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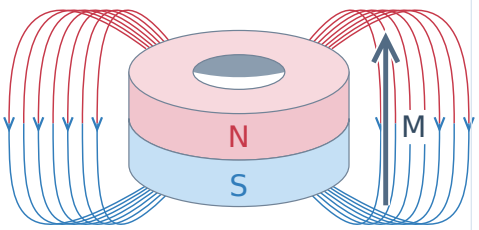
Magnet calculation report

MP 12/5x2 / N38
Generated: 23.10.2026 15:32:25
Open the interactive calculator with this configuration →

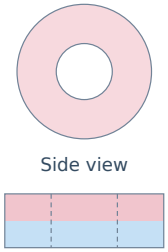
Scanning the code opens the interactive calculator with an identical set of parameters

3D schematic



D 12 / d 5 / H 2 mm

Top view



H 2 mm

Red: N pole | Blue: S pole | M: magnetization S → N
External field: N → S. Pole colours are symbolic.
Not to scale; field paths are schematic, not a simulation.

Shape:	ring
Dimensions:	⌀12.0 / ⌀5.0 × 2.0 mm
Grade:	**N38**
Br:	12.2-12.6 kGs
Hcb:	860-915 kA/m
BHmax:	287-303 kJ/m³
Temperature:	**≤ 80 °C**

Catalog data

MP 12x5x2 / N38 - ring magnet

Catalog number	**030498**	Induction	**195.97 mT / 1,960 Gs**
Dimensions	**⌀12.0 / ⌀5.0 × 2.0 mm**	Coating	**[NiCuNi] Nickel**
Magnetization direction	**axial**	Grade	**N38**

https://dhit.pl/en/product/ring-magnet-12x5x2-n38-axial

Calculation result

N/D	-1,901 Gs	1.40 g	0.268 Pc
PULL FORCE	BZ (Z = 0,01 MM)	MAGNET MASS	PERMEANCE COEFF.

Range resulting from material tolerance: Bz -1,931.65 – -1,870.33 Gs

Pull force unavailable: axial field in the bore is not the field across the annular pole face. A product measurement is required.

Table of contents

1.	Catalog data	17.	How many magnets do I need?
2.	Calculation result	18.	Load direction vs. real holding force
3.	Model methodology and validation	19.	Grade comparison
4.	Force and induction vs. distance	20.	Two magnets — attraction and repulsion
5.	Shear force (sliding)	21.	Magnet stack
6.	Effect of steel thickness	22.	Additional parameters
7.	Demagnetisation curve and operating point	23.	Engineering indicators
8.	Force loss vs. temperature	24.	Temperature derating curve
9.	Extended thermal analysis	25.	Steel thickness effect curve
10.	Sensitivity and tolerance analysis	26.	Ageing and long-term stability
11.	Comparison of calculation methods	27.	Recommended safety factors
12.	Axial field thresholds — not safe clearances	28.	How to use this data in practice
13.	Magnetic flux	29.	Material data sources
14.	Attraction dynamics	30.	Production repeatability
15.	Force vs. load angle	31.	Reference conditions
16.	Typical mounting scenarios	32.	Coatings: selection and limitations

Key takeaways for the designer

1. Axial Bz is the field in the bore, not the field distribution across the annular pole face. Substituting it into Maxwell pressure does not yield a valid pull-force rating.

2. Bz describes a point on the axis in air; field sign is not force sign.

3. The Br interval is a material tolerance, not evidence of measurement accuracy.

4. Check temperature, coating and actual mounting for the specific product.

Model methodology and validation

Axial Bz is the field in the bore, not the field distribution across the annular pole face. Substituting it into Maxwell pressure does not yield a valid pull-force rating.

The k_cal = 1.4837 calibration for solid flat pole faces is not applied here to determine pull force.

