

C	Si	Mn	Cr	Mo	W	V	Co
0.83			4.1	5.0	6.4	1.9	

### Features and Uses

This is general-purpose high-speed steel and is a standard material with leading toolmakers for the manufacture of high-class cutting tools.

It has excellent wear resistance combined with toughness and is readily machinable in the annealed condition.

Applications include turning planning and slotting tools, reamers, drills, cutters, hobs, taps, punches and dies, blanking dies and punches for steel sheet and plate, high silicon transformer materials, stainless steel and iron, brass, copper, zinc and hard abrasive metals generally. Deep drawing dies, cupping dies, forming dies. Sheet metal forming rolls, shear blades for strip and sheet including flying shears. Circular cutters for cold rolled strip. Trimmer dies, thread rolling dies, cold extrusion dies. Broaches, plug gauges, ring gauges, special taps, staybolt taps. Brick and tile mould liners. Master hobs for cold hobbing, plastic moulds. Cut moulds for plastics.

### Working and Heat Treatment

#### Forging

Pre-heat at 900°C / 950°C. then raise temperature to 1050° / 1150°C. Soak until uniformly heated. The temperature must not be allowed to fall below 880° / 900°C. Cool very slowly after forging and protect from draughts.

#### Annealing

Saben 652 is supplied in the annealed and machinable condition. Re-annealing will only be necessary if the steel has been forged by the toolmaker

or if it is desired to machine a hardened tool.

To anneal, heat slowly and uniformly to 850°C. in a closed container. Soak for three to four hours and allow to cool in the furnace to shop temperature.

#### Stress relieving

When tools are heavily machined, ground or otherwise subjected to cold work, the relief of internal strains is advisable before hardening to minimize the possibility of distortion. Stress relieving should be done after rough machining. To stress relieve, heat carefully at 650° / 700°C. Soak well and cool in the furnace or in air. The tools may then be finish-machined before hardening.

#### Hardening

Very slow initial heating is essential when hardening high speed steels and the steel should be warmed through on the furnace top then pre-heated slowly to 840° / 860°C. and allow to soak at this temperature. It is preferable to heat the tools in a controlled atmosphere. If this is not possible, pack hardening is recommended. A reducing atmosphere is desirable. The tools may then be brought up to 1200° / 1240°C. Avoid undue soaking at the hardening temperature but remove when the tools are soaked through.

Hardening in a neutral salt bath is advantageous when treating cutters or other tools with delicate teeth or edges as it will minimize decarburisation. The tools should be air quenched from the hardening temperature in a dry air blast or oil, removed, and left to cool until hand warm before tempering.

Martempering is an alternative hardening procedure, which may be used when suitable salt bath equipment is available. By this method internal strain, distortion and risk of quench cracking are reduced to the minimum. Pre-heat dry at 300° / 400°C. Pre-heat in salt at 850 / 900°C holding in the salt for ten minutes per inch of ruling section. Raise to the hardening temperature of 1200° / 1240°C. holding in the salt until heated through.

Marquench in salt at 550° / 580°C, allow to equalize, remove and cool in still air until hand warm. Tempering will be necessary.

#### Tempering

Double tempering is recommended. Tempering should be done with the least possible delay after hardening, preferably when the tools are still hand warm. Refer to the tempering curve and select a suitable temperature bearing in mind the service requirements usually 540 ° / 560°C. Heat slowly and uniformly. When the tool has reached the desired temperature, soak for at least sixty minutes, withdraw from the furnace and allow to cool in air. Double tempering is essential for maximum tool performance, The second tempering should be a repetition of the first.

#### Final Grinding

Select the correct grade of wheel in consultation with the grinding wheel manufacturer. Keep the wheel in good condition by means of a suitable dressing tool. Wet grinding is preferable using a copious supply of coolant. If dry grinding is resorted to, use a very soft wheel.

#### Martempering