

Helical Springs

Mechanical Engineering

How wire diameter, coil diameter and coil count set the stiffness.

Stiffness rises as the fourth power of wire diameter and falls as the cube of coil diameter.

$$k = G d^4 \div (8 D^3 N_a) \cdot N_a = \text{active coils}$$

Double the wire size

Fourth power of d.

Sixteen times stiffer

Double the coil size

Cube of D.

One eighth the stiffness

Double the active coils

k goes as $1 \div N_a$.

Half the stiffness

THE COMMON MISTAKE

✗ **Counting every coil as active**

✓ **The end coils do not deflect**

With squared and ground ends the active count is the total minus two. Using the total makes the spring softer on paper than in the machine.

Springs also buckle if too slender and take a permanent set if overstressed. Spring steel data governs.