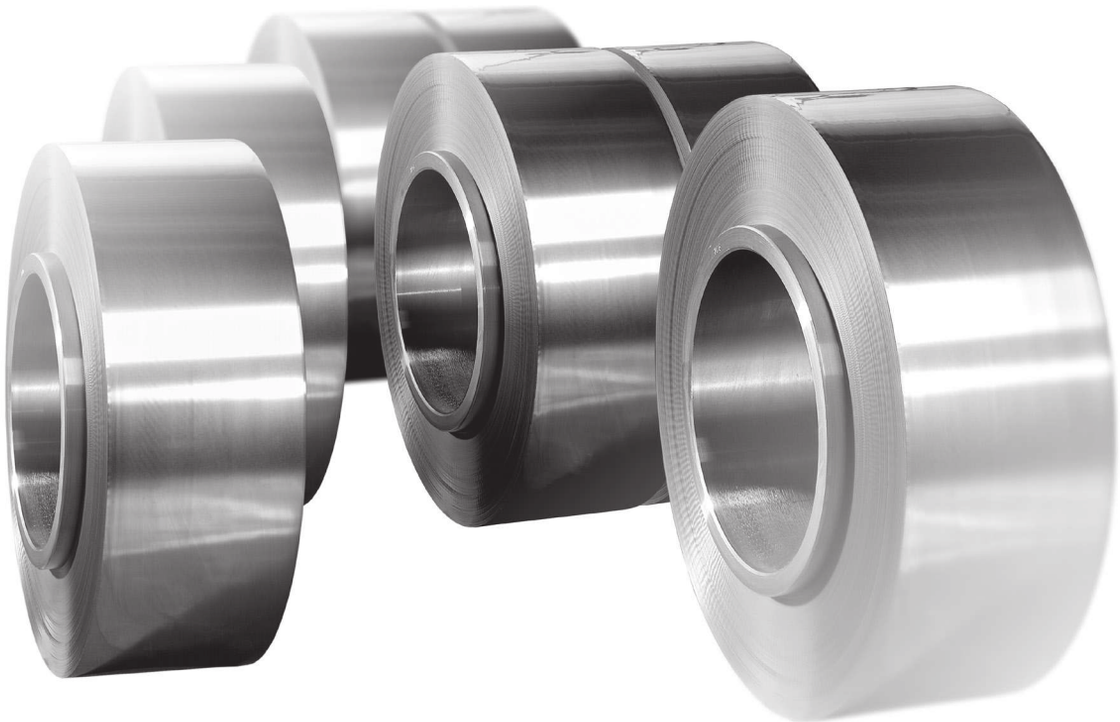
APPLICATION NOTES

VAC ALLOYS

FOR MOTOR AND GENERATOR APPLICATIONS



COBALT-IRON ALLOYS
(VACOFLUX, VACODUR)

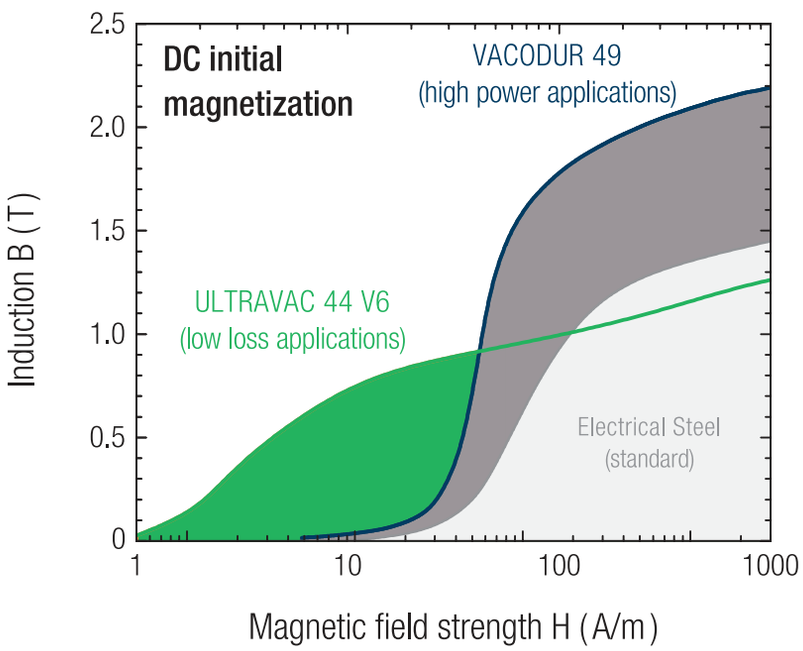
- Maximum forces and power densities
- Low losses
- High strength

NICKEL-IRON ALLOYS
(PERMENORM, MEGAPERM, ULTRAVAC)