Cylinder axial field; z measured from the face

$$B_c(R,H,z) = \frac{B_r}{2}\left[\frac{H+z}{\sqrt{R^2+(H+z)^2}} - \frac{z}{\sqrt{R^2+z^2}}\right]$$

Ring — signed difference of two cylinder fields

$$B_z(z) = B_c(R_o,H,z) - B_c(R_i,H,z)$$

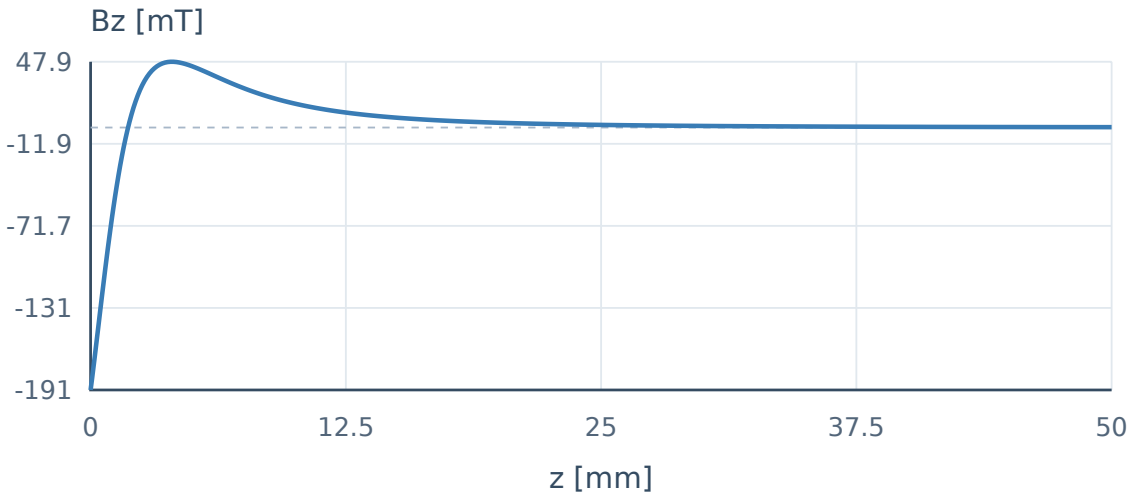
Permeance coefficient — geometry approximation

$$P_c = \frac{1.7\,k}{1+0.9\,k};\ k = \frac{H}{D_e}$$

Equivalent diameter for permeance

$$D_e = 2\sqrt{R_o^2 - R_i^2}$$

Force and induction vs. distance



z [mm]	Bz [Gs]	Bz [mT]
0.00	-1 912.50	-191.250
0.01	-1 900.99	-190.099
1.00	-706.90	-70.690
2.00	94.05	9.405
3.00	413.94	41.394
5.00	444.90	44.490
10.00	174.20	17.420
15.00	71.60	7.160
20.00	34.78	3.478
30.00	11.63	1.163
50.00	2.72	0.272

z is measured from the sphere pole surface or the top plane of the ring. A negative Bz indicates direction, not a negative pull force.

Shear force (sliding)

Not applicable / no validated model. Axial Bz is the field in the bore, not the field distribution across the annular pole face. Substituting it into Maxwell pressure does not yield a valid pull-force rating.

Effect of steel thickness

Not applicable / no validated model. Axial Bz is the field in the bore, not the field distribution across the annular pole face. Substituting it into Maxwell pressure does not yield a valid pull-force rating.

Demagnetisation curve and operating point

Pc is exactly 2 for a uniformly magnetized sphere; for a ring it is a geometry approximation. The air operating point below is a linear model, not a measured B–H curve. The steel-contact operating point of a cylinder is not transferred.

