CPM S45VN is a martensitic stainless steel designed to offer improved corrosion and wear resistance over CPM S35VN. Its chemistry has been rebalanced so that it forms more chromium carbides, while at the same time leaving more free chromium in the matrix. The use of Niobium and Nitrogen in place of some of the Vanadium and Carbon produces an excellent combination of edge retention, wear resistance, corrosion resistance and toughness properties making this the ideal choice for an EDC knife steel.

The CPM process produces very homogeneous, high quality steel characterized by superior dimensional stability, grindability and toughness compared to steels produced by conventional melting practices.

<table>
<thead>
<tr>
<th>Carbide Type and Volume</th>
<th>Vanadium</th>
<th>Niobium</th>
<th>Chromium</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPM S45VN</td>
<td>3.0%</td>
<td>0.5%</td>
<td>11.5%</td>
<td>15.0%</td>
</tr>
<tr>
<td>CPM S35VN</td>
<td>3.0%</td>
<td>0.5%</td>
<td>10.5%</td>
<td>14.0%</td>
</tr>
<tr>
<td>CPM S30V</td>
<td>4.0%</td>
<td>12.0%</td>
<td>12.0%</td>
<td>12.0%</td>
</tr>
<tr>
<td>440C</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>154 CM</td>
<td>0%</td>
<td>17.5%</td>
<td>17.5%</td>
<td>17.5%</td>
</tr>
<tr>
<td>CPM S90V</td>
<td>9.0%</td>
<td>11.0%</td>
<td>11.0%</td>
<td>20.0%</td>
</tr>
</tbody>
</table>

Tool Steel Comparograph

- Toughness
- Wear Resistance
- Corrosion Resistance

Relative Values

Typical Applications

Long-Wearing Specialty Cutlery
Plastic Injection and Extrusion Feed Screws and Dies
Non-Return Valve Components
Pelletizing Equipment
Wear Components for Food and Chemical Processing

Note: These are some typical applications. Your specific application should not be undertaken without independent study and evaluation for suitability.

Crucible Industries LLC

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Thermal Treatments

Forging: 2100°F (1150°C) Do not forge below 1750°F (950°C).
Annealing: Heat to 1650°F (900°C), hold 2 hours, slow cool no faster than 25°F (15°C) per hour to 1100°F (595°C), then furnace cool or cool in still air to room temperature.
Annealed Hardness: About BHN 255

Stress Relieving
Annealed Parts: Heat to 1100-1300°F (595-705°C), hold 2 hours, then furnace cool or cool in still air.
Hardened Parts: Heat to 25-50°F (15-30°C) below original tempering temperature, hold 2 hours, then furnace cool or cool in still air.
Straightening: Best done warm 400-800°F (200-425°C)

Hardening
Preheat: Heat to 1550-1600°F (845-870°C) Equalize.
Austenitize: 1900-2000°F (1035-1095°C), hold time at temperature 15-30 minutes.
Quench: Air or positive pressure quench (2 bar minimum) to below 125°F (50°C), or salt or interrupted oil quench to about 1000°F (540°C), then air cool to below 125°F (50°C).
Temper: Double temper at 400-750°F (200-400°C). Hold for 2 hours minimum each time. (See Table) A freezing treatment may be used between the first and second tempers. Freezing treatments help to attain maximum hardenability and must always be followed by at least one temper. NOTE: For optimum stress relieving, CPM S45VN may be tempered at 1000-1025°F (540-550°C). Tempering in this range may result in a slight decrease in corrosion resistance.
Size Change: +0.05 to +0.10% when fully martensitic. The presence of retained austenite may reduce the net growth. When hardening at 400-750°F (200-400°C), freezing treatments may be necessary to minimize retained austenite.

Recommended Heat Treatment:
Austenitize 1950°F (1065°C). Quench to below 125°F (50°C).
Double temper at 600°F (315°C) 2 hrs. minimum each temper. Cool to hand warm between tempers. A freezing treatment may be added between tempers.
Aim hardness: 59-61 HRC

Machinability and Grindability
In the annealed condition, CPM S45VN is much easier to machine than CPM S90V and easier to machine than CPM S30V. Similar grinding equipment and practices used for high speed steels are recommended. “SG” type alumina wheels or CBN wheels have generally given the best performance with CPM steels.