<table>
<thead>
<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>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>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>X 40 CrMoV 5-1 KU</td>
<td>C = 0.40, Si = 0.40, Mn = 0.30, Cr = 13.00</td>
<td>= 720 N/mm²</td>
<td>Tool steel for through hardening low corrosion, 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 ESU (ESR)</td>
<td>X 40 CrMoV 5-1</td>
<td>C = 0.40, Si = 0.40, Mn = 0.30, Cr = 13.00</td>
<td>= 720 N/mm²</td>
<td>Tool steel for through hardening low corrosion, 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>1.2085</td>
<td>Z 35 CD 17 S</td>
<td>C = 0.33, Si = 0.30, Mn = 0.80, Cr = 16.00, 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>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 alloyed</td>
<td>Moulding plates and machine parts</td>
</tr>
<tr>
<td>1.2210</td>
<td>115 Cr/3</td>
<td>C = 1.18, Si = 0.25, Mn = 0.30, Cr = 0.70, V = 0.10</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>40 CrMo 8</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>40 CrMoS 8</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>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>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 high-alloy</td>
<td>Moulding plates and inserts for plastic injection mould tools</td>
</tr>
<tr>
<td>1.2343 ESU (ESR)</td>
<td>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 plastic injection mould tools</td>
</tr>
<tr>
<td>1.2344</td>
<td>X 40 CrMoV 5-1</td>
<td>C = 0.40, Si = 1.00, Mn = 0.40, Cr = 5.30, Mo = 1.40, V = 1.00</td>
<td>= 780 N/mm²</td>
<td>Hot-work steel high-temperature resistant, high temperature wear resistant, excellent thermal conductivity, high-alloy</td>
<td>Standard material for hot-work tools, extrusion moulds, dies, tools for plastics processing</td>
</tr>
<tr>
<td>1.2344 ESU (ESR)</td>
<td>X 40 CrMoV 5-1</td>
<td>C = 0.40, Si = 1.00, Mn = 0.40, 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>
for the right application. If in doubt, a specialist (e.g. steel manufacturer, hardening shop) should be consulted. Liability does not lie with this general information is only a recommendation for anyone to apply freely. For individual cases the buyer must make sure the purchase material.

