VIMAC3V®

High Speed Steel

VILLARES METALS
a voestalpine company

The presented information in this datasheet is only for technical guidance and represents our present state of knowledge of this product. This information shall not be considered as warranty of specific properties or fitness for a particular application of this product.

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SIMILAR STANDARDS

VIMAC3V® is similar to the following grades: AISI M3:2; EN 1.3345; HS-6-5-3C; W.Nr. 1.3395; AFNOR Z 120 WDCV 06-05-04-03; UNS T11323; JIS SKH53.

GENERAL INFORMATION

VIMAC3V® is a molybdenum-tungsten-vanadium high speed steel with excellent properties of wear resistance and improved grindability when compared with other 3% vanadium conventional high speed steels.

MAIN CHARACTERISTICS

VIMAC3V® vanadium content is responsible for the formation of primary MC type carbides, which promote a high abrasive wear resistance, Addition of molybdenum and tungsten assures a high adhesive wear resistance due to the formation of M_2C and M_6C carbides. Special thermomechanical processing is used to the control of the carbide size, optimizing the balance between toughness and wear resistance.

CHEMICAL COMPOSITION

Typical Analysis (Weight Percent)

C	Si	Mn	Cr	Mo	W	V	Fe
1.20	0.40	0.30	3.85	6.50	5.90	2.80	Bal.

STANDARD PRODUCTION RANGE

Production Route	Standard	Production Range*	Finishing
Rolled Products	ASTM A600 EN ISO 4957	Round coils: 5,00-13,50 mm Round bars: 3,00-152mm	As rolled Centerless ground Peeled
Forged Products		Rounds: 152 – 360 mm	Turned Peeled

*Square and flats are also available upon inquiry.

DELIVERY CONDITION

VIMAC3V® is usually available in round bars in annealed condition with maximum hardness of 290 HB and in round coils with maximum hardness of 269 HB.

HEAT TREATMENTS

Soft Annealing

Soft annealing should be carried out by heating between 870 and 900°C for 2 hours, followed by cooling with cooling rate between 10 and 20°C per hour until 650°C followed by air cooling. In this treatment, the use of protective atmosphere is important to avoid surface oxidation and decarburization.

Stress Relief

Stress relief heat treatment consists in heating to 600-700°C for 2 hours minimum followed by furnace cooling until 500°C.

Hardening

Preheat the part in to steps at 540-650°C and 845-870°C and followed by austenitizing to a temperature between 1205 and 1230°C. Lower austenitizing temperatures (1100 to 1150 °C) should be considered for cold-work applications.

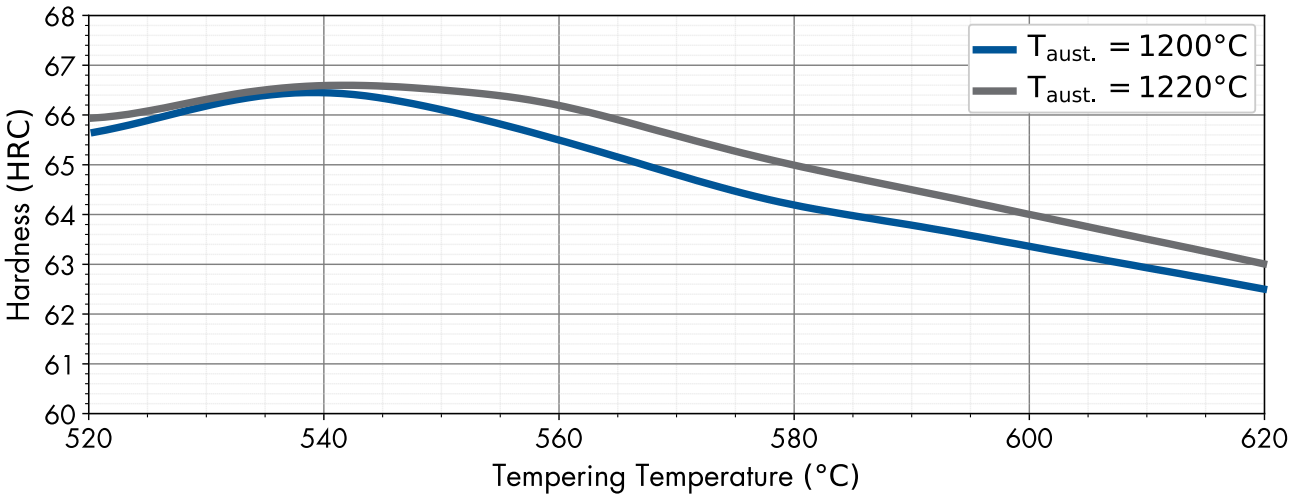
After austenitization, the quenching can be performed in different quench media as:

- Pressurized vacuum furnace with pressure higher than 5 bar,
- Salt or fluidized bed between 450 - 550°C,
- Air cooling.

Tempering

The parts shall be tempered immediately after quenching, i.e. as soon as they reach 60°C. It is necessary, at least, double tempering. Triple tempering is recommended. After each tempering parts shall be slowly cooled to room temperature.

Tempering temperatures are generally between 540-595°C depending upon the desired hardness. The time of each tempering cycle shall be at least 2 hours in temperature. For parts with thickness larger than 70 mm, the time at temperature should be calculated according to their size, being a reference for calculation about one hour for each inch of thickness.



Tempering curve of VIMAC3V® after hardening at 1200°C and 1220°C. Tempering time: 2 hours
Curve obtained from specimens with 20 mm x 20 mm x 20 mm

Surface Treatments

Surface treatments as PVD and CVD are recommended when higher adhesive and abrasive wear resistance are required.

