

SANDVIK 12R10 / SANDVIK T302

SPRING WIRE

WIRE

DATASHEET

Sandvik 12R10 and Sandvik T302 are austenitic stainless steels characterized by moderate tensile strength, high corrosion resistance and moderate fatigue and relaxation resistance. Service temperature: -200 to 250°C (-330 to 480°F).

STANDARDS

- ASTM: 302
- ISO: X9 CrNi 18-8 Grade 1 NS
- EN Number: 1.4310 NS
- EN Name: X 10 CrNi 18-8 NS
- W.Nr.: 1.4310
- JIS: SUS 302/304-WPB

Product standards

EN	10270-3
Standards not fully fulfilled	
ISO	6931-1
ASTM	A 313/A 313M
JIS	G 4314

CHEMICAL COMPOSITION (NOMINAL) %

Steel grade	C	Si	Mn	P	S	Cr	Ni
12R10	0.08	0.5	1.2	≤0.040	≤0.010	18	8.2
T302	0.07	0.5	1.3	≤0.035	≤0.015	18.5	8.0

FORMS OF SUPPLY

Surface finish	Size range, mm
Coated	0.20–10.00
Nicoat A (nickel coating)	0.22–2.50
Bright	0.15–0.80
Nicoat B (nickel coating + bright)	0.18–0.80
Mechanically polished	0.40–6.00
Flat wire	

Surface finish	Size range, mm
Width	0.50–7.00
Thickness	0.05–4.00
Wall thickness	< 25

Delivery forms

Standard delivery forms are:

- Coils with weight up to 150 kgs
- Spools of various types with wire weight up to 1000 kgs
- Compact coils with weight up to 1200 kgs
- Straightened lengths up to 4 m

MECHANICAL PROPERTIES

Mechanical properties in the 'as delivered' condition

Tensile strength and proof strength, MPa (ksi)

Wire diameter	Nominal, R _m ¹	Nominal R _{p0.2}			
mm	in.	MPa	ksi	MPa	ksi
0.15 – 0.20	0.0059 - 0.0079	2365	343	1890	274
>0.20 – 0.30	>0.0079 - 0.012	2310	335	1850	268
>0.30 – 0.40	>0.012 - 0.016	2260	328	1810	262
>0.40 – 0.50	>0.016 - 0.020	2200	319	1760	255
>0.50 – 0.65	>0.020 - 0.026	2150	312	1720	249
>0.65 – 0.80	>0.026 - 0.031	2095	304	1680	244
>0.80 – 1.00	>0.031 - 0.039	2045	297	1635	237
>1.00 – 1.25	>0.039 - 0.049	1990	289	1590	231
>1.25 – 1.50	>0.049 - 0.059	1935	281	1550	225
>1.50 – 1.75	>0.059 - 0.069	1880	273	1505	218
>1.75 – 2.00	>0.069 - 0.079	1830	265	1465	212
>2.00 – 2.50	>0.079 - 0.098	1775	257	1420	206
>2.50 – 3.00	>0.098 - 0.118	1720	249	1375	199
>3.00 – 3.50	>0.118 - 0.138	1665	241	1330	193
>3.50 – 4.25	>0.138 - 0.167	1615	234	1290	187
>4.25 – 5.00	>0.167 - 0.197	1560	232	1250	181
>5.00 – 6.00	>0.197 - 0.236	1505	218	1205	175
>6.00 – 7.00	>0.236 - 0.276	1450	210	1160	168
>7.00 – 8.50	>0.276 - 0.335	1400	203	1120	162
>8.50 – 10.00	>0.335 - 0.394	1345	195	1075	156
Flat wire		800-2200	116 - 319	0.85*R _m	0.85 * ksi
Other strength levels		On request			

1) Tolerance on tensile strength + /- 7.0 % in accordance with EN 10 270-3 (ISO 6931-1).

Tensile strength can be increased by 150–250 MPa (22 - 36 ksi) by tempering. Click on heat treatment for further

information. The tensile strength variation between spools/coils within the same production lot is ± 50 MPa (7ksi) maximum. Proof strength in the tempered condition is approx. 85 % of the tempered tensile strength. Tensile strength values are guaranteed and are measured directly after production. During storage, the strength will increase slightly due to ageing. Depending on the storage conditions, ageing can increase the strength by 0 - 50 MPa (0 - 7 ksi).