<table>
<thead>
<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>1.2363</td>
<td>DIN: X 100 C/MoV 5</td>
<td>C - 1.00, Si - 0.30, Mn - 0.50, Cr - 5.20, Mo - 1.10, V - 0.20</td>
<td>810 N/mm²</td>
<td>Steel for through hardening; dimensional stability and high hardenability; wear-resistant, cold-work steel with good cutting properties</td>
<td>Mould plates and inserts as well as cutting punches, wear parts and cutting dies with high requirements toughness</td>
</tr>
<tr>
<td>1.2379</td>
<td>DIN: X 155 C/VMo 121</td>
<td>C - 1.53, Si - 0.30, Mn - 0.35, Cr - 12.00, Mo - 0.80, V - 0.80</td>
<td>850 N/mm²</td>
<td>Steel for through hardening; wear-resistant cold-work steel, high-alloy</td>
<td>Mould plates and inserts as well as wear plates or cutting dies with increased wear resistance</td>
</tr>
<tr>
<td>1.2714</td>
<td>DIN: 56 Ni/CrMoV 7</td>
<td>C - 0.56, Cr - 1.10, Mn - 0.50, Mo - 1.70, V - 0.10</td>
<td>850 N/mm²</td>
<td>Steel for through hardening; good high-temperature resistance and toughness</td>
<td>Auxiliary tools for extruders, hot-forging tools, dies for processing tin, lead and zinc alloys</td>
</tr>
<tr>
<td>1.2714 HH</td>
<td>DIN: 56 Ni/CrMoV 7</td>
<td>C - 0.56, Cr - 1.10, Mn - 0.50, Mo - 1.70, V - 0.10</td>
<td>1350 N/mm² (± 43 HRC)</td>
<td>Steel for through hardening, quenched and tempered; good high-temperature resistance and toughness</td>
<td>Mould inserts, cores and slides for die casting (Al, Mg, Zn etc.) and injection mould tools</td>
</tr>
<tr>
<td>1.2738</td>
<td>DIN: 40 CrMnNiMo 8-6-4</td>
<td>C - 0.40, Mn - 1.50, Si - 0.20, Cr - 1.90, Mo - 1.10, Ni - 0.30</td>
<td>1080 N/mm²</td>
<td>Steel for through hardening; quenched and tempered section steel with uniform strength even in plates and bars with larger dimensions; suitable for polishing and nitriding</td>
<td>Large cavity plates with deep cavities for items such as bumpers or dashboards</td>
</tr>
<tr>
<td>1.2767</td>
<td>DIN: 45 Ni/CrMo 16</td>
<td>C - 0.45, Si - 0.25, Mn - 0.40, Cr - 1.35, Mo - 0.25, Ni - 4.00</td>
<td>830 N/mm²</td>
<td>Steel for through hardening; special alloy suitable for polishing, with high resistance to pressure and good flexural strength</td>
<td>High-performance cavity plates and inserts; cutting and bending inserts for high compressive loads</td>
</tr>
<tr>
<td>1.2842</td>
<td>DIN: 90 MnCr 8</td>
<td>C - 0.90, Si - 0.20, Mn - 2.00, Cr - 0.40, V - 0.10</td>
<td>760 N/mm²</td>
<td>Steel for through hardening; dimensional stability and high hardenability; wear-resistant, cold-work steel with very good cutting properties</td>
<td>Cavity plates and inserts exposed to abrasive stress; wear plates, cutting dies and guiding plates; pressure pads and guiding rails</td>
</tr>
<tr>
<td>1.3343</td>
<td>DIN: 2.85 WDCV 6</td>
<td>C - 0.90, Si - 0.30, Mn - 0.30, Cr - 0.15, Mo - 4.00, V - 1.90, W - 6.20</td>
<td>920 N/mm²</td>
<td>HSS - High speed steel; very high resistance to adhesion and wear in combination with high toughness and compressive strength</td>
<td>Blocks for eroding, cutting punches and fine blanking punches; impact extrusion punches and dies; inserts with a very high wear resistance</td>
</tr>
<tr>
<td>1.3344 PM</td>
<td>DIN: W 6 Mo 5 Cr 4 V 3</td>
<td>C - 1.25, Si - 0.30, Mn - 0.30, Cr - 4.00, Mo - 5.00, V - 3.0, W - 6.2</td>
<td>870 N/mm²</td>
<td>HSS powder metallurgy steel; Outstanding resistance to adhesive and abrasive wear; optimal toughness and good through hardenability</td>
<td>Blocks for eroding, cutting punches and dies with particularly durable edges, inserts with excellent wear resistance</td>
</tr>
<tr>
<td>1.7131</td>
<td>DIN: 16 MnCr 5</td>
<td>C - 0.16, Si - 0.25, Mn - 1.15, Cr - 0.95</td>
<td>600 N/mm²</td>
<td>Steel for case-hardening; alloyed</td>
<td>Guiding elements, cores and machine parts</td>
</tr>
<tr>
<td>1.7225</td>
<td>DIN: 42 CrMo 4</td>
<td>C - 0.42, Si - 0.25, Mn - 0.75, Cr - &lt;0.035</td>
<td>720 N/mm²</td>
<td>Tempered steel; high resistance, high toughness, universally useable in engineering</td>
<td>Engineering, Groundplates, Axes, Gear shafts, Gear wheels</td>
</tr>
<tr>
<td>3.3547 (AW-5083)</td>
<td>DIN: AlMg 4.5 Mn</td>
<td>Si - 0.40, Fe - 0.40, Cu - 0.10, Mn - 0.70, Mg - 4.40, Cr - 0.15, Zn - 0.15, Ti - 0.15</td>
<td>≤ 290 N/mm² (depending on thickness)</td>
<td>Aluminium alloy</td>
<td>Plates for mould bases and jigs</td>
</tr>
<tr>
<td>3.4365 (AW-7075)</td>
<td>DIN: AlMgCu 1.5</td>
<td>Si - 0.40, Fe - 0.50, Cu - 1.60, Mn - 0.30, Mg - 2.40, Cr - 0.23, Zn - 5.40, Ti - 0.20</td>
<td>≤ 540 N/mm² (depending on thickness)</td>
<td>Aluminium zinc alloy; high-strength, hardened</td>
<td>Plates for mould tools and dies with increased requirements on strength</td>
</tr>
</tbody>
</table>
### Material No.: 1.0577

