EM42 High speed steel

CHEMICAL COMPOSITION

<table>
<thead>
<tr>
<th>C</th>
<th>Cr</th>
<th>Mo</th>
<th>W</th>
<th>Co</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.08</td>
<td>3.8</td>
<td>9.4</td>
<td>1.5</td>
<td>8.0</td>
<td>1.2</td>
</tr>
</tbody>
</table>

STANDARDS
- Europe: HS 2-9-1-8
- Germany: 1.3247
- France: AFNOR Z110DKCWV9.8.4.2.1
- Japan: JIS SKH59
- USA: AISI M42
- Sweden: SS2723
- UK: BM42

DELIVERY HARDNESS
- Soft annealed: max. 280 HB
- Cold drawn: max. 320 HB
- Cold rolled: max. 320 HB

DESCRIPTION
EM42 is a highly cobalt alloyed high speed steel to be used when the demand for hot hardness is of great importance. EM42 has a good machinability and a good wear resistance.

APPLICATIONS
- Twist drills
- Milling cutters
- End mills
- Broaches
- Reamers
- Bandsaws

FORM SUPPLIED
- Wire rod
- Drawn wire
- Round bars
- Flat bars
- Square bars
- Sheets
- Discs
- Bi-metal edge
Available surface conditions: drawn, ground, rolled, hot rolled, cold rolled, peeled, turned.

HEAT TREATMENT
- Soft annealing in a protective atmosphere at 850-900°C for 3 hours, followed by slow cooling 10°C per hour down to 700°C, then air cooling.
- Stress-relieving at 600°C to 700°C for approximately 2 hours, slow cooling down to 500°C.
- Hardening in a protective atmosphere with pre-heating in 2 steps at 450-500°C and 850-900°C and austenitising at a temperature suitable for chosen working hardness.
- 3 tempers at 560°C are recommended with at least 1 hour holding time each time.

GUIDELINES FOR HARDENING

<table>
<thead>
<tr>
<th>Tool</th>
<th>Hardening</th>
<th>Tempering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-edge cutting tools</td>
<td>1190°C</td>
<td>560°C</td>
</tr>
<tr>
<td>Multi-edge cutting tools</td>
<td>1150-1180°C</td>
<td>550-570°C</td>
</tr>
<tr>
<td>Cold work tools</td>
<td>1050-1150°C</td>
<td>550-570°C</td>
</tr>
</tbody>
</table>

PROCESSING
EM42 can be worked as follows:
- machining (grinding, turning, milling)
- polishing
- hot forming
- electrical discharge machining
- welding (special procedure including preheating and filler materials of base material composition).

GRINDING
During grinding, local heating of the surface, which can alter the temper, must be avoided. Grinding wheel manufacturers can provide advice on the choice of grinding wheels.

SURFACE TREATMENT
The steel grade is a perfect substrate material for PVD coating. If nitriding is requested, a small diffusion zone is recommended but avoid compound and oxidized layers.
PROPERTIES

PHYSICAL PROPERTIES

<table>
<thead>
<tr>
<th>Property</th>
<th>Temperature 20°C</th>
<th>Temperature 400°C</th>
<th>Temperature 600°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density g/cm³</td>
<td>8.0</td>
<td>7.9</td>
<td>7.9</td>
</tr>
<tr>
<td>Modulus of elasticity kN/mm²</td>
<td>225</td>
<td>200</td>
<td>180</td>
</tr>
<tr>
<td>Thermal expansion ratio per °C</td>
<td>-</td>
<td>11.5x10⁻⁶</td>
<td>11.8x10⁻⁶</td>
</tr>
<tr>
<td>Thermal conductivity W/m°C</td>
<td>24</td>
<td>28</td>
<td>27</td>
</tr>
<tr>
<td>Specific heat J/kg °C</td>
<td>420</td>
<td>510</td>
<td>600</td>
</tr>
</tbody>
</table>

IMPACT TOUGHNESS

4-POINT BEND STRENGTH

- Rmb = Ultimate bend strength in kN/mm²
- Reb = Bend yield strength in kN/mm²
- Tot. work = Total work in Nm

SAFETY DATA SHEET SDS: B

COMPARATIVE PROPERTIES

Machinability | Wear resistance | Toughness | Hot hardness | Grindability
--- | --- | --- | --- | ---
E M2 | | | | |
E M35 | | | | |
E M42 | | | | |
WKE42 | | | | |
ASP® 2023 | | | | |
ASP® 2030 | | | | |
ASP® 2052 | | | | |
ASP® 2053 | | | | |
ASP® 2060 | | | | |

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