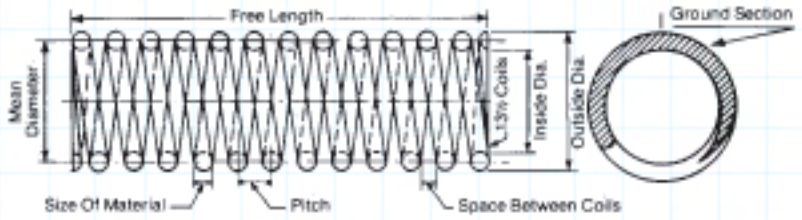

ace
SPRING &
WIRE
FORM EXPERTS
ISO 9001:2008 Certified
ITAR Registered
ace wire spring & form co., inc.

# Shortcuts to Better Spring Ordering

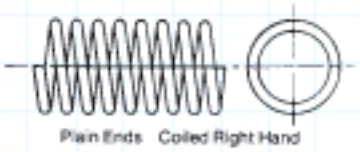
## Specifications for Compression Springs

When ordering, please give the following information as completely as possible:

- Free length – maximum/minimum
- Controlling diameter – outside diameter maximum, inside diameter minimum, pitch diameter, works inside (dia. hole), works over (dia. shaft)
- Number of coils
- Wire size – decimal size if possible
- Material – type and grade
- Loads at deflected positions
- Style of ends (see illustrations)
- Right or left hand wound
- Finish (plain unless otherwise specified)
- Maximum solid length
- Frequency of compression



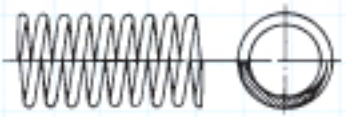

### TYPE OF END FINISHES



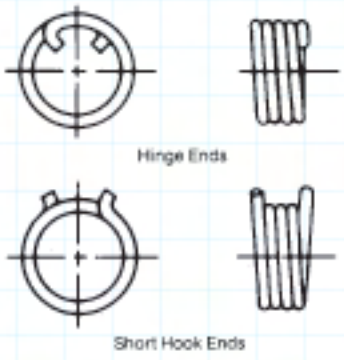
Plain Ends Coiled Right Hand
Total Coils = Active Coils (N)

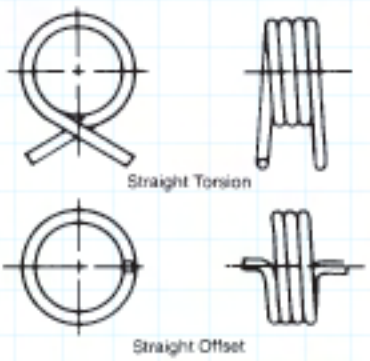
Squared And Ground Ends Coiled Left Hand
Total Coils = Active Coils + 2

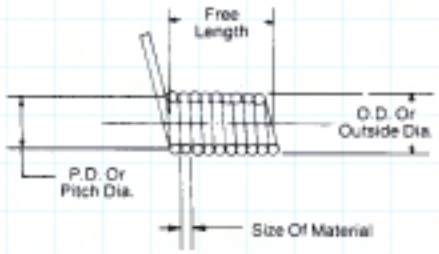
Squared Or Closed Ends Not Ground Coiled Right Hand
Total Coils = Active Coils + 2

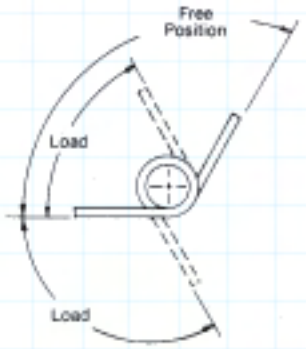


Plain Ends Ground Coiled Left Hand
Total Coils = Active Coils (N)




## Specifications for Torsion Springs

When ordering, please give the following information as completely as possible:

- Inside/outside diameter
- **If spring works on a rod, give size of rod, as spring must not bind when wound up to its limit of travel**
- Free length and number of coils. If spring cannot increase in length as wound up, allow sufficient space between coils
- Right or left hand wound
- Wire size – decimal size if possible
- Material – type and grade
- Style of ends (see illustrations)
- Number of turns deflection to hold given load and radius of loaded arm. This length may be the length of the arm, or the arm may be attached to a movable machine member, in which case the length to application point of the load is given
- Finish (plain unless otherwise specified)

## Specifications for Extension Springs

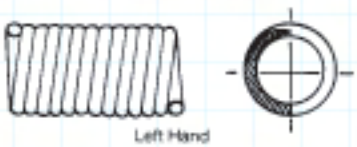
When ordering, please give the following information as completely as possible:

- Length – maximum/minimum (over all, over coil, inside hooks)
- Controlling diameter – outside diameter maximum, inside diameter minimum
- Wire size – decimal size if possible
- Material – type and grade
- Number of coils
- Style of ends (see illustrations)
- Right or left hand wound
- Finish (plain unless otherwise specified)
- Load required – length inside hooks (length of coil if wire size not specified)
- Maximum extended length – over all, over coil, inside hooks
- Deflection or distance of travel
- Frequency of extension
- Is position of ends important? (Making the ends of springs bear a definite relation to each other usually adds to the cost of manufacture)