**Designation**
- DIN: S 355 J2 (St 52-3)
- AFNOR: A 52 FP
- UNI: -
- AISI: A738

**Indicatory analysis:**
- C: ≤ 0.22
- Si: ≤ 0.55
- Mn: ≤ 1.60

**Strength:**
≈ 550 N/mm²

**Thermal conductivity at 20 °C:**
40 \( \frac{W}{mK} \)

### Character:
unalloyed **structural steel** with good weldability

### Application:
for common applications in tool, mould and machine construction

### Treatment by
- Welding: very good weldability due to its low carbon content
- Polishing:
- Etching:
- EDM: not usual
- Nitriding:
- Hard chroming:

### Heat treatment:
- Soft annealing: 650 to 700 °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. 180 HB

---

**Technical Tip**
- If no welding is required, we recommend 1.1730
- better machinability in spite of higher strength
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:
- \( \approx 640 \, \text{N/mm}^2 \)

Thermal conductivity at 20 °C:
- \( 50 \, \frac{\text{W}}{\text{mK}} \)

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:
- Nitriding:
- Hard chroming: not usual

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*

Designation
DIN: X 40 Cr 13
AFNOR: Z 40 C 14
UNI:
AISI: 420 / 420 ESR

Indicatory analysis:
C 0.40
Si 0.40
Mn 0.30
Cr 13.00

Strength: ≈ 720 N/mm²

Thermal conductivity at 100°C: \( 18 \frac{W}{m \cdot K} \)

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:
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 oil/compressed gas/hot bath
obtainable hardness: 53 - 56 HRC

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

Technical Tip
- cold-work steel
- must be tempered several times after hardening (max. 52HRC).
The demand for “max. hardness” often ends up in material breakage.
- mould temperature max. 200°C
- corrosion-resistant after hardening

- The ESR quality guarantees an extremely pure and homogeneous microstructure.
Material No.:

<table>
<thead>
<tr>
<th>Designation</th>
<th>DIN: X 33 CrS 16</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AFNOR: Z 35 CD 17.S</td>
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<tr>
<td></td>
<td>UNI: -</td>
</tr>
<tr>
<td></td>
<td>AISI: ≈ 422 + S</td>
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</tbody>
</table>

Indicatory analysis:

<table>
<thead>
<tr>
<th>Element</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0.33</td>
</tr>
<tr>
<td>Si</td>
<td>0.30</td>
</tr>
<tr>
<td>Mn</td>
<td>0.80</td>
</tr>
<tr>
<td>Cr</td>
<td>16.00</td>
</tr>
<tr>
<td>S</td>
<td>0.06</td>
</tr>
<tr>
<td>Ni</td>
<td>0.30</td>
</tr>
</tbody>
</table>

Strength: ≈ 1080 N/mm²

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

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: not recommended
- EDM:
- Nitriding:
- Hard chroming:

Heat treatment:

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

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

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

Tempering chart:

![Tempering chart](image-url)
Material No.: 1.2162

Designation:
- DIN: 21 MnCr 5
- AFNOR: 20 MC 5
- UNI: 5120
- 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
- Etching: possible
- Polishing: possible
- EDM: possible
- 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 heat treatment: 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:

Technical Tip

- For mirror finish, we recommend the through hardening steel 1.2767.
<table>
<thead>
<tr>
<th>Material No.:</th>
<th>1.2210</th>
<th>Technical Tip</th>
</tr>
</thead>
<tbody>
<tr>
<td>Designation:</td>
<td>DIN: 115 CrV 3</td>
<td>- Silver steel 1.2210 is finish-ground to h9 tolerance.</td>
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<tr>
<td></td>
<td>AFNOR: 100 C3</td>
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<tr>
<td></td>
<td>UNI: 107 CrV 3 KU</td>
<td></td>
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<tr>
<td></td>
<td>AISI: L2</td>
<td></td>
</tr>
<tr>
<td>Indicatory analysis:</td>
<td>C 1.18</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Si 0.25</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mn 0.30</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cr 0.70</td>
<td></td>
</tr>
<tr>
<td></td>
<td>V 0.10</td>
<td></td>
</tr>
<tr>
<td>Strength:</td>
<td>$\approx 740 \text{ N/mm}^2$</td>
<td></td>
</tr>
<tr>
<td>Thermal conductivity at 100 °C:</td>
<td>$33 \frac{\text{W}}{\text{m K}}$</td>
<td></td>
</tr>
<tr>
<td>Character:</td>
<td>Chrome-Vanadium alloyed <strong>cold-work steel</strong> with high resistance; also known as silver steel.</td>
<td></td>
</tr>
<tr>
<td>Application:</td>
<td>small turned parts, core pins, punches and engraving tools</td>
<td></td>
</tr>
<tr>
<td>Treatment by</td>
<td>Polishing:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Etching:</td>
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<tr>
<td></td>
<td>EDM:</td>
<td>$&gt;$ unusual</td>
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<tr>
<td></td>
<td>Nitriding:</td>
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<td></td>
<td>Hard chroming:</td>
<td></td>
</tr>
<tr>
<td>Heat treatment:</td>
<td>Annealing:</td>
<td>710 to 740 °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>
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<tr>
<td></td>
<td>further cooling in air, max. 220 HB</td>
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</tr>
<tr>
<td></td>
<td>Hardening:</td>
<td>780 to 840 °C</td>
</tr>
<tr>
<td></td>
<td>15 to 30 minutes keeping curing temperature</td>
<td></td>
</tr>
<tr>
<td></td>
<td>quenching in water/oil</td>
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<tr>
<td></td>
<td>obtainable hardness: $64-66 \text{ HRC}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tempering:</td>
<td>slow heating to tempering temperature immediately after hardening;</td>
</tr>
<tr>
<td></td>
<td>minimum time in furnace: 1 hour per 20 mm part thickness;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>min. 2 hours/cooling in air</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tempering chart:</td>
<td></td>
</tr>
<tr>
<td>Material No.:</td>
<td>1.2311</td>
<td>Technical Tip</td>
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<tr>
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<tr>
<td>Designation</td>
<td>DIN: 40 CrMnMo 7</td>
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<td>AFNOR: 40 CMD 8</td>
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<td></td>
<td>UNI: 35 CrMo 8 KU</td>
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<td>Mo 0.20</td>
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</tr>
<tr>
<td>Strength:</td>
<td>≈ 1080 N/mm²</td>
<td></td>
</tr>
<tr>
<td>Thermal conductivity at 100 °C:</td>
<td>$\frac{35 \text{ W}}{\text{m K}}$</td>
<td></td>
</tr>
<tr>
<td>Character:</td>
<td>alloyed and pre-toughened tool steel, especially suitable for polishing; high dimensional stability</td>
<td></td>
</tr>
<tr>
<td>Application:</td>
<td>moulding plates, inserts and high-tensile machine parts</td>
<td></td>
</tr>
<tr>
<td>Treatment by</td>
<td>Polishing: good suitability for polishing; for higher surface requirements, through hardened steels are recommended.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Etching: ( &gt; ) possible</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EDM:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nitriding: increases the steel's wear resistance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hard chroming: particularly increases wear resistance and corrosion resistance</td>
<td></td>
</tr>
<tr>
<td>Heat treatment:</td>
<td>already pre-toughened; usually no heat treatment required</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nitriding: Before nitriding, stress-relief annealing is recommended at 580 °C. (Meusburger standard)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hard chroming: To prevent hydrogen brittleness, the tool must be tempered for approximately 3 to 4 hours at 180 °C after the hard chroming.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hardening: 840 to 860 °C</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cooling: to 180 °C/220 °C in oil/hot bath, then in air to about 100 °C</td>
<td></td>
</tr>
<tr>
<td></td>
<td>obtainable hardness: 52 HRC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tempering: slow heating to tempering temperature immediately after hardening; minimum time in furnace: 1 hour per 25 mm part thickness</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tempering chart:</td>
<td></td>
</tr>
</tbody>
</table>

