Grain Boundary Diffused Magnets

DATA SHEET

NEODYMIUM

Grain Boundary Diffused Neodymium magnets are the most powerful magnets available. They are the premium choice for maximum performance and this data sheet covers the Grain Boundary Diffused range of NdFeB magnets that are currently available for use in all industries.

Grain Boundary Diffused magnets employ a secondary manufacturing process to concentrate the Heavy Rare Earth Element Dysprosium into the grain boundaries of the magnet microstructure, hence the name. This not only nets a performance increase but uses less Dysprosium making them more price stable than traditional method magnets.

The standard range is available on different data sheet. All GBD Neodymium NdFeB is REACH and ROHS compliant and does not contain SVHC's whilst licensed grades are produced to ISO9001 and ISO14001 Quality Control Standards. Certificates of Conformity, MSDS and PPAP's can be supplied on request.

GBD Neodymium grades exist with maximum recommended temperature ratings - from +150 °C up to +220 °C but these ratings are GUIDELINE values only. The actual maximum temperature rating depends on the shape of the magnet and the design of the application. GBD magnets are limited in thickness to 8mm, and certain grades are not available with some magnet geometries. Please contact us for the highest available grade in your magnet design.

Exceeding the actual maximum temperature results in a permanent demagnetisation (a permanent weakening of magnetic output) which is only recoverable by re-magnetisation.

All Neodymium NdFeB grades require a protective coating to prevent and minimise corrosion.

The coating is usually a Ni-Cu-Ni plating although other coatings/finishes exist. Neodymium NdFeB magnets can be made in blocks, discs, rings, arcs, spheres, triangles, trapezoids and many other shapes. Certificates of Conformity, MSDS's and PPAP's can be provided on request.

Grain Boundary Diffused Neodymium

Properties	Br		HcB		HcJ		(BH)max		Temp. Coef.		Tw
Grade**	Typical mT	Typical gauss	min kA/m	min oersteds	min kA/m	min oersteds	Typical kJ/m^3	Typical MGOe	a(B,J %/°C	a (HcJJ %/°C	max oc
N45SH	1350	13500	979	12300	1592	20000	354	44	-0.12	-0.549	150
N48SH	1390	13900	1011	12700	1592	20000	374	47	-0.12	-0.549	150
N50SH	1425	14250	836	10500	1592	20000	390	49	-0.12	-0.549	150
N52SH	1440	14400	1067	13400	1592	20000	402	51	-0.12	-0.549	150
N55SH	1460	14600	1083	13600	1512	19000	418	53	-0.12	-0.549	150
N38UH	1260	12600	876	11000	1990	25000	307	39	-0.12	-0.465	180
N40UH	1285	12850	915	11500	1990	25000	318	40	-0.12	-0.465	180
N42UH	1310	13100	955	12000	1990	25000	330	41	-0.12	-0.465	180
N45UH	1350	13500	979	12300	1990	25000	354	44	-0.12	-0.465	180
N48UH	1390	13900	1011	12700	1990	25000	374	47	-0.12	-0.465	180
N50UH	1410	14100	1051	13200	1990	25000	386	49	-0.12	-0.465	180
N52UH	1430	14300	1067	13400	1990	25000	394	50	-0.12	-0.465	180
N30EH	1125	11250	812	10200	2388	30000	243	31	-0.12	-0.472	200
N33EH	1165	11650	820	10300	2388	30000	267	34	-0.12	-0.472	200
N35EH	1200	12000	836	10500	2388	30000	279	35	-0.12	-0.472	200
N38EH	1260	12600	876	11000	2388	30000	307	39	-0.12	-0.472	200
N40EH	1285	12850	915	11500	2388	30000	318	40	-0.12	-0.472	200
N42EH	1310	13100	955	12000	2388	30000	330	42	-0.12	-0.472	200
N44EH	1310	13100	971	12200	2388	30000	338	43	-0.12	-0.472	200
N46EH	1360	13600	1011	12700	2388	30000	362	46	-0.12	-0.472	200
N48EH	1385	13850	1027	12900	2388	30000	370	48	-0.12	-0.472	200
N30AH	1125	11250	812	10200	2706	34000	243	31	-0.12	-0.449	220
N33AH	1165	11650	820	10300	2706	34000	267	34	-0.12	-0.449	220
N35AH	1200	12000	836	10500	2706	34000	279	35	-0.12	-0.449	220
N38AH	1260	12600	876	11000	2706	34000	307	39	-0.12	-0.449	220
N40AH	1285	12850	915	11500	2706	34000	318	40	-0.12	-0.449	220

Direction of Magnetisation

A letter "A" is often used to denote the dimension that the direction of magnetisation (DoM) runs parallel with. The A usually means Alignment, although (shared/common) Axis is also used. e.g. D5mm x 30mmA is an axially magnetised rod magnet. If an arrow is present on the drawing, the arrow shows the direction of magnetisation and it points to the North pole face. The North poleface of a permanent magnet is a North seeking pole (it seeks the geographic North). By scientific definition of unlike poles attracting, the Earth's geographic North pole is actually a magnetic South pole. We use this definition for DoM.

MAGNET APPLICATIONS
A Division of BUNTING

Temperature Ratings

MAGNET TYPE SUFFIX	Rev. Temp. Coeff. %/°C (20-100°C)		Ref. Max. Temp.
	Br (α)	Hci (β)	
	-0.120	-0.70	80 0C = 176 ⁰F *
M	-0.115	-0.65	1000C = 212 ⁰F*
H	-0.110	-0.60	1200C = 248 ⁰F
SH	-0.105	-0.55	150 0C = 302 ⁰F
UH	-0.100	-0.55	180 0C = 356 ⁰F
EH	-0.095	-0.50	200 0C = 392 ⁰F
VH/AH	-0.090	-0.49	230 0C = 446 ⁰F

* Max. Temp. should only be used for reference. Magnet component geometry and magnetic circuit design significantly impact real-world maximum operating temperature.

