Material Grades
## Material Grades

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<tr>
<th>Material no.</th>
<th>Designation</th>
<th>Indicatory analysis</th>
<th>Strength</th>
<th>Character</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0577</td>
<td>DIN: S 355 J2 (St 52-3)</td>
<td>C ≤ 0.22, Si ≤ 0.55, Mn ≤ 1.60</td>
<td>≈ 550 N/mm²</td>
<td>Structural steel, unalloyed, with good weldability</td>
<td>For common applications in tool, mould and machine construction</td>
</tr>
<tr>
<td>1.1730</td>
<td>DIN: C 45 U</td>
<td>C = 0.45, Si = 0.30, Mn = 0.70</td>
<td>≈ 640 N/mm²</td>
<td>Tool steel, unalloyed, suitable for flame hardening</td>
<td>Unhardened parts for mould and jig construction or plates and frames for tools and dies</td>
</tr>
<tr>
<td>1.2083</td>
<td>DIN: X 40 Cr 13</td>
<td>C = 0.40, Si = 0.40, Mn = 0.30, Cr = 13.00</td>
<td>≈ 720 N/mm²</td>
<td>Tool steel suitable for mirror polishing, electro-slag remelted, high-alloy</td>
<td>Cavity plates and inserts for the processing of plastics, mainly when corrosive plastic melts are being used</td>
</tr>
<tr>
<td>1.2083 (ESR)</td>
<td>DIN: X 33 Cr 16</td>
<td>C = 0.33, Si = 0.30, Mn = 0.80, Cr = 16.00, Mo = 1.20, S = 0.06, Ni = 0.30</td>
<td>≈ 1080 N/mm²</td>
<td>Tool steel, pre-toughened, corrosion resistant, with good cutting properties, high-alloy</td>
<td>Plates for corrosion resistant mould tools and die sets; moulds for corrosive plastics</td>
</tr>
<tr>
<td>1.2162</td>
<td>DIN: 21 MnCr 5</td>
<td>C = 0.21, Si = 0.25, Mn = 1.25, Cr = 1.20</td>
<td>≈ 660 N/mm²</td>
<td>Steel for case-hardening</td>
<td>Moulding plates and machine parts</td>
</tr>
<tr>
<td>1.2210</td>
<td>DIN: 115 CrV3</td>
<td>C = 1.18, Si = 0.25, Mn = 0.30, Cr = 0.70, Ni = 0.10, Ti = 0.20</td>
<td>≈ 740 N/mm²</td>
<td>Cold-work steel, alloyed, wear-resistant</td>
<td>Core pins, punches, small turned parts</td>
</tr>
<tr>
<td>1.2311</td>
<td>DIN: 40 CrMnMo 7</td>
<td>C = 0.40, Si = 0.40, Mn = 1.50, Cr = 1.90, Mo = 0.20</td>
<td>≈ 1080 N/mm²</td>
<td>Tool steel, alloyed and pre-toughened, ideal for nitriding and polishing</td>
<td>Moulding plates, inserts and high-tensile machine parts</td>
</tr>
<tr>
<td>1.2312</td>
<td>DIN: 40 CrMnMoS 86</td>
<td>C = 0.40, Si = 0.40, Mn = 1.50, Cr = 1.90, Mo = 0.20, S = 0.06</td>
<td>≈ 1080 N/mm²</td>
<td>Tool steel, alloyed and pre-toughened, good cutting properties</td>
<td>Plates for mould tools and dies with increased requirements on strength</td>
</tr>
<tr>
<td>1.2316</td>
<td>DIN: X 38 CrMo 16</td>
<td>C = 0.36, Cr = 16.00, Mo = 1.20</td>
<td>≈ 1010 N/mm²</td>
<td>Tool steel, pre-toughened, corrosion-resistant, polishable, high-alloy</td>
<td>Moulds for processing corrosive plastics</td>
</tr>
<tr>
<td>1.2343</td>
<td>DIN: X 38 CrMoV 51</td>
<td>C = 0.38, Si = 1.00, Mn = 0.40, Cr = 5.30, Mo = 1.20, V = 0.40</td>
<td>≈ 780 N/mm²</td>
<td>Hot-work steel</td>
<td>Moulding plates and inserts for die casting (Al, Mg, Zn etc.) and injection mould tools</td>
</tr>
<tr>
<td>1.2343 (ESR)</td>
<td>DIN: X 38 CrMoV 51</td>
<td>C = 0.38, Si = 1.00, Mn = 0.40, Cr = 5.30, Mo = 1.20, V = 0.40</td>
<td>≈ 780 N/mm²</td>
<td>Hot-work steel, suitable for mirror polishing, electro-slag remelted, high-alloy</td>
<td>Moulding plates and inserts for die casting (Al, Mg, Zn etc.) and injection mould tools</td>
</tr>
<tr>
<td>1.2344</td>
<td>DIN: X 40 CrMoV 5-1</td>
<td>C = 0.40, Si = 1.00, Cr = 5.30, Mo = 1.40, V = 1.00</td>
<td>≈ 780 N/mm²</td>
<td>Hot-work steel, suitable for mirror polishing, electro-slag remelted, high-alloy</td>
<td>Standard material for hot-work tools, extrusion moulds, dies, tools for plastics processing</td>
</tr>
<tr>
<td>1.2344 (ESR)</td>
<td>DIN: X 40 CrMoV 5-1</td>
<td>C = 0.40, Si = 1.00, Cr = 5.30, Mo = 1.40, V = 1.00</td>
<td>≈ 780 N/mm²</td>
<td>Hot-work steel, suitable for mirror polishing, electro-slag remelted, high-alloy</td>
<td>Standard material for hot-work tools, extrusion moulds, dies, tools for plastics processing</td>
</tr>
</tbody>
</table>
### Material no. | Designation | Indicatory analysis | Strength | Character | Application
--- | --- | --- | --- | --- | ---
1.2363 | DIN: X 100 CrMoV 5  | C: 1.00 | 810 N/mm² | Steel for through hardening | Mould plates and inserts as well as cutting punches, wear plates and cutting dies with high requirements on toughness
 | AFNOR: Z 100 CDV 5 | Si: 0.30 | | | |
 | UNI: X 100 CrMoV 5-1 KU | Mn: 0.50 | | | |
 | AISI: A2 | Cr: 5.20 | | | |
 | | Mo: 1.10 | | | |
 | | V: 0.20 | | | |
1.2379 | DIN: X 155 CrMo 121 | C: 1.53 | 850 N/mm² | Steel for through hardening | Mould plates and inserts as well as wear plates or cutting dies with increased wear resistance
 | AFNOR: Z 160 CDV 12 | Si: 0.30 | | | |
 | UNI: X 155 CrMo 12 1 KU | Mn: 0.35 | | | |
 | AISI: D2 | Cr: 12.00 | | | |
 | | Mo: 0.80 | | | |
 | | V: 0.80 | | | |
1.2714 | DIN: 56 NiCrMoV 7 | C: 0.56 | 850 N/mm² | Steel for through hardening | Auxiliary tools for extruders, hot-forging tools, dies for processing tin, lead and zinc alloys
 | AFNOR: 55 NCDV 7 | Si: 1.10 | | | |
 | UNI: X 155 CrMoV 12 1 KU | Cr: 1.27 | | | |
 | AISI: L6 | Mo: 0.50 | | | |
 | | Ni: 1.70 | | | |
 | | V: 0.10 | | | |
1.2714 HH | DIN: 56 NiCrMoV 7 | C: 0.56 | 1350 N/mm² | Steel for through hardening, quenched and tempered | Mould inserts, cores and slides for die casting (Al, Mg, Zn etc.) and injection mould tools
 | AFNOR: 55 NCDV 7 | Si: 1.10 | | | |
 | UNI: X 155 CrMoV 12 1 KU | Cr: 1.27 | | | |
 | AISI: L6 | Mo: 0.50 | | | |
 | | Ni: 1.70 | | | |
 | | V: 0.10 | | | |
1.2738 | DIN: 40 CrMnNiMo 8-6-4 | C: 0.40 | 1080 N/mm² | Tool steel | Large cavity plates with deep cavities for items such as bumpers or dashboards
 | AFNOR: 40 CMND 8 | Si: 1.50 | | | |
 | UNI: P20 +Ni | Mn: 2.00 | | | |
 | AISI: P20 + Ni | Mo: 0.20 | | | |
 | | Ni: 1.10 | | | |
1.2767 | DIN: 45 NiCrMo 16 | C: 0.45 | 830 N/mm² | Steel for through hardening | High-performance cavity plates and inserts; cutting and bending inserts for high compressive loads
 | AFNOR: 45 NCD 16 | Si: 0.25 | | | |
 | UNI: 40 NiCrMoV 16 KU | Mn: 0.40 | | | |
 | AISI: 6F7 | Mo: 0.25 | | | |
 | | Ni: 4.00 | | | |
1.2842 | DIN: 90 MnCrV 8 | C: 0.90 | 760 N/mm² | Steel for through hardening | Cavity plates and inserts exposed to abrasive stress; wear plates, cutting dies and guiding plates; pressure pads and guiding rails
 | AFNOR: 90 MV 8 | Si: 0.20 | | | |
 | UNI: 90 MnCrV 8 KU | Mn: 2.00 | | | |
 | AISI: O2 | Cr: 0.40 | | | |
 | | Mo: 0.20 | | | |
1.3344 PM | DIN: PM 6-5-3 | C: 1.25 | 870 N/mm² | HSS powder metallurgy steel | Blocks for eroding, cutting punches and dies with particularly durable edges, inserts with excellent wear resistance
 | AFNOR: X 130 WMCrV 6-5-4 | Si: 0.30 | | | |
 | UNI: W 6 Mo 5 Cr 4 V 3 | Mn: 0.30 | | | |
 | AISI: M 3-2 (PM) | Mo: 4.0 | | | |
 | | W: 5.0 | | | |
 | | V: 3.0 | | | |
1.7131 | DIN: 16 MnCr 5 | C: 0.16 | 600 N/mm² | Steel for case-hardening | Guiding elements, cores and machine parts
 | AFNOR: 16 MC 5 | Si: 0.25 | | | |
 | UNI: 5115 | Mn: 1.15 | | | |
 | | Cr: 0.95 | | | |
3.3547 | DIN: AlMg 4.5 Mn | Si: 0.40 | ≤ 290 N/mm² | Aluminium alloy | Plates for standard moulds and jigs
 | EN: ISO 5083 | Fe: 0.40 | (depending on thickness) | | |
 | AFNOR: A-GA 5MC | Cu: 0.10 | | | |
 | UNI: 7790 | Mn: 0.70 | | | |
 | | Mg: 4.40 | | | |
 | | Cr: 0.15 | | | |
 | | Zn: 0.25 | | | |
 | | Ti: 0.15 | | | |
3.4365 | DIN: AlZnMgCu 1.5 | Si: 0.40 | ≤ 540 N/mm² | Aluminium zinc alloy | Plates for mould tools and dies with increased requirements on strength
 | EN: SO 7075 | Fe: 0.50 | (depending on thickness) | | |
 | AFNOR: A-ZSGU | Cu: 1.60 | | | |
 | UNI: 90072 | Mn: 0.30 | | | |
 | | Mg: 2.40 | | | |
 | | Cr: 0.23 | | | |
 | | Zn: 5.60 | | | |
 | | Ti: 0.20 | | | |

