High-Carbon, High Chromium Cold Work Tool Steel (D2)

- **Similar Steels**

<table>
<thead>
<tr>
<th></th>
<th>GMTC</th>
<th>AISI</th>
<th>B.S.</th>
<th>DIN</th>
<th>JIS</th>
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</thead>
<tbody>
<tr>
<td>ED11</td>
<td>D2</td>
<td>BD2</td>
<td>1.2379</td>
<td>SKD11</td>
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</tbody>
</table>

- **Chemical Composition**

<table>
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<tr>
<th>鋼種</th>
<th>C</th>
<th>Si</th>
<th>Mn</th>
<th>P</th>
<th>S</th>
<th>Cr</th>
<th>Mo</th>
<th>V</th>
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</thead>
<tbody>
<tr>
<td>ED11</td>
<td>1.40</td>
<td>MAX</td>
<td>MAX</td>
<td>MAX</td>
<td>MAX</td>
<td>11.00</td>
<td>0.80</td>
<td>0.20</td>
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<tr>
<td></td>
<td>1.60</td>
<td>0.40</td>
<td>0.40</td>
<td>0.030</td>
<td>0.030</td>
<td>13.00</td>
<td>1.20</td>
<td>0.50</td>
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</table>

Remark: Cu: max. 0.25% Ni: max. 0.50%

- **Characteristics**
  1. High-carbon, high—chromium cold work tool steel.
  2. Deep hardening, with low distortion and high safety in hardening.
  3. Good wear resistance and good softening resistance at elevated temperature.
  4. Fine carbide size and grain size with high toughness.
  5. Low sulfur content with high cleanliness.

- **Application**
  For high efficiency cutting tool:
  1. **Tooling Industry**: Punch, Immediate Roller for Cold Rolling.
  2. **Wire Cutting Industry**: Mould
  3. **Steel Tube Industry**: Rolling Cutter, Shaping Wheel.
  4. **Screw Industry**: Screw Wheel, Screw Mould, Drawing Die.
**Heat Treatment**

1. Annealing---Heating slowly and uniformly to 800~850 °C, furnace cooling to 600 °C at a rate 10~20 °C/h., Hardness max. HB 255.

2. Stress Relieving---650~700 °C, furnace cooling.

3. Hardening---
   - Preheating(1): Warming to 550~600 °C, holding 30 minutes per 25 mm.
   - Preheating(2): Warming to 800~850 °C, holding 30 minutes per 25 mm.
   - Austenitizing: Heating to 975~1050 °C, holding 30 minutes per 25 mm.
   - Quenchant: By oil (40~70 °C) or by air.

4. Tempering---
   - Low temperature tempering: Heating to 150~200 °C, holding over 60 minutes per 25 mm. Air-cooling. Hardness min. HRC 61
   - High temperature tempering: Heating to 480~540 °C, holding over 60 minutes per 25 mm. Air-cooling. Double tempering. Hardness min. HRC 58

**Notes:** In low temperature tempering, steel must be hold at lower austenitizing temperature, about 975~1025 °C. In high temperature tempering, steel must be hold at higher austenitizing temperature, about 1000~1050 °C.

**Instruction For Treatment**
**Hardness vs Tempering Temperature**

![Graph showing hardness vs tempering temperature]

**Applicable Documents**
2. Inclusions: According to ASTM E45 Method A.

**Availability**
1. Spheroidizing.
2. Available size range: 5 ø ø ø 410mm.

**Reference**