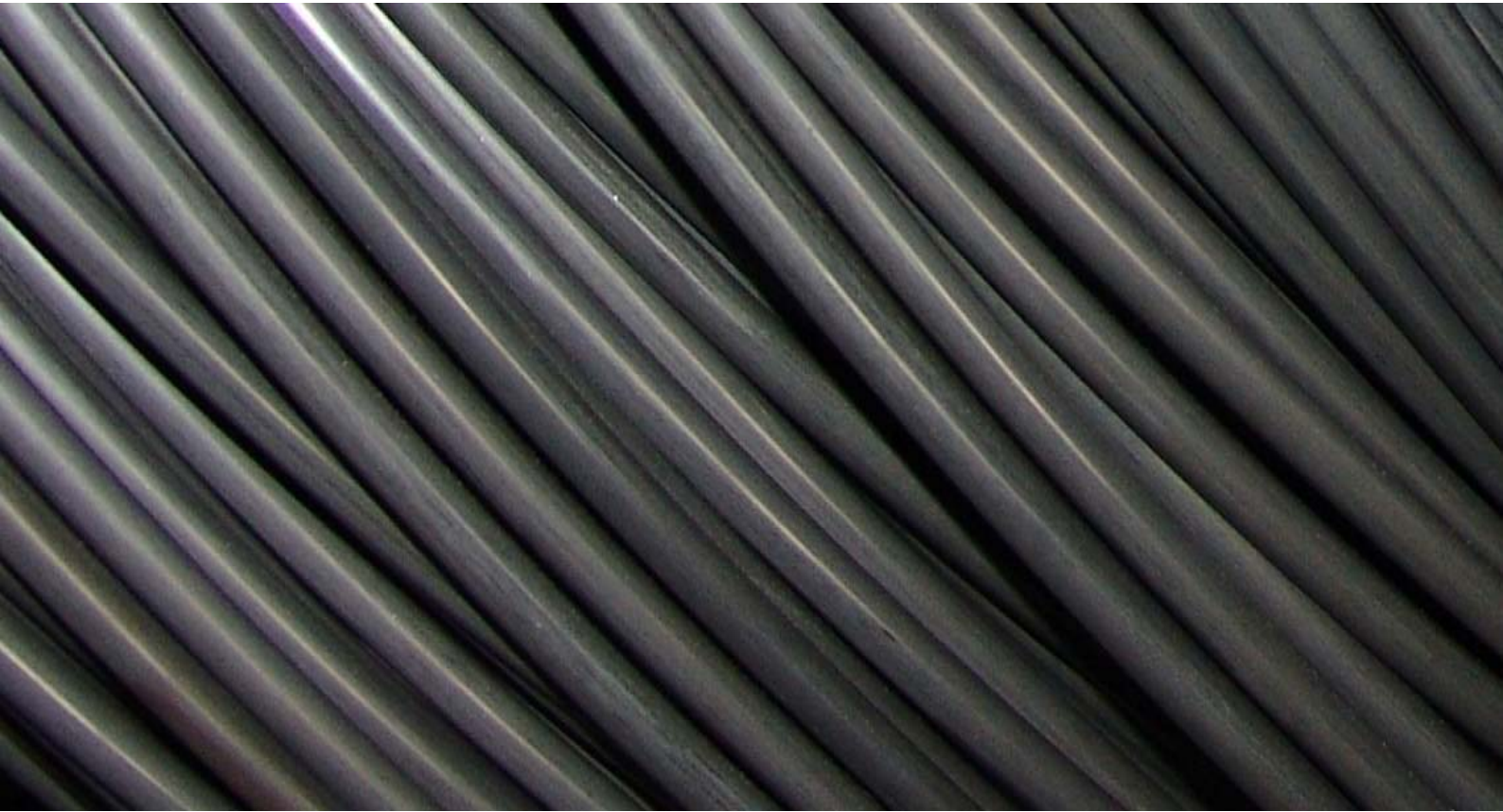


# **SPRING WIRE**

**Patented Cold-drawn Steel Wire for Mechanical Spring**

**Hard Drawn Steel Wire**



**XINHUA Metal Products Co., Ltd.**

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## Guide for Ordering Spring Wire

Lead-patenting steel wire has fine pearlite structure and higher resistance to fatigue and sag compare with hard-drawn wire without lead patenting.

Hard drawn steel wire can be used for mattress, hose reinforcing, screwdriver, hairpins and springs with static load.