This general information is only a recommendation for anyone to apply freely. For individual cases the buyer must make sure they purchase for the right application. If in doubt, a specialist (e.g. steel manufacturer, hardening shop) should be consulted. Liability does not lie with Meusburger Georg GmbH & Co KG.
<table>
<thead>
<tr>
<th>Material No.:</th>
<th>1.0577</th>
<th>Technical Tip</th>
</tr>
</thead>
<tbody>
<tr>
<td>Designation</td>
<td></td>
<td>- If no welding is required, we recommend 1.1730 → better machinability in spite of higher strength</td>
</tr>
<tr>
<td>Indicatory analysis:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>≤ 0.22</td>
</tr>
<tr>
<td></td>
<td>Si</td>
<td>≤ 0.55</td>
</tr>
<tr>
<td></td>
<td>Mn</td>
<td>≤ 1.60</td>
</tr>
<tr>
<td>Strength:</td>
<td></td>
<td>≈ 550 N/mm²</td>
</tr>
<tr>
<td>Thermal conductivity at 20 °C:</td>
<td>40 W/m K</td>
<td></td>
</tr>
<tr>
<td>Character:</td>
<td>unalloyed structural steel with good weldability</td>
<td></td>
</tr>
<tr>
<td>Application:</td>
<td>for common applications in tool, mould and machine construction</td>
<td></td>
</tr>
<tr>
<td>Treatment by</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Welding:</td>
<td></td>
<td>very good weldability due to its low carbon content</td>
</tr>
<tr>
<td>Polishing:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Etching:</td>
<td></td>
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</tr>
<tr>
<td>EDM:</td>
<td></td>
<td>not usual</td>
</tr>
<tr>
<td>Nitriding:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hard chroming:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heat treatment:</td>
<td></td>
<td>Soft annealing:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>650 to 700 °C for about 2 to 5 hours</td>
</tr>
<tr>
<td></td>
<td></td>
<td>slow controlled cooling of 10 to 20 °C per hour to about 600 °C; further cooling in air, max. 180 HB</td>
</tr>
</tbody>
</table>
Material No.: 1.1730

