

**Material for Springs V2019-01-24**

| Material No. | Material Description   | DIN EN ISO    | SAE Grade | Density [g/cm <sup>3</sup> ] | Modulus of Rigidity G [N/mm <sup>2</sup> ] | Young's Modulus E [N/mm <sup>2</sup> ] | Tensile Strength Rm [N/mm <sup>2</sup> ] | Shear Strength [N/mm <sup>2</sup> ] | Condition as delivered | Heat Treatment  | T [°C]         | Duration [Hours] | Cooling    | Tmax [°C]       | Use   |
|--------------|--|---------------|-----------|------------------------------|--|--|--|-------------------------------------|------------------------|---|----------------|------------------|------------|-----------------|---|
| 1.1200       | Music Wire (Spring Steel) Type C                               | EN 10270-1-SH |           | 7,85                         | 81500                                      | 210000                                 | 1200-3400                                | 600-1700                            | Spring hardened        | Tempering   | 270            | 0,5              | Air        | -40 until +80   | Patented drawn music wire (spring steel) suitable for static or quasi-static applications<br>Wire diameter maximum d=20mm                             |
| 1.1211       | Music Wire (Spring Steel) Type D                               | EN 10270-1-DH |           | 7,85                         | 81500                                      | 210000                                 | 1200-3400                                | 600-1700                            | Spring hardened        | Tempering   | 270            | 0,5              | Air        | -40 until +80   | Patented drawn music wire (spring steel) suitable for static or dynamic applications<br>Wire diameter maximum d=20mm                                  |
| 1.71.. ff    | 67SiCr5<br>Oteva 70<br>VDSiCr<br>FDSiCr<br>(Valve Spring Wire) |               |           | 7,85                         | 79000                                      | 200000                                 | 1670-2230                                | 835-1040                            | Spring hardened        | Annealing<br>Shot peening<br>Tempering<br>1 x Setting | 450<br>270     | 1<br>10 min      | Air<br>Air | -40 until +120  | Oil tempered music wire (spring steel) for highly dynamic applications valve springs, clutch springs  |
| 1.8159       | 51CrV4<br>(50CrV4)   |               | 6150      | 7,85                         | 78500                                      | 206000                                 | 1350-1650                                | 700-950                             | Annealed               | Hardening<br>Tempering                                | 850±10<br>450  | xxx<br>1         | Oil<br>Air | -40 until +80   | Hardenable music wire (spring steel) for applications in large wire sizes also suitable for highly dynamic applications chassis springs, turbines     |
| 1.1231       | Ck67 (C67S)  |               | 1070      | 7,85                         | 81500                                      | 210000                                 |  |                                     | Soft oder hardened     | Hardening<br>Tempering                                | 850<br>350-420 | 0,083 (5min)     | Oil        | -40 until +80   | Cold-rolled music wire (spring steel) for standard applications<br>disc springs, wave spring washers, leaf springs                                    |
| 1.1248       | Ck75 (C75S)  |               | 1075      | 7,85                         | 81500                                      | 210000                                 |  |                                     | Soft oder hardened     | Hardening<br>Tempering                                | 850<br>350-420 | 0,083 (5min)     | Oil        | -40 until +80   |   |
| 1.1269       | Ck85 (C85S)  |               | 1085      | 7,85                         | 81500                                      | 210000                                 |  |                                     | Soft oder hardened     | Hardening<br>Tempering                                | 850<br>350-420 | 0,083 (5min)     | Oil        | -40 until +80   |   |
| 1.4310       | X10CrNi18-8<br>(V2A)   | EN 10270-3    | 302       | 7,90                         | 73000                                      | 187500                                 | 1300-2600                                | 650-1300                            | Spring hardened        | Tempering   | 380            | 0,5              | Air        | -200 until +250 | Stainless steel for the most common applications suitable for a humid environment, but not seawater resistant slightly magnetic due to work hardening |

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|--------------|------------------------------|------------|-----------|------------------------------|--|--|--|-------------------------------------|------------------------|----------------|---------|------------------|---------|-----------------|---|
| 1.4568       | X7CrNiAl17-7 (V4A)           | EN 10270-3 | 17/7PH    | 7,98                         | 78000                                      | 200000                                 | 1150-2000                                | 575-1000                            | Spring hardened        | Hardening      | 450-480 | 0,5-1,0          | Air     | -200 until +350 | Precipitation-hardenable chromium-nickel steel for dynamic loads has excellent corrosion resistance aerospace, food industry  |
| 1.4571       | X6CrNiMoTi17-12-2 (V4A)      |            | 316Ti     | 7,98                         | 71000                                      | 185000                                 | 1200-2100                                | 600-1050                            | Spring hardened        | Hardening      | 450-480 | 0,5-1,0          | Air     | -200 until +350 | Precipitation-hardenable chromium-nickel steel resistant to seawater - high operating temperature shipping, aviation and aerospace, food industry   |
| 2.1020       | CuSn6 Phosphor Bronze        |            |           | 8,82                         | 39000                                      | 118000                                 | 950                                      | 550                                 | R980                   | Tempering      | 165-190 | 1                | Air     | -250 until +100 | Copper alloy with low strength, but very good conductivity and solderability, can also be used in a vacuum Electrical industry, apparatus engineering, vacuum technology, ship building               |
| 2.1247       | CuBe2 (BeCu25)               |            |           | 8,30                         | 47000                                      | 120000                                 | 1310-1520                                | 733                                 | 950-1150               | Hardening      | 315     | 2                | Air     | -250 until +200 | Low alloy copper-beryllium copper with high strength  |
|              |                              |            |           |                              |  |  | 950-1150                                 | 525                                 | 950-1150               | Tempering      | 200     | 0,5              | Air     | -250 until +200 |   |
| 2.4610       | NiMo16Cr15Fe6W4 Hastelloy C4 |            |           | 8,64                         | 81200                                      | 212400                                 | 1400-1700                                | 784                                 | Spring hardened        | Annealing      | 400-450 | 2                | Air     | -200 until +400 | High-alloy nickel-chromium steel with extreme resistance to chemicals and very good heat resistance Chemical industry, fertilizer production, valve technology  |
| 2.4632       | NiCr20Co18Ti Nimonic 90      |            |           | 8,18                         | 82500                                      | 227000                                 | 1500-1800                                | 812                                 | Spring hardened        | Hardening      | 650     | 4                | Air     | +350            | High-alloy nickel-chromium steel with high resistance to chemicals and good heat resistance suitable for both static and dynamic applications Aerospace, heating technology, research and development |
| 2.4669       | NiCr15Fe7TiAl Inconel X-750  |            |           | 8,28                         | 75800                                      | 218000                                 | 1350-1750                                | 675                                 | Spring hardened        | Hardening      | 650     | 4                | Air     | +370            | Music wire (spring steel) made of a nickel-chromium alloy which, when properly heat treated, exhibits   |
|              |                              |            |           |                              |  |  | 1100-1250                                | 550                                 | Spring hardened        | Annealing      | 1150    | 2                | Air     | +550            |   |
|              |                              |            |           |                              |  |  |  |                                     |                        | Stabili.       | 843     | 24               | Air     |                 |   |
|              |                              |            |           |                              |  |  |  |                                     | Hardening              | 704            | 20      | Air              |         |                 |   |