VACODUR 49

Laminations and an assembled stator produced from VACODUR 49 strip material

COMPOSITION (in wt%)

49 Co – 49 Fe – 2 V + Nb
IEC 60404-8-6 F11
ASTM A 801-09 Alloy Type 1

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 49 can be set over a wide range from 210 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.

TYPICAL APPLICATIONS

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

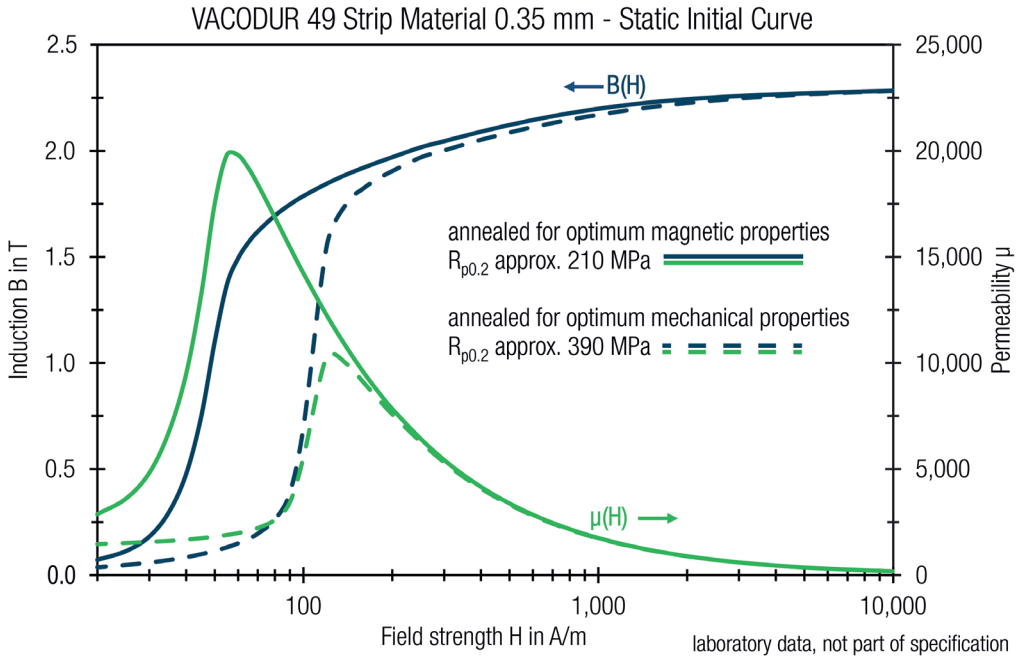
MAIN PROPERTIES

- Saturation polarization of J_S = 2.30 T
- Electrical resistivity of ρ_e = 0.42 µΩm
- Yield strength $R_{p0.2}$ up to 400 MPa

FORMS OF SUPPLY

- Strip material, thickness 0.05 – 1 mm, width 120 – 320 mm
- Stamped parts, laminations and laminated assemblies

Other dimensions, solid material and tolerances upon request



STRIP MATERIAL 0.35 mm - TYPICAL VALUES

PHYSICAL PROPERTIES	Unit	
Mass density ρ	g/cm^3	8.12
Thermal conductivity (25 °C) λ	W/(m · K)	32
Thermal expansion coefficient (20 – 100 °C) α	10^{-6}/K	8.9
Electrical resistivity ρ_e	µΩm	0.42

STATIC MAGNETIC PROPERTIES		magnetically optimized	mechanically optimized
Coercivity H_C	A/m	50	110
Saturation polarization J_S	T	2.30	2.30
Saturation magnetization B_S at H = 40 kA/m	T	2.35	2.35
Maximum Permeability μ_{max}		18,000	8,000
Magnetostriction constant λ_S	ppm	+70	+70
Curie temperature T_C	°C	950	950

SPECIFIC IRON LOSSES OF STRIP MATERIAL AFTER FINAL HEAT TREATMENT		Strip thickness			Strip thickness		
		0.15 mm	0.20 mm	0.35 mm	0.15 mm	0.20 mm	0.35 mm
p_{Fe} 1.5 T 50 Hz	W/kg	1.3	1.5	1.6	2.5	2.6	3.0
p_{Fe} 1.5 T 400 Hz	W/kg	15	19	31	24	28	42
p_{Fe} 1.5 T 1,000 Hz	W/kg	55	74	150	76	96	174
p_{Fe} 2.0 T 50 Hz	W/kg	2.0	2.3	2.5	4.0	4.1	5.0
p_{Fe} 2.0 T 400 Hz	W/kg	25	32	60	40	46	78
p_{Fe} 2.0 T 1,000 Hz	W/kg	100	138	333	134	172	365

MECHANICAL PROPERTIES (final annealed)		magnetically optimized	mechanically optimized
Young's modulus E	GPa	200	250
Yield strength $R_{p\,0.2}$	MPa	210	390
Tensile strength R_m	MPa	400	720
Elongation A	%	4	8
Hardness	HV	185	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		magnetically optimized	mechanically optimized
Atmosphere		hydrogen	hydrogen
Temperature	°C	880	750
Annealing time	h	6	3
Cooling rate	K/h	100 – 300	100 – 300

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