

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®)

- Lowest Losses
- Highest Permeabilities



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) 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 50 is a further development 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 open up new possibilities for high power density solutions.



In Comparison to Silicon-Iron VAC alloys offer lower iron losses in all cases:

- Lower Hysteresis Losses because of lower Coercivity Forces: Nickel-Iron Alloys: PERMENORM, MEGAPERM
- Lower Eddy Current Losses because of higher electrical resistivity Nickel-Iron Alloys: PERMENORM, MEGAPERM
- 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 COMPARISON (typical values for strip material)				
Property	Coercivity	Electrical	Induction	Saturation
	Force	Resistivity	at $H = 16 \text{ A/cm}$	Polarisation
	H _C	$ ho_{el}$	B ₁₆	J _S
Unit	(A/cm)	(μΩm)	(T)	(T)
Silicon Iron (FeSi3)	0,2	0,40	1,45	2,03
Cobalt-Iron Alloys				
VACOFLUX 48	< 0,4	0,40	2,25	2,35
VACOFLUX 50	< 0,8	0,40	2,20	2,35
VACODUR 50 (*)	< 1,6	0,40	2,15	2,30
VACODUR S+ (*)	< 1,4	0,40	2,07	2,30
Nickel-Iron Alloys				
PERMENORM 5000 V5	0,04	0,45	1,55	1,55
MEGAPERM 40L	0,06	0,60	1,48	1,48
PERMENORM 3601 K5	0,1	0,75	1,30	1,30

(*) With optimum magnetic properties

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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