Choose your specification according to type of spring

Type of Spring	International	Chinese	JIS	ASTM	Example
None-mechanical	-	YB/T 5220-93	G3521	A407	Mattress
Static Mechanical	ISO 8458-2:2002 SL/SM/SH	GB 4357-89	G3521 SW-A/B/C	A227	General Compression & Tension Spring
Dynamic Mechanical	ISO 8458-2:2002 DM/DH	GB/T 4358-1995	G3522 SWP-A/B	A228	Valve Spring

Choose your standard and type according to application of spring.

Standard	Size & Type	Application
ISO 8458-2: 2002 EN 10270-1: 2001	SL (1.00-10.00mm) Low Strength SM (0.30-13.00mm) Medium Strength SH (0.30-20.00mm) High Strength DM (0.30-20.00mm) Medium Strength DH (0.05-20.00mm) High Strength	-Static -Medium and high stress static or few dynamic -High stress static or slight dynamic spring -Medium and high stress dynamic spring, and wire forms with exquisite deformation -High stress static or medium stress, dynamic
JIS G 3521-91	SW-A (0.08-10.0mm) SW-B (0.08-13.0mm) SW-C (0.08-13.0mm)	Static with low stress, or wire form Mainly for static spring and screen Mainly for static spring
JIS G 3522-91	SWP-A (0.08-10.0mm) SWP-B (0.08-7.00mm) SWP-V (1.00-6.00mm)	Static Dynamic Spring Valve Spring

The maximum working temperature of Carbon steel spring is 121 °C

### Special Need

- Shape wire: Square, rectangle or hexagon etc.
- Annealed wire
- Stabilized wire
- Surface other than phosphated and cold drawn.

### Packing

All spring wire will be delivered in coil, packed by polypropylene cloth, unless otherwise agreed. All spring wire will be oiled unless otherwise agreed.

### Identification

Each coil will be labeled and show following information:

- Name of Product
- Name, logo and address of the manufacturer
- Nominal Diameter, grade and specification number
- Heat number
- Coil weight
- Others may be negotiated.

# Patented Cold-drawn Steel Wire for Mechanical Spring

## Category

Standard applicable	Grade	Diameter range available
ISO 8458-2: 2002	SL	1-10mm
	SM、SH	0.30-14.00mm
	DH、DM	0.30-14.00mm
JIS G 3522-1991	SWP-A	0.30-10.00mm
	SWP-B	0.30-7.00mm

## Chemical Composition, % (wt) (cast analyses)

Type	C	Si	Mn	P max.	S max.	Cu min.
SL/SM/SH	0.35-1.00	0.10-0.30	0.30-1.20	0.030	0.030	0.20
DH/DM	0.45-1.00	0.10-0.30	0.30-1.20	0.020	0.025	0.12
SWP	0.60-0.95	0.12-0.32	0.30-0.90	0.025	0.025	0.20

## Torsion

Diameter, mm	Minimum number of torsion					
	Diameter, mm	ISO 8458-2			JIS 3522	
0.70~ 1.40		SL SM SH	20	DH DM	25	SWP-A
1.41~ 2.00	18		22		25	
2.01~ 3.50	16		20		SWP-B	20
3.51~ 6.00	14		18			15
1.00~6.00	-			SWP-V	25	

## Permissible tolerance and out of roundness

ISO 8458-1: 2002			JIS G 3522-1991		
Nominal Diameter mm	Permissible Tolerance ± mm		Nominal Diameter mm	Permissible Tolerance mm	Out of Roundness mm
	SH,DM,DH	SL,SM			
0.09≤d<0.17	0.004	-	0.08-0.19	±0.004	≤0.004
0.17≤d<0.26	0.005	-	0.20-0.49	±0.008	≤0.008
0.26≤d<0.37	0.006	0.010	0.50-0.99	±0.010	≤0.010
0.37≤d<0.65	0.008	0.012	1.00-1.99	±0.015	≤0.015
0.65≤d<0.80	0.010	0.015	2.00-3.19	±0.020	≤0.020
0.80≤d<1.01	0.015	0.020	3.20-5.49	±0.030	≤0.030
1.01≤d<1.78	0.020	0.025	5.50-8.49	±0.040	≤0.040
1.78≤d<2.78	0.025	0.030	8.50-10.0	±0.050	≤0.050
2.78≤d<4.00	0.030	0.030			
4.00≤d<5.45	0.035	0.035			
5.45≤d<7.10	0.040	0.040			
7.10≤d<9.00	0.045	0.045			
9.00≤d<10.00	0.050	0.050			
10.00≤d<11.10	0.070	0.070			
11.10≤d<14.50	0.080	0.080			

Note 1: Grade A refer to type SH, DM and DH, grade B refer to type SL and SM.

