VF800ATIM®

Cold Work Tool 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.

Edition 1, 01.2021

SIMILAR STANDARDS

VF800ATIM® is a non-standardized steel developed by Villares Metals. This steel has no similar standard.

GENERAL INFORMATION

VF800ATIM® is a cold work tool steel with excellent arrange of properties. In relation AISI D series tool steels, VF800ATIM® presents finer structure, improved by ESR processing assuring a high isotropy of the properties, which leads to high toughness keeping higher wear resistance.

MAIN CHARACTERISTICS

VF800ATIM® has a martensitic matrix with chromium, vanadium and molybdenum primary carbides. Due to its microstructure and chemical balance, VF800ATIM® presents a higher resistance to cracking or chipping when compared to other AISI D types such as D2, D3 and D6, which results in a better machinability and grindability.

This steel is produced by ESR (Electro-Slag Remelting) process to assure high isotropy of mechanical properties. Due to its high isotropy, this steel is commonly indicated for applications where the resistance to initiation and propagation of mechanical and thermal cracks are essential.

When compared to other cold work steels, VF800ATIM® has also a higher resistance to adhesive wear, dimensional stability, even when it is heat treated to 62 HRC, and a high hardenability, leading to minimum distortion and resistance to cracking during quenching.

CHEMICAL COMPOSITION

Typical Analysis (Weight Percent)

C	Si	Mn	Cr	Mo	V	Fe
0,85	0,90	0,4	8,40	2,1	0,5	Bal.

STANDARD PRODUCTION RANGE

Production Route	Production Range	Finishing
Rolled Products	Thickness between 8 to 152 mm with width between 25 to 320mm Rd. 5.50-152mm	Centerless ground Peeled Turned
Forged Products	Rd. 152 – 550 mm Thickness up to 300mm with width up to 500mm	Turned Peeled Milled

*Other dimensions and conditions are available upon inquiry.

DELIVERY CONDITION

Usually VF800ATIM® is available in round, square or flat bars in annealed condition with maximum hardness of 255HBW. This steel can also be supplied in the final heat treatment condition.
Identification color: white, blue, white. 

HEAT TREATMENTS

Soft Annealing

Soft annealing should be carried out by heating between 870 and 900° for 1 hour for each inch of thickness followed by a cooling rate between 10 and 20°C per hour until 650°C and, then, 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 aims to reduce the residual stress of the part and it shall be employed after machining and before hardening. It shall be applied in parts with draws and profiles, in which the machining removal has been higher than 30% in other to minimize distortions after hardening.

Stress relief heat treatment consists in a slowly heating to 500-600°C, holding 2 hours in temperature and furnace cooling until 200°C and then free cooling in air. In case that this heat treatment is applied after hardening and tempering, the stress relief shall employ a temperature 50°C lower than that of the last tempering temperature.

Hardening

Preheat the part to 790- 830°C in two steps, until the temperature from center to surface is equal in each step. The austenitizing temperature should be between 1020 and 1050°C. The choice of the ideal temperature should also consider aspects of design and finishing details of the parts.

