire in adjacent active coils (recommended practice is to specify number of active coils rather than pitch.

Rate (R) - Change in load per unit deflection, generally given in pounds per inch.

Remove set - The process of closing to solid height a compression spring which has been coiled longer than the desired finished length, so as to increase the apparent elastic limit.

Residual stress - Stresses induced by set removal, shot peening, cold working, forming or other means. These stresses may or may not be beneficial, depending on the application.

Set - Permanent distortion which occurs when a spring is stressed beyond the elastic limit of the material.

Solid height (H) - Length of a compression spring when under sufficient load to bring all coils into contact with adjacent coils.

Spring index - Ratio of mean coil diameter (D) to wire diameter (d).

Squared and ground ends - See *Closed and ground ends.*

Squared ends - See *Closed* ends.

Stress range - The difference in operating stresses at minimum and maximum loads.

Stress relieve - To subject springs to low-temperature heat treatment so as to relieve residual stresses.

Shot peening - A cold-wound process in which the material surface is peened to induce compressive stresses and thereby improve fatigue life.

Squareness of ends - Angular deviation between the axis of a compression spring and a normal to the plane of the ends.

Torque (M) - A twisting action in torsion springs which tends to produce rotation, equal to the load multiplied by the distance (or moment arm) from the load to the axis of the spring body. Usually expressed in inch-oz., inch-pounds or in foot-pounds.

Total number of coils (N) - Number of active coils (n) plus coils forming the ends.

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