Utilization
Mould and die casting, Prototypes, Serial parts, Springs, etc.

Material Properties
Martensite hardening steel, low warping, very good toughness properties, high extension limit and tensile strength. Uniform contraction (0.09%)

Physical Properties
Thermal conductivity: 14.2 W/mK at 20 °C
19.0 W/mK at 500 °C
21.0 W/mK at 600 °C
28.6 W/mK at 1300 °C

Coefficient of thermal expansion: 10.3 x 10^-6 m/mK at 20°C to 100°C

Tensile strength: ≈ 1100 N/mm² (directly after the generative process) max. ≈ 2050 N/mm² (heat treated at 510 °C)

Yield point Rp 0,2: ≈ 2000 N/mm² (heat treated at 510 °C)

Elongating at fracture: ≈ 11% (directly after the generative process) ≈ 4% (heat treated at 510 °C)

Hardness: ≈ 35 HRC (directly after the generative process) = 52 HRC (heat treated at 510 °C)

Special Properties using generative manufacturing
Surface roughness: depending to the used layer thickness min. Rz 40-60 μm
(without finishing)
Density: in average 99.9 % (8.1 kg/dm³)
Minimum wall thickness: ≈ 0.5 mm (depending to the geometry)
Part accuracy: max. ± 0.05 mm (depending to the geometry)

Chemical composition:

| Element | C      | Si     | Mn    | Ni    | MO    | Ti    | Co    | Al    | P    | S    | Cr   |
|---------|--------|--------|-------|-------|-------|-------|-------|-------|------|------|------|------|
| Volume %| max. 0,03 | max. 0,1 | max. 0,1 | 17 -19 | 4,5 -5,2 | max. 0,8 | 8,5 -9,5 | max. 0,1 | max. 0,01 | max. 0,01 | max. 0,5 |

(double checked for each lot by spectral analyzing)
**Tensil strength**

This area is not permissible for a heat treatment!

![Graph showing tensile strength](image)

**Results:**

<table>
<thead>
<tr>
<th>Nr</th>
<th>S0 mm²</th>
<th>Rp 0.2 MPa</th>
<th>Rm MPa</th>
<th>ε-Bruch %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>28.27</td>
<td>2052.81</td>
<td>2076.54</td>
<td>5.85</td>
</tr>
<tr>
<td>2</td>
<td>28.65</td>
<td>2064.74</td>
<td>2092.90</td>
<td>5.42</td>
</tr>
<tr>
<td>3</td>
<td>28.46</td>
<td>2074.70</td>
<td>2081.98</td>
<td>4.05</td>
</tr>
<tr>
<td>4</td>
<td>28.94</td>
<td>1973.67</td>
<td>2074.89</td>
<td>4.64</td>
</tr>
<tr>
<td>5</td>
<td>28.75</td>
<td>2040.16</td>
<td>2085.71</td>
<td>5.82</td>
</tr>
</tbody>
</table>

**Statistic:**

<table>
<thead>
<tr>
<th>Serie</th>
<th>Rp 0.2 MPa</th>
<th>Rm MPa</th>
<th>ε-Bruch %</th>
</tr>
</thead>
<tbody>
<tr>
<td>n = 5</td>
<td>2041.22</td>
<td>2082.40</td>
<td>5.15</td>
</tr>
<tr>
<td>x</td>
<td>39.91</td>
<td>7.28</td>
<td>0.79</td>
</tr>
<tr>
<td>min</td>
<td>1973.67</td>
<td>2074.89</td>
<td>4.05</td>
</tr>
<tr>
<td>max</td>
<td>2074.70</td>
<td>2092.90</td>
<td>5.85</td>
</tr>
</tbody>
</table>

**Serial chart**

![Serial chart showing deformation and stress](image)
Density analyses

Test performed at: Euro-Labor Universitätsstr. 142
44799 Bochum Telefon + 49-234-5866295
Fax + 49-234-58617666 info@euro-labor.com

**Powder:** 1.2709  
**Heat treatment:** hardened (measuring result 52 HRC)  
**Section grinding:** no etching  
**fiftyfold magnification**  
**Status:** not metallic inclusions (mainly Oxides), nearly no pores

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HERE DISPLAYED: AREA WITH MAX. NUMBER OF INCLUSIONS
In case of heat treating or hardening the following has to be absolutely considered:

**The heat treatment of 1.2709 has to be implemented in a controlled furnace.**
The minimum temperature to be reached for heat treatment is 490 °C. This applies also in the case where the required hardness is less than 54 HRC. In this case a temperature above 500 °C has to be set.

**Procedure for heat treating:**
1. Reaching the target temperature (e.g. 510 °C) this must be maintained for min. 6 hours.
2. For cooling down the furnace temperature must be controlled and reduced uniformly.
3. The optimal cooling rate is 2 °C/min
4. Reaching 300 °C the furnace can be cooled down non-controlled.

**Quenching work pieces and targeting faster cooling rates is not permissible! This damages the material properties.**