ace SPRING & WIRE FORM EXPERTS

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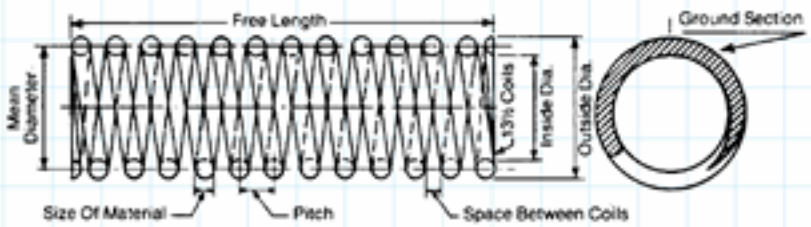
ace wire spring & form co., inc.

Shortcuts to Better Spring Ordering

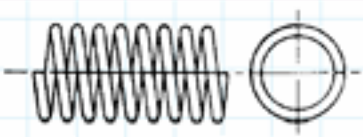
Specifications for Compression Springs

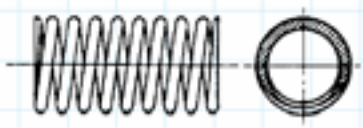
When ordering, please give the following information as completely as possible:

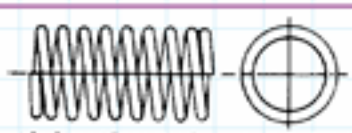
- Free length – maximum/minimum
- Controlling diameter – outside diameter maximum, inside diameter minimum, pitch diameter, works inside (dia. hole), works over (dia. shaft)
- Number of coils
- Wire size – decimal size if possible
- Material – type and grade
- Loads at deflected positions
- Style of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

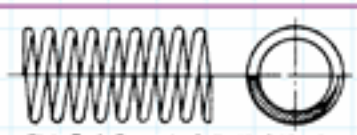


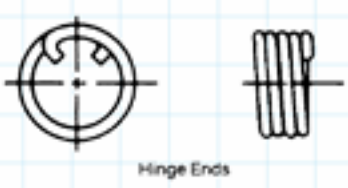
TYPE OF END FINISHES

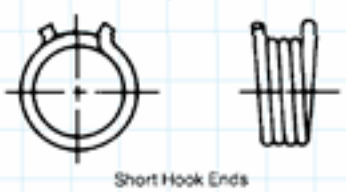

Plain Ends Coiled Right Hand
Total Coils = Active Coils (N)

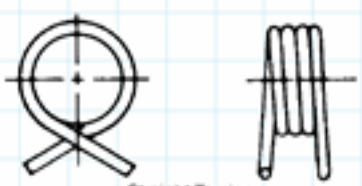

Squared And Ground Ends Coiled Left Hand
Total Coils = Active Coils + 2

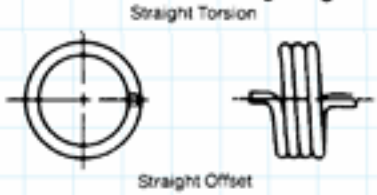

Squared Or Closed Ends Not Ground Coiled Right Hand
Total Coils = Active Coils + 2

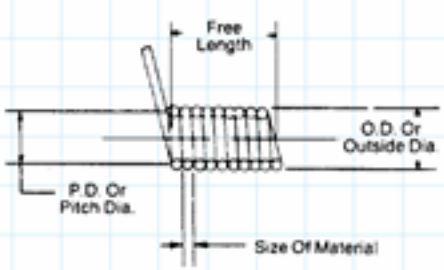

Plain Ends Ground Coiled Left Hand
Total Coils = Active Coils (N)

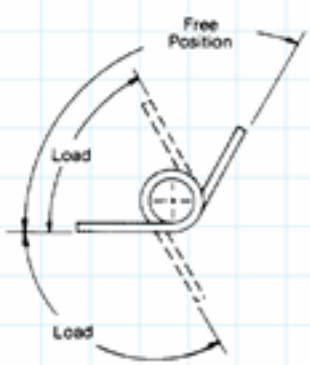

Hinge Ends


Short Hook Ends


Straight Torsion


Straight Offset





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

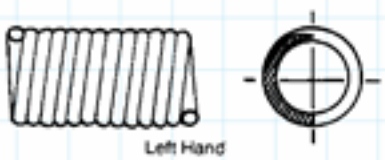
When ordering, please give the following information as completely as possible:

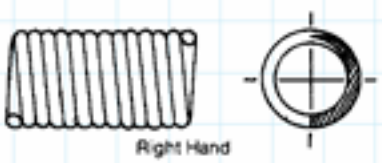
- Length – maximum/minimum (over all, over coil, inside hooks)
- Controlling diameter – outside diameter maximum, inside diameter minimum
- Wire size – decimal size if possible
- Material – type and grade
- Number of coils
- Style of ends (see illustrations)
- Right or left hand wound
- Finish (plain 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)

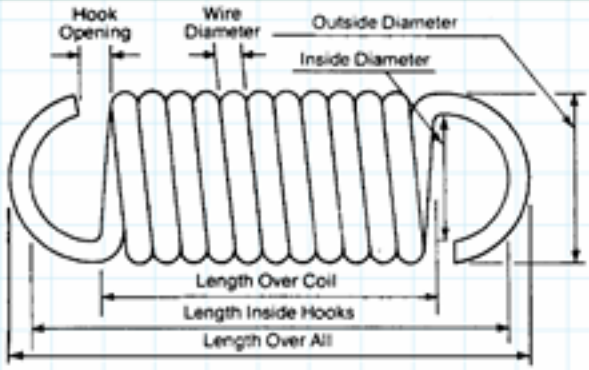
Note: *Extension springs made from tempered or hard-drawn wires can be and usually are wound with initial tension. Such tension may average 20% of the total safe stress of the springs, but will not increase the elastic limit.*

Coil Direction

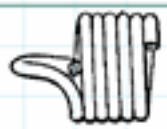
To determine coil direction, hold with axis of spring on horizontal plane. Angle of coil from top to bottom determines direction.