Pc	Bd [T]	|Hd| [kA/m]
0.268	0.252	748.946

Force loss vs. temperature

T [°C]	Br [T]	Bz [Gs]	Ideal model [kg]	Scope
20	1.240	-1 900.99	Not applicable / no validated model.	Reversible model
40	1.213	-1 859.17	Not applicable / no validated model.	Reversible model
60	1.185	-1 817.34	Not applicable / no validated model.	Reversible model
80	1.158	-1 775.52	Not applicable / no validated model.	Reversible model
100	Not applicable / no validated model.	Not applicable / no validated model.	Not applicable / no validated model.	Outside catalogue limit

Constant geometry; Br coefficient −0.11%/K as in the web model. Above the grade limit, extrapolation is not published as an allowable result.

Extended thermal analysis

No validated irreversible-loss model for this configuration. Temperature limit from the grade-properties export: 80.0 °C.

Sensitivity and tolerance analysis

Br bound	Br [T]	Bz [Gs]
min	1.220	-1 870.33
avg	1.240	-1 900.99
max	1.260	-1 931.65

This range comes from the specified Br interval; it is not a statistical confidence interval or measurement accuracy.

Comparison of calculation methods

Not applicable / no validated model. Axial Bz is the field in the bore, not the field distribution across the annular pole face. Substituting it into Maxwell pressure does not yield a valid pull-force rating.

Axial field thresholds — not safe clearances

Axial field thresholds are not safety clearances. Implant manufacturer guidance and medical advice apply; no safe distance is determined here.

Ring axial field need not decrease monotonically. Neither the first threshold crossing nor the sign of Bz is used to assess reach.

Magnetic flux

Parameter	Value
m	0.184450 A·m²
V	0.187 cm³
Mass	1.402 g
Pc	0.268

m = (Br/μ0)·V. Pole-face flux is not replaced by bore field times annulus area, or by a sphere great-circle area.

Attraction dynamics

Not applicable / no validated model. Axial Bz is the field in the bore, not the field distribution across the annular pole face. Substituting it into Maxwell pressure does not yield a valid pull-force rating.

Force vs. load angle

Not applicable / no validated model. Axial Bz is the field in the bore, not the field distribution across the annular pole face. Substituting it into Maxwell pressure does not yield a valid pull-force rating.

Typical mounting scenarios

Not applicable / no validated model. Axial Bz is the field in the bore, not the field distribution across the annular pole face. Substituting it into Maxwell pressure does not yield a valid pull-force rating.

How many magnets do I need?

Not applicable / no validated model. Axial Bz is the field in the bore, not the field distribution across the annular pole face. Substituting it into Maxwell pressure does not yield a valid pull-force rating.

Load direction vs. real holding force

Not applicable / no validated model. Axial Bz is the field in the bore, not the field distribution across the annular pole face. Substituting it into Maxwell pressure does not yield a valid pull-force rating.

Grade comparison

Grade	Br [T]	Bz [Gs]
N35	1.190	-1 824.34
N38	1.240	-1 900.99
N42	1.305	-2 000.64
N45	1.345	-2 061.96
N48	1.395	-2 138.61
N52	1.445	-2 215.26

Same geometry and uniform axial magnetization; no product specifications are changed.

Two magnets — attraction and repulsion

Not applicable / no validated model. Axial Bz is the field in the bore, not the field distribution across the annular pole face. Substituting it into Maxwell pressure does not yield a valid pull-force rating.

Magnet stack

Not applicable / no validated model. Axial Bz is the field in the bore, not the field distribution across the annular pole face. Substituting it into Maxwell pressure does not yield a valid pull-force rating.

