Alleima® 11R51 / 11R51 HV medical wire
Wire
Datasheet

Alleima® 11R51 and Alleima® 11R51 HV (vacuum remelted) are austenitic stainless steels alloyed with molybdenum that are characterized by high tensile strength and high resistance to corrosion, fatigue and relaxation.

Vacuum-remelted Alleima® 11R51 HV offers higher cleanliness compared to Alleima® 11R51, which is usually required for medical applications.

Compared with the standard grade Alleima® 12R10 medical wire,Alleima® 11R51 and Alleima® 11R51 HV offer:

- Higher tensile strength and tempering effect
- Higher relaxation resistance, especially at elevated temperatures
- Higher fatigue strength
- Better corrosion resistance, through the addition of molybdenum

Service temperature: -200 to 300°C (-330 to 570°F)
These grades are used for applications such as root canal files, reamers, broaches, surgical suture needles, braces, and acupuncture needles.

Standards

- UNS: S30151
- ISO: X9 CrNi 18-8
- EN Number: 1.4310
- EN Name: X10CrNi18-8

Product standards

EN	10270-3
ISO	6931-1
ASTM	F 899, A 313/A 313M

Applications

Alleima® 11R51 medical wire is used in applications such as root canal files, reamers, broaches, surgical suture needles, braces, and acupuncture needles.

Chemical composition (nominal) %

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C	Si	Mn	P	S	Cr	Ni	Mo
0.08	1.5	1.8	≤0.025	≤0.010	17	7.5	0.7

Forms of supply

Wire is delivered in a number of different forms to suit customers' requirements:

- In coils with weights up to 150 kg
- On various types of spools with wire weights up to 500 kg
- In straightened lengths up to 4 m

Click on the following items for detailed information about surfaces finishes, delivery forms spools and coils, diameter tolerances and ovality.

Surface finishes and size range

Surface finish	Size range, mm
Coated	0.20- 8.50
Nicoat A (nickel coating)	0.22- 2.50
Bright	0.11- 0.80
Nicoat P (nickel coating + bright)	0.40- 6.00
Mechanically polished	0.40 - 6.00

Mechanical properties

Mechanical properties in the ȧs delivered´condition

Tensile strength and proof strength, MPa (ksi)

Wire diameter		Nominal		Nominal	
		R_m [1]		$R_{p0.2}$	
mm	in.	MPa	ksi	MPa	ksi
0.15 – 0.20	0.0059 - 0.0079	2530	367	2150	312
>0.20 – 0.30	>0.0079 - 0.012	2470	358	2100	305
>0.30 – 0.40	>0.012 - 0.016	2420	351	2060	299
>0.40 – 0.50	>0.016 - 0.020	2365	343	2010	292
>0.50 – 0.65	>0.020 - 0.026	2310	335	1960	284
>0.65 – 0.80	>0.026 - 0.031	2260	328	1920	278
>0.80 – 1.00	>0.031 - 0.039	2200	319	1870	271
>1.00 – 1.25	>0.039 - 0.049	2150	312	1830	265

>1.25 – 1.50	>0.049 - 0.059	2100	305	1785	259
>1.50 – 1.75	>0.059 - 0.069	2040	296	1730	251
>1.75 – 2.00	>0.069 - 0.079	1990	289	1690	245
>2.00 – 2.50	>0.079 - 0.098	1880	273	1600	232
>2.50 – 3.00	>0.098 - 0.118	1830	265	1555	225
>3.00 – 3.50	>0.118 - 0.138	1775	257	1510	219
>3.50 – 4.25	>0.138 - 0.167	1720	249	1460	212
>4.25 – 5.00	>0.167 - 0.197	1670	242	1420	206
>5.00 – 6.00	>0.197 - 0.236	1610	233	1370	199
>6.00 – 7.00	>0.236 - 0.276	1560	226	1330	193
>7.00 – 8.50	>0.276 - 0.335	1505	218	1280	186
Other strength levels		On request			

[1)] tolerance on tensile strength + / - 7.0 % in accordance with En 10 270-3 grade 1.4310HS.

The tensile strength can be increased by 150–300 MPa (22 - 44 ksi) by tempering. Please click on heat treatment for further information. The tensile strength variation between spools/coils within the same production lot is ±50 MPa (7 ksi) maximum. The proof strength in the tempered condition is approx. 90% of the tempered tensile strength. The tensile strength values are guaranteed and are measured directly after production. During storage, the strength will increase marginally due to aging. Depending on the storage conditions, aging can increase the strength by 0 - 80 MPa (0 - 12 ksi). S-2140

Straightened lengths

After straightening the strength is approx. 7% lower.

Static strength, tempered and pre-stressed cylindrical helical springs

Sandvik Product Research

The strength data below is based on laboratory tests performed by Alleima R&D. The data applies at 20°C in normal, dry atmosphere, unless otherwise stated. They are not guaranteed values but should be taken as recommendations in the choice of wire gauge, stress level, etc. A description of the testing procedure can be found, together with explanations under the following items:

E- and G-moduli
S-2130

Strength and mechanical testing
S-2131

Physical properties

The physical properties of a steel are related to a number of factors, including alloying elements, heat treatment and manufacturing route , but the following data can be used for rough calculations.

Density: 7.9 g/cm^3, 0.29 lb/in^3

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	µΩm	Temperature, °F	µΩin.
20	0.90	70	35.0
100	0.95	210	37.0
200	1.00	390	39.0
300	1.05	570	41.5

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 ($x10^{-6}$)

Magnetic permeability, $\mu_{max:}$ about 35

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 (180°F) increase in service temperature.

Corrosion resistance

It is very important to avoid corrosion in spring applications so as not to impair spring properties. Alleima® 11R51/11R51HV are austenitic stainless steels and have sufficient corrosion resistance in most spring applications.

The corrosion resistance of the material is slightly higher compared to Alleima® 12R10 and standard ASTM 301, due to the addition of molybdenum.

Compared to other stainless spring steels, Alleima® 11R51/11R51HV have superior performance. However, all austenitic steels of this type are susceptible to stress corrosion cracking (SCC) when in contact with chloride solutions at elevated temperatures.

Heat treatment

By tempering at 425°C (780°F)/0.5 - 4 h, the tensile strength will increase by about 150-300 MPa (20 - 45 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 475°C (780°F).
- In the ȁs delivered´condition the ratio of proof strength/tensile strength is about 0.85. After tempering the ratio will be about 0.90.

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 tempering at 250°C (480°F)/0.5–3 h, or continuous tempering in a conveyor furnace with a holding time of 3–5 minutes at about 300°C (570°F). S-2131. Click here for information on heat treatment in batch, continuous furnaces and on Why temper springs? S-2140

Bending

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

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