Designation
- DIN: C 45 U
- AFNOR: XC 48
- UNI: -
- AISI: 1045

Indicatory analysis:
- C: 0.45
- Si: 0.30
- Mn: 0.70

Strength: ≈ 640 N/mm²

Thermal conductivity at 20 °C: 50 W/mK

Character: unalloyed tool steel with excellent machinability; chilled cast steel, suitable for flame and inductive hardening

Application: unhardened parts for mould and jig construction or plates and frames for tools and dies

Treatment by
- Polishing:
- Etching:
- EDM: not usual
- Nitriding:
- Hard chroming:

Heat treatment:
- Soft annealing: 680 to 710 °C for about 2 to 5 hours; slow controlled cooling of 10 to 20 °C per hour to about 600 °C; further cooling in air, max. 190 HB
- Hardening: 800 to 830 °C; quenching in water; obtainable hardness: 58 HRC; hardening depth: 3–5 mm; max. 15 mm through hardening thickness
- Tempering: slow heating to tempering temperature immediately after hardening, to 180 to 300 °C depending on desired hardness; 1 hour per 20 mm: min. 2 hours

Tempering chart:
### Material No.:

**1.2083 / 1.2083 ESR**

<table>
<thead>
<tr>
<th>Designation</th>
<th>DIN: X 40 Cr 13</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AFNOR: Z 40 C 14</td>
</tr>
<tr>
<td></td>
<td>UNI:</td>
</tr>
<tr>
<td></td>
<td>AISI: 420 / 420 ESR</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Indicatory analysis:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0.40</td>
</tr>
<tr>
<td>Si</td>
<td>0.40</td>
</tr>
<tr>
<td>Mn</td>
<td>0.30</td>
</tr>
<tr>
<td>Cr</td>
<td>13.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Strength:</th>
<th>720 N/mm²</th>
</tr>
</thead>
</table>

| Thermal conductivity at 100°C: | 18 W/m K      |

### Character:
low corrosion, high-alloy, low warpage steel for through hardening with excellent properties for mirror polishing as well as good photoetching, good machinability, high wear resistance and high dimensional stability

### Application:
mould plates and inserts for working with chemically aggressive plastics; because of excellent polishing, suitable for optical and medical products

### Treatment by
- Polishing: can be polished in the annealed and hardened state; good preliminary surface preparation work is decisive for a good polish
- Etching: good photoetching (graining)
- Spark eroding: in the hardened and tempered condition, treat again for stress relief about 20°C below the last temperature
- Nitriding: > not recommended
- Hard chroming: not recommended

### Heat treatment:
- **Annealing:** 750 to 800°C for about 2 to 5 hours
  slow controlled cooling of 10 to 20°C per hour to about 650°C;
  further cooling in air, **max. 200 HB**
- **Hardening:** 1000 to 1050°C
  15 to 30 minutes keeping curing temperature
  quenching in water/oil
  obtainable hardness: **53 - 56 HRC**
- **Tempering:** slow heating to tempering temperature immediately after hardening;
  minimum time in furnace: 2 hour per 20 mm part thickness;
  twice tempering is recommended

### Technical Tip
- cold-work steel
- must be tempered several times after hardening (max. 50HRC).
  The demand for “max. hardness” often ends up in material breakage.
- mold temperature max. 200°C
- corrosion-resistant after hardening
- The **ESR quality** guarantees an extremely pure and homogeneous microstructure.

### Diagram
![Tempering chart](image)
Material No.: 1.2085

Designation
- **DIN**: X 33 CrS 16
- **AFNOR**: Z 35 CD 17.S
- **UNI**: -
- **AISI**: ≈ 422 + S

Indicatory analysis:
- **C**: 0.33
- **Si**: 0.30
- **Mn**: 0.80
- **Cr**: 16.00
- **Mo**: 1.20
- **S**: 0.06
- **Ni**: 0.30

Strength: ≈ 1080 N/mm²

Thermal conductivity at 100 °C: 18 W/mK

Character: corrosion resistant, high-alloy, pre-toughened tool steel with good machinability due to Sulphur (S) additive

Application: Plates for corrosion resistant mould tools and die sets; moulds for corrosive plastics; the expense for protection and care of mould tools is reduced thanks to increased corrosion resistance; not suitable for mould inserts

Treatment by
- Polishing:
- Etching:
- EDM: > not recommended
- Nitriding:
- Hard chroming:

Heat treatment:
Usually no heat treatment is required.

Annealing:
850 to 880 °C for about 2 to 5 hours
slow controlled cooling; hardness max. 240 HB

Hardening:
1000 to 1030 °C
30 minutes keeping curing temperature
quenching in oil is preferable
obtainable hardness: 48 HRC

Tempering:
slow heating to tempering temperature immediately after hardening;
minimum time in furnace: 2 hour per 20 mm part thickness;
tempering twice is recommended

Tempering chart:
Material No.: 1.2162

Designation
DIN: 21 MnCr 5
AFNOR: 20 MC 5
UNI: -
AISI: 5120

Indicatory analysis:
C  0.21
Si  0.25
Mn 1.25
Cr  1.20

Strength:
≥ 660 N/mm²

Thermal conductivity at 100 °C:
38.5 W/m K

Character:
standard steel for case-hardening with good machinability; high surface hardness with tough core

Application:
machine parts and moulding plates with a high surface hardness; synthetic resin press moulds for the processing of thermoplastics and thermosets

Treatment by
Polishing:
Etching:
EDM:
Nitriding:
Usually, hardened parts are not nitrided → loss of hardness.
Hard chroming:
recommended, results in increased wear and corrosion resistance

Heat treatment:
Annealing:
670 to 710 °C for about 2 to 5 hours
slow controlled cooling, further cooling in air, max. 205 HB

Carburising:
900 to 950 °C. The choice of the carburising means and carburising temperature depends on the desired surface carbon content, the carburising graph and the required case depth.

