

VR 400 ESR



Plastic mould steel

1 Main characteristics and applications

VR400 is a high hard tool steel ideal to produce block with thickness up to 1300mm in large size with an high performance of trough hardening homogeneity. To be used for plastic injection moulds, compression moulds, big sizes moulds for automotive industry with texturing.

VR400 is designed to provide improved performances and offers the following advantages:

- uniform hardness across the full thickness up to 1300mm.
- high polishability.
- high machinability.
- excellent suitability for texturing.
- greatly increased thermal conductivity.
- improved weldability as W 1.2738.
- good toughness.

2 Chemical composition (typical; in weight %)

C	Mn	Si	P	S	Cr	Mo	Ni
0.29	1.50	Max 0.30	0.010	0.001	1.3	0.57	1.05

3 Production technology

Electro-slag-remelting (ESR) - Forging - Heat treatment QT

4 US specification

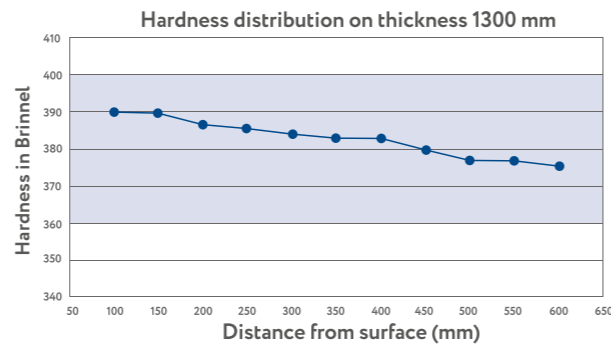
In according to standard EN10228-3 Class 4 and standard SEP 1921 Class E/e

5 Delivery condition

VR400 is delivered in quenched and tempered condition, with hardness range 360 - 400 HB (39 - 43 HRC).

6 Through hardenability

The high performance of hardenability for thickness 1300 mm, is obtained by an optimized balance of chemical composition and a special manufactured process.



7 Physical properties (reference values)

	20°C	100°C	250°C	500°C
Thermal expansion coefficient (10 ⁻⁶ /K)	11.4	11.6	12.7	14.2
Thermal conductivity (W/mk)	36	36.7	38	34.3
Young modulus (Kn/mm ²)	211	207	199	166

12 Polishing Range

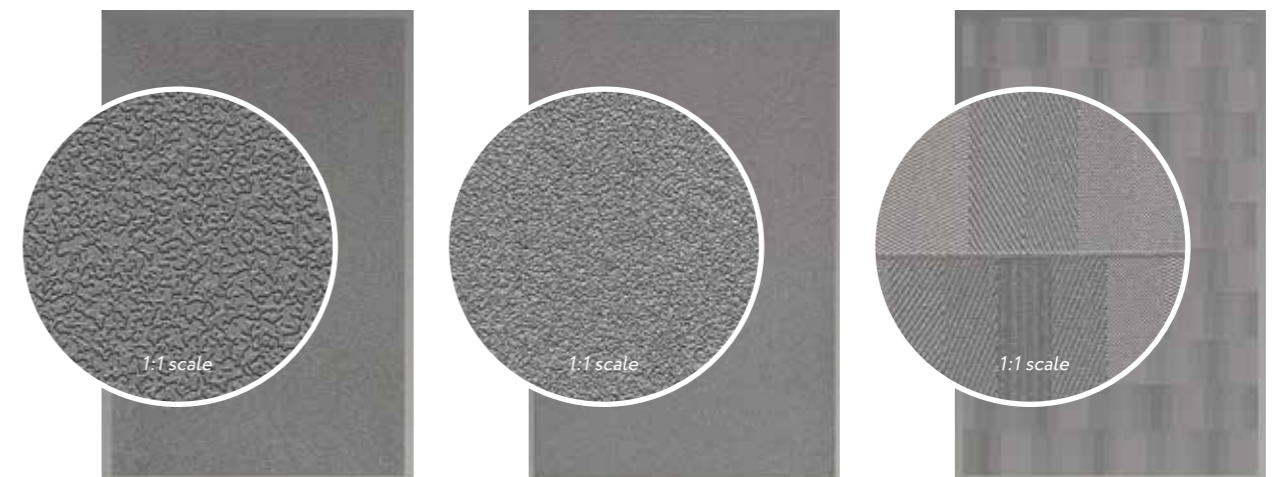
Code	Type of polishing	Application	Roughness μm
VR01	Silicon Carbide Grinding Paper "100"	Technical polishing of internal parts or stamp	RA 0.69-RZ 4.62
VR03	Silicon Carbide Grinding Paper "150"	Technical polishing of extraction parts	RA 0.57-RZ 3.62
VR05	Silicon Carbide Grinding Paper "240"	Technical polishing of stamps and mold	RA 0.39-RZ 3.40
VR07	Silicon Carbide Grinding Paper "400"	Technical polishing of mold product to paint	RA 0.23-RZ 2.28
VR09	Silicon Carbide Grinding Paper "800"	Pre-Lapping	RA 0.21-RZ 1.22
VR11	Polishing Pads 320 Sisal	Polishing from pads 320 and Sisal	RA 0.06-RZ 0.34
VR13	Dry Diamond Polishing Pads 400 (3 μm)	Lapping of paint pieces (frompads 400)	RA 0.03-RZ 0.12
VR15	Dry Diamond Polishing Pads (Lapping 1 μm)	Lapping of transparent pieces	RA 0.02-RZ 0.10
VR17	Optical lapping 1/4 μm	Special lapping of transparent pieces (glasses lens)	