![Tempering chart](image)
**Material No.:** 1.2312

**Designation**
- DIN: 40 CrMnMoS 86
- AFNOR: 40 CMD 8.S
- UNI: -
- AISI: P20 + S

**Indicatory analysis:**
- C: 0.40
- Si: 0.40
- Mn: 1.50
- Cr: 1.90
- Mo: 0.20
- S: 0.06

**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: not recommended
- 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 graph](image-url)
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 W/m 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: reduces the corrosion resistance
- Nitriding: for superior surfaces

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:
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

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

Strength:
- $\approx 780 \text{ N/mm}^2$

Thermal conductivity at 200 °C:
- $27 \text{ W m}^{-1} \text{ K}^{-1}$

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 plastic injection mould tools;
- *ESR for applications for die casting (Al, Mg, Zn)

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:

Technical Tip
- 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

High temperature strength chart:
### Material No.:

1.2344 / 1.2344 ESR*

### Designation

- DIN: X 40 CrMoV 5-1
- AFNOR: Z 40 CDV 5
- UNI: X 40 CrMoV 5-1 KU
- AISI: H13 / H13 ESR

### Indicatory analysis:

- C: 0.40
- Si: 1.00
- Cr: 5.30
- Mo: 1.40
- V: 1.00

### Strength:

- 780 N/mm²

### Thermal conductivity at 100 °C:

- $26 \frac{W}{m \cdot K}$

### Character:

- 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 *ESR (Electro-Slag Remelted)

### Application:

- standard material for hot-work tools, extrusion moulds, dies, tools for plastic processing

### Treatment by

- Polishing: > possible
- Etching: > in special cases
- EDM: > in special cases
- Nitriding: > in special cases
- Hard chroming: > in special cases

### Heat treatment:

- **Annealing:**
  - 750 to 800 °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. 230 HB
- **Hardening:**
  - 1020 to 1060 °C
  - 15 to 30 minutes keeping curing temperature
  - quenching in water/oil
  - obtainable hardness: 54 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.: 1.2363

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:
Material No.: 1.2379

**Designation**
- DIN: X 155 CrVMo 121
- AFNOR: Z 160 CDV 12
- UNI: X 155 CrVMo 12 1 KU
- AISI: ≈ D2

**Indicatory analysis:**
- C: 1.53
- Si: 0.30
- Mn: 0.35
- Cr: 12.00
- Mo: 0.80
- V: 0.80

**Strength:**
- ≈ 850 N/mm²

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

**Character:**
- high-alloy steel for through-hardening with moderate machinability;
- extremely wear resistant and low warpage, good dimensional stability,
- toughness and through hardenability