Shear modulus, MPa (ksi)

As delivered: approx 71 000 (10 295)

Tempered: approx 73 000 (10 585)

Modulus of elasticity, MPa (ksi)

As delivered: approx 185 000 (26 825)

Tempered: approx 190 000 (27 550)

The strength will decrease by 3–4% per 100°C (184°F) increase in service temperature.

Straightened lengths

After straightening, the strength is approx. 7% lower.

PHYSICAL PROPERTIES

Density: 7.9 g/cm³, 0.29 lb/in³

Specific heat capacity

500 J/kg °C	in the temperature range 50 - 100°C
0.12 Btu/lb °F	in the temperature range 120 - 210°F

Thermal conductivity

Temperature, °C	W/m °C	Temperature, °F	Btu/ft h °F
20	15	68	9
100	16	210	9
200	18	390	10.5
300	19	570	11.5

Resistivity

Temperature, °C	$\mu\Omega\text{m}$	Temperature, °F	$\mu\Omega\text{in.}$
20	0.80	68	31
100	0.85	200	33
200	0.90	400	36
300	0.95	600	38

Thermal expansion 1)

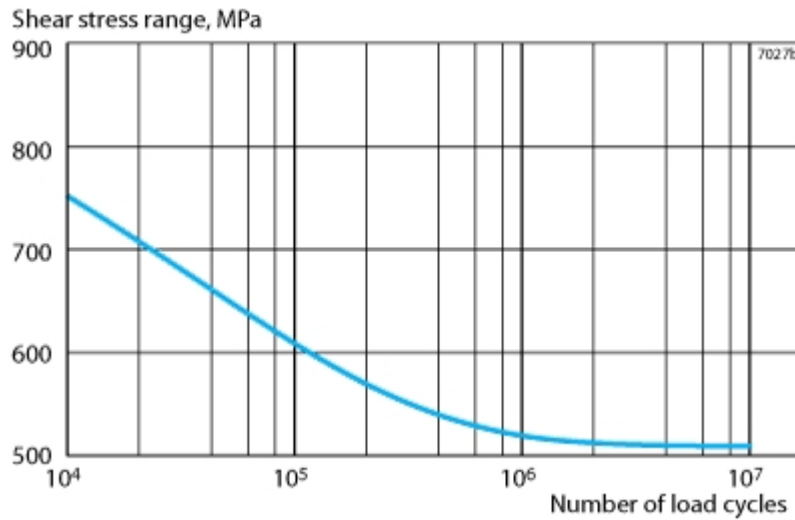
Temperature, °C	per °C	Temperature, °F	per °F
20 - 100	17	68 - 210	9.5
20 - 200	17.5	68 - 390	9.5
20 - 300	18.5	68 - 570	10.0

1) Mean values in temperature ranges ($\times 10^{-6}$)

Permeability, μ_{max} : about 10

FATIGUE STRENGTH - TEMPERED AND PRE-STRESSED CYLINDRICAL HELICAL SPRINGS

Wöhler diagram, mean stress 450 MPa

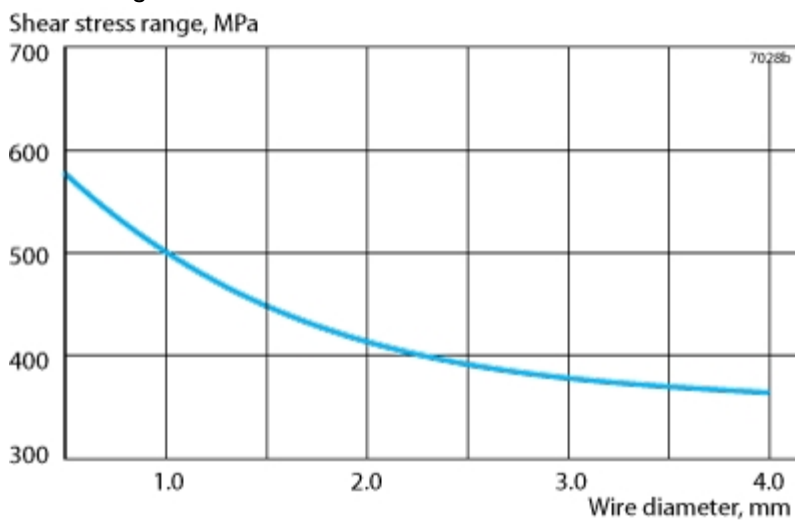


The curve is valid for springs coiled from wire 1 mm in diameter and represents a 90% security against failure.

