1. Main characteristics and applications

Steel suitable for air hardening. It is characterized by fairly good dimensional stability during heat treatment. It maintains high wear resistance up to temperatures of around 600 °C. This steel also possesses excellent toughness and high level insensitivity to thermal shock and thermal fatigue. A nitriding type surface treatment can be carried out on this steel to increase the service life of the tooling.

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

The tools should be preheated to temperatures in the range 250 - 300 °C before use.

2. 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>X40CrMoV51.1KU</td>
<td>1.2344</td>
<td>X40CrMoV51</td>
<td>(H13)</td>
<td>(BH13)</td>
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</tr>
</tbody>
</table>

3. Chemical analysis

<table>
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<tr>
<th>C</th>
<th>Mn</th>
<th>Si</th>
<th>Cr</th>
<th>Mo</th>
<th>Ni</th>
<th>V</th>
<th>P+S</th>
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<tbody>
<tr>
<td>0.36</td>
<td>0.30</td>
<td>0.90</td>
<td>5.00</td>
<td>1.20</td>
<td>0.85</td>
<td>0.44</td>
<td>0.50</td>
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4. Critical points

- Ac1 860 °C
- Ms 340 °C

5. Supply Conditions

Annealed HB max 230

6. Heat treatments

**Isothermal annealing**
- Heat to 880 °C, hold at temperature for 1/2 h to 1 h
- Furnace cooling to 780 °C and hold at temperature for at least 5 hours
- Cool by 10 °C/h to 750 °C
- Cooling in air
- Maximum hardness 230 HB

**Stress relieving**
- To be carried after machining and before final heat treatment
- Heat to 650 - 700 °C hold for 4 - 6 h
- Furnace cooling to 300 - 350 °C
- Cooling in air

**Hardening**
- Initial preheating to 350 - 450 °C
- Second preheating to 750 - 850 °C
- Heat to hardening temperature in the range 1000 - 1050 °C and hold at temperature
- Cooling in air
- Quenched hardness: 52 - 56 HRC

**Tempering**
- In the range 550 - 630 °C for at least 3 h according to hardness requirements and condition 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
7. C.C.T. curve

Austenitizing temperature: 1050°C

[Diagram of C.C.T. curve showing critical points and phases]

8. Tempering curve

[Diagram of Tempering curve showing hardness and strength vs. tempering temperature]

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