Case hardening:
870 to 930 °C in powder/salt bath, cooling in oil/hot bath at 160 to 250 °C
Intermediate annealing:
630 to 650 °C, for about 2 to 4 hours with slow furnace cooling

Preheating:
350 °C depending on dimensions

Hardening:
curing temperature 810 to 840 °C in oil of ~ 60 °C warmth

Cooling:
in to about 100 °C oil, then in air to about 50 °C

Tempering:
1 hour per 20 mm part thickness, min. 2 hours

Tempering chart:

- For mirror finish, we recommend the through hardening steel 1.2767.
Material No.: 1.2210

Designation
- DIN: 115 CrV 3
- AFNOR: 100 C3
- UNI: 107 CrV 3 KU
- AISI: L2

Indicator analysis:
- C: 1.18
- Si: 0.25
- Mn: 0.30
- Cr: 0.70
- Ni: 0.10
- Ti: 0.20

Strength: ≈ 740 N/mm²

Thermal conductivity at 100 °C: 33 W/m K

Character: Chrome-Vanadium alloyed cold-work steel with high resistance; also known as silver steel.

Application: small turned parts, core pins, punches and engraving tools

Treatment by
- Polishing:
- Etching: > unusual
- EDM:
- Nitriding:
- Hard chroming:

Heat treatment:
- Annealing: 710 to 740 °C for about 2 to 5 hours, slow controlled cooling of 10 to 20 °C per hour to about 600 °C, further cooling in air, max. 220 HB
- Hardening: 780 to 840 °C, 15 to 30 minutes keeping curing temperature, quenching in water/oil, obtainable hardness: 64–66 HRC
- Tempering: slow heating to tempering temperature immediately after hardening; minimum time in furnace: 1 hour per 20 mm part thickness; min. 2 hours/cooling in air

Technical Tip
- Silver steel 1.2210 is finish-ground to h9 tolerance.

Tempering chart:
<table>
<thead>
<tr>
<th>Material No.:</th>
<th>1.2311</th>
</tr>
</thead>
</table>
| Designation | DIN: 40 CrMnMo 7  \
|             | AFNOR: 40 CMD 8  \
|             | UNI: 35 CrMo 8 KU  \
|             | AISI: P20 |
| Indicatory analysis: | C 0.40  \
|                   | Si 0.40  \
|                   | Mn 1.50  \
|                   | Cr 1.90  \
|                   | Mo 0.20  |
| Strength: | \( = 1080 \, \text{N/mm}^2 \)  
| Thermal conductivity at 100 °C: | \( \frac{35 \, \text{W}}{\text{m} \cdot \text{K}} \) |
| Character: | alloyed and pre-toughened tool steel, especially suitable for polishing; high dimensional stability  
| Application: | moulding plates, inserts and high-tensile machine parts |
| Treatment by | Polishing: good suitability for polishing; for higher surface requirements, through hardened steels are recommended.  
|             | Etching: [possible]  
|             | EDM:  
|             | Nitriding: increases the steel's wear resistance  
|             | Hard chroming: particularly increases wear resistance and corrosion resistance  
| Heat treatment: | already pre-toughened; usually no heat treatment required  
| Nitriding: | Before nitriding, stress-relief annealing is recommended at 580 °C. (Meusburger standard)  
| Hard chroming: | To prevent hydrogen brittleness, the tool must be tempered for approximately 3 to 4 hours at 180 °C after the hard chroming.  
| Hardening: | 840 to 860 °C  
| Cooling: | to 180 °C/220 °C in oil/hot bath, then in air to about 100 °C  
| obtainable hardness: | 52 HRC  
| Tempering: | slow heating to tempering temperature immediately after hardening; minimum time in furnace: 1 hour per 25 mm part thickness  
| Tempering chart: | ![Tempering Chart](image)  

- core strength decreases with increasing plate thickness  
\[ \rightarrow \text{For thickness} > 300 \, \text{we recommend 1.2738.} \]
Material No.: 1.2312  

**Technical Tip**
- for increased surface quality requirements use material grade 1.2311.

<table>
<thead>
<tr>
<th>Indicatory analysis:</th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0.40</td>
<td></td>
</tr>
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<td>0.40</td>
<td></td>
</tr>
<tr>
<td>Mn</td>
<td>1.50</td>
<td></td>
</tr>
<tr>
<td>Cr</td>
<td>1.90</td>
<td></td>
</tr>
<tr>
<td>Mo</td>
<td>0.20</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>0.06</td>
<td></td>
</tr>
</tbody>
</table>

**Strength:**  
≈ 1080 N/mm²

**Thermal conductivity at 100 °C:**  
35 W/m K

**Character:**
alloyed and pre-toughened **tool steel**, with excellent machinability in the hardened condition because of the Sulphur additive; high dimensional stability

**Application:**
plates for mould tools and dies with increased requirements on strength; high-tensile machine parts

**Treatment by**
- Polishing: technical polishing possible; for higher surface requirements we recommend 1.2311 or 1.2738
- Etching:
- EDM: not recommended
- Nitriding: increases the steel's wear resistance

**Heat treatment:**
- already pre-toughened, usually no heat treatment required
- Nitriding: before nitriding, stress-relief annealing at 580 °C (Meusburger standard) is recommended
- Hardening: 840 to 860 °C
- Cooling: to 180 °C/220 °C in oil/hot bath
- obtainable hardness: **52 HRC**
- Tempering: slow heating to tempering temperature immediately after hardening; minimum time in furnace: 1 hour per 25 mm part thickness.

**Tempering chart:**

![Tempering chart](image)
### Material No.: 1.2316

| Designation | DIN: X 38 CrMo 16  
| AFNOR: Z 35 CD 17  
| UNI: X 38 CrMo 16 KU  
| AISI: 422 |

### Indicatory analysis:
- C: 0.36
- Cr: 16.00
- Mo: 1.20

### Strength:
- ≈ 1010 N/mm²

### Thermal conductivity at 100 °C:
- $18 \, \frac{W}{m \cdot K}$

### Character:
corrosion resistant, high-alloy, polishable, pre-toughened tool steel

### Application:
mould tools for processing corroding plastics

### Treatment by
- **Polishing:** good suitability
- **Etching:** possible
- **EDM:** possible
- **Nitriding:** reduces the corrosion resistance

### Heat treatment:
- already pre-toughened; usually no heat treatment required

#### Annealing:
- 760 bis 800 °C, for about 4 to 5 hours
- slow controlled cooling of 10 to 20 °C per hour to about 650 °C
- further cooling in air, max. 230 HB

#### Hardening:
- 1030 to 1050 °C
- 15 to 30 minutes keeping curing temperature
- quenching in water/oil
- obtainable hardness: 49 HRC

#### Tempering:
- slow heating to tempering temperature immediately after hardening;
- minimum time in furnace: 1 hour per 20 mm part thickness