Note 2: Out of roundness is difference between max. and min. value of diameter at same section.

Note 3: The out of roundness should not be great than range of diameter tolerance.

## Tensile Strength of Patented Spring Wire

ISO 8458-2: 2002

Nominal Diameter mm	Tensile Strength, MPa				
	SL	SM	DM	SH	DH
0.10			2710-3020		2800-3380
0.11			2690-3000		2800-3350
0.12			2660-2960		2800-3320
0.14			2620-2910		2800-3250
0.16			2570-2860		2800-3200
0.18			2530-2820		2800-3160
0.20			2500-2790		2800-3110
0.22			2470-2760		2770-3080
0.25			2420-2710		2720-3010
0.28			2390-2670		2680-2970
0.30		2370-2650	2370-2650	2660-2940	2660-2940
0.32		2350-2630	2350-2630	2640-2920	2640-2920
0.34		2330-2600	2330-2600	2610-2890	2610-2890
0.36		2310-2580	2310-2580	2590-2890	2590-2890
0.38		2290-2560	2290-2560	2570-2850	2570-2850
0.40		2270-2550	2270-2550	2560-2830	2570-2830
0.43		2250-2520	2250-2520	2530-2800	2570-2800
0.45		2240-2500	2240-2500	2510-2780	2570-2780
0.48		2220-2480	2240-2500	2490-2760	2570-2760
0.50		2200-2470	2200-2470	2480-2740	2480-2740
0.53		2180-2450	2180-2450	2460-2720	2460-2720
0.56		2170-2430	2170-2430	2440-2700	2440-2700
0.60		2140-2400	2140-2400	2410-2670	2410-2670
0.63		2130-2380	2130-2380	2390-2650	2390-2650
0.65		2120-2370	2120-2370	2380-2640	2380-2640
0.70		2090-2350	2090-2350	2360-2610	2360-2610
0.80		2050-2300	2050-2300	2310-2560	2310-2560
0.85		2030-2280	2030-2280	2290-2530	2290-2530
0.90		2010-2260	2010-2260	2270-2510	2270-2510
0.95		2000-2240	2000-2240	2250-2490	2250-2490
1.00	1720-1970	1980-2220	1980-2220	2230-2470	2230-2470
1.05	1710-1950	1960-2220	1960-2220	2210-2450	2210-2450
1.10	1690-1940	1950-2190	1950-2190	2200-2430	2200-2430
1.20	1670-1910	1920-2160	1920-2160	2170-2400	2170-2400
1.25	1660-1900	1910-2130	1910-2130	2140-2380	2140-2380
1.30	1640-1890	1900-2130	1900-2130	2140-2370	2140-2370
1.40	1620-1860	1870-2100	1870-2100	2110-2340	2110-2340
1.50	1600-1840	1850-2080	1850-2080	2090-2310	2090-2310
1.60	1590-1820	1830-2050	1830-2050	2060-2290	2060-2290
1.70	1570-1800	1810-2030	1810-2030	2040-2260	2040-2260
1.80	1550-1780	1790-2010	1790-2010	2020-2240	2020-2240
1.90	1540-1760	1770-1990	1770-1990	2000-2220	2000-2220
2.00	1520-1750	1760-1970	1760-1970	1980-2200	1980-2200
2.10	1510-1730	1740-1960	1740-1960	1970-2180	1970-2180
2.25	1490-1710	1720-1930	1720-1930	1940-2150	1940-2150
2.40	1470-1690	1700-1910	1700-1910	1920-2130	1920-2130
2.50	1460-1680	1690-1890	1690-1890	1900-2110	1900-2110
2.60	1450-1660	1670-1880	1670-1880	1890-2100	1890-2100
2.80	1420-1640	1650-1850	1650-1850	1860-2070	1860-2070
3.00	1410-1620	1630-1830	1630-1830	1840-2040	1840-2040
3.20	1390-1600	1610-1810	1610-1810	1820-2020	1820-2020
3.40	1370-1580	1590-1780	1590-1780	1790-1990	1790-1990
3.60	1350-1560	1570-1760	1570-1760	1770-1970	1770-1970
3.80	1340-1540	1550-1740	1550-1740	1750-1950	1750-1950
4.00	1320-1520	1530-1730	1530-1730	1740-1930	1740-1930
4.25	1310-1500	1510-1700	1510-1700	1710-1900	1710-1900
4.50	1290-1490	1500-1680	1500-1680	1690-1880	1690-1880
4.75	1270-1470	1480-1670	1480-1670	1680-1840	1680-1840
5.00	1260-1450	1460-1650	1460-1650	1660-1830	1660-1830

