Technical Data Sheet - Alnico Magnets

Alnico Magnets

Alnico magnets have the best temperature coefficients of any magnet material.
Alnico magnets should be regarded as the best choice in extremely high temperature applications.
Alnico magnets can be produced by Casting or Sintering. Alnico is also rarely made by Bonding within a binder.
Cast Alnico is the most common form of Alnico magnet. Casting is often used to get "near net shape" Alnico magnets.
Casting Alnico is cost effective for both low and high volume, for small and very large magnets.
Sintered Alnico is cost effective for medium to high volume runs due to tooling cost. The parts are generally small to medium.
Sintered Alnico magnets are not so commonly used due to lower magnetic performance and limitation to simpler shapes.
Anisotropic magnets have the direction of magnetisation (DoM) permanently within the structure and give the maximum performance.
Isotropic magnets can be magnetised in many ways as they have no preferred direction of magnetisation but give reduced performance.
Cast Alnico 5 is the most common grade of Alnico, with the LNG44 variant of Alnico 5 (Alcomax 3) being the most popular.
Alnico5, Alnico 8 and Alnico 9 all exist with several sub-grades with differing performance characteristics.
Where the shape is new, tooling charges may apply. It is common for the magnet pole faces to be machined to finish.
Alnico produced to specific Br, Hc, Hci and BHmax may be possible but at extra cost. Keeping within normal grades is advised.
Custom or bespoke magnet shapes may carry an additional tooling cost and even a minimum order charge.
Alnico Assemblies are also possible.

Anisotropic Cast Alnico

Typical Range of Values

Material	Br		Hc (Hcb)		Hci (Hcj)		BHmax	
	T	kG	kA/m	kOe	kA/m	kOe	kJ/m^3	MGOe
Alnico 5 (Alnico5_LNG34)	1.10	11.0	50	0.63	52	0.65	34	4.25
Alnico 5 (Alnico5_LNG37)	1.18	11.8	50	0.61	51	0.64	37	4.63
Alnico 5 (Alnico5_LNG40)	1.20	12.0	50	0.63	52	0.65	40	5.00
Alnico 5 (Alnico5_LNG44)	1.25	12.5	50	0.65	54	0.68	44	5.50
Alnico 6 (Alnico6_LNG28)	1.15	11.5	58	0.73	60	0.75	28	3.50
Alnico 5DG (Alnico5DG_LNG52)	1.30	13.0	56	0.70	58	0.73	52	6.50
Alnico 5-7 (Alnico5-7_LNG60)	1.35	13.5	58	0.73	60	0.75	60	7.50
Alnico 8 (Alnico8_LNGT38)	0.80	8.0	110	1.38	112	1.4	38	4.75
Alnico 8 (Alnico8_LNGT40)	0.85	8.5	115	1.44	117	1.46	40	5.00
Alnico 8 (Alnico8_LNGT44)	0.90	9.0	115	1.44	117	1.46	44	5.50
Alnico 8HC (Alnico8HC_LNGT36J)	0.72	7.2	150	1.18	152	1.90	36	4.50
Alnico 9 (Alnico9_LNGT60)	1.00	10.0	110	1.38	112	1.4	60	7.50
Alnico 9 (Alnico9_LNGT72)	1.05	10.5	115	1.44	117	1.46	72	9.00
Alnico 9 (Alnico9_LNGT80)	1.08	10.8	120	1.50	122	1.53	80	10.00

Alnico 5 (LNG44) = Alcomax 3 = Alnico 500 = LNG44
Alnico 6 (LNG28) = Alcomax 4 = Alnico 400 = LNG28
Alnico 5DG (LNG52) = Alcomax 3SC = Alnico 600 = LNG52
Alnico 5-7 (LNG60) = Columax = Alnico 700 = LNG60
Alnico 8 (LNGT44) = Hycomax 3 = Alnico 8HE = LNGT44
Alnico 8 (LNGT40) = Hycomax 2 = Alnico 8H = LNGT40
Alnico 8 (LNGT38) = Alnico 8B = LNGT38
Alnico 8HC (LNGT36J) = Alnico 8HC = LNGT36J