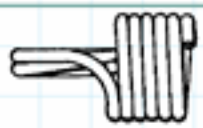







Machine Half Hook over Center


Hand Half Loop over Center


Double Twisted Full-Loop over Center


Full Loop at Side

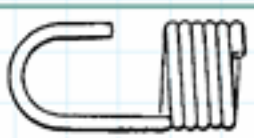

Small Eye at Side

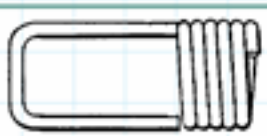

Small Eye over Center

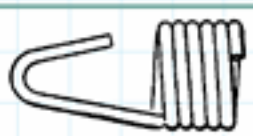

Small Off-set Hook at Side

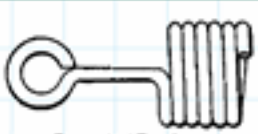

Plain Square Cut Ends

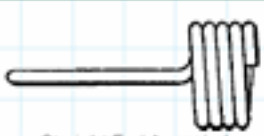

One End Ground Flat

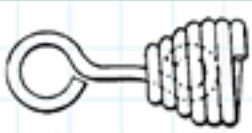

Long Round End Hook over Center

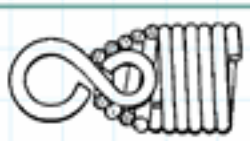

Long Square End Hook over Center

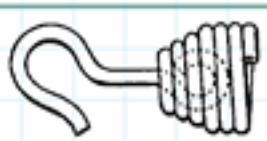

V Hook over Center


Extended Eye from either Center or Side

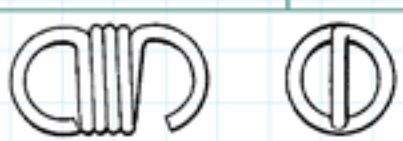

Straight End Annealed to allow Forming


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

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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 ASTM A 228	C 0.70-1.00% Mn 0.20-0.60%	230-399 (1586-2751)	30 (207)	45	11.5 (79.3)	250	121	C41-60	Cold drawn high and uniform tensile. High quality springs and wire forms. Suitable for cyclic applications.
	Hard Drawn ASTM A 227	C 0.45-0.85% Mn 0.60-1.30%	CLI 147-283 (1014-1951) CLII 171-324 (1179-2234)	30 (207)	40	11.5 (79.3)	250	121	C31-52	Cold drawn. Average stress applications. Lower cost springs and wire forms.
	High Tensile Hard Drawn ASTM A 679	C 0.65-1.00% Mn 0.20-1.30%	238-350 (1641-2413)	30 (207)	45	11.5 (79.3)	250	121	C41-60	Cold drawn. Higher quality springs and wire forms.
	Oil Tempered ASTM A 229	C 0.55-0.85% Mn 0.60-1.20%	CLI 165-293 (1138-2020) CLII 191-324 (1317-2234)	30 (207)	45	11.5 (79.3)	250	121	C42-55	Cold drawn and heat treated before fabrication. General purpose spring wire.
	Carbon Valve ASTM A 230	C 0.60-0.75% Mn 0.60-0.90%	215-240 (1482-1655)	30 (207)	45	11.5 (79.3)	250	121	C45-49	Cold drawn and heat treated before fabrication. Good surface condition and uniform tensile. Suitable for cyclic applications.
Alloy Steel Wire	Chrome Vanadium ASTM A 231	C 0.48-0.53% Cr 0.80-1.10% Si 0.15 Min%	190-300 (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 ASTM A 401	C 0.51-0.59% Cr 0.60-0.80% Si 1.20-1.60%	235-300 (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 ASTM A 313	Cr 17.-19.% Ni 8.-10.%	125-325 (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 ASTM A 313	Cr 16.-18.% Ni 10.-14.% Mo 2.-3.%	110-245 (758-1689)	28 (193)	40	10 (69.0)	550	288	C35-45	Cold drawn. Heat resistant and better corrosion resistance than 302. Magnetic in spring temper.
	17-7 PH ASTMA A 313 (631)	Cr 16.-18.% Ni 6.5-7.5% A1 0.75-1.5%	Cond CH 235-335 (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. Slightly magnetic in spring temper.
Non-Ferrous Alloy Wire	Phosphor Bronze Grade A ASTM B 159	Cu 94.-96.% Sn 4.-6.%	105-145 (724-1000)	15 (103)	40	6.25 (43.1)	200	93.3	B98-104	Cold drawn. Good corrosion resistance and electrical conductivity.
	Beryllium Copper ASTM B 197	Cu 98% Be 2%	150-230 (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. High physicals.
	Monel 400 AMS 7233 Model K 500 QQ-N 286	Ni 66% Cu 31.5% C/Fe Ni 65.0% Cu 29.5% C/Fe/A1/Ti	145-180 (1000-1241) 160-200 (1103-1379)	26 (179) 26 (179)	40 40	9.5 (65.5) 9.5 (65.5)	450 550	232 288	C23-32 C23-35	Cold drawn. Good corrosion resistance at moderately elevated temperature. Excellent corrosion resistance at moderately elevated temperature.
High Temperature Alloy Wire	A 286 Alloy	Ni 26.% Cr 15.% Fe 53%	160-200 (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 QQ – W – 390	Ni 76.% Cr 15.8% Fe 7.2%	170-230 (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% Cr 18.6% Fe 18.5%	210-250 (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 ASM 5698, 5699	Ni 73.% Cr 15.% Fe 6.75%	No. IT 155 Min. (1069) Spg. T 190-230 (1310-1586)	31 (214)	40	12 (82.7)	750-1100	399-593	C34-39 C42-48	Cold drawn and precipitation hardened after fabrication. Good corrosion resistance at elevated temperature.

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1105 Thompson Avenue
McKees Rocks, PA 15136-3818

Phone: 412.331.3353
Toll Free: 1.800.828.3353
Fax: 412.331.1602
E-mail: aceinfo@acewirespring.com
www.acewirespring.com