**Continued**

**ISO 8458-2: 2002**

Nominal Diameter mm	Tensile Strength, MPa				
	SL	SM	DM	SH	DH
5.30	1240-1430	1440-1630	1440-1630	1640-1820	1640-1820
5.60	1230-1420	1430-1610	1430-1610	1620-1800	1620-1800
6.00	1210-1390	1400-1580	1400-1580	1590-1770	1590-1770
6.30	1190-1380	1390-1560	1390-1560	1570-1750	1570-1750
6.50	1180-1370	1380-1550	1380-1550	1560-1740	1560-1740
7.00	1160-1340	1350-1530	1350-1530	1540-1710	1540-1710
7.50	1140-1320	1330-1500	1330-1500	1510-1680	1510-1680
8.00	1120-1300	1310-1480	1310-1480	1490-1660	1490-1660
8.50	1110-1280	1290-1460	1290-1460	1470-1630	1470-1630
9.00	1090-1260	1270-1440	1270-1440	1450-1610	1450-1610
9.50	1070-1250	1260-1420	1260-1420	1430-1590	1430-1590
10.00	1060-1230	1240-1400	1240-1400	1410-1570	1410-1570
10.50		1220-1380	1220-1380	1390-1550	1390-1550
11.00		1210-1370	1210-1370	1380-1530	1380-1530
12.00		1180-1340	1180-1340	1350-1500	1350-1500
12.50		1170-1320	1170-1320	1330-1480	1330-1480
13.00		1160-1310	1160-1310	1320-1470	1320-1470
14.00		1130-1280	1130-1280	1290-1440	1290-1440

Note: For intermediate values of the wire diameter the specifications given for the next larger diameter are applicable.

**Type DM and DH are piano wire quality**



**Piano Wire****JIS G 3522-1991**

Standard Diameter mm	Tensile Strength, N/mm <sup>2</sup>		
	SWP—A	SWP—B	SWP—V
0.10	2790-3090	3090-3380	-
0.12	2750-3040	3040-3330	-
0.14	2700-2990	2990-3290	-
0.16	2650-2940	2940-3240	-
0.18	2600-2890	2890-3190	-
0.20	2600-2840	2840-3090	-
0.23	2550-2790	2790-3040	-
0.26	2500-2750	2750-2990	-
0.29	2450-2700	2700-2940	-
0.32	2400-2650	2650-2890	-
0.35	2400-2650	2650-2890	-
0.40	2350-2600	2600-2840	-
0.45	2300-2550	2550-2790	-
0.50	2300-2550	2550-2790	-
0.55	2260-2500	2500-2750	-
0.60	2210-2450	2450-2700	-
0.65	2210-2450	2450-2700	-
0.70	2160-2400	2400-2650	-
0.80	2110-2350	2350-2600	-
0.90	2110-2300	2300-2500	-
1.00	2060-2260	2260-2450	2010-2210
1.20	2010-2210	2210-2400	1960-2160
1.40	1960-2160	2160-2350	1910-2110
1.60	1910-2110	2110-2300	1860-2060
1.80	1860-2060	2060-2260	1810-2010
2.00	1810-2010	2010-2210	1770-1910
2.30	1770-1960	1960-2160	1720-1860
2.60	1770-1960	1960-2160	1720-1860
2.90	1720-1910	1910-2110	1720-1860
3.20	1670-1860	1860-2060	1670-1810
3.50	1670-1810	1810-1960	1670-1810
4.00	1670-1810	1810-1960	1670-1810
4.50	1620-1770	1770-1910	1620-1770
5.00	1620-1770	1770-1910	1620-1770
5.50	1570-1710	1710-1860	1570-1720
6.00	1520-1670	1670-1810	1520-1670
6.50	1520-1670	1670-1810	-
7.00	1470-1620	1620-1770	-
8.00	1470-1620	-	-
9.00	1420-1570	-	-
10.0	1420-1570	-	-

Note: For intermediate values of the wire diameter the specifications given for the next larger diameter are applicable.