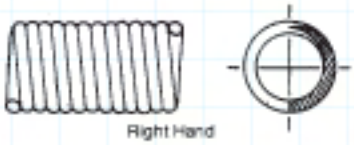
**Note:** *Extension springs made from tempered or hard-drawn wires can be and usually are wound with initial tension. Such tension may average 20% of the total safe stress of the springs, but will not increase the elastic limit.*

## Coil Direction

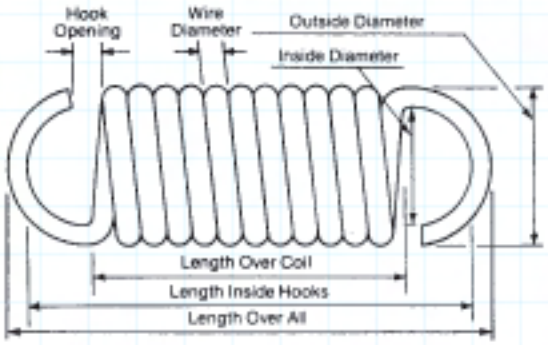
To determine coil direction, hold with axis of spring on horizontal plane. Angle of coil from top to bottom determines direction.



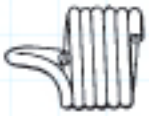
Left Hand



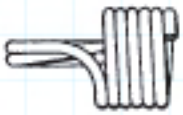
Right Hand




Machine Half Hook over Center



Hand Half Loop over Center



Double Twisted Full-Loop over Center

Full Loop at Side

Small Eye at Side

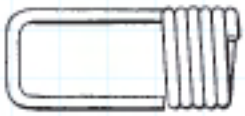
Small Eye over Center

Small Off-set Hook at Side

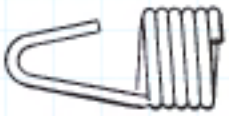
Plain Square Cut Ends

One End Ground Flat

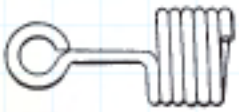
Long Round End Hook over Center



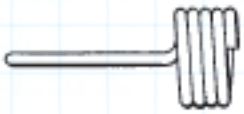
Long Square End Hook over Center



V Hook over Center



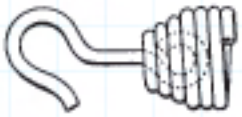
Extended Eye from either Center or Side



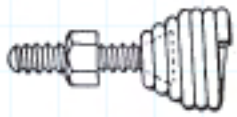
Straight End Annealed to allow Forming

Coned End to Hold Long Swivel Eye

Coned End with Short Swivel Eye



Coned End with Swivel Hook



Coned End with Swivel Bolt

Machine Loop and Machine Hook Shown in Line

Machine Loop and Machine Hook Shown at Right Angles

Hand Loop and Hook at Right Angles

Full Loop on Side and Small Eye from Center

# Properties of Common Spring Materials

| | Material | Nominal Analysis | Tensile Properties: Minimum Tensile Strength psi x $10^3$ (MPa) | Tensile Properties: Modulus of Elasticity E psi x $10^6$ (MPa x $10^3$) | Torsional Properties: Design Stress % Minimum Tensile | Torsional Properties: Modulus in Torsion G psi x $10^6$ (MPa x $10^3$) | Maximum Operating Temperature °F | Maximum Operating Temperature °C | Rockwell Hardness | Method of Manufacture Chief Uses Special Properties |
|---|---|---|---|---|---|---|---|---|---|---|
| High Carbon Spring Wire | Music Wire<br>ASTM A 228 | C 0.70-1.00%<br>Mn 0.20-0.60% | 230-399<br>(1586-2751) | 30 (207) | 45 | 11.5 (79.3) | 250 | 121 | C41-60 | Cold drawn high and uniform tensile.<br>High quality springs and wire forms.<br>Suitable for cyclic applications. |
| | Hard Drawn<br>ASTM A 227 | C 0.45-0.85%<br>Mn 0.60-1.30% | CLI 147-283<br>(1014-1951)<br>CLII 171-324<br>(1179-2234) | 30 (207) | 40 | 11.5 (79.3) | 250 | 121 | C31-52 | Cold drawn.<br>Average stress applications.<br>Lower cost springs and wire forms. |
| | High Tensile Hard Drawn<br>ASTM A 679 | C 0.65-1.00%<br>Mn 0.20-1.30% | 238-350<br>(1641-2413) | 30 (207) | 45 | 11.5 (79.3) | 250 | 121 | C41-60 | Cold drawn.<br>Higher quality springs and wire forms. |
| | Oil Tempered<br>ASTM A 229 | C 0.55-0.85%<br>Mn 0.60-1.20% | CLI 165-293<br>(1138-2020)<br>CLII 191-324<br>(1317-2234) | 30 (207) | 45 | 11.5 (79.3) | 250 | 121 | C42-55 | Cold drawn and heat treated before fabrication.<br>General purpose spring wire. |
| | Carbon Valve<br><br>ASTM A 230 | C 0.60-0.75%<br><br>Mn 0.60-0.90% | 215-240<br><br>(1482-1655) | 30 (207) | 45 | 11.5 (79.3) | 250 | 121 | C45-49 | Cold drawn and heat treated before fabrication.<br>Good surface condition and uniform tensile.<br>Suitable for cyclic applications. |