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

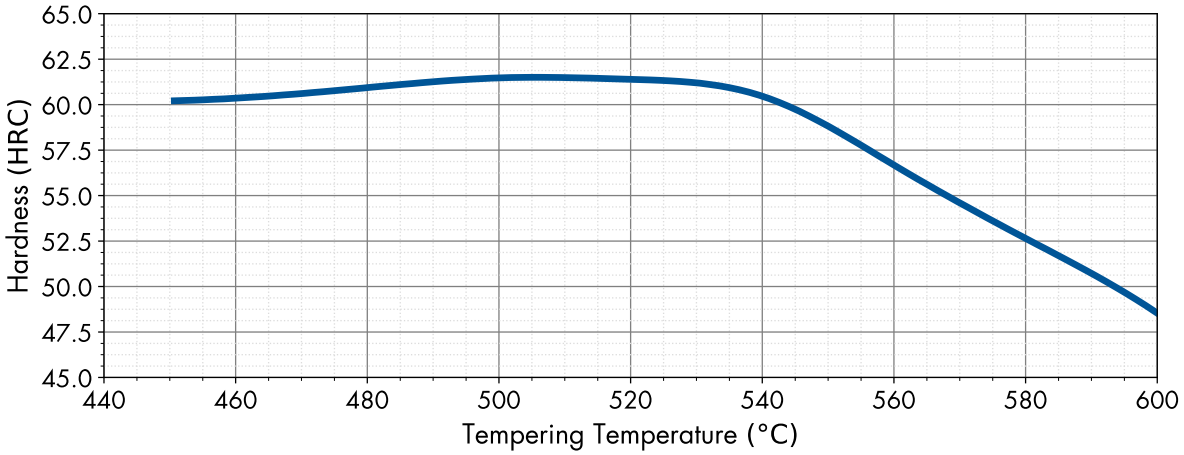
- Pressurized vacuum furnace with pressure higher than 5 bar.
- Warm oil between 40 - 70°C.
- Salt or fluidized bed between 450 - 550°C.
- Forced air cooling.

Tempering

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

Tempering temperatures are generally between 500-600°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 VF800ATIM® after hardening at 1030°C. Tempering time: 2 hours
Curve obtained from specimens with 20 mm x 20 mm x 20 mm

Surface Treatments

Surface treatments as nitriding, PVD and CVD are recommended when higher values of surface hardness and high abrasion wear resistance are required. Surface treatments shall be employed after hardening and tempering since their temperatures is at least 50°C lower than tempering heat treatments.
As tempering temperatures are higher than 500°C, VF800ATIM® have no risk of decrease in core hardness during nitriding. This is another advantage in relation to AISI D grades.
PVD or CVD coatings can also be applied in VF800ATIM® without decrease in core hardness.

MAIN APPLICATIONS

VF800ATIM® can be employed in several cold work tools, including that where both high wear resistance and toughness are necessary. Some typical applications are:

- Blanking, piercing and coining dies
- Punches and dies used to cold form metals in stamping presses and extrusion.
- Tools for press forming dies.
- Deep drawing and thread-rolling dies.
- Blades for cold shearing flat materials, with thickness up to 13 mm (1/2 inches). Also for cold slitting up to 6.5 mm (1/4 inches),
- Cold rolling mill rolls
- Cold heading dies

MACHINABILITY

VF800ATIM® can be conventionally machined in the annealed condition. Due to its refined structured, VF800ATIM® presents good behavior in grinding operations, considerably better than D2, D6 and D3 steels. This contributes to reduce the risk to surface overheating and cracking.
Care need to be taken in the selection of the tool and the speed to allow a good machinability. In order to avoid distortions on the part during the hardening and tempering heat treatments, it is recommended to perform a stress relief heat treatment before hardening, if it was removed more than 30% of part weight in machining operations.
Electro-erosion process can be employed in heat treated dies or molds. After electro-erosion machining it is recommended to remove the superficial layer thru fine grinding wheel. After grinding, it is recommended to perform a tempering heat treatment in temperature around 50°C lower than that of the last tempering.

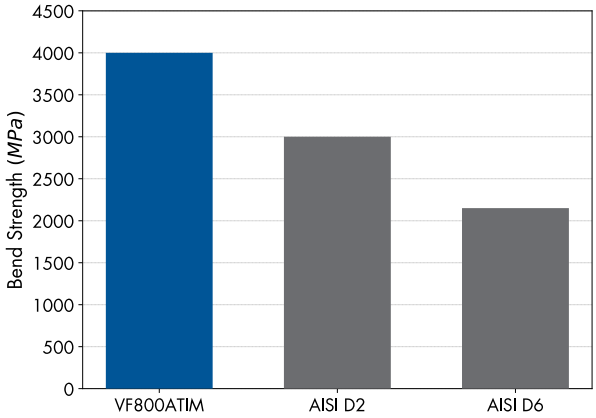
WELDING

It is not recommended to perform welding operations on VF800ATIM® steel. Welding operations will produce Heat Affected Zones (HAZ), which will reduce the performance of the steel in the application. In exceptional cases and always considering that the welding would be a temporary solution,
VF800ATIM® may be welded using special procedures to minimize the HAZ. The welding procedure in this case shall consider a pre-heating and post heat treatment of stress relief in temperatures around 50°C lower than that of the last tempering employed. The filler material shall be selected from the same grade.