Shear stress range = double the stress amplitude.

To reach 99.9% certainty against failure the curve must be lowered to about 80 % of present values.

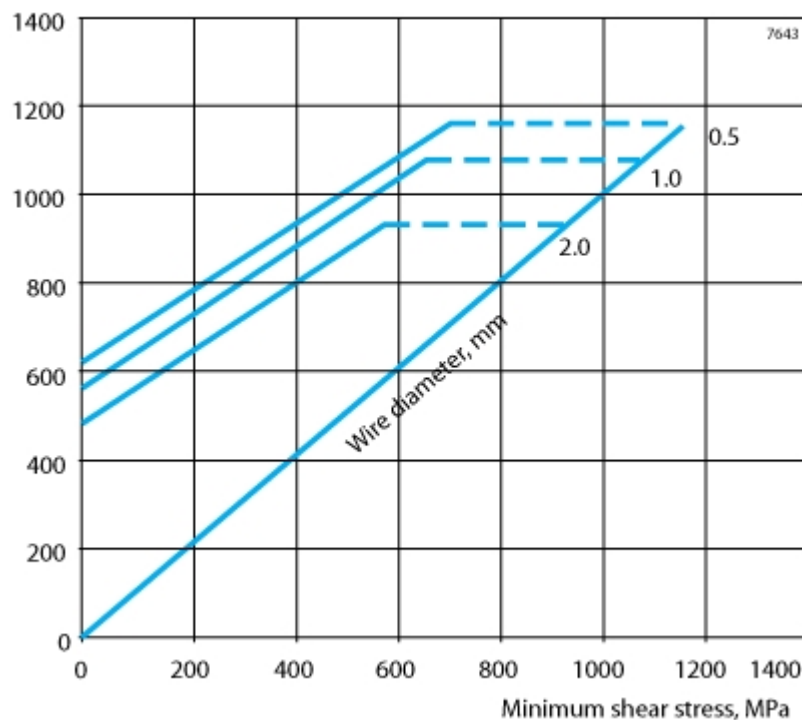
Stress range for different wire diameters, mean stress 450 MPa



Shear stress range at 10⁷ load cycles as a function of the wire diameter.

Modified Goodman diagramme for different wire diameters

Maximum and minimum shear stress, MPa



At elevated temperatures, the fatigue strength decreases at:

100°C (210°F)	by about 5 %
200°C (390°F)	by about 10%

HEAT TREATMENT

By tempering springs at 350°C (660°F)/0.5–3 h, the tensile strength will increase by about 100–250 MPa (15 - 35 ksi). If a shorter tempering time is used the tempering effect will be lower. In continuous conveyor furnaces, where the holding time at temperature is very short (min. 3 minutes), the temperature can be increased to about 425°C (780°F).

In the 'as delivered' condition, the ratio proof strength/tensile strength is about 0.80. After tempering the ratio will be about 0.85.

Please note that tension springs coiled with initial tension must not be tempered at the same high temperature as other types of spring. We recommend batch annealing at 200°C (390°F)/0.5–3 h, or continuous tempering in a conveyor furnace with a holding time of 3–20 minutes at about 250°C (480°F).

BENDING

The minimum bending radius should not be less than half the wire diameter. Wire surfaces should be free from any damage caused by tooling, since slight imperfections in the surface can lead to fracture even at large bending radii.

Disclaimer: Recommendations are for guidance only, and the suitability of a material for a specific application can be confirmed only when we know the actual service conditions. Continuous development may necessitate changes in technical data without notice. This datasheet is only valid for Sandvik materials.