**Application:**
- mould plates and inserts as well as wear plates and cutting dies with increased wear resistance

**Treatment by**
- Polishing: ideal when hardened
- Nitriding: very well suited, due to the fact that the hardness of the base material will not fall below 60 HRC
- EDM:
- Hard chroming: possible
- Etching:

**Heat treatment:**
- Soft annealing:
  - 800 to 850 °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:
  - 1020 °C
  - 1060 to 1080 °C
  - quenching in oil/air/hot bath
  - obtainable hardness: 63−65 HRC
- Tempering:
  - 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: 60−62 HRC

**Tempering chart:**

---

**Technical Tip**
- secondary hardening, very good base material for nitriding or coating
Material No.: 1.2714

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

Indicatory analysis:
C 0.56
Cr 1.10
Mo 0.50
Ni 1.70
V 0.10

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:
Material No.: 1.2714 HH

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

Indicatory analysis:
C  0.56
Cr  1.10
Mo  0.50
Ni  1.70
V  0.10

Strength: through-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

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:
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 1.90
- Mo 0.20
- Ni 1.10
- Si 0.30

Strength: 1080 N/mm²

Thermal conductivity at 100 °C: 33.5 W/m 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:
- EDM:
- Nitriding:
- Hard chroming: > 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/m K

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, with moderate machinability; very high resistance against bending and 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:
<table>
<thead>
<tr>
<th>Material No.:</th>
<th>1.2842</th>
<th>Technical Tip</th>
</tr>
</thead>
</table>
| Designation | DIN: 90 MnCrV 8  
AFNOR: 90 MV 8  
UNI: 90 MnVCr 8 KU  
AISI: § O2 | - Steel grade 1.2510 is an adequate alternative with regards to its properties, machinability and dimensional stability after heat treatment. |
| 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 W/m 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](image-url)
## Material No.:

1.3343 (HSS)

### Designation

<table>
<thead>
<tr>
<th>DIN:</th>
<th>HS 6-5-2 C</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFNOR:</td>
<td>Z 85 WDCV 6</td>
</tr>
<tr>
<td>UNI:</td>
<td>X 82 WMoV 6 5</td>
</tr>
<tr>
<td>AISI:</td>
<td>M 2 reg. C</td>
</tr>
</tbody>
</table>

### Indicatory analysis:

- C: 0.9
- Si: 0.3
- Mn: 0.3
- Cr: 4.0
- Mo: 5.0
- V: 1.9
- W: 6.2

### Strength:

- = 920 N/mm²

### Thermal conductivity at 100°C:

- 27.4 W/m K

### Character:

- high-speed steel featuring high resistance to abrasion and wear in combination with high toughness and compressive strength.

### Application:

- blocks for eroding, cold forming tools such as cutting, fine blanking and impact extrusion punches and dies
- inserts with a very high wear resistance

### Treatment by

- Polishing: suitable
- Nitriding: highly suitable
- EDM: highly suitable for EDM
- Coating: highly suitable

### Heat treatment:

**Annealing:**

- 820 to 850 °C, about 2 to 5 hours
- slow controlled cooling of 10 to 20°C per hour to about 55°C;
- then further cooling in air. **Maximum 270HB**

**Hardening:**

- 1190 - 1230 °C
- quenching in oil/compressed gas/air/hot bath
- obtainable hardness: **66 HRC**

**Tempering:**

- slow heating to tempering temperature (to avoid forming of cracks)
- immediately after hardening;
- triple tempering is recommended

### Technical Tip

- excellent for PVD and CVD coating;
- highest dimensional stability because the steel was tempered at more than 520 °C.