Roughness tolerance: RA +/- 10% from VR01 to VR09 and +/- 15% from VR11 to VR17
RZ +/- 10% from VR01 to VR09 and +/- 15% from VR11 to VR17



13 Texturing Samples

Texturing performed by Standex Mold-tech with patterns Standex MT 9086, MT 9055 and 9083

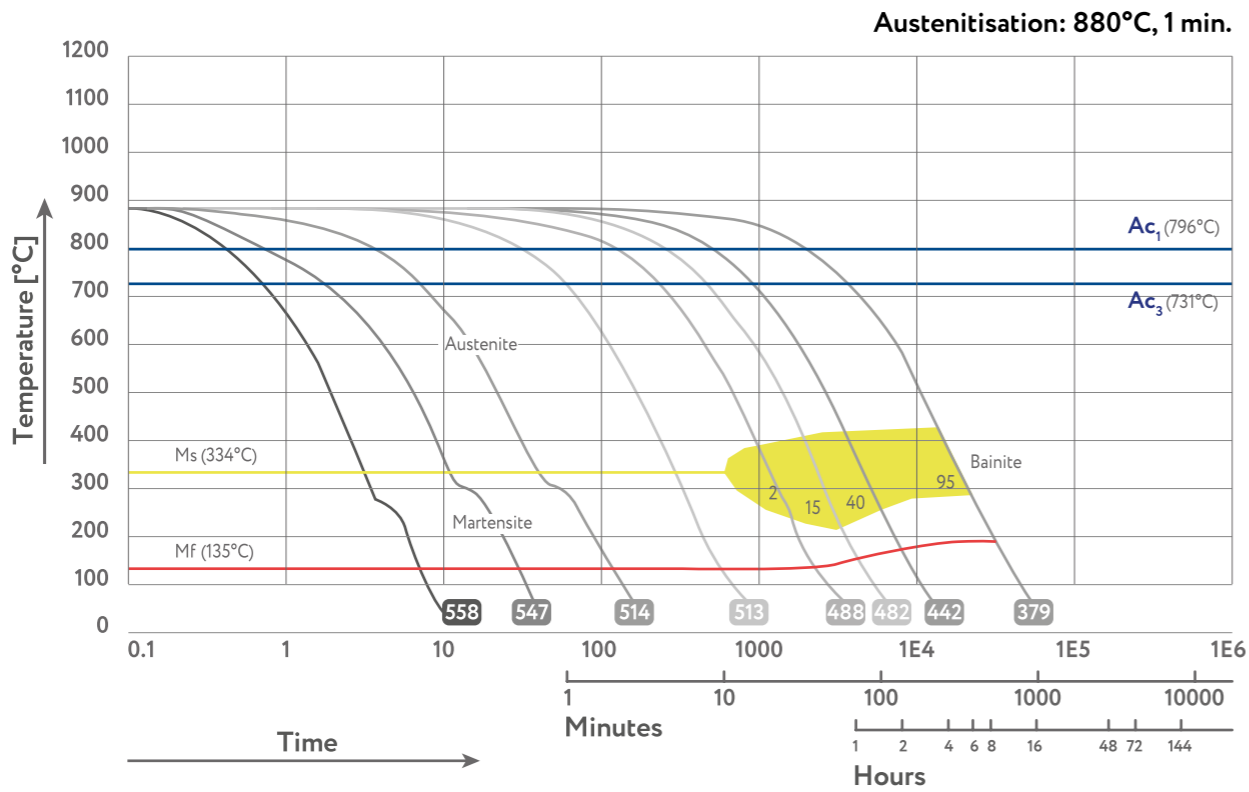




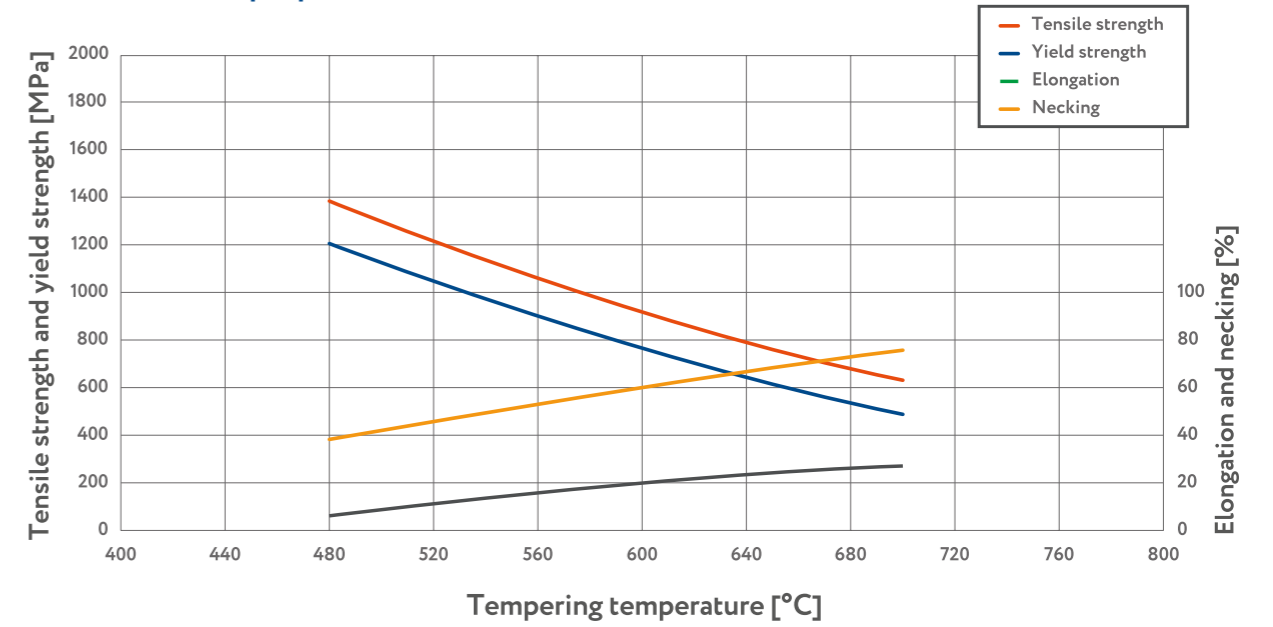
8 Heat treatment

TREATMENT	TEMPERATURE	HOLDING TIME (HT)	COOLING	COMMENTS
Annealing	Heat to 650 - 700 °C	Min. H.T. for 2 minute /mm	Air or furnace	In order to obtain hardness lower than 250 HB (24 HRC) to improve machinability
Stress relieving	Heat to 500 - 550 °C	Min. H.T. for 2 minute /mm	Air or furnace	To be carried out after machining, is recommended to eliminate the residual stresses induced by mechanical working
Hardening	Heat to 860 - 900 °C	Min. H.T. for 1 minute /mm	Polymer	-
Tempering	Heat to 550 - 610 °C	Min. H.T. for 3 minute /mm	Air or furnace	To be carried out after hardening. 2nd Tempering must be performed to max 30°C below tempering temperature

9 C.C.T. curve



10 Mechanical properties



11 Tempering curve