- Lowest losses
- Highest permeabilities

ADVANCED MAGNETIC SOLUTIONS

VACUUMSCHMELZE

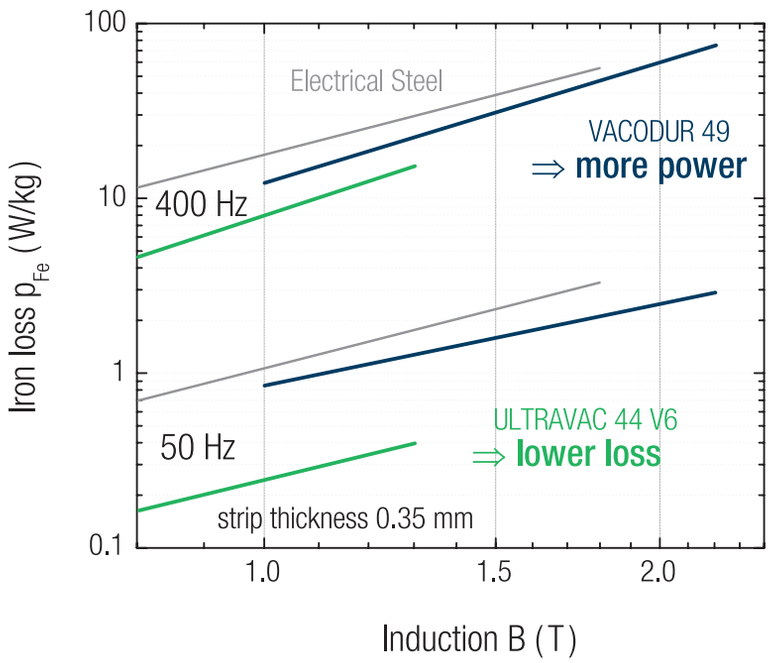


VACUUMSCHMELZE is one of the world leaders in the field of magnetic materials. The product range covers soft magnetic materials and products as well as permanent magnets and inductive components. Our strength is the development and production of innovative materials.
VAC's product range of soft magnetic materials comprises nickel-iron (e.g. PERMENORM®, MEGAPERM®, ULTRAVAC®) and cobalt-iron (VACOFLUX®, VACODUR®) alloys as well as amorphous and nanocrystalline alloys.

Our cobalt-iron alloys VACOFLUX 48 and VACOFLUX 50 have the highest saturation polarisation and surpass all known soft magnetic materials. A variety of properties may be obtained by using special compositions and selecting the optimum production procedures.

VACODUR 49 and VACODUR 50 are further developments of VACOFLUX 50 with respect to higher strength and ductility. Optimum mechanical performance for high-speed rotating motors and generators can be achieved with the newly developed VACODUR S Plus. This material shows extra high strength properties in combination with good magnetic performance.

A high induction B is the most important property to achieve a maximum magnetic force F. Due to the fact that the force in motors and actuators increases with square of the induction VACOFLUX and VACODUR open up new possibilities for high power density solutions.



In comparison to Electrical Steel VAC alloys offer lower iron losses in all cases:

- Lower hysteresis losses because of lower coercivity forces:
  Nickel-iron alloys: PERMENORM, MEGAPERM, ULTRAVAC

- Lower eddy current losses because of higher electrical resistivity
  Nickel-iron alloys: PERMENORM, MEGAPERM, ULTRAVAC

- Lower additional loss effect
  Cobalt-iron alloys: VACOFLUX, VACODUR

Beside the iron losses the easy magnetisation of the VAC alloys offers a reduction of the required current to achieve equivalent induction values. Therefore the copper losses are minimized, too.

ALLOY COMPARISION (typical properties for 0.35 strip material)							
Property	**Induction**	**Iron Loss**					**Yield**
	@800A/m	**@1T/50Hz**	**@1T/400Hz**	**@1.5T/50Hz**	**@1.5T/400Hz**	**@2T/50Hz**	**Strength**
	B_{800}	p_{Fe} 1/50	p_{Fe} 1/400	p_{Fe} 1.5/50	p_{Fe} 1.5/400	p_{Fe} 2/50	$R_{P0.2}$
Unit	(T)	(W/kg)	(W/kg)	(W/kg)	(W/kg)	(W/kg)	(MPa)
Electrical Steel (Standard)							
M270-35A	1.45	1.0	17	2.5	42	–	450
Cobalt-Iron Alloys (High Power & Strength)							
VACOFLUX 48	**2.18**	0.8	13	1.5	30	2.2	190
VACODUR 49 (mag. opt.)	**2.10**	0.9	13	1.6	31	2.5	210
VACODUR 49 (mech. opt.)	**2.05**	1.6	19	2.9	43	5.0	390
VACODUR S+ (mech. opt.)	1.20	7.1	64	17	154	32	**800**
Nickel-Iron Alloys (Low Loss)							
PERMENORM 5000 V5	1.45	0.25	9.1	**0.59**	**26**	–	< 250
MEGAPERM 40 L	1.45	**0.28**	**8.6**	–	–	–	< 250
ULTRAVAC 44 V6	1.25	**0.25**	**8.1**	–	–	–	< 250

FORMS OF SUPPLY AND DELIVERY STATES

Materials

Cold rolled strips and sheets
- Thickness range 0.05 - 2 mm, customized production
- Customized width
- Optional with insulation coating

Hot rolled, forged or cold drawn rods
- Diameter range 4 - 100 mm, customized production
- Customized surface condition

In order to achieve optimum soft-magnetic properties the material has to get a final magnetic heat treatment. If this cannot be done by the customer, the heat treatment can be offered by VAC. Further information can be found in our brochure 'Soft Magnetic Materials and Semi-finished Products' (www.vacuumschmelze.com)

Parts

VAC is also producing parts, final annealed laminations and assemblies especially for motor and generator applications. Please see our separate leaflet.

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VAC ALLOYS • EDITION 2014
Published by VACUUMSCHMELZE GmbH & Co. KG, Hanau, February 2022

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