

# 12R10/12R10HV Datasheet

## Medical Wire



Zapp is certified according to ISO 9001

12R10 and 12R10HV (vacuum remelted) are austenitic stainless steels characterized by moderate tensile strength, good corrosion resistance and moderate fatigue and relaxation resistance.

Vacuum-remelted 12R10HV offers higher cleanliness compared to 12R10, which is usually required for medical applications.

Service temperature: -200 to 250 °C (-330 to 480 °F).

12R10 and 12R10 HV are characterized by:

- High tensile strength and tempering effect
- Good relaxation resistance, especially at elevated temperatures
- High fatigue strength

### Standards

- ASTM: 302/302VM, '304V'
- ISO: X9CrNi18-8 Grade 1 NS
- EN Number: 1.4310NS
- EN Name: X10CrNi18-8NS
- W.Nr.: 1.4310
- JIS: SUS 302/304-WPB

### Product Standards

EN	10270-3
ISO	6931-1
ASTM	A 313/A 313 M, F899
JIS	G 4314

### Applications

12R10/12R10HV can be used for blood lancets, stylets, acupuncture needles and dental files and reamers.

### Chemical Composition (nominal) %

C	Si	Mn	P	S	Cr	Ni
0.08	0.5	1.2	≤ 0.040	≤ 0.010	18.0	8.3

### Forms of Supply

Surface finish	Size range, mm
Coated	0.20 – 10.00
Nicoat A (nickel coating)	0.22 – 2.50
Bright	0.11 – 0.80
Nicoat P (nickel coating + bright)	0.11 – 0.80
Mechanically polished	0.40 – 6.00
Degreased	0.50 – 5.00

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

- In coils with weights up to 150 kg
- On spools with wire weights up to 500 kg
- In straightened lengths up to 4 m, diameters between 0.6 to 10 mm

## Forms of Supply

Mechanical properties in the 'as delivered' condition

Tensile strength and proof strength, MPa (ksi)

Wire diameter		Nominal, R <sub>m</sub> <sup>1)</sup>		Nominal R <sub>p0.2</sub>	
mm	in.	MPa	ksi	MPa	ksi
0.15 - 0.20	0.0059 - 0.0079	2,365	343	1,890	274
> 0.20 - 0.30	> 0.0079 - 0.012	2,310	335	1,850	268
> 0.30 - 0.40	> 0.012 - 0.016	2,260	328	1,810	262
> 0.40 - 0.50	> 0.016 - 0.020	2,200	319	1,760	255
> 0.50 - 0.65	> 0.020 - 0.026	2,150	312	1,720	249
> 0.65 - 0.80	> 0.026 - 0.031	2,095	304	1,680	244
> 0.80 - 1.00	> 0.031 - 0.039	2,045	297	1,635	237
> 1.00 - 1.25	> 0.039 - 0.049	1,990	289	1,590	231
> 1.25 - 1.50	> 0.049 - 0.059	1,935	281	1,550	225
> 1.50 - 1.75	> 0.059 - 0.069	1,880	273	1,505	218
> 1.75 - 2.00	> 0.069 - 0.079	1,830	265	1,465	212
> 2.00 - 2.50	> 0.079 - 0.098	1,775	257	1,420	206
> 2.50 - 3.00	> 0.098 - 0.118	1,720	249	1,375	199
> 3.00 - 3.50	> 0.118 - 0.138	1,665	241	1,330	193
> 3.50 - 4.25	> 0.138 - 0.167	1,615	234	1,290	187
> 4.25 - 5.00	> 0.167 - 0.197	1,560	232	1,250	181
> 5.00 - 6.00	> 0.197 - 0.236	1,505	218	1,205	175
> 6.00 - 7.00	> 0.236 - 0.276	1,450	210	1,160	168
> 7.00 - 8.50	> 0.276 - 0.335	1,400	203	1,120	162
> 8.50 - 10.00	> 0.335 - 0.394	1,345	195	1,075	156

<sup>1)</sup> Tolerance on tensile strength  $\pm 7.0\%$  in accordance with EN 10 270-3 (ISO 6931-1).

12R10 can be supplied in the annealed condition.

### 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  $\pm 50$  MPa (7 ksi) 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 storage conditions, ageing can increase the strength by 0 - 50 MPa (0 - 7 ksi)

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/cm, 0.29 lb/in

### 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	9.0
100	16	210	9.0
200	18	390	10.5
300	19	570	11.5

### Resistivity

Temperature °C	μΩm	Temperature °F	μΩin.
20	0.80	68	31
100	0.85	200	33
200	0.90	400	36
300	0.95	600	38

### Thermal expansion<sup>1)</sup>

Temperature °C	Per °C	Temperature °F	Per °F
20 - 100	17.0	68 - 210	9.5
20 - 200	17.5	68 - 390	9.5
20 - 300	18.5	68 - 570	10.0

<sup>1)</sup> Mean values in temperature ranges (x10<sup>-6</sup>)

### Magnetic Permeability

- $\mu_{\max}$  : about 10

### 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)

### 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.

### Heat Treatment

By tempering 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).

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