Physical Properties

Characteristic	Symbol	Unit	Value
Density	D	g/cm^3	7.5
Vickers Hardness	Hv	D.P.N	570
Compression Strength	C.S	N/mm^2	780
Coeff. of Thermal Expansion	C//	10^{-6}/°C	3.4
	C⊥	10^{-6}/°C	-4.8
Electrical Resistivity	ρ	μ Ω.cm	150
Temp. coeff. of resistivity	α	10^{-4}/°C	2
Electrical Conductivity	σ	10^6S/m	0.667
Thermal Conductivity	k	kCal/(m.h.°C)	7.7
Specific Heat Capacity	c	kCal/(kg.°C)	0.12
Tensile Strength	σ_{UTS}, S_U	kg/mm^2	8
Young's Modulus	λ / E	$10^{11}N/m^2$	1.6
Flexural Strength	β	$10^{-12}m^2/N$	9.8
Compressibility	σ	$10^{-12}m^2/N$	9.8
Rigidity	E.I	N/m^2	0.64
Poisson's Ratio	υ		0.24
Curie Temperature	Tc	°C	310

Examples of Coatings Available

NdFeB should always be given a protective coating to reduce any risk of corrosion. Please advise us of your requirements.

Nickel-Copper-Nickel (Ni-Cu-Ni) [this is the standard coating]	Everlube (6102G)	Nickel (Ni)	Epoxy (Black, Grey)
Nickel-Copper plus Black Nickel	Zinc (Zn)	White Zinc and Black Zinc	Copper (NiCu or NiCuNiCu)
Gold (Au) [this is actually NiCuNi plus Gold]	Tin (Sn)	Parylene C	Titanium (Ti)
Silver (Ag) [this is actually NiCuNi plus Silver]	Ni-Cu-Ni plus Rubber	Zn plus Rubber	Ni-Cu-Ni plus Parylene C
PTFE ("Teflon®") in black	PTFE ("Teflon®") in white	PTFE ("Teflon®") in silvery	PTFE ("Teflon®") in grey
Coloured (red, green, blue, pink, purple, etc.)	Titanium Nitride (TiN)	Chrome (bright/standard, black)	Ni-Cu-Ni plus PTFE
Zn plus Everlube	Ni-Cu-Ni plus Everlube	Ni-Cu-Ni plus Epoxy	Tin (Sn) plus Parylene C
Phosphate Passivation	Ni-Cu-Ni-Au-Parylene C	Zinc Chromate	Rhodium

Relative Coating Performance - Examples with Realistic Timescale Figures for 6 commonly used Coatings

"PLATING APPLIED	Overall Thickness	Pressure Test (PCT) 2 Bar, 120°C, 100% RH	Salt Spray Test 5% NaCl Sol., 35°C
Nickel Copper Nickel (NiCuNi)	15-21 microns	48 hours	24 hours
NiCu + Black Nickel	15-21 microns	48 hours	24 hours
NiCuNi + Black Epoxy	20-28 microns	72 hours	48 hours
NiCuNi + Gold	16-23 microns	72 hours	36 hours
NiCuNi + Silver	16-23 microns	48 hours	24 hours
Zinc	7-15 microns	24 hours	12 hours
Nickel Copper Nickel (NiCuNi)	15-21 microns	48 hours	24 hours

Tolerances

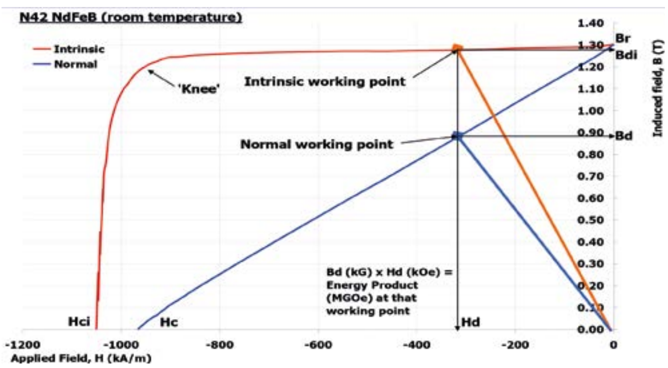
The standard magnet tolerances are +/-0.1mm. For a small additional fee +/-0.05mm is possible for virtually all the magnet shapes.

Our Precision Magnetics range offers tolerances down to as small as +/-0.005mm but is subject to minimum production runs of 100k pieces and we will state the tolerances achievable.

The shape and finish determines the tolerances that can be achieved.

Please feel free to contact us for a free and without obligation quotation.

Example of a BH curve (second quadrant demagnetisation)



Additional Notes

How the magnet is used affects the working point of the magnet (shape, magnetic circuit, temperature, and humidity). When determining suitability, use the Intrinsic curve during analysis, not the Normal curve. Optimum performance is obtained by keeping the intrinsic working point above the 'knee' and ideally at the BHmax working point.
When using glue, you are bonding onto the plating and not the material itself. If the plating fails, the magnet may be free to move.

If in any doubt, please contact us for technical assistance. www.buntingeurope.com sales@buntingeurope.com. We reserve the right to change any of the above information without notice and cannot accept any responsibility or liability for errors or problems caused by using any of the above information.