Anisotropic Sintered Alnico

Typical Range of Values

Material	Br		Hc (Hcb)		Hci (Hcj)		BHmax	
	T	kG	kA/m	kOe	kA/m	kOe	kJ/m^3	MGOe
Alnico 5 (Alnico5_FLNG34)	1.15	11.5	48	0.60	50	0.63	34	4.25
Alnico 6 (Alnico6_FLNG28)	1.10	11.0	58	0.73	60	0.75	28	3.50
Alnico 8HC (Alnico8HC_FLNG36J)	0.72	7.2	150	1.88	152	1.90	36	4.50
Alnico 8 (Alnico8_FLNGT38)	0.80	8.0	110	1.38	112	1.40	38	4.75
Alnico 8 (Alnico8_FLNGT44)	0.85	8.5	120	1.50	122	1.53	44	5.50
Alnico 8 (Alnico8_FLNGT48)	0.92	9.2	125	1.56	127	1.59	48	5.50

Isotropic Cast Alnico

Typical Range of Values

Material	Br		Hc (Hcb)		Hci (Hcj)		BHmax	
	T	kG	kA/m	kOe	kA/m	kOe	kJ/m^3	MGOe
Alnico 3 (Alnico3_LN10)	0.65	6.5	38	0.48	40	0.50	10	1.25
Alnico 2 (Alnico2_LNG12)	0.75	7.5	45	0.56	46	0.58	12	1.50
Alnico 8 (Alnico8_LNG18)	0.55	5.5	90	1.21	97	1.21	18	2.25

Isotropic Sintered Alnico

Typical Range of Values

Material	Br		Hc (Hcb)		Hci (Hcj)		BHmax	
	T	kG	kA/m	kOe	kA/m	kOe	kJ/m^3	MGOe
Alnico 3 (Alnico3_FLN10)	0.65	6.5	40	0.50	42	0.53	10	1.25
Alnico 2 (Alnico2_FLNG12)	0.75	7.5	45	0.56	46	0.58	12	1.50
Alnico 8 (Alnico8_FLNGT18)	0.60	6.0	95	1.19	98	1.23	18	2.25
Alnico 8 (Alnico8_FLNGT20)	0.62	6.2	100	1.25	105	1.31	20	2.50

Bonded Alnico

Typical Range of Values

Material	Br		Hc (Hcb)		Hci (Hcj)		BHmax	
	T	kG	kA/m	kOe	kA/m	kOe	kJ/m^3	MGOe
Alnico_BLN7	0.31	3.1	79	1.00	103	0.85	6.77	0.86
Alnico_BLN8	0.34	3.4	83	1.05	107	1.00	7.96	1.00

Physical Characteristics (Typical)

Characteristic	Symbol	Unit	Value
Density	D	g/cc	6.9-7.3
Vickers Hardness	Hv	D.P.N	520-700
Curie Temperature	Tc	°C	800
Compression Strength	C.S	N/mm^2	300-400
Coefficient of Thermal Expansion	C//	10^{-6}/°C	11.5-13
	C⊥	10^{-6}/°C	11.5-13
Electrical Resistivity	ρ	μ Ω.cm	45-70
Tensile Strength	σ_{UTS} or S_U	x10^6 Pa	20-450 (37 LNG44)
Hardness		Rockwell	45-55
Curie Temperature	Tc	°C	810-860

Max Working Temperature
(Please note - your application will affect the performance available)

Material	Maximum recommended temperature
Alnico 2	450 degrees C
Alnico 3	450 degrees C
Alnico 5	525 degrees C
Alnico 6	525 degrees C
Alnico 5DG	525 degrees C
Alnico 5-7	525 degrees C
Alnico 8	550 degrees C
Alnico 8HC	550 degrees C
Alnico 9	550 degrees C
Bonded Alnico	200 degrees C

