VACODUR MAX

COMPOSITION (in wt%)
49 Co – 49 Fe – 1 V + Nb

PRODUCT DESCRIPTION
The family of VACODUR® alloys has been developed for more demanding requirements with respect to high strength combined with high saturation. The yield strength can be adjusted by varying the heat treatment temperature.

The yield strength of VACODUR Max can be set over a wide range from 150 to 400 MPa. This makes the material especially suitable for applications in electric motors: stator and rotor laminations can be stamped from the same strip to achieve the most efficient use of material before undergoing different heat treatments in order to attain a magnetically optimized stator and a mechanically optimized rotor with defined yield strength.

For even higher yield strengths please refer to VACODUR S Plus.

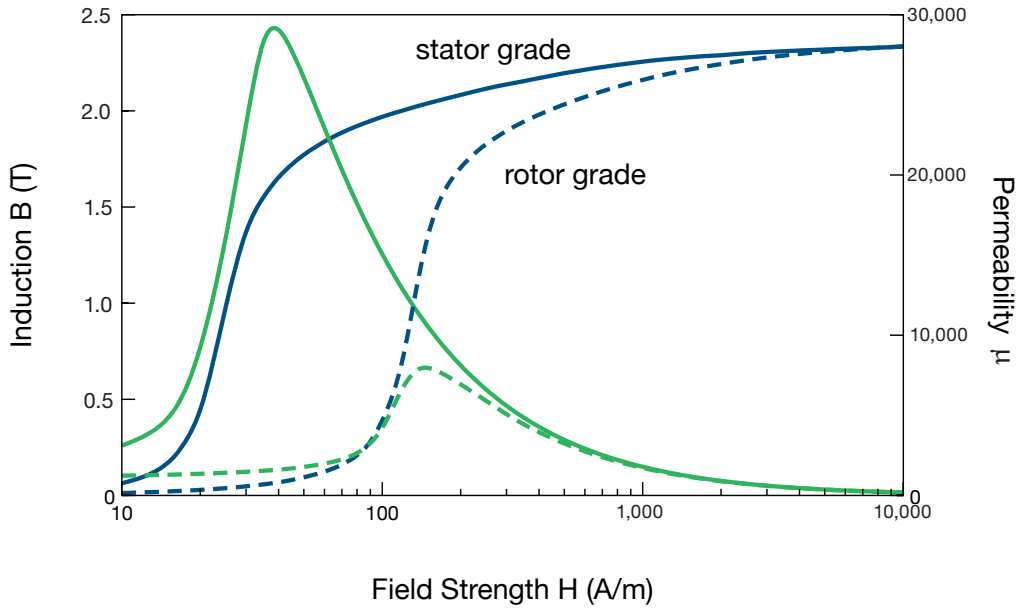
MAIN PROPERTIES
- Saturation polarization of J_S = 2.35 T
- Electrical resistivity of ρ_e = 0.31 µΩm
- Yield strength $R_{p0.2}$ up to 400 MPa

TYPICAL APPLICATIONS
Rotors and stators of high speed rotating electrical motors and generators.

FORMS OF SUPPLY
- Strip material, thickness 0.05 – 0.15 mm, width 120 – 320 mm
- Stamped parts, laminations and laminated assemblies

Other dimensions, solid material and tolerances upon request

VACODUR Max Strip Material – Typical Static Initial Curve



STRIP MATERIAL 0.1 mm- TYPICAL VALUES

PHYSICAL PROPERTIES	Unit	
Mass density ρ	g/cm^3	8.14
Thermal conductivity (25 °C) λ	W/(m · K)	42
Thermal expansion coefficient (20 – 100 °C) α	10^{-6}/K	9
Electrical resistivity ρ_e at 20 °C	µΩm	0.31

STATIC MAGNETIC PROPERTIES (20 °C)		stator grade	rotor grade
Coercivity H_C	A/m	35	120
Saturation polarization J_S	T	2.35	2.35
Saturation magnetization B_S at H = 40 kA/m	T	2.4	2.40
Maximum Permeability μ_{max}		22,000	7,000
Magnetostriction constant λ_S	ppm	+65	+65
Curie temperature T_C	°C	950	950

SPECIFIC IRON LOSSES OF STRIP MATERIAL AFTER FINAL HEAT TREATMENT		stator grade				rotor grade			
		0,1 mm		0,15 mm		0,1 mm		0,15 mm	
		20 °C	120 °C	20 °C	120 °C	20 °C	120 °C	20 °C	120 °C
p_{Fe} 1.5 T 50 Hz	W/kg	1.1	1.0	1.2	1.0	3.3	3.2	3.1	3.0
p_{Fe} 1.5 T 400 Hz	W/kg	13	12	15	14	30	29	31	29
p_{Fe} 1.5 T 1,000 Hz	W/kg	44	41	60	57	91	84	101	95
p_{Fe} 2.0 T 50 Hz	W/kg	1.8	1.6	1.8	1.7	5.8	5.6	5.3	5.1
p_{Fe} 2.0 T 400 Hz	W/kg	21	19	26	24	52	51	53	51
p_{Fe} 2.0 T 1,000 Hz	W/kg	74	70	109	102	152	147	175	168

MECHANICAL PROPERTIES (final annealed)		stator grade	rotor grade
Young's modulus E	GPa	200	250
Yield strength $R_{p\,0.2}$	MPa	150	400
Tensile strength R_m	MPa	350	700
Elongation A	%	4	8
Hardness	HV	180	220

MECHANICAL PROPERTIES (cold rolled)		
Yield strength $R_{p\,0.2}$	MPa	1,150
Tensile strength R_m	MPa	1,230
Elongation A	%	1
Hardness	HV	360

RECOMMENDED PARAMETERS FOR THE FINAL HEAT TREATMENT		stator grade	rotor grade
Atmosphere		hydrogen	hydrogen
Temperature	°C	915	735
Annealing time	h	6	3
Cooling rate	K/h	100 – 200	100 – 200

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