OTEVA 70 SC Plus

Oil tempered SiCr-alloyed valve spring wire

OTEVA® 70 SC PLUS is intended for manufacture of valve springs and other springs requiring extremely high fatigue properties and good relaxation properties at increased working temperatures.

Chemical composition

Element	Weight %
C	0.50% - 0.60%
Si	1.20% - 1.60%
Mn	0.50% - 0.80%
P max.	0.025%
S max.	0.020%
Cr	0.50% - 0.80%

Cleanliness in steel

The presence of non-metallic inclusions in the wire rod is inspected for every heat of OTEVA® 70 SCin accordance with the Suzuki Garphyttan method by the steel supplier.

Before release for production, Suzuki Garphyttan performs non-metallic inclusion inspection for every fifth heat. The criteria for supplier inspection and releasing inspection are the following;

For wire rod samples: Inclusion size max. 15 µm down to 1 mm below surface. Inspection area: 1 000 mm^2.

Inclusion size, surface	5-10 µm	>10-15 µm	>15 µm
Max. number of inclusions	50	7	0

For OTEVA 70 SC PLUS, every heat is inspected including a SEM-EDS analysis of inclusions > 10µm to verify a Super Clean composition.

As stated by IVSWMA, International Valve Spring Wire Manufacturers Association, it is likely to find occasional inclusions in valve spring quality steel of a size larger than 30 µm.

Mechanical properties

Table definitions

Diameter: Other wire sizes on request.
Tolerance: Ovality, i. e. the difference between the largest and smallest dimension of a cross section, is maximum half the tolerance range.
Tensile strength: Conversion from tensile strength to hardness values can be calculated in standard ISO EN 18265. The tensile strength Rm within one coil does not vary more than 50 N/Mm^2.
Torsions: Torsion test is carried out at ≤ 6.0 mm for assessing deformability. The fracture of the torsion test piece shall be smooth and perpendicular to the wire axis. The rupture shall show no longitudinal cracks.

For round wire

Diameter (mm)	Tolerance (mm)	Tensile Strength (N/mm^2)	Torsions (l=300 mm, min. revs)	Reduct. of area (min. %)
0.50 - 0.80	±0.010	2080 - 2210	6	
0.81 - 1.30	±0.015	2080 - 2210	5	50
1.31 - 1.40	±0.015	2080 - 2210	5	50
1.41 - 1.60	±0.020	2080 - 2210	5	50
1.61 - 2.00	±0.020	2010 - 2160	5	50
2.01 - 2.50	±0.020	1960 - 2060	5	50
2.51 - 3.00	±0.020	1910 - 2010	4	50
3.01 - 3.20	±0.020	1910 - 2010	4	45

Diameter (mm)	Tolerance (mm)	Tensile Strength (N/mm^2)	Torsions (l=300 mm, min. revs)	Reduct. of area (min. %)
3.21 - 3.50	±0.025	1910 - 2010	4	45
3.51 - 4.50	±0.025	1860 - 1960	4	45
4.51 - 5.00	±0.025	1810 - 1910	3	45
5.01 - 5.60	±0.030	1810 - 1910	3	40
5.61 - 6.00	±0.035	1760 - 1860	3	40
6.01 - 6.50	±0.035	1760 - 1860		40
6.51 - 7.00	±0.040	1710 - 1810		40
7.01 - 8.00	±0.045	1710 - 1810		40
8.01 - 9.00	±0.045	1660 - 1760		35
9.01 - 10.00	±0.050	1660 - 1760		35

Yield point

The proof stress $R_{p0.2}$ is min. 0.9 x tensile strength of the wire.

Surface conditions

Surface condition

Surface condition – non-destructive testing
In the standard size range 2.00 - 6.00 mm the wire is tested continuously in Eddy Current equipment to a surface level of ≥ 40 microns. For size range 6.01-8.60 mm is tested continuously in Eddy Current equipment to a surface level of ≥ 60 microns. Other wire sizes on request.

Surface condition – end sample test
The wire is end sample tested by means of etch testing and binocular inspection as well as microscopical inspection of the material structure.

Max. permissible depth of partial surface decarburization and surface defects, 1 % x wire diameter. In shaved condition; for diameters <=2 .00 mm 10 µm, for diameters > 2.00 mm 0.5% x d. For diameters > 6.60-10.00 mm 0.7% x d.

