

Reference for carbon steel spring wire

Tempering

The purpose of spring tempering:

- 1) It increase the proof stress of the material to about 90% of tensile strength and this will improve creep performance of spring;
- 2) It relieve the residual stress formed during wire drawing and coiling, this will help to improve fatigue and creep performance.
- 3) Make the spring shape more stable (external diameter will be reduced slightly during tempering).

Industry experience :

- 1) Tempering with higher temperature for shorter time should not be first choice.
- 2) **Hardness:** Hardness decreases after a slight increase as the tempering temperature increases. Temperature for best fatigue performance is lower than temperature with the highest hardness.
- 3) **Shrinking:** Spring external diameter will be smaller after tempering, so size margin should be leaved.
- 4) **Tempering color:** Tempering color is related to temperature and residual on wire surface. Color uniformity is related to temperature distribution or air flow in the furnace. If desired color uniformity, manage the furnace and loading properly. Local oil or finger print may result in color change.
- 5) **Tempering temperature:** Typical range is 250–280°C. Tensile strength can be increased if tempered at 200–250°C, but ductility will be worse and wire may fracture during further bending.
- 6) **Compression spring:** Slight low temperature tempering after hammering reduces deformation.
- 7) **Tension spring:** Initial stress will be reduced after tempering, this should be considered during design.
- 8) **Torsion spring:** tempering at 280°C after coiling, or 250°C if further processing required.
- 9) **Hook of tension spring and arm of torsion spring:** Position will be changed after tempering.

Tempering data for reference:

Tempering process is related to working conditions of spring, spring characteristics requirement and type of furnace. Following is typical tempering data for carbon steel spring:

Type	When fatigue is required	For static or light dynamic load
Spring with dynamic load	300-350°C/20-30min.	200-350°C/15-20min.
Spring with static load	200-250°C/20-30min.	



Properties

Tensile modulus of elasticity: 205GPa

Torsion modulus of elasticity: 79GPa

Designed torsional stress levels: 40% for static load and 45% for dynamic load.

Wire Hardness: HRC31–60 (Roughly correlated with strength)

Conservation

Care should be taken in handling and storage to prevent damage to the product due to friction, deformation and rust.

Safety and environment

Care should be taken when handling, stacking and de-coiling wire to avoid injury by crushing, scratching or spring back. Please dispose waste packaging properly, support waste recycling and reduce waste.