



## SPRINGS TERMINOLOGY



**Active Coils** – coils which are free to deflect under load.

**Allow for Set** – when a spring is supplied longer than specified to compensate for length loss when fully compressed in assembly by customer; recommended for large quantity orders to reduce cost.

**Angular Relationship of Ends** – the relative position of the hooks/loops of an extension spring or ends/legs of a torsion spring to each other.

**Baking** – the heating of electroplated springs to relieve hydrogen embrittlement.

**Buckling** – the bowing or lateral deflection of compression springs when compressed, related to the slenderness ratio (L/D).

**Close Wound** – when springs are coiled with adjacent coils in contact.

**Closed Ends** – ends of compression springs where the pitch/helix angle of the end coils is progressively reduced until the end of the material touches the adjacent coils.

**Closed and Ground Ends** – same as closed ends, except the end coil is ground to provide a flat plane.

**Compression Spring** – a spring whose length is reduced in the direction of applied load.

**Cycle Test** – a test to determine if a spring will meet the minimum number of deflections as required for its application.

**Deflection** – the relative displacement of the ends of a spring under the application or removal of an external load.

**Elastic Limit** – the maximum stress to which a material may be subjected without permanent deformation/set.

**Endurance Limit** – the maximum stress at which any given material will operate indefinitely without failure for a given minimum stress.

**Extension Spring** – a spring whose length is increased in the direction of applied force.

**Free Angle** – the angular relationship between the arms of a torsion spring which is not under load.

**Free Length** – the overall length of a spring which is not under load.

**Frequency (Natural)** – the lowest inherent rate of free vibration of a spring itself (usually in cycles per second) with ends restrained.

**Grinding** – the removal of material from the end faces of a spring by using abrasive wheels, in order to obtain a flat surface that is square with the spring axis.

**Heat Setting** – fixturing a spring at an elevated temperature to minimize loss of load at operating temperature.

**Helix** – the spiral form (open or closed) of compression, extension and torsion springs.

**Hooks** – the open loops or 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.

**Hysteresis** – the mechanical energy loss occurring during cyclic loading and unloading of a spring within the elastic range, represented by the area between the loading and unloading load-deflection curves.

**Inactive Coils** – coils which are not free to deflect under load and do not contribute to the rate of a spring.

**Index** – the ratio of the mean coil diameter (M) to either the material diameter (d), for circular sections, or the radial width of the cross section for rectangular or trapezoidal sections.

**Initial Tension** – the force that keeps the coils of a close wound extension spring closed and which must be overcome before the coils start to open.

**Inside Diameter (I.D.)** – the diameter of the cylindrical envelope formed by the inside surface of the spring coils.

**Load** – the force applied to a spring that causes a deflection.

**Loops** – circular formed ends of extension springs that provide a means for attachment and force application.

**Mean Coil Diameter** – the average diameter of the spring, equal to half the sum of the inside and outside spring diameters.

**Modulus in Shear or Torsion (Modulus of Rigidity)** – the coefficient of stiffness used for extension and compression springs.

**Modulus in Tension or Bending (Young's Modulus)** – the coefficient of stiffness used for torsion and flat springs.

**Moment** – see Torque.

**Open Ends** – ends of compression springs with a constant pitch for each coil.

**Open and Ground Ends** – same as open ends, except followed by an end grinding operation.

**Outside Diameter (O.D.)** – the diameter of the cylindrical envelope formed by the outside surface of the spring coils.

**Passivation** – acid treatment of stainless steel to remove contaminants and improve corrosion resistance.

**Permanent Set** – a material is said to have a “permanent set” when it deflects so far that it exceeds its elastic properties and does not return to its original condition upon release of load.

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

**Preset or Remove Set** – full compression of a spring to solid state by manufacturer when needed to prevent length loss in operation.

**Rate** – change in load per unit deflection, generally given in pounds per inch (lbs/in) or Newtons per millimeter (N/mm).

**Relaxation** – the loss of force with time when deflected to a fixed position. Dependent upon, and increases with, the magnitude of stress, temperature and time.

**Residual Stress** – stress mechanically 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** – change in length, height or position after a spring is stressed beyond the material’s elastic limit.

**Shot Peening** – a cold working process in which the material surface is peened with steel or glass pellets to induce compressive stresses and thereby improve fatigue life.

**Slenderness Ratio** – ratio of spring length to mean coil diameter (L/D).

**Solid Height** – height of a compression spring when under sufficient load to bring all coils into contact with adjacent coils; sometimes referred to as closed length.

**Spring Index** – ratio of the mean coil diameter to wire diameter (D/d).

**Squared Ends** – see Closed Ends.

**Squared and Ground Ends** – see Closed and Ground Ends.

**Squareness of Ends** – angular deviation between the axis of a compression spring and a line normal to the plane of the ends.

**Squareness Under Load** – same as in Squareness of Ends, except measured with the spring under load.

**Stress Range** – the difference in operating stresses at minimum and maximum loads.

**Stress Relieve** – to subject springs to low-temperature heat treatment to relieve residual stresses induced by cold forming.

**Thickness** – thickness of rectangular or side of square material.

**Torque or Moment** – 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 pounds (in/lbs) or Newton millimeters (N/mm).

**Total Number of Coils** – number of active coils plus the coils forming the ends.

**Wahl Factor** – a factor to correct stress in helical springs that accounts for the effects of coil curvature and direct shear.

**Width** – width of rectangular material.

**Wire Diameter** – diameter of round material.

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