#### Tempering chart:

[Graph showing HRC vs. temperature]
**Material No.:** 1.2343 / 1.2343 ESR*  

**Designation**  
DIN: X 38 CrMoV 51  
AFNOR: Z 38 CDV 5  
UNI: X 37 CrMoV 51 KU  
AISI: H11 / H11 ESR

<table>
<thead>
<tr>
<th>Element</th>
<th>Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0.38</td>
</tr>
<tr>
<td>Si</td>
<td>1.00</td>
</tr>
<tr>
<td>Mn</td>
<td>0.40</td>
</tr>
<tr>
<td>Cr</td>
<td>5.30</td>
</tr>
<tr>
<td>Mo</td>
<td>1.20</td>
</tr>
<tr>
<td>V</td>
<td>0.40</td>
</tr>
</tbody>
</table>

**Indicatory analysis:**  
C 0.38  
Si 1.00  
Mn 0.40  
Cr 5.30  
Mo 1.20  
V 0.40

**Strength:**  
≥ 780 N/mm²

**Thermal conductivity at 200 °C:**  
27 W m K⁻¹

**Character:**  
high-alloy hot-work steel with high toughness and heat resistance, hot cracks resistance and good thermal conductivity;  
for very high requirements available in grade *ESR (Electro-Slag Remelted)

**Application:**  
moulding plates and inserts for die casting (Al, Mg, Zn etc.) and injection mould tools

**Treatment by**  
Polishing: highly suitable  
Etching: very easily feasible (graining)  
EDM: in the hardened and tempered condition, treat again for stress relief about 20 °C below the last tempering temperature  
Nitriding: increases the wear resistance and prevents the bonding of casting material  
Hard chroming: in special cases

**Heat treatment:**  
Annealing:  
750 to 800 °C, about 4 to 5 hours  
slow controlled cooling of 10 to 20 °C per hour to about 600 °C;  
further cooling in air, max. 205 HB  
Nitriding:  
Before nitriding stress-relief annealing is recommended at 550 °C.  
(Meusburger standard)  
A treatment at 525 °C in ammonia gas results in a surface hardness of approx. 55 HRC.  
Hardening:  
1000 to 1040 °C  
15 to 30 minutes keeping curing temperature  
quenching in water/oil/air  
obtainable hardness: 50–56 HRC  
Tempering:  
slow heating to tempering temperature immediately after hardening;  
minimum time in furnace: 1 hour per 20 mm part thickness;  
repeated tempering is recommended

**Tempering chart:**

**High temperature strength chart:**

- susceptible to corrosion;  
during machining, continuous corrosion protection has to be ensured (especially during wire EDM)
- 1.2343 ESR is highly suitable for mirror polishing
<table>
<thead>
<tr>
<th>Material No.:</th>
<th>1.2344 / 1.2344 ESR*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Designation</strong></td>
<td>DIN: X 40 CrMoV 5-1</td>
</tr>
<tr>
<td></td>
<td>AFNOR: Z 40 CDV 5</td>
</tr>
<tr>
<td></td>
<td>UNI: X 40 CrMoV 5-1 KU</td>
</tr>
<tr>
<td></td>
<td>AISI: H13 / H13 ESR</td>
</tr>
<tr>
<td><strong>Indicatory analysis:</strong></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>0.40</td>
</tr>
<tr>
<td>Si</td>
<td>1.00</td>
</tr>
<tr>
<td>Cr</td>
<td>5.30</td>
</tr>
<tr>
<td>Mo</td>
<td>1.40</td>
</tr>
<tr>
<td>V</td>
<td>1.00</td>
</tr>
<tr>
<td><strong>Strength:</strong></td>
<td>≥ 780 N/mm²</td>
</tr>
<tr>
<td><strong>Thermal conductivity at 100 °C:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>26 ( \frac{W}{m \cdot K} )</td>
</tr>
<tr>
<td><strong>Character:</strong></td>
<td>high-alloy hot-work steel, high heat resistance, high wear resistance, good toughness, thermal conductivity and hot cracks resistance, limited use for water cooling; for very high requirements available in grade <em>ESR (Electro-Slag Remelted)</em></td>
</tr>
<tr>
<td><strong>Application:</strong></td>
<td>standard material for hot-work tools, extrusion moulds, dies, tools for plastic processing</td>
</tr>
<tr>
<td><strong>Treatment by</strong></td>
<td>Polishing:</td>
</tr>
<tr>
<td></td>
<td>Etching: &gt; possible</td>
</tr>
<tr>
<td></td>
<td>EDM: in special cases</td>
</tr>
<tr>
<td></td>
<td>Nitriding:</td>
</tr>
<tr>
<td></td>
<td>Hard chroming:</td>
</tr>
<tr>
<td><strong>Heat treatment:</strong></td>
<td>Annealing:</td>
</tr>
<tr>
<td></td>
<td>750 to 800 °C for about 4 to 5 hours</td>
</tr>
<tr>
<td></td>
<td>slow controlled cooling of 10 to 20 °C per hour to about 600 °C</td>
</tr>
<tr>
<td></td>
<td>further cooling in air, max. 230 HB</td>
</tr>
<tr>
<td></td>
<td>Hardening:</td>
</tr>
<tr>
<td></td>
<td>1020 to 1060 °C</td>
</tr>
<tr>
<td></td>
<td>15 to 30 minutes keeping curing temperature</td>
</tr>
<tr>
<td></td>
<td>quenching in water/oil</td>
</tr>
<tr>
<td></td>
<td>obtainable hardness: 54 HRC</td>
</tr>
<tr>
<td></td>
<td>Tempering:</td>
</tr>
<tr>
<td></td>
<td>slow heating to tempering temperature immediately after hardening; minimum time in furnace: 1 hour per 20 mm part thickness</td>
</tr>
</tbody>
</table>

**Technical Tip**
- susceptible to corrosion; during machining, continuous corrosion protection has to be ensured (especially during wire EDM)
- 1.2344 ESR is highly suitable for mirror polishing

![Tempering Chart](chart.png)
Material No.: 1.2363

Designation
- DIN: X 100 CrMoV 5
- AFNOR: Z 100 CDV 5
- UNI: X 100 CrMoV 5-1 KU
- AISI: A2

Indicatory analysis:
- C: 1.00
- Si: 0.30
- Mn: 0.50
- Cr: 5.20
- Mo: 1.10
- V: 0.20

Strength: ≈ 810 N/mm²

Thermal conductivity at 100°C: 19 W/m K

Character: Steel for through hardening with good machinability, high wear resistance and low warpage; very good dimensional stability, toughness and through hardenability

Application: mould plates and inserts as well as cutting punches, wear plates and cutting dies with high requirements on toughness

