

Alnico Magnets

CAST, SINTERED AND BONDED

DATA SHEET

Alnico exists in Cast, Sintered and Bonded versions. Cast Alnico magnets are the most common.

Alnico magnets have superb temperature coefficients and work at the highest temperatures.

Alnico 5 (in particular the Alnico5_ACA44 variety) is the most popular cast magnet.

Sintered Alnico magnets are not so commonly used due to lower magnetic performance.

Anisotropic magnets have the direction of magnetisation permanently within the structure.

Isotropic magnets (no preferred direction of magnetisation) allow flexibility on magnetisation within the magnets.

Anisotropic magnets have higher magnetic outputs.

Alnico5, Alnico 8 and Alnico 9 exist with more than one set of properties (sub grades).

We have split the sub grades into more specific naming



for clarity e.g. Alnico5_ACA44=Anisotropic Cast Alnico 5 with Maximum Energy Product, (BH)max, of 44kJ/m³.

It may be possible to produce Alnico with specific Br, Hc, Hci and BHmax upon request.

Bespoke magnet shapes may carry an additional tooling cost and even a minimum order charge.

Bonded magnets will carry an additional tooling cost and a minimum order quantity charge.

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_ACA34)	1.10	11.0	50	0.63	52	0.65	34	4.25
Alnico 5 (Alnico5_ACA37)	1.18	11.8	50	0.61	51	0.64	37	4.63
Alnico 5 (Alnico5_ACA40)	1.20	12.0	50	0.63	52	0.65	40	5.00
Alnico 5 (Alnico5_ACA44)	1.25	12.5	50	0.65	54	0.68	44	5.50
Alnico 6 (Alnico6_ACA28)	1.15	11.5	58	0.73	60	0.75	28	3.50
Alnico 5DG (Alnico5DG_ACA52)	1.30	13.0	56	0.70	58	0.73	52	6.50
Alnico 5-7 (Alnico5-7_ACA60)	1.35	13.5	58	0.73	60	0.75	60	7.50
Alnico 8 (Alnico8_ACAT38)	0.80	8.0	110	1.38	112	1.4	38	4.75
Alnico 8 (Alnico8_ACAT40)	0.85	8.5	115	1.44	117	1.46	40	5.00
Alnico 8 (Alnico8_ACAT44)	0.90	9.0	115	1.44	117	1.46	44	5.50
Alnico 8HC (Alnico8HC_ACAT36J)	0.72	7.2	150	1.88	152	1.90	36	4.50
Alnico 9 (Alnico9_ACAT60)	1.00	10.0	110	1.38	112	1.4	60	7.50
Alnico 9 (Alnico9_ACAT72)	1.05	10.5	115	1.44	117	1.46	72	9.00
Alnico 9 (Alnico9_ACAT80)	1.08	10.8	120	1.50	122	1.53	80	10.00

Alnico 5 (ACA44) ≡ Alcomax 3 ≡ Alnico 500 ≡ LNG44

Alnico 6 (ACA28) ≡ Alcomax 4 ≡ Alnico 400 ≡ LNG28

Alnico 5DG (ACA52) ≡ Alcomax 3SC ≡ Alnico 600 ≡ LNG52

Alnico 5-7 (ACA60) ≡ Columax ≡ Alnico 700 ≡ LNG60

Alnico 8 (ACAT44) ≡ Hycomax 3 ≡ Alnico 8HE ≡ LNGT44

Alnico 8 (ACAT40) ≡ Hycomax 2 ≡ Alnico 8H ≡ LNGT40

Alnico 8 (ACAT38) ≡ Alnico 8B ≡ LNGT38

Alnico 8HC (ACAT36J) ≡ Alnico 8HC ≡ LNGT36J

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_ICA10)	0.65	6.5	38	0.48	40	0.50	10	1.25
Alnico 2 (Alnico2_ICA12)	0.75	7.5	45	0.56	46	0.58	12	1.50
Alnico 8 (Alnico8_ICA18)	0.55	5.5	90	1.21	97	1.21	18	2.25

Corrosion Resistance

Alnico offers very good to excellent corrosion resistance for many applications.