## Hard Drawn Steel Wire

JIS G 3521-1991

Chemical composition applicable (wt.%)

C	Mn	P	S	Si
0.45-0.86	0.30-0.90	≤0.035	≤0.035	0.15-0.35

Range of carbon and Manganese depend on customer's requirements.

Tolerance of diameter

Size range	1.60-2.00mm	2.01-3.20mm	3.21-5.50mm	5.51-6.00mm	6.01-8.50mm	8.51-13.00mm
Tolerance	±0.030mm	±0.040mm	±0.050mm	±0.060mm	±0.060mm	±0.070mm

Out of roundness: Less than half of tolerance range at same section.

Tensile Strength

Nominal Diameter mm	Tensile Strength, MPa		
	SW—A	SW—B	SW—C
1.60	1320—1570	1570—1810	1810—2060
1.80	1270—1520	1520—1770	1770—2010
2.00	1270—1470	1470—1720	1720—1960
2.30	1230—1420	1420—1670	1670—1910
2.60	1230—1420	1420—1670	1670—1910
2.90	1180—1370	1370—1620	1620—1860
3.20	1180—1370	1370—1570	1570—1810
3.50	1180—1370	1370—1570	1570—1770
4.00	1180—1370	1370—1570	1570—1770
4.50	1130—1320	1320—1520	1520—1720
5.00	1130—1320	1320—1520	1520—1720
5.50	1080—1270	1270—1470	1470—1670
6.00	1030—1230	1230—1420	1420—1620
6.50	1030—1230	1230—1420	1420—1620
7.00	980—1180	1180—1370	1370—1570
8.00	980—1180	1180—1370	1370—1570
9.00	930—1130	1130—1320	1320—1520
10.0	930—1130	1130—1320	1320—1520
11.0	—	1080—1270	1270—1470
12.0	—	1080—1270	1270—1470
13.0	—	1030—1230	1230—1420

Note: For intermediate values of the wire diameter the specifications given for the next larger diameter are applicable.



## Technical Information (High carbon steel, for reference only)

### Temper of spring

#### The purpose:

- 1) Raise the yield point of material to about 90% of tensile strength and improve the creeping properties.
- 2) Relieve the residual stress caused by wire drawing and coiling, so improve the fatigue resistance and sag resistance.
- 3) Stabilizing the shape of spring (After temper for about 15-30 minutes, the coil size will be stable.)

#### Cautions:

- 1) Do not shorten the temper time by raising temperature outside the standard;
- 2) Hardness: When raising the temperature, the hardness tends to decline after slight increase. Temperature for best fatigue resistance is a little lower than the point for maximum hardness;
- 3) Shrinking of coil: Diameter of spring will show a reduction after temper, so it is necessary to form a larger size to allow shrinking.
- 4) Temper color: Temper color is decided by temper temperature and residual on steel wire. Proper air circulation, temperature control and charging method is helpful for even color. Oil and finger print will cause uneven color;
- 5) Temper temperature: 250-280°C in many cases. If temper at 200-250°C, the tensile strength will be maximized value and toughness will be minimized. This will cause wire break during hook rising or arm working.
- 6) Compression spring: Light low-temperature annealing after peening or setting prevents deformation;
- 7) Extension spring: Initial stress reduces after temper, surplus should be considered;
- 8) Torsion Spring: 280°C temper after coiling. If partial working is made after coiling, tempering at 250°C;
- 9) Hook of extension spring and arm of torsion spring: The position will change after temper, this change should be determined if precious position is required.

#### Temper parameter:

Depend of working condition of spring, characteristics of spring and type of oven:

Type	For good fatigue property	Static or slight dynamic
Dynamic Spring	300-350 C° /20-30 min.	200-350 C° /15-20 min.
Static Spring	200-250 C° /20-30 min.	

#### Mechanical Properties

Tensile Elastic Modulus: 205GPa

Torsion Elastic Modulus: 79GPa

Designing torsion stress level: 40% (static load) and 45% (Dynamic load)

Hardness: HRC31-60 (relate to tensile strength)

#### Safety and Products Protection

Proper handling and decoiling is helpful for preventing injury and damage.

Keep in dry storage to prevent rusting of steel wire.

#### Environmental Protection

Proper dispose the packing materials to reduce environmental impact.



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These data will subject to change without notice