# OTEVA 70 SC, OTEVA 70 SC PLUS

OTEVA® 70 SC is a Super Clean steel, especially intended for the manufacture of clutch/ transmission springs with extremely high fatigue properties and good relaxation properties at moderately increased working temperature. The wire is manufactured in shaved or unshaved condition (Ø 6.50 – 14.00 mm in unshaved condition subcontracted) in sizes from Ø 0.50 mm to 6.50 mm, or in egg or elliptical shape corresponding to round cross section 2.50 mm to 6.50 mm Other wire sizes and shapes on request.

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. Further information about the approval process for OTEVA SC PLUS is found here.

## CHEMICAL COMPOSITION

| C (%) | Si (%) | Mn (%) | P max. (%) | S max. (%) | Cr (%) |
|---|---|---|---|---|---|
| 0.50 - 0.60 | 1.20 - 1.60 | 0.50 - 0.80 | 0.025 | 0.020 | 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.*

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## MECHANICAL PROPERTIES

1) Other wire sizes on request.
2) Ovality, i. e. the difference between the largest and smallest dimension of a cross section, is maximum half the tolerance range.
3) 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$^2$.
4) Torsion test is carried out 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 |
| 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 |

### YIELD POINT

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

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## 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. 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.

## PHYSICAL PROPERTIES

### E AND G MODULUS OF ELASTICITY

206 kN/mm$^2$

### E AND G MODULUS OF SHEAR

79.5 kN/mm$^2$

## STANDARDS

### NEAREST EQUIVALENT STEEL GRADES

EN VDSiCr, SIS 142090-05

### NEAREST EQUIVALENT STANDARDS

EN 10270-2, ASTM A877 A, BS 2803 685A55HD, JIS G3561 SWOSC-V

## RECOMMENDATIONS

### HEAT TREATMENT

As soon as possible after coiling, the springs should be stress relieved.

### 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.

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## 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 |
| **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.

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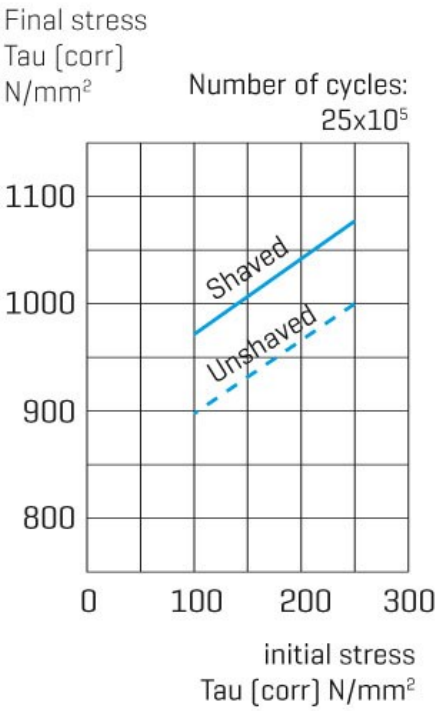


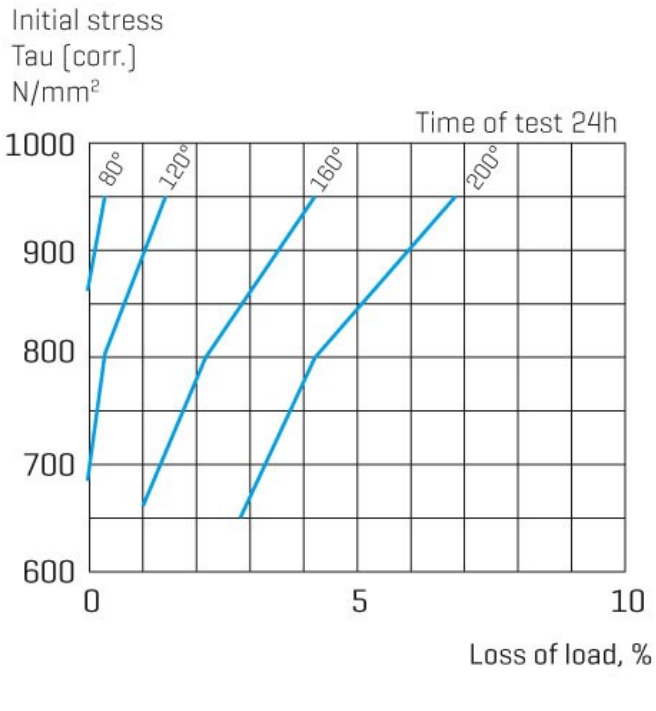


## ADDITIONAL

### ADDITIONAL INFORMATION

**Delivery forms**
See separate sheet.