| Alloy Steel Wire | Chrome Vanadium<br>ASTM A 231 | C 0.48-0.53%<br>Cr 0.80-1.10%<br>Si 0.15 Min% | 190-300<br>(1310-2069) | 30 (207) | 45 | 11.5 (79.3) | 425 | 218.5 | C41-55 | Cold drawn and heat treated before fabrication. Used for shock loads and moderately elevated temperature. |
| | Chrome Silicon<br>ASTM A 401 | C 0.51-0.59%<br>Cr 0.60-0.80%<br>Si 1.20-1.60% | 235-300<br>(1620-2069) | 30 (207) | 45 | 11.5 (79.3) | 475 | 246 | C48-55 | Cold drawn and heat treated before fabrication. Used for shock loads and moderately elevated temperature. |
| Stainless Steel Wire | AISI 302/304<br>ASTM A 313 | Cr 17.-19.%<br>Ni 8.-10.% | 125-325<br>(862-2241) | 28 (193) | 35 | 10 (69.0) | 550 | 288 | C35-45 | Cold drawn general purpose corrosion and heat resistant. Magnetic in spring temper. |
| | AISI 316<br>ASTM A 313 | Cr 16.-18.%<br>Ni 10.-14.%<br>Mo 2.-3.% | 110-245<br>(758-1689) | 28 (193) | 40 | 10 (69.0) | 550 | 288 | C35-45 | Cold drawn. Heat resistant and better corrosion resistance than 302.<br>Magnetic in spring temper. |
| | 17-7 PH<br>ASTMA A 313 (631) | Cr 16.-18.%<br>Ni 6.5-7.5%<br>Al 0.75-1.5% | Cond CH<br>235-335<br>(1620-2310) | 29.5 (203) | 45 | 11 (75.8) | 650 | 343 | C38-57 | Cold drawn and precipitation hardened after fabrication. High strength and general purpose corrosion resistance.<br>Slightly magnetic in spring temper. |
| Non-Ferrous Alloy Wire | Phosphor Bronze Grade A<br>ASTM B 159 | Cu 94.-96.%<br>Sn 4.-6.% | 105-145<br>(724-1000) | 15 (103) | 40 | 6.25 (43.1) | 200 | 93.3 | B98-104 | Cold drawn. Good corrosion resistance and electrical conductivity. |
| | Beryllium Copper<br>ASTM B 197 | Cu 98%<br>Be 2% | 150-230<br>(1034-1586) | 18.5 (128) | 45 | 7.0 (48.3) | 400 | 204 | C35-42 | Cold drawn and may be mill hardened before fabrication. Good corrosion resistance and electrical conductivity.<br>High physicals. |
| | Monel 400<br>AMS 7233 | Ni 66%<br>Cu 31.5%<br>C/Fe | 145-180<br>(1000-1241) | 26 (179) | 40 | 9.5 (65.5) | 450 | 232 | C23-32 | Cold drawn. Good corrosion resistance at moderately elevated temperature. |
| | Model K 500<br>QQ-N 286 | Ni 65.0%<br>Cu 29.5%<br>C/Fe/Al/Ti | 160-200<br>(1103-1379) | 26 (179) | 40 | 9.5 (65.5) | 550 | 288 | C23-35 | Excellent corrosion resistance at moderately elevated temperature. |
| High Temperature Alloy Wire | A 286 Alloy | Ni 26.%<br>Cr 15.%<br>Fe 53% | 160-200<br>(1103-1379) | 29 (200) | 35 | 10.4 (71.7) | 950 | 510 | C35-45 | Cold drawn and precipitation hardened after fabrication. Good corrosion resistance at elevated temperature. |
| | Inconel 600<br>QQ – W – 390 | Ni 76.%<br>Cr 15.8%<br>Fe 7.2% | 170-230<br>(1172-1586) | 31 (214) | 40 | 11.0 (75.8) | 700 | 371 | C35-45 | Cold drawn and precipitation hardened at elevated temperature. |
| | Inconel 718 | Ni 52.5%<br>Cr 18.6%<br>Fe 18.5% | 210-250<br>(1448-1724) | 29 (200) | 40 | 11.2 (77.2) | 1100 | 593 | C45-50 | Cold drawn and precipitation hardened after fabrication. Good corrosion resistance at elevated temperature. |
| | Inconel x 750<br>ASM 5698, 5699 | Ni 73.%<br>Cr 15.%<br>Fe 6.75% | No. IT 155 Min.<br>(1069)<br>Spg. T 190-230<br>(1310-1586) | 31 (214) | 40 | 12 (82.7) | 750-1100 | 399-593 | C34-39<br>C42-48 | Cold drawn and precipitation hardened after fabrication. Good corrosion resistance at elevated temperature. |

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