

## Material Data Sheet: Material 1.2709 (Maraging Steel)

### 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:**  $10,3 \times 10^{-6}$  m/mK at 20°C to 100°C

**Tensile strength:**  $\approx 1100$  N/mm<sup>2</sup> (directly after the generative process)  
max.  $\approx 2050$  N/mm<sup>2</sup> (heat treated at 510 °C)

**Yield point Rp 0,2:**  $\approx 2000$  N/mm<sup>2</sup> (heat treated at 510 °C)

**Elongating at fracture:**  $\approx 11\%$  (directly after the generative process)  
 $\approx 4\%$  (heat treated at 510 °C)

**Hardness:**  $\approx 35$  HRC (directly after the generative process)  
 $\approx 52$  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/dm<sup>3</sup>)

**Minimum wall thickness:**  $\approx 0,5$  mm (depending to the geometry)

**Part accuracy:** max.  $\pm 0,05$  mm (depending to the geometry)

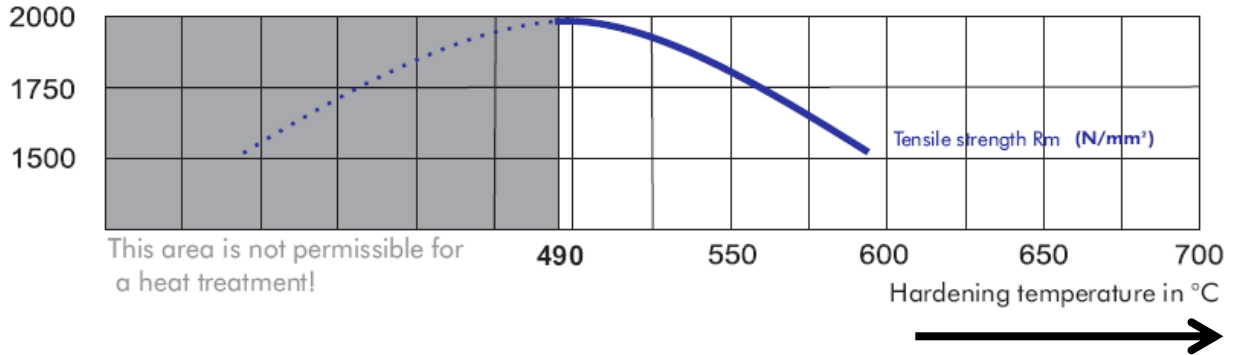
### Chemical composition:

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)

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### Tensile strength:



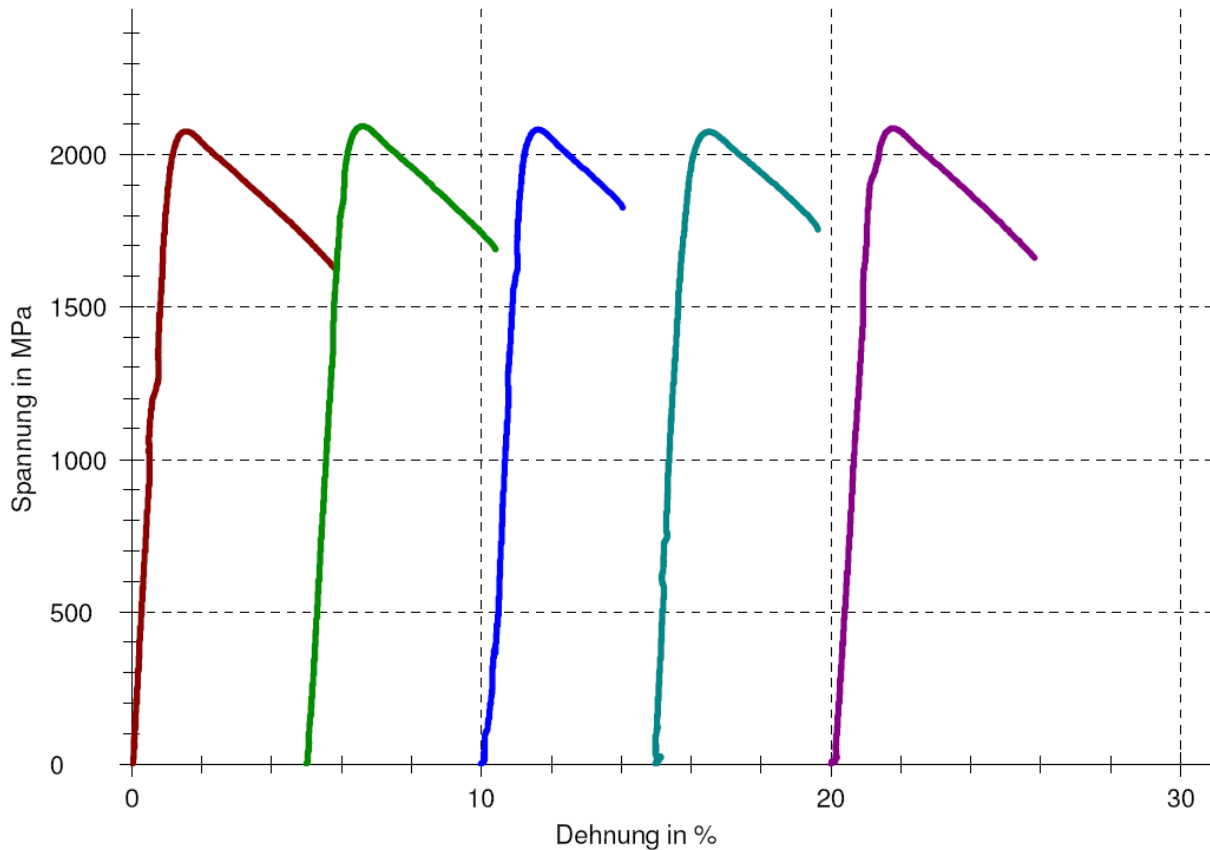
### Results:

