SPRINGS

Types

- Compression Spring
- Tension Spring
    - Coil spring
    - Leaf spring
    - Composite leaf spring

SPRINGS

- SPRING DESIGN

Spring dimensions can be calculated with a high degree of accuracy, using theoretical models. We use in-house developed software for all traditional spring types, and we use specially configured FEM

Manufacturing of Springs

The process of manufacturing springs is fairly straightforward, with some variations based on the type of spring being made.

In their most basic variation, springs are created via a process of

1. Spring winding, 2. Heat treating, 3. Grinding, 4. Coating and Finishing.

1. Spring Winding

- First, the spring wire is fed into mechanical spring machinery. This semi-automatic machine first straightens the wire from the coil it arrived in, re-setting the wire into a default straight line. From there, the machine coils, forms or bends the spring wire into the desired shape.
- Coiling, Forming, Bending

Coiling

Coiling utilizes a spring coiler. The technician operating the machine sets it up to prepare it for the specific type of coil being made and feeds the wire into a set of rollers, which pulls the spring wire toward a set of guides. Eventually, the guides lead the wire to a coiling point or set of coiling points, which coil the wire backward to form a spring. This type of mechanism makes compression, extension and torsion springs

Forming

This is done using a spring former or CNC spring former machine.

In this type of machine, there are six to eight tooling slides on the face, which enable it to perform several types of bends, hoops and radii in addition to the spring coil.

Spring formers are often used to make extension springs, torsion springs and sometimes compression springs

Bending

Wire bending utilizes a CNC wire bender.

The machine works by feeding the wire into a set of rollers, which pull the wire to wire guides and push it to a moveable tooling head. The tooling head performs various bends and shapes.

The wire bender is mostly used to create wire forms.

2. HEAT TREATING

Once a spring is formed, it typically needs to undergo a stress-relieving process, which will allow the spring to retain its memory. This memory allows the spring to bounce back when placed under stress. To accomplish this, manufacturers must heat treat springs after they are formed.

2. HEAT TREATING

In the heat treating process, the spring is heated to a specific temperature for a specific amount of time.

The temperature and time setting varies depending on the type and amount of wire involved.

Once this is done, the spring may go through additional heat treating steps such as,

quenching or annealing. The process is repeated again, depends on the type of material and the manufacturing process involved.

3. GRINDING

- Grinding may be applied to compression and coil springs. In the grinding process, the ends of the spring are ground flat, allowing it to stand up straight without wobbling when oriented vertically.
- The spring grinding machine has two horizontal grinding wheels, spaced apart in a way that allows the length of the spring to enter between the wheels. A separate part called the spring dish holds the spring and slowly moves it between the two grinding wheels.
- As the plate moves, the ends of the spring make contact with the grinding wheels, grinding down the ends so the end surfaces are perpendicular to the sides of the spring.

4. COATING AND FINISHING

As a final touch, springs are usually finished with some type of coating, plating or finishing process.

In finishing processes, the spring's surface undergoes additional steps to help combat erosion, lend new properties to the spring or simply improve the spring's overall appearance.

Finishing includes: Shot Peening, Plating, Powder coating.

Shot peening

- Shot peening is a finish applied to cold-worked springs.
- In this process, spherical shots are shot at the wire, resulting in compression stress and forming layers of compression dimples.
- As a result, the material's surface hardens, making it more resistant to fatigue, corrosion and cracking.