Additional parameters

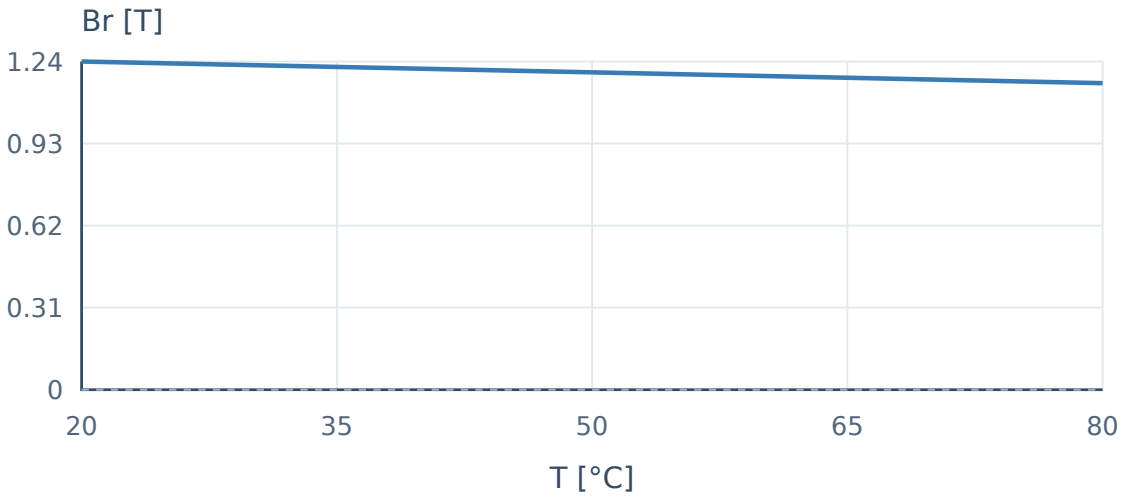
Parameter	Value
m	0.184450 A·m²
V	0.187 cm³
Mass	1.402 g
Pc	0.268

Not applicable / no validated model. Contact pressure and frictional holding torque are not calculated.

Engineering indicators

Compare mass, geometry, magnetic moment and Bz. Do not use force/mass or force/price indicators without a validated contact-force rating.

Temperature derating curve



Reversible Br change only, at constant geometry up to the catalogue temperature limit. This is not an irreversible-demagnetization model.

Steel thickness effect curve

Not applicable / no validated model. Axial Bz is the field in the bore, not the field distribution across the annular pole face. Substituting it into Maxwell pressure does not yield a valid pull-force rating.

Ageing and long-term stability

Percentage pull-force losses are not presented as long-term measurements for this geometry. Durability also depends on coating, environment, temperature and damage.

Recommended safety factors

Not applicable / no validated model. Axial Bz is the field in the bore, not the field distribution across the annular pole face. Substituting it into Maxwell pressure does not yield a valid pull-force rating.

How to use this data in practice

1. Check grade and dimensions. 2. Establish contact and loading direction. 3. For an unavailable result, measure the actual part rather than using zero. 4. Check magnet temperature and coating condition.

Material data sources

Grade properties come from the same properties.json export as the web calculator. Sphere equations match the separate JS fieldAt/pullForce model; the ring model superposes two cylinders. This is not independent measurement validation.

Production repeatability

The Br interval describes material tolerance. Idealized values and model fitting do not replace checks of the actual specimen and tests on the intended surface.