### Tempering chart:

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

<table>
<thead>
<tr>
<th>Designation</th>
<th>DIN: PM 6-5-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFNOR:</td>
<td>X 130 WMoCrV 6-5-4-3</td>
</tr>
<tr>
<td>UNI:</td>
<td>W 6 Mo 5 Cr 4 V 3</td>
</tr>
<tr>
<td>AISI:</td>
<td>M 3-2 (PM)</td>
</tr>
</tbody>
</table>

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

Strength: ≈ 870 N/mm²

Thermal conductivity at 100 °C: 24 W/m·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: best metallurgical properties for mirror finish
- 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. 260HB

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

Quenching in oil/compressed gas/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:

---

Technical Tip

- excellent for PVD and CVD coating;
- highest dimensional stability because the steel was tempered at 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: $44 \frac{W}{m \cdot K}$

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:
Etching: possible
EDM:
Nitriding: Usually, hardened parts are not nitrided → 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 heat treatment: 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.: 1.7225

Designation:
- DIN: 42 CrMo 4
- AFNOR: 42 CD 4
- UNI: 42 CrMo 4
- AISI: 4140

Indicatory analysis:
- C: 0.42
- Si: 0.25
- Mn: 0.75
- S: <0.035
- Cr: 1.10
- Mo: 0.22

Strength:
- ~720 N/mm²

Tensile strength:
- Heat treated max. 720 N/mm²

Thermal conductivity at 20°C: 42.6 W/m K

Character:
- Alloyed and pre-toughened steel with high resistance and high toughness;
- Universally useable in engineering

Application:
- Machine construction, base plates, axes, gear shafts, gear wheels

Treatment by
- Nitriding: suitable
- Welding: not recommended
- EDM: suitable for EDM
- Coating: suitable

Heat treatment:
- Normalizing:
  - 840 to 880 °C afterwards air cooling
  - Some components need tempering afterwards
- Annealing:
  - 680 to 720 °C, about 2 to 5 hours
  - Slow controlled cooling of 10 to 20 °C per hour to about 600 °C
  - Then further cooling in air. Maximum 217 HB
- Toughening:
  - Max. 1.600 N/mm²
- Hardening:
  - 820 to 880 °C
  - Quenching in oil or water
  - Oil hardening for thin and complex,
  - Water hardening for large and simple components
  - Obtainable hardness: 53–61 HRC
- Tempering:
  - Slow heating to temperature (to avoid forming of cracks)
  - Immediately after hardening; at least 60 minutes
  - Cooling in air
- Tempering chart:
Material No.: 3.3547

Designation

DIN: AlMg4,5Mn / ISO 5083
AFNOR: A - G4,5MC
UNI: 7790
AISI: -

Indicatory analysis:

<table>
<thead>
<tr>
<th>Element</th>
<th>Mass Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Si</td>
<td>0.40</td>
</tr>
<tr>
<td>Fe</td>
<td>0.40</td>
</tr>
<tr>
<td>Cu</td>
<td>0.10</td>
</tr>
<tr>
<td>Mn</td>
<td>0.40–1.00</td>
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<td>Mg</td>
<td>4.00–4.90</td>
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<tr>
<td>Cr</td>
<td>0.05–0.25</td>
</tr>
<tr>
<td>Zn</td>
<td>0.25</td>
</tr>
<tr>
<td>Ti</td>
<td>0.15</td>
</tr>
</tbody>
</table>

Strength: 

\[ \approx 230\text{–}290\ \text{N/mm}^2 \] (depending on the thickness)

Thermal conductivity at 100 °C: 

\[ 110\text{–}140 \frac{\text{W}}{\text{m K}} \]

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

Density: 2.66 kg/dm³

Thermal expansion coefficient: 24.2 \times 10^{-6} \text{ m/mK}

Max. temperature permanent/short term: 90/110 °C

Application:

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

Treatment by

Polishing: suitably

EDM: suitable

Etching: 

Milling: ideally suited

Repair welding: 

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 Rp0.2 [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 \( \frac{W}{m \cdot K} \)

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 kg/dm³
- Thermal expansion coefficient: 23.4 \( 10^{-6} \) m/mK
- Max. temperature permanent/short term 90/120 °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 aggressive 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.

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

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 guarantees 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.