It can start to corrode when subjected to prolonged exposure to water (as iron is present in Alnico).

Alnico can be coated or painted (e.g. Red Paint) but this is usually for aesthetic purposes.

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_ASA34)	1.15	11.5	48	0.60	50	0.63	34	4.25
Alnico 6 (Alnico6_ASA28)	1.10	11.0	58	0.73	60	0.75	28	3.50
Alnico 8HC (Alnico8HC_ASA36)	0.72	7.2	150	1.88	152	1.90	36	4.50
Alnico 8 (Alnico8_ASA38)	0.80	8.0	110	1.38	112	1.40	38	4.75
Alnico 8 (Alnico8_ASA44)	0.85	8.5	120	1.50	122	1.53	44	5.50
Alnico 8 (Alnico8_ASA48)	0.92	9.2	125	1.56	127	1.59	48	5.50

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_ISA10)	0.65	6.5	40	0.50	42	0.53	10	1.25
Alnico 2 (Alnico2_ISA12)	0.75	7.5	45	0.56	46	0.58	12	1.50
Alnico 8 (Alnico8_ISA18)	0.60	6.0	95	1.19	98	1.23	18	2.25
Alnico 8 (Alnico8_ISA20)	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_BA7	0.31	3.1	79	1.00	103	0.85	6.77	0.86
Alnico_BA8	0.34	3.4	83	1.05	107	1.00	7.96	1.00

Temperature coefficients

Rev.Temp.Coeff. of Induction (Br), α , %/°C	Rev.Temp.Coeff. 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)

Additional Notes

How the magnet is used affects the working point of the magnet (shape, magnetic circuit, temperature, etc). When determining suitability, use the Intrinsic curve during analysis (not the Normal curve). Maximum performance is obtained by keeping the Intrinsic working point above the 'knee'. Although working at the BHmax working point minimises magnet volume, it can be near to the 'knee' in Alnico, risking demagnetisation. It is often advisable to take the Intrinsic working point considerably above the 'knee'. The intrinsic curve is very similar to the normal curve. Be aware that a single BH curve is given on data sheets and this is usually the Normal curve rather than the Intrinsic curve. Use the Intrinsic curve for correct calculations. Alnico can be easily demagnetised as the Intrinsic working point passes to the left of the 'knee'. The working point can vary if the magnetic circuit varies (e.g. magnets on a rotor has a variable air gap). Alnico magnets have the best temperature coefficients so have least change in field output over a change in temperature. They can also operate at the highest temperatures of any magnet. So be aware that the Intrinsic working point relative to the 'knee' of the curve can change with the environmental conditions and the application. If demagnetisation happens, the BH curve shape changes and performance falls. The risk of demagnetisation can be reduced if the working point is improved (e.g. use a magnet that is longer than before to increase the length to diameter ratio, introduce magnetic steel to the circuit, etc). A length to diameter (L/D) ratio of at least 4 or 5 is a good rule of thumb guide for Alnico. However, any external demagnetising factors must be taken into account. A big L/D ratio and improved magnetic circuit may be required. Very small air holes may be seen from time to time in the structure of cast Alnico magnets. This is natural for cast magnets and cannot be avoided.

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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.L	10 ⁻⁶ /°C	11.5-13
Electrical Resistivity	ρ	$\mu \Omega \cdot \text{cm}$	45-70
Tensile Strength	σ_{UTS} or S_{U}	$\times 10^6 \text{ Pa}$	20-450 (37 ACA44)
Hardness		Rockwell	45-55
Curie Temperature	Tc	°C	810-860

Max Working Temperature

(Note - this varies with the magnetic working point!)

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

Example of a BH curve (second quadrant demagnetisation)