Nitriding can also be performed in order to improve abrasive wear resistance. Surface treatments shall be carried out after hardening and tempering.

MAIN APPLICATIONS

The properties of VIMAC3V® make possible its use in many applications, being classified as a general-purpose high-speed steel. Some typical application are presented below:

- Taps,
- Broaches,
- Milling cutters,
- General purpose drills,
- Knives and saws,
- Reamers,
- Dies or inserts for cold work tooling where high wear resistance is required.

MACHINABILITY

VIMAC3V® can be conventionally machined in the annealed condition. Care need to be taken in the selection of the tool and the speed in order to allow a good machinability and reduce the risk to surface overheating and cracking. When machining removal is greater than 30%, a stress relief is recommended as to avoid distortions on the part during the hardening and tempering,

Electro-erosion process can be employed in heat treated parts. After electro-erosion machining it is recommended to remove the superficial layer thru fine grinding wheel and perform a tempering heat treatment in temperatures around 50°C lower than that of the last tempering.

MECHANICAL PROPERTIES

Typical bend test results for VIMAC3V® are presented in the table below.

Bend Strength	Fracture Energy	Total Deflection
3200 MPa	8,9 J	1.5 mm

PHYSICAL PROPERTIES

Density:

Temperature	g/cm³	lb/in³
20°C (68°F)	8.10	0.292

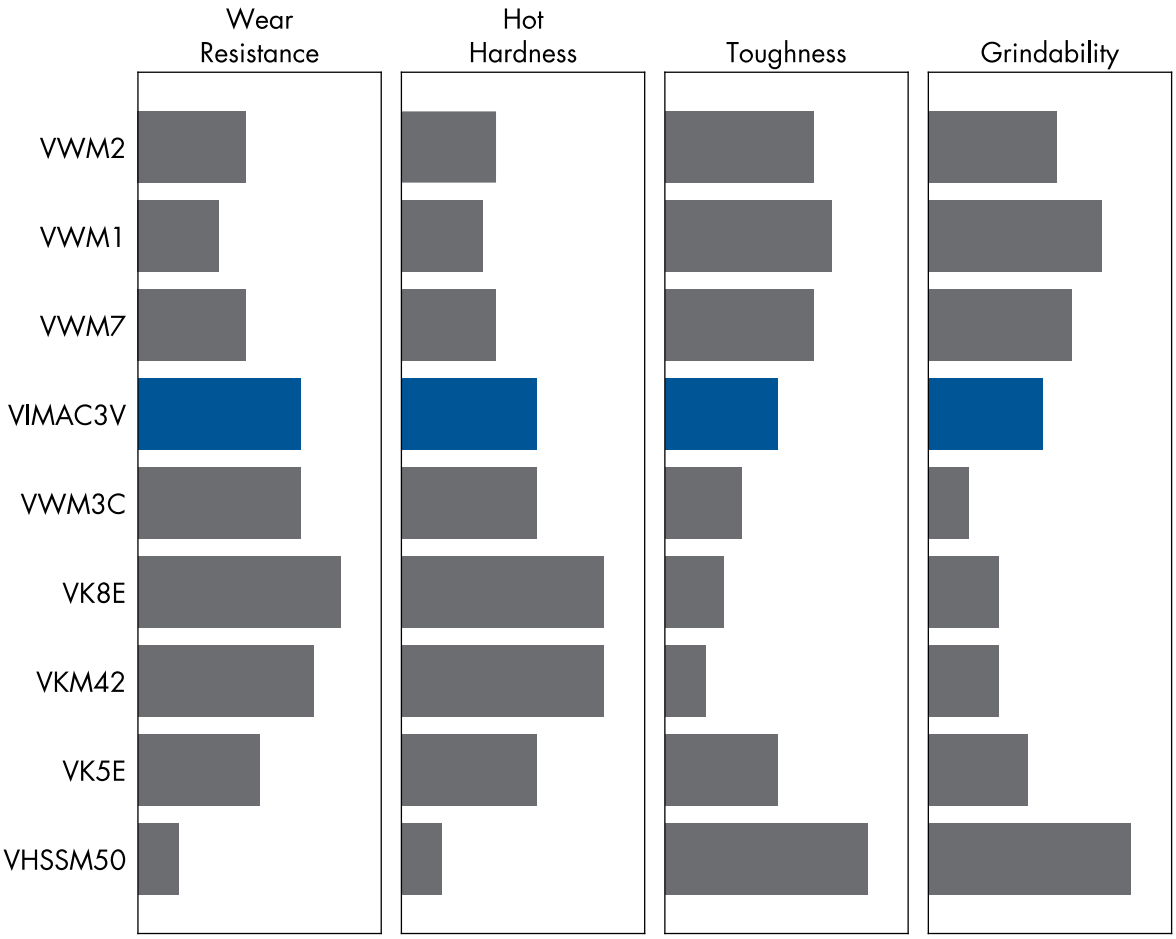
Specific Heat:

Temperature 20 °C to (68°F to)	J/kg.K	Btu/lb.°F
100°C (212°F)	460	0.110

Thermal Expansion Coefficient:

Temperature 20 °C to (68°F to)	10^{-6} m/m.K	10^{-6} in/in.°F
425°C (797°F)	11.5	6.4
540°C (1004°F)	12.0	6.7
650°C (1202°F)	12.8	7.1

COMPARISON BETWEEN VILLARES METALS HIGH SPEED STEELS



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AS 9100 D
NORSOK M-650
NADCAP – Heat Treating and Non Destructive Testing

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