



SPRING WORKS UTAH
Springs • Wire Fabrications • Stampings

Glossary of Terms

Active coils (n_a)

Those coils which are free to deflect under load.

Alloy

A metal composed of two or more metal elements bound together.

Angular relationship of ends

The relative position of the plane of the hooks or loops of extension springs to each other.

ASTM

The American Society of Testing Materials.

Arbor

A round rod on a spring coiler over which wire is coiled to form a spring.

Baking

Heating of electroplated springs to relieve hydrogen embrittlement.

Brass

A copper-base alloy of copper and zinc.

Bronze

A copper-base alloy of copper and tin.

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.

Closed length

See *Solid Height*.

Close-wound

Coiled with adjacent coils touching.

Coils per inch

See *Pitch*.

Deflection (F)

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

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Elastic limit

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

Endurance limit

Maximum stress to which any given material will operate indefinitely without failure for a given minimum stress.

Fatigue Failure

When a spring is deflected continually, the metal becomes fatigued and failure may occur at a stress level far below the elastic limit.

Fatigue Life

Number of deflection cycles until failure occurs at a predetermined stress.

Fatigue Strength (Endurance Strength)

Stress at which failure occurs after a specific number of deflections.

Force (P)

Active power applied to a spring to cause a deflection. Is erroneously called load.

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.

Frequency (natural)

The lowest inherent rate of free vibration of a spring itself (usually in cycles per second) with ends restrained.

Gauge

A standard for measuring material thickness.

Gradient

See *Rate* (R).

Heat Setting

Fixturing a spring at elevated temperature to minimize loss of load at operating temperature.

Helix

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

Hooke's Law

Load is proportional to displacement.

Hooks

Open loops or ends of extension springs.

Hot pressing

See *Heat setting*.



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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.

Hysteresis

The mechanical energy loss that always occurs under cyclic loading and unloading of a spring, proportional to the area between the loading and unloading load-deflection curves within the elastic range of a spring.

Initial tension (P_i)

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 causes 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).

Moment (M)

See *Torque*.

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).

Poisson's Ratio

The ratio of the strain in the transverse direction to the strain in the longitudinal direction.

Preset

See *Remove set*.



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Proportional Limit

Maximum load at which strain or deformation is directly proportional to stress, at zero percent offset.

Rate (R)

Change in load per unit deflection, generally given in pounds per inch (N/mm).

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.

Resilience

Elastic ability of a material to rebound to its original shape after deflection.

Set

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

Shot peening

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

Slenderness ratio

Ratio of spring length (L) to mean coil diameter (D).

Solid height (H)

Length of 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*.

Squareness of ends

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

Squareness under load

As in *Squareness of ends*, except with the spring under load.

Strain

The deformation produced by a stress as compared to the original shape.

Stress range

The difference in operating stresses at minimum and maximum loads.



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Stress relieve

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

Tensile Strength

Maximum force which a material is capable of sustaining. It equals force reached divided by original cross-sectional area.

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 oz * in., lb. * in., lb. * ft., or in N * mm.

Total number of coils (N_t)

Number of active coils (n_a) plus the coils forming the ends.

Wahl Factor

A factor to correct stress in helical springs effects of curvature and direct shear.

Yield Point

Stress point which will cause an elongation to the original length of the spring.