

PENTHOR 943

Edition 04/2016
Replaces edition 01/2012

Oil tempered silicon/chromium/vanadium alloyed spring wire

External standard :

The material conforms to TDSiCrV according to EN 10270 - 2 : 2011

Further equivalent standards:

ASTM A-1000 Grade D

Applications:

For coil springs subjected to moderate dynamic stresses, such as clutch springs or springs requiring similar moderate fatigue resistance as well as high tensile strength and excellent relaxation properties at elevated temperatures (up to approx. 250 °C).

Range of diameters :

0.40 to 6.50 mm Ø

Chemical composition (heat analysis):

C %	Si %	Mn %	P max. %	S max. %	Cu max. %	Cr %	V %
0.50 - 0.70	1.20 - 1.65	0.40 - 0.90	0.020	0.020	0.10	0.50 - 1.00	0.10 - 0.25

Raw material:

Wire rod according to in-house specifications.

Cleanliness acc. to DIN 50602, inclusions chart 1:

max. size 2 for all types of inclusions

* IVSWMA: International Valve Spring Wire Manufacturers Association

Mechanical properties: Penthor 943 - Edition 04/2016 (replaces edition 01/2012)

Wire diameter mm	Tolerance mm	Tensile strength MPa	Minimum reduction %	Minimum number of torsions min.	Permissible depth of surf. defects ¹⁾	Permissible part. decarburization depth ¹⁾
0.40 to 0.60	± 0.010	2230 to 2380	-	-	max. 0.008 mm	
> 0.60 to 0.80		2230 to 2380		5	max. 1.3% of wire diameter	
> 0.80 to 1.00	± 0.015	2230 to 2380	50	5		
> 1.00 to 1.30	± 0.020	2230 to 2380		45		4
> 1.30 to 1.40		2210 to 2360				
> 1.40 to 1.60		2210 to 2360				
> 1.60 to 2.00	± 0.025	2160 to 2310	45	4		
> 2.00 to 2.50		2100 to 2250				
> 2.50 to 2.70		2060 to 2210				
> 2.70 to 3.00	± 0.030	2060 to 2210	45	3		
> 3.00 to 3.20		2060 to 2210				
> 3.20 to 3.50		2010 to 2160				
> 3.50 to 4.00		2010 to 2160				
> 4.00 to 4.20	± 0.035	1960 to 2110	40	3		
> 4.20 to 4.50		1960 to 2110				
> 4.50 to 4.70		1960 to 2110				
> 4.70 to 5.00		1960 to 2110				
> 5.00 to 5.60	± 0.040	1910 to 2060	35	-		
> 5.60 to 6.00		1910 to 2060				
> 6.00 to 6.50		1910 to 2060				

- a) Range of tensile strength within one coil max. 60 MPa
- b) Ovality : Difference between the largest and smallest diameter of a cross section does not exceed 50 % of the diameter tolerance.
- c) Yield point (0.2% limit) at least 90 % of the tensile strength
- d) Modulus of elasticity E = 206.000 MPa } Standard
Shear modulus G = 79.500 MPa }
- e) Torsion tests are carried out according to EN 10218 - 1
- ¹⁾ End samples

Surface inspection:

Wires with diameters from 2.5 to 6.50 mm are eddy current surface inspected after oil hardening and tempering using a combination of two methods to detect both transverse and longitudinal defects.

Testing of wires < 2.5 mm can be agreed upon separately.

Defects ≥ 60 µm are recorded and marked.

Based on type and shape a surface defect of more than 60 µm may not be detected by EC testing. See Position statement of IVSWMA.*

Heat treatment:

After coiling, the springs should be stress relieved as soon as possible at 380 - 425 °C, with a holding time of 30 minutes at temperature.

After shot peening, the springs must be stress relieved at approx. 240 °C for 30 minutes.

Shot peening:

The shot size and blast time must be chosen to ensure complete coverage of the inside of the springs.

Particular attention should be paid to the above in case of springs with small index and pitch.

Please inquire for special tolerances, tensiles, sections, etc.