High hardenability & toughness Hot Work Die Steel

General use hot work die steel with high hardenability and excellent toughness available for large die casting dies as improved substitute for DHA1 (H13 eq.)

- High hardenability: High toughness even in large sized dies due to optimum alloy designing
- Single melt steel: Excellent quality similar to double melt steels due to state-of-the-art production technologies

Heat treatment

- DHA1-EX: 1,2387 steel, Double melted, Re-forging: 1,2387 steel, Quenching: 1030℃, Gas quenching with Air

DHA WORLD

Features

- Machinability

Main applications

<table>
<thead>
<tr>
<th>Applications</th>
<th>Hardness (HRC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al, Zn, Mg die casting dies</td>
<td>41~48</td>
</tr>
<tr>
<td>Die casting die parts (Plunger sleeve, Plunger chip)</td>
<td>45~50</td>
</tr>
<tr>
<td>Hot extrusion dies</td>
<td>43~50</td>
</tr>
<tr>
<td>Hot shear blades</td>
<td>35~45</td>
</tr>
<tr>
<td>Hot forging dies</td>
<td>42~50</td>
</tr>
</tbody>
</table>

Heat treatment of specimens

- Quenching: 1030℃, AC, Tempering: 615℃, AC, Twice

DHA World

High hardenability & toughness Hot Work Die Steel

DHA1-EX: 1,2387 steel, Double melted, Re-forging: 1,2387 steel, Quenching: 1030℃, Gas quenching with Air

DHA1-A

DHA1

DHA21

Heat treatment

<table>
<thead>
<tr>
<th>Re-forging Temperature (°C)</th>
<th>Heat treatment (°C)</th>
<th>Hardness</th>
<th>Transformation Temp. (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>900~1200</td>
<td>Annealing</td>
<td>50~60HRC</td>
<td>815~875</td>
</tr>
<tr>
<td>820~870</td>
<td>Quenching</td>
<td>550~650HRC</td>
<td>35~53HRC</td>
</tr>
<tr>
<td>1000~1050</td>
<td>Tempering</td>
<td>≤ 229HSW</td>
<td>300(Austenitized at 1030°C)</td>
</tr>
</tbody>
</table>

DHA is a registered trademark or trademark of Daido Steel Co., Ltd.
Properties

**Tempered hardness**
- Specimen: 10mm x 15mm x 20mm
  - Quenching: 1300°C x 15min, AC

**Softening resistance**
- Specimen: 200mm H x 800mm W x 200mm L (Center)
  - Quenching: 1030°C, Gas cooling (5-8hr)

**CCT diagram**
- Aустенитній відділ, 1030°C x 15min

**Mechanical properties**

**Toughness**
- Specimen: 200mm H x 600mm W x 300mm L (Center)
  - Quenching: 1030°C, Gas cooling (6-8hr)

**Dimensional change**
- Specimen: Ø 50 x 45mm
  - Quenching: 1030°C x 1hr, Gas cooling

**Heat checking resistance**
- Material: 550mm x 200mm x 255mm (43HRC)
  - Quenching: 1030°C, Gas cooling (6hr)
  - Die casting: 1500mm, ADC12 (700°C) - Observed at 10.000mm

**Al erosion resistance**
- Specimen: Ø 10 x 30mm
  - Quenching: 1030°C, Gas cooling

**Nitriding characteristics**
- Nitriding: PS treatment
  - Initial hardness: 45HRC

**DHA WORLD**
- Gate
  - Opposite side of gate

**DHA1**
- Gate
  - Opposite side of gate