MECHANICAL PROPERTIES

Typical bend test properties of VF800ATIM® indicates better toughness in comparison with AISI D2 and AISI D6. VF800ATIM® presents much higher toughness and is therefore able to reduce the tendency to failures by cracking, chipping or spalling. Besides, its higher

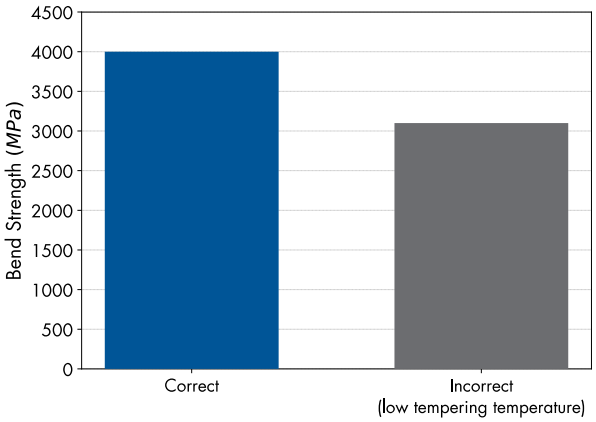
toughness contribute to improve adhesive wear resistance, which in many application, is better than that for AISI D2.



Values for specimens taken from the core of a 60 mm round bar, in longitudinal orientation. Hardness of 60 HRC

