1. Main characteristics and applications

Steel with excellent heat properties, toughness, wear resistance, resistant to heat shock and with a good tempering strength. Possible applications include moulds for the steel production, pipe mandrels (including water cooling), dies, insert for extrusion and moulding for ferrous materials, even for equipments with hot wear resistance. It can be coated with processes (e.g. PVD) or it can be subject to surface hardening with the most common nitriding treatments. Before using it is necessary to preheat the instruments at about 250 ÷ 300 °C.

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>
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</thead>
<tbody>
<tr>
<td>12367</td>
<td>X38CrMoV5-3</td>
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3. Chemical analysis

<table>
<thead>
<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>
</tr>
</thead>
<tbody>
<tr>
<td>0.34</td>
<td>0.20</td>
<td>0.10</td>
<td>4.80</td>
<td>2.70</td>
<td>0.40</td>
<td>0.42</td>
<td>0.50</td>
</tr>
</tbody>
</table>

4. Critical points

- Ac1 820 °C
- Ms 290 °C

5. Supply Conditions

Annealed HB max 230

6. Heat treatments

Isothermal annealing
- Heat to 820 ÷ 850°C, with hold at minimum rate for 3 hours
- Furnace cooling to about 600 °C

Stress relieving
- To be carried out after machining and before the final heat treatment
- Heating to 600 ÷ 650 °C for 2 - 3 hours, followed by slow furnace cooling

Hardening
- Initial preheating to 350 ÷ 400 °C
- Second preheating to 750 ÷ 800 °C
- Austenitizing at 1030 ÷ 1080 °C
- Cooling in air, vacuum, in oil, salts at 500 ÷ 55
- According to the steel shape and size
- Quenched hardness HRC 53 ÷ 58 HRC

Tempering
- Tempering must be repeated at least three times after the hardening, with preheating to 350 ÷ 400 °C
- Initial tempering at about the same temperature of the secondary hardness. Second tempering useful to obtain the work hardness, normally 35 ÷ 50 HRC
- Third tempering at 30 ÷ 40 °C lower than the second tempering
- Cooling in air
7 C.C.T. curve

Austenitizing temperature: 1050°C

8 Tempering curve