HIGH QUALITY TOOL STEEL

SX105V

COLD WORK TOOL STEEL WITH SUPERIOR FLAME-HARDENABILITY

Main Features

/Easy to Flame-harden
Sufficient hardenability
- Good hardness is obtainable even in still air.
Wide temperature range for flame-hardening.
- to prevent the scattering distribution of hardness
Flame-hardening of SX105V can be done very easily and successfully.

/High Toughness on the flame-hardened edges without tempering
SX105V has a sufficiently toughness and resistance to chipping and cracking.

/Good Weldability
SX105V intimate with welded metal , and also welded metal melts into SX105V smoothly. Welding of SX105V can be done more easily and successfully, even if tools to be welded are full-hardened.

/Excellent Wear Resistance
SX105V is flame-hardened to high and uniform hardness and shows a excellent wear resistance in combination with high toughness.

Applications
Blanking dies ,Forming dies,Trimming dies, Thread rolling dies,
Cold hobbing dies ,Gage and Shear blades
Flame-hardenability

Working temperature range of flame-hardening

Using oxygen-acetylene gas burner, flame-hardening can be easily carried out. After heating die edges to about 900°C, it is able to obtain high hardness by cooling in still air.

Table: Temperature range of flame-hardening of SX105V to obtain higher hardness than HRC60

<table>
<thead>
<tr>
<th>Material</th>
<th>Temperature Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>SX105V</td>
<td>825°C - 1075°C</td>
</tr>
</tbody>
</table>

(wide range) - Easy to handle

Hardness distribution after flame-hardening

Flame-hardened zone (Example) (higher than HRC50)

Steady high hardness

Wide hardened zone (>3mm)

Toughness of flame-hardened sample by bending

SX105V has superior good flame-hardenability.

(Technical data)

Quenching hardness curve

Tempering hardness curve

Hardenability (Jominy Curve)

Machinability by Drill

Drill: High speed steel
Feed: 0.07mm/rev.
Speed of rev.: 2000 rpm
Specimen: SX105V (H8197), SKD11 (H8197)

Toughness of full-hardened sample by bending

SX105V has superior good flame-hardenability.
Flame-hardening Procedure

Step 1. Appropriate operating place for flame-hardening
★ Flame-hardening should be done under the shade to identify the temperature of the work piece.
★ Under the excessive light, the judgment of temperature of heating die edge is difficult.

Step 2. Selection of gas burners
Suitable gas burners for flame-hardening

<table>
<thead>
<tr>
<th>Type of burner</th>
<th>Cutting torch</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.100-300</td>
<td>No.1-2</td>
</tr>
<tr>
<td>Pressure of gases</td>
<td></td>
</tr>
<tr>
<td>Oxygen</td>
<td>1.5Kg/cm²</td>
</tr>
<tr>
<td>Acetylene</td>
<td>0.2Kg/cm²</td>
</tr>
<tr>
<td>Pressure of gases</td>
<td></td>
</tr>
<tr>
<td>1.5Kg/cm²</td>
<td>0.3Kg/cm²</td>
</tr>
</tbody>
</table>

★ No.225 type burner is recommended for general use.
★ Use No.100-150 type burner when the shape of dies is liable to distort.

Step 3. Arrangement of dies
★ In case of the assembled dies, disassemble all the dies from the die holder. If the dies are flame-hardened on the holder as assembled, a gap between dies might be widened by distortion of dies.
★ Put the die on the position easy to perform flame-hardening.

Step 4. Adjustment of flame
★ Fig. A shows an appropriate flame-hardening.
★ Control the shape of neutral to be spherical.

Step 5. Heating for flame-hardening
★ Fig. B shows a general setting figure of the burner for flame-hardening.
★ As the die edge is heated to a temperature 950-1000°C, advance the burner.
(Austenitizing temperature range of SX165V is 825-1075°C)

Step 6. Cooling
★ Cooling in still air is good enough to obtain high hardness.

Step 7. Hardness test
★ After the dies cool down to room temperature, test the hardness of die edge by a file or a scriber.
★ If the desired hardness might not be obtained, refer to the following.

Case 1. If an excessive hardness be obtained, temper the die at a temperature 150-200°C
Case 2. If the hardness be lower than the desired one, following two causes are considered.

(1) Caused by poor heating
   Return to the Step 5 and the die edge is heated at a higher temperature than the previous one.
(2) Caused by overheat
   a) Polish the die edge surface to a depth sufficient to remove overheated surface layer.
   b) After annealing the die or tempering it at 650°C return to the Step 5 and heat the die edge at a lower temperature than the previous one.
Full-hardening

Quenching: from 825-875°C in oil

Tempering (150°C~)

Welding procedure

SX105V even in hardened condition, can be welded easily and successfully.

1. Prior to welding, **preheat the die to 150-200°C** to avoid welding crack.
2. **Weld:** Keep the temperature during the welding operation to avoid welding crack.
3. After welding, postheat to 150-200°C, then cool in air.

Reference. Chemical composition of some welded metals generally used for SX105V in Japan

<table>
<thead>
<tr>
<th>Consumables</th>
<th>Hardness of welded metal</th>
<th>Chemical composition of welded metal(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HRC52-59</td>
<td>C    Si    Mn    Cr    Mo    V    W</td>
</tr>
<tr>
<td>SB</td>
<td>HRC52-59</td>
<td>0.51 0.51 0.35 6.50 1.30 0.62 -</td>
</tr>
<tr>
<td>EA600W</td>
<td>HRC52-56</td>
<td>0.4-0.5 2.5-3.0 0.4-0.5 8.0-9.0 - -</td>
</tr>
<tr>
<td>H-11Cr</td>
<td>HRC48-51</td>
<td>0.30 0.83 2.46 10.78 - -</td>
</tr>
<tr>
<td>HF-650</td>
<td>HRC55-59</td>
<td>0.65 0.92 0.87 5.10 1.13 0.53 1.40</td>
</tr>
<tr>
<td>CS-650</td>
<td>HRC55-58</td>
<td>0.36 2.77 0.43 7.93 0.54 - -</td>
</tr>
<tr>
<td>QD-600</td>
<td>HRC55-59</td>
<td>0.40 0.30 0.34 7.42 1.30 - 9.76</td>
</tr>
</tbody>
</table>

Note:

[Select electrodes (Check electrodes)]

- For MMA welding, it is recommended that coated electrodes be heated to 80-150°C to remove hydrogen which cause hydrogen cracking.

[Surface preparation for welding]

- Surface of the die materials must be clean and dry before welding.
- All cracks and the rough tool marks should be removed.

[Preparation of repair area]

- A groove depth of about 3.2mm is commonly used.
- In case of repairing the entire cutting or working edge, the edge should be chanfered at 45° for a sufficient depth.

[Welding]

- If the diameter of welding rod is 3.2 φ, the selection of welding electric current is 100-120A.
- In case of the large area, it can be partially build up with a soft metal and then completed with a tool filler metal.
- Pinning is often required to reduce distortion and prevent cracking.

The information and data in this sheet are typical or average values which performed on specific condition. There is no warranty with respect to the values in actual conditions.