1. Main characteristics and applications

High wear resistance hot-working steel, also be used for wear resistance and polished plastic moulds. Steel is easy to machine in the annealed condition and needs a hardening process before final machining. This steel also shows excellent toughness and high level insensitivity to thermal shock and thermal fatigue. A nitriding surface treatment can be carried out to increase the life of the tooling.

Main applications:
- dies for the pressure casting of light alloys.
- wear resistance plastic moulds.
- tooling for the extrusion of light alloys and steels.
- hot work shear blades.
- rolls for profiling tools (welding area).
- Forging dies.

Hot working tools should be preheated to temperatures in the range 250 – 300°C before use.

2. Chemical composition (typical; in weight %)

<table>
<thead>
<tr>
<th>Element</th>
<th>C</th>
<th>Mn</th>
<th>Si</th>
<th>Cr</th>
<th>Mo</th>
<th>P</th>
<th>S</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.39</td>
<td>0.4</td>
<td>1</td>
<td>5</td>
<td>1.3</td>
<td>0.015</td>
<td>0.003</td>
<td>1</td>
</tr>
</tbody>
</table>

3. Critical points

- Ac1 860 °C
- Ac3 940 °C
- Ms 340 °C

4. Production technology

Electro-slag-remelting (ESR) - Forging – Heat treatment +EFS

5. US specification

In according to standard EN10228-3 Class 4 and standard SEP 1921 Class E/e

6. Delivery condition

W1.2344 is delivered in annealed condition (EFS), with hardness max 230 HB (21 HRC)

7. Comparable standards

<table>
<thead>
<tr>
<th>UNI</th>
<th>W.Nr</th>
<th>DIN</th>
<th>AFNOR</th>
<th>AISI/SAE</th>
<th>BS</th>
</tr>
</thead>
<tbody>
<tr>
<td>X40CrMoV5-1</td>
<td>1.2344</td>
<td>X40CrMoV5</td>
<td>(H13)</td>
<td>(H13)</td>
<td></td>
</tr>
</tbody>
</table>

Chemical composition (typical; in weight %):

- C 0.39
- Mn 0.4
- Si 1
- Cr 5
- Mo 1.3
- P 0.015
- S 0.003
- V 1

Critical points:

- Ac1 860 °C
- Ac3 940 °C
- Ms 340 °C

Production technology:

Electro-slag-remelting (ESR) - Forging – Heat treatment +EFS

US specification:

In according to standard EN10228-3 Class 4 and standard SEP 1921 Class E/e

Delivery condition:

W1.2344 is delivered in annealed condition (EFS), with hardness max 230 HB (21 HRC)
## Physical properties (reference values)

<table>
<thead>
<tr>
<th></th>
<th>20°C</th>
<th>100°C</th>
<th>250°C</th>
<th>500°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal expansion coefficient (10⁻6/K)</td>
<td>11.3</td>
<td>11.6</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>Thermal conductivity (W/mK)</td>
<td>18.8</td>
<td>19</td>
<td>22.9</td>
<td>25.1</td>
</tr>
<tr>
<td>Young modulus (Kn/mm²)</td>
<td>212</td>
<td>209</td>
<td>197</td>
<td>175</td>
</tr>
</tbody>
</table>

## Heat treatment

<table>
<thead>
<tr>
<th>TREATMENT</th>
<th>TEMPERATURE</th>
<th>HOLDING TIME (HT)</th>
<th>COOLING</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annealing</td>
<td>Heat to 850 °C</td>
<td>Min. H.T. for 2 minute /mm</td>
<td>Furnace up to 550°C than in air</td>
<td></td>
</tr>
<tr>
<td>Stress relieving</td>
<td>Heat to 650-700°C</td>
<td>Min. H.T. for 2 minute /mm</td>
<td>Furnace up to 300-350°C</td>
<td>To be carried out after machining, is recommended to eliminate the residual stresses induced by mechanical working</td>
</tr>
<tr>
<td>Hardening</td>
<td>Preheating to 350-400°C, Second preheating to 750-850°C, Heat to hardening temperature to 1000-1020°C</td>
<td>Min. H.T. for 1 minute /mm</td>
<td>Air or pressure gas by vacuum</td>
<td>Quenched hardness 52-56HRC</td>
</tr>
<tr>
<td>Tempering</td>
<td>In the range 350 - 600°C for at least 3 h according to hardness requirements and conditions of use, Tempering must be repeated a second time at a temperature equal to or 20°C lower than the previous, Before tempering, the parts must be preheated to 200 - 300°C</td>
<td>Air</td>
<td>Usual service hardness: 44-52 HRC</td>
<td></td>
</tr>
</tbody>
</table>