Treatment by
- Polishing:
- Etching:
- Nitriding: × possible
- Hard chroming:

Heat treatment:
- Soft annealing: 800 to 840°C for about 4-5 hours
- slow controlled cooling of 10 to 20°C per hour to about 650°C
- further cooling in air, max. 230 HB

Hardening:
- 950 to 980°C
- quenching in calm air
- obtainable hardness: 62 HRC

Tempering:
- slow heating to tempering temperature immediately after hardening;
- tempering twice recommended

Tempering chart:
<table>
<thead>
<tr>
<th>Material No.:</th>
<th>1.2379</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Designation</strong></th>
<th><strong>Technical Tip</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>DIN: X 155 CrVMo 121</td>
<td>- secondary hardening, very good base material for nitriding or coating</td>
</tr>
<tr>
<td>AFNOR: Z 160 CDV 12</td>
<td></td>
</tr>
<tr>
<td>UNI: X 155 CrVMo 12 1 KU</td>
<td></td>
</tr>
<tr>
<td>AISI: ≈ D2</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Indicatory analysis:</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>1.53</td>
</tr>
<tr>
<td>Si</td>
<td>0.30</td>
</tr>
<tr>
<td>Mn</td>
<td>0.35</td>
</tr>
<tr>
<td>Cr</td>
<td>12.00</td>
</tr>
<tr>
<td>Mo</td>
<td>0.80</td>
</tr>
<tr>
<td>V</td>
<td>0.80</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Strength:</strong></th>
<th>≈ 850 N/mm²</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Thermal conductivity at 100 °C:</strong></th>
<th>21 W/m K</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Character:</strong></th>
<th>high-alloy steel for through-hardening with moderate machinability; extremely wear resistant and low warpage, good dimensional stability, toughness and through hardenability</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Application:</strong></th>
<th>mould plates and inserts as well as wear plates and cutting dies with increased wear resistance</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th><strong>Treatment by</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Polishing:</td>
<td>ideal when hardened</td>
</tr>
<tr>
<td>Nitrating:</td>
<td>very well suited, due to the fact that the hardness of the base material will not fall below 60 HRC</td>
</tr>
<tr>
<td>EDM:</td>
<td></td>
</tr>
<tr>
<td>Hard chroming:</td>
<td>possible</td>
</tr>
<tr>
<td>Etching:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Heat treatment:</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft annealing:</td>
<td>800 to 850 °C for about 2 to 5 hours</td>
</tr>
<tr>
<td></td>
<td>slow controlled cooling of 10 to 20 °C per hour to about 600 °C</td>
</tr>
<tr>
<td></td>
<td>further cooling in air, max. 235 HB</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hardening:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1020 °C</td>
<td></td>
</tr>
</tbody>
</table>

| 1060 to 1080 °C | |
| quenching in oil/air/hot bath | |
| obtainable hardness: | 63-65 HRC |

<table>
<thead>
<tr>
<th>Tempering:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>slow heating to tempering temperature (to avoid forming of cracks) immediately after hardening; triple tempering at max. secondary hardening temperature is recommended; rapid cooling following the tempering improves the dimensional stability; maximum hardness achievable after tempering:</td>
<td>60 to 62 HRC</td>
</tr>
</tbody>
</table>

| Tempering chart: |  |
Material No.: 1.2714

Designation
DIN: 56 NiCrMoV 7
AFNOR: 55 NCDV 7
UNI -
AISI: L6

Indicatory analysis:
<table>
<thead>
<tr>
<th>Element</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0.56</td>
</tr>
<tr>
<td>Cr</td>
<td>1.10</td>
</tr>
<tr>
<td>Mo</td>
<td>0.50</td>
</tr>
<tr>
<td>Ni</td>
<td>1.70</td>
</tr>
<tr>
<td>V</td>
<td>0.10</td>
</tr>
</tbody>
</table>

Strength: ≈ 850 N/mm²

Thermal conductivity at 100 °C: $36 \frac{W}{m \cdot K}$

Character: steel for through-hardening with good heat resistance, hardenability and toughness

Application: extrusion dies, hot-forging tools, dies for processing tin, lead and zinc alloys

Treatment by
- Polishing: technical polishing possible
- Etching:
- EDM: possible
- Nitriding:
- Hard chroming:

Heat treatment:
- Annealing: 650 to 700 °C for about 4 to 5 hours, slow controlled cooling of 10 to 20 °C per hour to about 600 °C, further cooling in air, max. 248 HB
- Hardening: 950 to 980 °C, 15 to 30 minutes keeping curing temperature, quenching in water/oil, obtainable hardness: 56 HRC
- Tempering: slow heating to tempering temperature immediately after hardening, minimum time in furnace: 1 hour per 20 mm part thickness

Tempering chart:

![Graph showing hardness vs. tempering temperature](image)
Material No.: 1.2714 HH

Designation

<table>
<thead>
<tr>
<th>DIN: 56 NiCrMoV 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFNOR: 55 NCDV 7</td>
</tr>
<tr>
<td>UNI:</td>
</tr>
<tr>
<td>AISI: L6</td>
</tr>
</tbody>
</table>

Indicatory analysis:

<table>
<thead>
<tr>
<th>Element</th>
<th>Mass fraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0.56</td>
</tr>
<tr>
<td>Cr</td>
<td>1.10</td>
</tr>
<tr>
<td>Mo</td>
<td>0.50</td>
</tr>
<tr>
<td>Ni</td>
<td>1.70</td>
</tr>
<tr>
<td>V</td>
<td>0.10</td>
</tr>
</tbody>
</table>

Strength: pre-hardened to 1350 N/mm² (≈ 43HRC)

Thermal conductivity at 100 °C: 36 W/m K

Character: steel for through-hardening, quenched and tempered, with good heat resistance, hardenability and toughness

Application: mould inserts, cores and slides for die casting (Al, Mg, Zn etc.) and injection mould tools

Treatment by

| Polishing: technical polishing possible |
| Etching:                               |
| EDM:                                   |
| Nitriding:                             |
| Hard chroming:                         |

Heat treatment:

Annealing:
650 to 700°C for about 4 to 5 hours
slow controlled cooling of 10 to 20 °C per hour to about 600 °C
further cooling in air, max. 248 HB

Hardening:
950 to 980 °C
15 to 30 minutes keeping curing temperature
quenching in water/oil
obtainable hardness: 56 HRC

Tempering:
slow heating to tempering temperature immediately after hardening;
minimum time in furnace: 1 hour per 20 mm part thickness

Tempering chart:

