

07 | Spring

01. Introduction

A spring is a mechanical part that uses elasticity to work. It is made of elastic material and will deform under the action of external force and return to its original shape after the external force is removed.

02. Classification

1. According to the different characteristics of the load during work, the coil spring can be divided into three types: compression, tension and torsion.

- Torsion spring (torsion spring): generates mechanical energy by twisting or rotating elastic materials, often used in mechanical balancing mechanisms, and widely used in automobiles, machine tools, electrical appliances and other fields.
- Compression spring (compression spring): bears axial pressure, deforms and stores energy when the spring is compressed, has various shapes, and is divided into equal pitch and variable pitch springs, the latter of which is becoming more and more popular.
- Tension spring (tension spring): bears axial tension, usually the coils are tight, and uses rebound force to control movement, store energy, etc. It is widely used in machines and instruments, and has a variety of hook shapes.

2. According to the structural characteristics, it can be divided into two categories: cylindrical coil springs and variable diameter coil springs; variable diameter coil springs mainly bear compression loads.

3. According to its shape characteristics, it can be divided into conical, volute, concave and convex.

4. In production and use, coil springs can also be divided into two categories according to the forming method and material diameter: large coil springs and small coil springs; the former is usually hot-formed, and the latter is cold-formed.

5. Other classifications

There are many types of helical springs. According to their appearance, they can be divided into: ordinary cylindrical helical springs and variable diameter helical springs.

According to the direction of the helical line, they can be divided into: left-handed springs; right-handed springs.

Variable diameter helical springs are divided into: conical helical springs, volute helical springs, and concave helical springs.

Cylindrical helical springs have a simple structure, are easy to manufacture, and are the most widely used. Their characteristic line is a straight line, and they can be used as compression springs, tension springs, and torsion springs. When the load is large and the radial size is limited, two compression springs with different diameters can be used together to form a combined spring.



Cylindrical helical compression spring



Cylindrical helical torsion spring

Cylindrical helical compression spring

Cylindrical helical compression spring

Conical helical compression spring

Spring

03. Materials and production

Springs are generally made of spring steel, but other materials such as stainless steel, rubber, memory alloys, etc. are also used for special types of springs. The production process of springs can be divided into cold coiling and hot coiling.

Our company mainly adopts the cold coiling method, which can produce various cylindrical helical springs, conical helical springs, cylindrical tension springs, torsion springs, etc. with a wire diameter of 0.8 to 5.0 mm. The materials include: 65Mn, 60Si2Mn, 55CrSi, SWPA piano wire, 304 stainless steel, etc.

The production process of cylindrical helical springs is: forming → tempering stress relief → grinding end → surface treatment → packaging. According to the fatigue performance requirements of the spring, strong pressure, shot blasting, sand blasting and other processes can also be added. According to the use environment of the parts, the surface of the spring can be oxidized, phosphated, electrophoresed, electroplated, painted, etc. Electroplating and other processes require pickling during the production process, so generally after the production is completed, dehydrogenation treatment is required to prevent hydrogen embrittlement of the spring.

04. Type

Springs can be divided into tension, compression, torsion and bending springs according to the nature of the force; according to the shape, there are disc, ring, leaf spring, spiral spring, etc.; according to the manufacturing process, there are cold-rolled and hot-rolled springs. Ordinary cylindrical springs are widely used because they are simple to manufacture and can adapt to a variety of loads.

The materials used to make springs must have high elastic limit, fatigue limit, impact toughness and good heat treatment performance. Common materials include carbon spring steel, alloy steel, stainless steel, copper alloy, nickel alloy and rubber.

The manufacturing methods of springs are divided into cold rolling and hot rolling. Cold rolling is used for diameters less than 8 mm, and hot rolling is used for diameters greater than 8 mm. Some springs also need to be pressed or shot peened to improve their load-bearing capacity.

05. Features and parameters

Springs have the function of storing energy, but they cannot release energy slowly. To achieve the slow release of energy, it is usually necessary to combine it with a large transmission ratio mechanism. The parameters of the spring include the working length (the length of the spring when it bears the working load), the spring stiffness (the load required to make the spring produce a unit deformation, the larger the value, the harder the spring) and the direction of rotation (divided into left-handed and right-handed).

06. Application and precautions

Springs are widely used in mechanical equipment such as clocks, toys, and automobiles. When using them, you need to pay attention to the load limit and avoid overloading to prevent the spring from deforming or breaking. At the same time, pay attention to the performance changes of the spring, such as elastic attenuation and dimensional changes, and check and maintain them regularly.