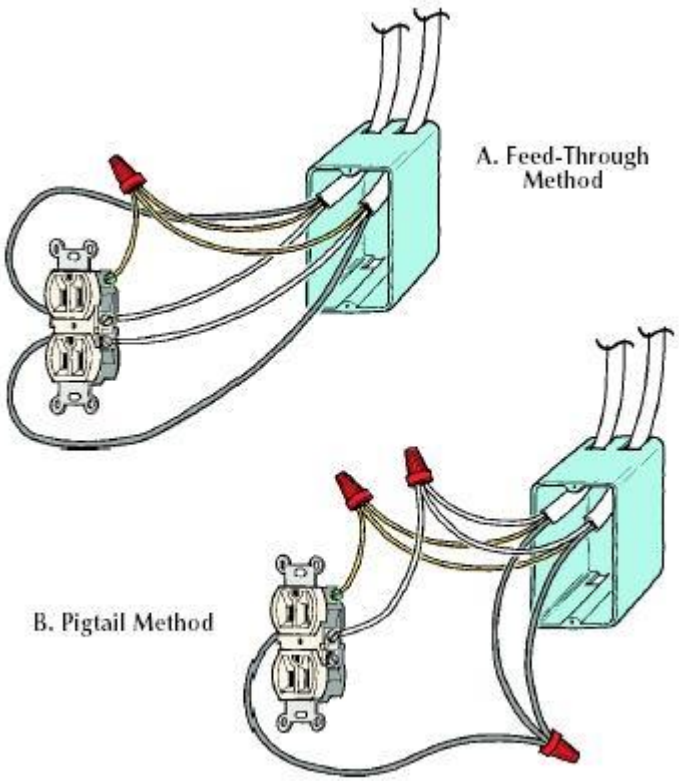
Plating

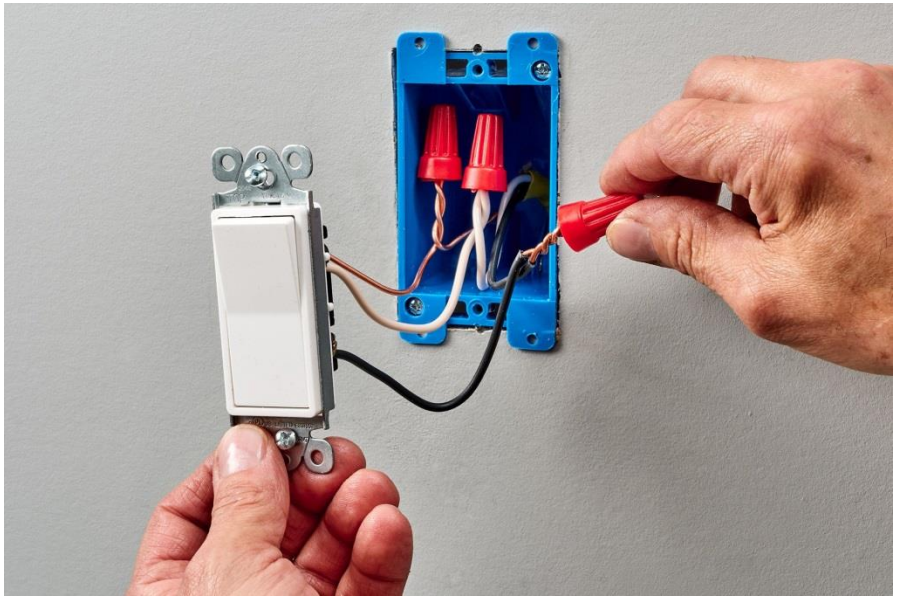
- Plating occurs when a thin layer of metal is applied to the surface of the spring.
- This is usually accomplished through an electroplating process.
- For example, copper and gold platings lend improved electrical conductivity for electronic and power applications, while nickel and cadmium platings provide a chrome finish.

Pig tail spring

- Springs have what is called “pigtail” ends.

The ends have a smaller diameter than the body of the springs. The only type of coil springs that can be safely cut are those with “tangential” ends. Tangential ends look as though they just twist off into space.


A. Feed-Through Method
B. Pigtail Method



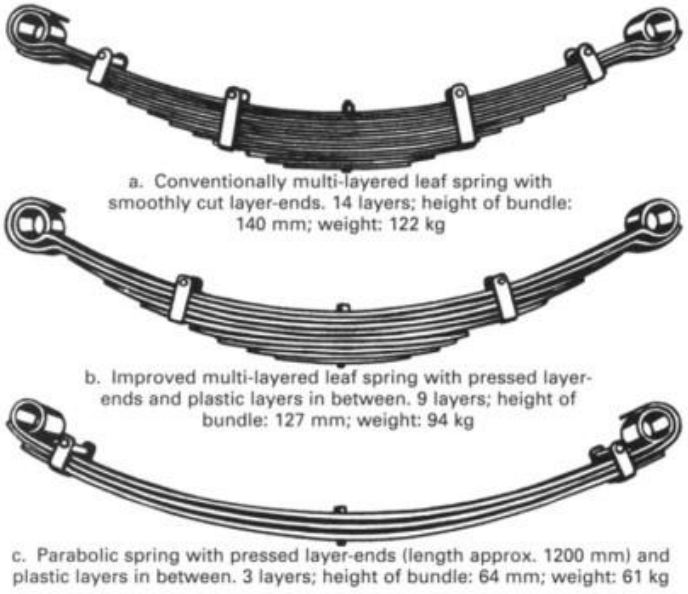
- https://www.youtube.com/watch?v=ZHRMyoMc1wk
- https://www.youtube.com/watch?v=s0erwBMl_xo
- https://www.youtube.com/watch?v=ieDrCR8xErI

Leaf spring

- Leaf springs are a crucial part of the suspension system of a Vehicle.
- They consist of a number of layers of leaves with a gradation in their size, the bigger layer being on the top with each layer joined to the other.
- Leaf springs are directly attached to the frame, either at both ends or at one end. The front end is attached to the frame while the other end is attached to a short swinging arm through a shackle. The main function of leaf springs is to provide comfort to the passengers by minimizing the vertical vibration caused by the nonuniformity of road geometry.

Leaf spring

- Leaf springs are subdivided into longitudinal and transverse leaf springs. Longitudinal leaf springs are used only on rigid axles, more commonly on commercial vehicles and trailers.



a. Conventionally multi-layered leaf spring with smoothly cut layer-ends. 14 layers; height of bundle: 140 mm; weight: 122 kg

b. Improved multi-layered leaf spring with pressed layer-ends and plastic layers in between. 9 layers; height of bundle: 127 mm; weight: 94 kg

c. Parabolic spring with pressed layer-ends (length approx. 1200 mm) and plastic layers in between. 3 layers; height of bundle: 64 mm; weight: 61 kg

Composite Leaf spring

- Composite Leaf Springs are lightweight,

high-performance aftermarket suspension springs used as an alternative to coil springs.