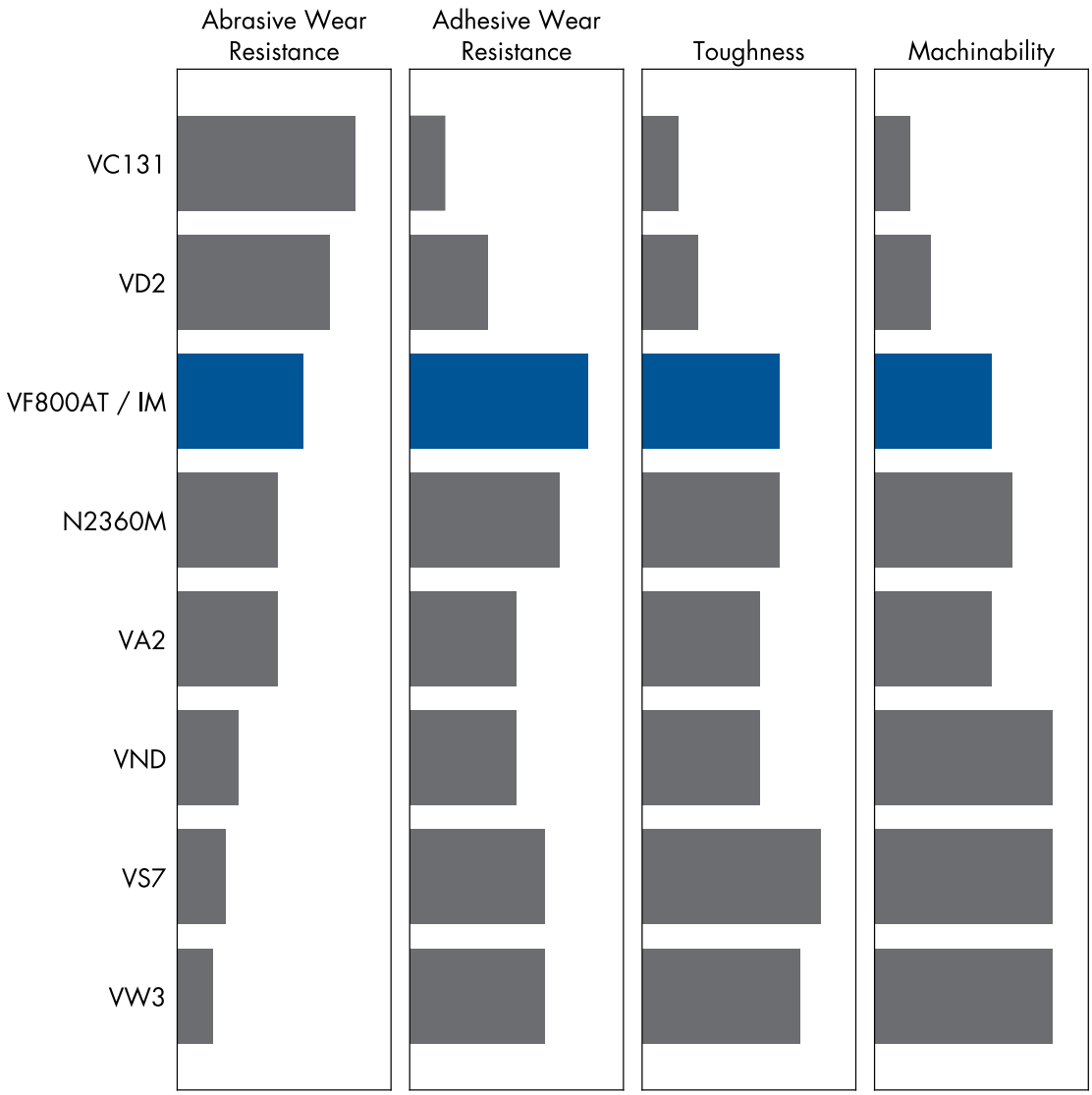
TOOL LIFE IMPROVEMENT

For optimizing tool life, a proper heat treatment is absolutely necessary (see item before). Incorrect heat hardening or tempering temperatures lead to considerable decrease in toughness and substantially reduce tool life.



Results for specimens taken from the core of a 60 mm round bar, in longitudinal direction orientation, correctly and incorrectly tempered to 60 HRC

COMPARISON BETWEEN VILLARES METALS COLD WORK STEEL



VILLARES METALS
a voestalpine company

Headquarters | Sales Office – Worldwide

Villares Metals S.A.
Rua Alfredo Dumont Villares, 155
Jardim Santa Carolina | CEP 13178.902
Sumaré - SP
+55 19 3303 8000
tooling@villaresmetals.com

Services & Solutions Centers – Brazil

Sumaré
Rua Alfredo Dumont Villares, 155
Jardim Santa Carolina | CEP 13178.902
Sumaré - SP
0800 707 0577
cac@villaresmetals.com

Flores da Cunha
Rod VRS 814, KM 1
Lagoa Bela | CEP 95270.000
Flores da Cunha - RS
0800 707 0577
cac@villaresmetals.com

Joinville
Perini Business Park
Rua Dona Francisca, 8.300, bloco C7
Distrito Industrial | CEP 89219.600
Joinville - SC
0800 707 0577
cac@villaresmetals.com

Vespasiano
Parque Norte Business Center
Avenida Três, 105
Morro Alto | CEP 33200.000
Vespasiano - MG
0800 707 0577
cac@villaresmetals.com

Sales Office – Europe

Villares Metals International B.V.
Delftse Poort - units 17.10-17.11
Weena 505
3013 AL - Rotterdam
The Netherlands
+31 6 15 95 14 51
info@villaresmetals.com

ISO 9001:2015
ISO 14001:2004 (ANAB and UKAS)
ISO 17025
ISO 50001
OHSAS 18001:2007
IATF 16949:2016
AS 9100 D
NORSOK M-650
NADCAP – Heat Treating and Non Destructive Testing