Nr	S0 mm <sup>2</sup>	Rp 0.2 MPa	Rm MPa	ε-Bruch %
1	28,27	2052,81	2076,54	5,85
2	28,65	2064,74	2092,90	5,42
3	28,46	2074,70	2081,98	4,05
4	28,94	1973,67	2074,89	4,64
5	28,75	2040,16	2085,71	5,82

### Statistic:

Serie n = 5	Rp 0.2 MPa	Rm MPa	ε-Bruch %
$\bar{x}$	2041,22	2082,40	5,15
s	39,91	7,28	0,79
min	1973,67	2074,89	4,05
max	2074,70	2092,90	5,85

### Serial chart:



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### Density analyses:

### Test performed at:

**EURO-LABOR** Universitätsstr. 142 44799 Bochum  
Telefon +49-234-5866295 Fax +49-234-58617666 info@euro-labor.com



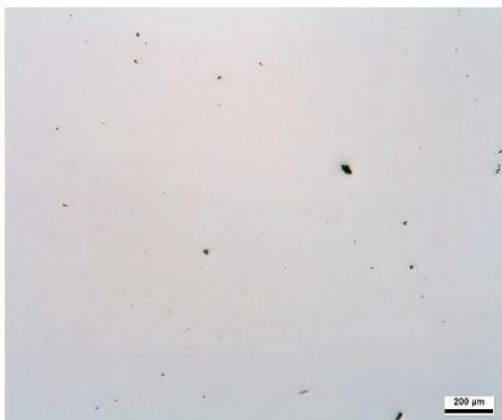
**Powder:** 1.2709

**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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**Heat treatment:** hardened (measuring result 52 HRC)

**Section grinding:** no etching

**fiftyfold magnification**

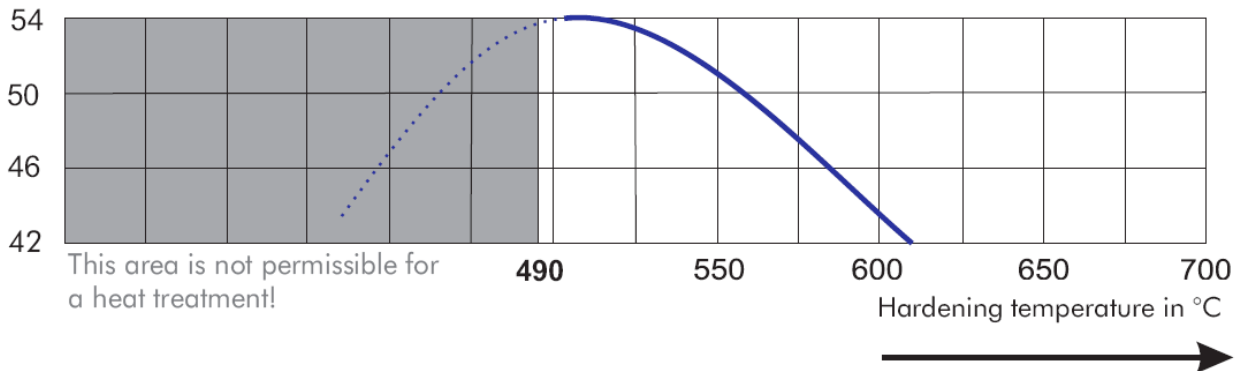
**Status:** not metallic inclusions (mainly Oxides), nearly no pores

**Here displayed: Area with max. number of inclusions**

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### Heat treatment:

#### Hardening chart for 1.2709



**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.**