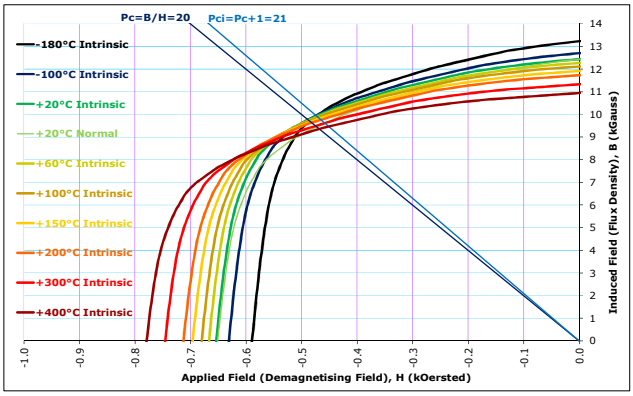
Corrosion Resistance

Alnico is regarded as having very good to excellent corrosion resistance for most applications.
Because iron exists within the Alnico alloy, corrosion may be seen during prolonged exposure to water.
Alnico can be coated or painted (e.g. Red Paint) but this is often only for aesthetic purposes.

Temperature coefficients

Rev.Temp.Coef. of Induction (Br), α, %/°C	Rev.Temp.Coef. of Intrinsic Coercivity (Hci), β, %/°C
-0.03 (Alnico 2, Cast)	-0.02 (Alnico 2, Cast)
-0.035 (Alnico 2, Sintered)	-0.025 (Alnico 2, Sintered)
-0.035 (Alnico 3, Cast)	-0.025 (Alnico 3, Cast)
-0.03 (Alnico 3, Sintered)	-0.02 (Alnico 3, Sintered)
-0.02 (Alnico 5, Cast and Sintered)	+0.01 (Alnico 5, Cast and Sintered)
-0.02 (Alnico 6, Cast and Sintered)	+0.03 (Alnico 6, Cast and Sintered)
-0.02 (Alnico 5DG, Cast)	+0.03 (Alnico 5DG, Cast)
-0.02 (Alnico 5-7, Cast)	+0.03 (Alnico 5-7, Cast)
-0.025 (Alnico 8, Cast and Sintered)	+0.01 (Alnico 8, Cast and Sintered)
-0.025 (Alnico 8HC, Cast and Sintered)	+0.01 (Alnico 8HC, Cast and Sintered)
-0.025 (Alnico 9, Cast and Sintered)	+0.01 (Alnico 9, Cast and Sintered)

Example Alnico second quadrant demagnetisation BH curve



Additional Information

The magnet shape, its environment, and the actual application affect how the Alnico magnet will perform.
The Intrinsic curve (not the Normal curve, although similar in shape for Alnico) is needed to assist in determining magnet suitability.
For Alnico, it is important to keep the working point above the "knee" of the Intrinsic curve to avoid severe demagnetisation.
Rotating machines and generators using Alnico need careful design due to the varying air gap during rotor rotation.
We can assist in designing in resistance to demagnetisation. We can guide you with your design options.
A length to diameter (L/D) ratio of at least 4 or 5 is a rule of thumb guide when using Alnico. A high L/D ratio is important for resisting demagnetising.
External demagnetising factors such as other magnets and electromagnets must be taken into account. They will put a field onto the magnet risking demagnetising it.
Even pushing two Alnico magnets in repulsion into each other can weaken their output. However careful handling will quickly resolve this. Alnico can be remagnetised.
The risk of demagnetisation of Alnico is reduced by improving the working point (e.g. use a longer magnet, increase the L/D ratio, use a higher Hc, introduce magnetic steel to the circuit, etc).
Alnico magnets have the best temperature coefficients of any magnet type. Alnico has the least change in field output over a change in temperature. They can also operate at the highest temperatures of any magnet.
Cast Alnico can have a blackened surface - this is the "As Cast" finish with the surface texture coming from the sand cast mold. Machining of the Alnico (e.g. precision ground pole faces) leaves a bright silvery metallic finish.
Very small air holes may be seen from time to time within the structure of cast Alnico magnets. This is natural for cast magnets (due to the casting process) and cannot be avoided.
If you have any more questions, require technical assistance and would like a quotation, simply contact us.

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FM31278