![Tempering chart](image-url)
Material No.: 1.2738

Designation
DIN: 40 CrMnNiMo 8-6-4
AFNOR: 40 CMND 8
UNI: -
AISI: P20 + Ni

Indicatory analysis:
- C: 0.40
- Mn: 1.50
- Cr: 2.00
- Mo: 0.20
- Ni: 1.10

Strength: ≈ 1080 N/mm²

Thermal conductivity at 100 °C: 33.5 \( \frac{W}{m \cdot K} \)

Character: low-sulphur tool steel, supplied in pre-toughened condition; due to its nickel content, it features uniform strength even with maximum plate dimensions

Application: large cavity plates with deep cavities for items such as bumpers, dashboards, moulding frames

Treatment by
- Polishing: highly suitable
- Etching: suitable
- EDM: suitable
- Nitriding: highly suitable
- Hard chroming: highly suitable

Heat treatment:
- already pre-toughened, usually no heat treatment required
- Annealing: 710 to 740 °C for about 2 to 5 hours
  slow controlled cooling of 10 to 20 °C per hour to about 600 °C
  further cooling in air, max. 235 HB
- Hardening: 840 to 870 °C
  15 to 30 minutes keeping curing temperature
  quenching in oil/hot bath/air 180 to 220 °C
  obtainable hardness: 53 HRC
- Tempering: slow heating to tempering temperature immediately after hardening;
  minimum time in furnace: 1 hour per 20 mm part thickness;
  tempering twice is recommended

Tempering chart:
Material No.: 1.2767

Designation
- DIN: 45 NiCrMo 16
- AFNOR: 45 NCD 16
- UNI: 40 NiCrMoV 16 KU
- AISI: 6F7

Indicatory analysis:
- C: 0.45%
- Si: 0.25%
- Mn: 0.40%
- Cr: 1.35%
- Mo: 0.25%
- Ni: 4.00%

Strength:
- ≈ 830 N/mm²

Thermal conductivity at 100 °C:
- 30 W/mK

Technical Tip
- To avoid unwanted warping during plastic injection, the tempering temperature after hardening must exceed the operating temperature by 50 °C.

Example:
- Operation at 200 °C
- Tempering at 250 °C = 52 HRC

Character:
Nickel alloyed steel for through hardening, moderate machinability, very high resistance against bending; high compressive strength, very high toughness and good through hardenability, also with bigger sections.

Application:
high-performance cavity plates and inserts for the processing of plastics with high surface requirements (mirror finish); stamping, forming, bending dies for particularly high pressure and bending stresses

Treatment by
- Polishing:
  - best metallurgical properties for mirror finish
- Etching:
  - is possible
- EDM:
  - highly suitable
- Nitriding:
  - not usual
- Hard chroming:
  - particularly increases the steel’s wear resistance and corrosion resistance

Heat treatment:
- Soft annealing:
  - 610 to 650 °C for about 2 to 5 hours
  - slow controlled cooling of 10 to 20 °C per hour to about 600 °C
  - further cooling in air, max. 260 HB
- Hardening:
  - 840 to 870 °C
  - Quenching in oil/hot bath/air
  - Obtainable hardness: 53–58 HRC
- Tempering:
  - Slow heating to tempering temperature immediately after hardening.
  - Minimum time in furnace: 1 hour per 20 mm part thickness.
  - Tempering twice is recommended.

Tempering chart:
**Material No.:** 1.2842

**Designation**
- DIN: 90 MnCrV 8
- AFNOR: 90 MV 8
- UNI: 90 MnVCr 8 KU
- AISI: O2

**Indicatory analysis:**
- C: 0.90
- Si: 0.20
- Mn: 2.00
- Cr: 0.40
- V: 0.10

**Strength:**
≈ 760 N/mm²

**Thermal conductivity at 100 °C:**
33 \( \frac{W}{m \cdot K} \)

**Character:**
Steel for through-hardening with good machinability and high wear resistance; low warping and high dimensional stability; with high toughness and through hardenability (uniform hardness for cross sections < 40 mm)

**Application:**
cavity plates and inserts exposed to abrasive stress; cutting punches; wear plates, cutting dies and guiding plates; pressure pads and guiding rails

**Treatment by**
- Polishing:
- Etching: not common → 1.2379
- Nitriding:
- EDM: is possible
- Hard chroming:

**Heat treatment:**
- Annealing: 680 to 720 °C for about 2 to 5 hours
  - slow controlled cooling of 10 to 20 °C per hour to about 600 °C
  - further cooling in air, max. 220 HB
- Hardening: 790 to 820 °C
  - quenching in oil/hot bath (200 to 250 °C)
  - obtainable hardness: 63–65 HRC
- Tempering: slow heating (to avoid forming of cracks) to tempering temperature immediately after hardening;
  - tempering twice with intermediate cooling down to 20 °C increases the steel’s toughness

**Tempering chart:**

![Tempering chart](image-url)
Material No.: 1.3344 PM (PM23)

**Designation**
- DIN: PM 6-5-3
- AFNOR: X 130 WMo Cr V 6-5-4-3
- UNI: W 6 Mo 5 Cr 4 V 3
- AISI: M 3-2 (PM)

**Indicatory analysis:**
- C: 1.25
- Si: 0.30
- Mn: 0.30
- Cr: 4.0
- Mo: 5.0
- W: 6.2
- V: 3.0

**Strength:**
- $\approx 870$ N/mm²

**Thermal conductivity at 100 °C:**
- $24 \frac{W}{m \cdot K}$

**Character:**
Powder metallurgy high-speed steel with good machinability, high resistance to adhesive and abrasive wear, with optimal toughness due to the uniform and fine carbide structure, very good through hardenability and high dimensional stability

**Application:**
Blocks for eroding, cutting punches and dies with particularly durable edges, inserts with excellent wear resistance

**Treatment by**
- Polishing: suitable for polishing
- Nitriding: highly suited for nitriding
- EDM: highly suited for EDM
- Coating: highly suited for coating

**Heat treatment:**
- Soft annealing: at 860 to 880 °C, for approx. 2 to 5 hours
- slow controlled cooling of 10 to 20 °C per hour to about 600 °C;
- further cooling in air, max. 260 HB

**Hardening:**
- 1180 °C
- 1150 °C
- 1100 °C

**Quenching in oil/air/hot bath**
**Attainable hardness:** 64–66 HRC

**Tempering:**
- Slow heating to tempering temperature (in order to avoid formation of cracks)
- immediately after hardening;
- tempering three times is recommended

**Tempering chart:**

- ideal for PVD and CVD coating, no risk of dimensional changes because the steel is tempered to more than 520 °C.
Material No.: 1.7131