Technical specification

Property	Value
E modulus of elasticity	206 kN/mm^2
G modulus of shear	79.5 kN/mm^2

Steel grades and product standards

Nearest equivalent product standards	EN 10270-2	ASTM A877 A	BS 2803 685A55H	JIS G3561 SWOSC-V
Nearest equivalent steel grades	EN VDSiCrV	SIS 142090-05		

Recommendations

Heat treatment

As soon as possible after coiling, the springs should be stress relieved. See recommended procedure in the table below.

Hot presetting

After shot peening, the springs should be hot preset or stress relieved. In order to reach optimum fatigue and relaxation properties, the springs must be preset at an appropriate stress.

Shot peening

In order to obtain optimum fatigue properties, the process time should be adjusted to get a complete treatment. Size of shots should be adapted to wire dimension, pitch and shot peening equipment.

Shot peening of the inside of the spring coils is particularly critical.

Spring conditions for tests

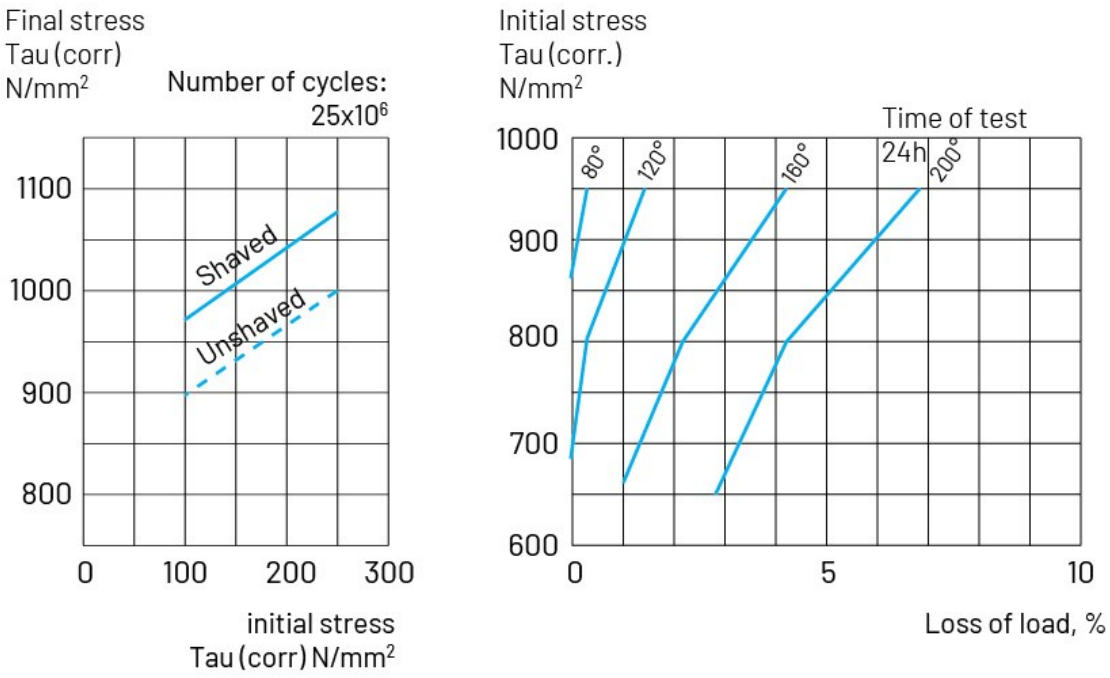
Spring conditions for fatigue and relaxation tests (specially designed test spring) Diagram 1 and 2:

Wire size	Ø 4.00 mm
Diameter external	28.00 mm
Spring length, l0	59.5 mm
N active	4.80
Spring index	6.0
Stress relieving	
Temperature	420 ±5°C (790 ±10 °F)
Time	30 minutes
Shot peening	Speed 48 m/sec. for 20 minutes, size of shots 0.8 mm
Hardness of Shot-peening grit (shot):	610-670 Hv
Aim for Almen arc-height	Min. 0.40-0.45 mm
Hot presetting (theoretically set)	1200 N/mm2
Temperature	200°C (max. 250°C)
Time	10 minutes

Relaxation and fatigue properties

In diagram 1 the fatigue properties of this grade are illustrated in a Goodman-diagram, based on a special test spring design.

Diagram 2 shows the relaxation properties (loss of load) of springs made from OTEVA® 70 SC wire subjected to static compression at different temperatures.



Additional

Additional information

Delivery forms
See separate sheet.