Designation
DIN: 16 MnCr 5
AFNOR: 16 MC 5
UNI: -
AISI: 5115

Indicatory analysis:
C 0.16
Si 0.25
Mn 1.15
Cr 0.95

Strength: 600 N/mm²

Thermal conductivity at 20 °C: 44 W/m K

Character: Steel for case hardening for parts requiring a core strength of 800 to 1000 N/mm² and high wear resistance

Application: guiding elements, cores and machine parts with high surface hardness; synthetic resin press moulds for processing thermoplastics and thermosetting plastics

Treatment by
Polishing: < possible
Etching:
EDM:
Nitriding:
Usually, hardened parts are not nitried → loss of hardness.
Hard chroming: recommended, increases wear and corrosion resistance

Heat treatment:
Annealing:
670 to 710 °C for about 2 to 5 hours
slow controlled cooling, further cooling in air, max. 205 HB
Carburising:
900 to 950 °C. The choice of the carburising means and carburising temperature depends on the desired surface carbon content, the carburising graph and the required case depth.
Case hardening:
870 to 930 °C in powder/salt bath, cooling in oil/hot bath at 160 to 250 °C
Intermediate annealing:
630 to 650 °C, for about 2 to 4 hours with slow furnace cooling
Preheating:
350 °C depending on dimensions
Hardening:
curing temperature 810 to 840 °C harden in 60 °C hot oil
Cooling:
down to about 100 °C in oil, then in air to about 50 °C
Tempering:
1 hour per 20 mm part thickness, min. 2 hours
Tempering: 150 °C - 200 °C
Material No.: 3.3547

Designation

<table>
<thead>
<tr>
<th>DIN</th>
<th>AlMg4,5Mn / ISO 5083</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFNOR</td>
<td>A - G4,5MC</td>
</tr>
<tr>
<td>UNI</td>
<td>7790</td>
</tr>
<tr>
<td>AISI</td>
<td>-</td>
</tr>
</tbody>
</table>

Indicatory analysis:

- Si: 0.40
- Fe: 0.40
- Cu: 0.10
- Mn: 0.40–1.00
- Mg: 4.00–4.90
- Cr: 0.05–0.25
- Zn: 0.25
- Ti: 0.15

Strength: 230–290 N/mm² (depending on the thickness)

Thermal conductivity at 100 °C: 110–140 W/m K

Character:

- not hardenable, homogenised, annealed aluminium alloy with particularly good machining and welding properties; excellent dimensional stability; ideally suited for anodising, hard chromium plating and chemical nickel plating; very high resistance to corrosion

<table>
<thead>
<tr>
<th>Density</th>
<th>2.66 kg/dm³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal expansion coefficient</td>
<td>24.2 10⁻⁶ m/mK</td>
</tr>
<tr>
<td>Max. temperature permanent/short term</td>
<td>90/110 °C</td>
</tr>
</tbody>
</table>

Application:

plates for mould tools, rotary tables, machined components for machine and jig construction, moulds for prototypes and foamed parts

Treatment by

- Polishing: suitable
- EDM: suitable
- Etching: ideally suited
- Milling: ideally suited
- Repair welding: ideally suited

Heat treatment:

Note:

Subsequent heat treatment may lead to a deterioration of the mechanical properties!
Material No.: 3.4365

Designation
DIN: AlZnMgCu 1.5 / ISO 7075
AFNOR: A - Z5GU
UNI: 9007 / 2
AISI: -

Indicatory analysis:
- Si: 0.40
- Fe: 0.50
- Cu: 1.20–2.00
- Mn: 0.30
- Mg: 2.10–2.90
- Cr: 0.18–0.28
- Zn: 5.10–6.10
- Ti: 0.20

Strength: depending on the thickness of the plate

<table>
<thead>
<tr>
<th>plate thickness [mm]</th>
<th>10</th>
<th>20</th>
<th>50</th>
<th>60</th>
<th>80</th>
<th>90</th>
<th>100</th>
<th>120</th>
<th>150</th>
<th>200</th>
</tr>
</thead>
<tbody>
<tr>
<td>tensile strength Rm [N/mm²]</td>
<td>540</td>
<td>540</td>
<td>530</td>
<td>525</td>
<td>495</td>
<td>490</td>
<td>460</td>
<td>410</td>
<td>360</td>
<td>360</td>
</tr>
<tr>
<td>yield point Rp02 [N/mm²]</td>
<td>470</td>
<td>470</td>
<td>460</td>
<td>440</td>
<td>420</td>
<td>390</td>
<td>360</td>
<td>300</td>
<td>260</td>
<td>240</td>
</tr>
</tbody>
</table>

Thermal conductivity at 100 °C: 130–160 \( \frac{\text{W}}{\text{mK}} \)

Character: hardened, high-strength aluminium zinc alloy with good properties for structure-etching, as well as good machinability, EDM and polishing properties

- Density: 2.8 \( \text{kg/dm}^3 \)
- Thermal expansion coefficient: 23.4 \( 10^{-6} \text{ m/mK} \)
- Max. temperature permanent/short term 90/120 \( ^\circ\text{C} \)

Application: plates for mould tools and dies with increased requirements on strength; components for machine and jig construction

Treatment by
- Polishing: possible
- Milling: possible
- EDM:
- Etching: suitable for structure-etching
- Repair welding: not suitable for welding

Heat treatment: Note:
Subsequent heat treatment may lead to a deterioration of the mechanical properties!
Cold-work steel
Cold-work steel is used for tools that are generally operated at a temperature lower than 200°C. The high alloy cold-work steel grades offer a high wear resistance combined to a good compressive strength. The low alloy grades and those having a low carbon content offer a higher toughness and sufficient compressive strength with a reduced wear resistance.
Other noteworthy features are: Economic machinability, cold formability, well polishable and sufficiently resistant against agressive plastics.

Hot-work steel
The permanent operation temperature of hot-work steel is above 200°C. The hot-work steel thus offers best properties for tools designed to process high performance plastics. Further applications are in the field of die casting, extrusion and die forging.
The following properties are expected of hot-work steel: high thermal resistance and toughness, high hot-wear resistance and high thermal shock resistance.

Steel of best quality
Meusburger stands for products of finest quality. Steel is delivered from the most famous European steel mills and is being stress-relieved in house with great care. This unique procedure garantees our customers a low warping subsequent machining. Thanks to the temperature being maintained for a long time and slow cooling of the oven at the rate of 35°C/h we obtain the best results in terms of stress-relieved material.

Inside our furnaces with a total capacity of 240 tons, the steel we process is heat treated for stress relief.

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