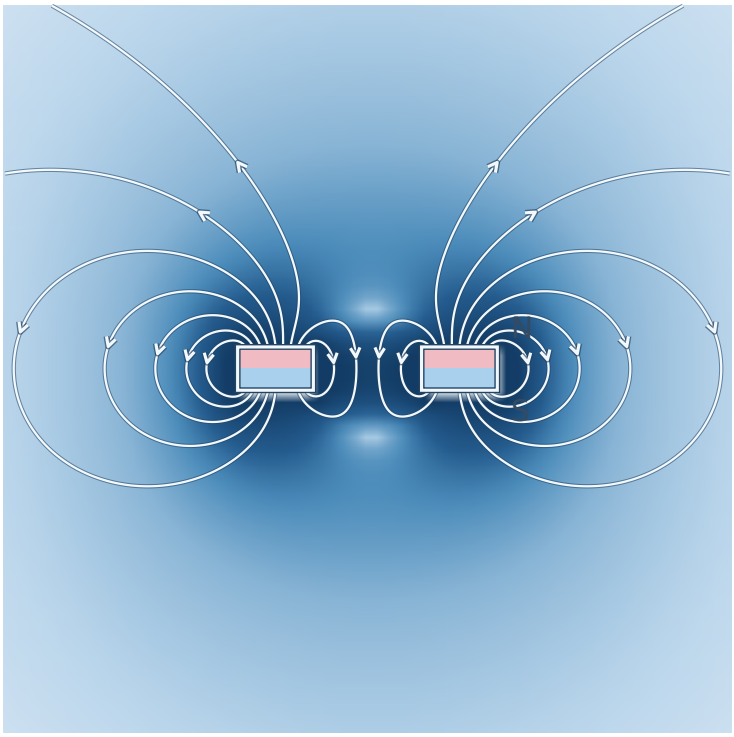
Reference conditions

Axial Bz is the field in the bore, not the field distribution across the annular pole face. Substituting it into Maxwell pressure does not yield a valid pull-force rating.

Field: uniform axial magnetization in air, without steel or a housing. The sphere model does not use cylinder calibration; the ring model does not determine pull force.

Calculated field in air — axial magnetization

Field in air | B [mT] | axial magnetization



B [mT]

- < 1
- 1–5
- 5–20
- 20–50
- 50–100
- 100–300
- ≥ 300

M: S → N

Red: N

Blue: S

Interpolated colours

x: −16.8 … +16.8 mm; z: −16.8 … +16.8 mm

J ≈ Br = 1.24 T; uniform magnetization; no steel or housing.

Calculated lines N → S outside. Not a pull-force or safety-clearance model.

Magnet grades and catalogue temperature limits

Family N

Grade	Br [kGs]	Hcj [kA/m]	T [°C]
N30	10.8-11.2	≥ 955	≤ 80
N33	11.4-11.7	≥ 955	≤ 80
N35	11.7-12.1	≥ 955	≤ 80
N38	12.2-12.6	≥ 955	≤ 80
N40	12.6-12.9	≥ 955	≤ 80
N42	12.9-13.2	≥ 955	≤ 80
N45	13.2-13.7	≥ 955	≤ 80
N48	13.7-14.2	≥ 955	≤ 80
N50	14-14.6	≥ 955	≤ 60
N52	14.2-14.7	≥ 955	≤ 60
N54	14.5-15.1	≥ 955	≤ 60

Family M

Grade	Br [kGs]	Hcj [kA/m]	T [°C]
N30M	10.8-11.2	≥ 1114	≤ 100
N33M	11.4-11.7	≥ 1114	≤ 100
N35M	11.7-12.1	≥ 1114	≤ 100
N38M	12.2-12.6	≥ 1114	≤ 100
N40M	12.6-12.9	≥ 1114	≤ 100
N42M	12.9-13.2	≥ 1114	≤ 100
N45M	13.2-13.7	≥ 1114	≤ 100
N48M	13.7-14.2	≥ 1114	≤ 100
N50M	14-14.6	≥ 1114	≤ 100

Family H

Grade	Br [kGs]	Hcj [kA/m]	T [°C]
N27H	10.2-10.6	≥ 1353	≤ 120
N30H	10.8-11.2	≥ 1353	≤ 120
N33H	11.4-11.7	≥ 1353	≤ 120
N35H	11.7-12.1	≥ 1353	≤ 120
N38H	12.2-12.6	≥ 1353	≤ 120
N40H	12.6-12.9	≥ 1353	≤ 120
N42H	12.9-13.2	≥ 1353	≤ 120
N44H	13.2-13.6	≥ 1353	≤ 120
N48H	13.7-14.2	≥ 1353	≤ 120

Family SH

Grade	Br [kGs]	Hcj [kA/m]	T [°C]
N27SH	10.2-10.6	≥ 1592	≤ 150
N30SH	10.8-11.2	≥ 1592	≤ 150
N33SH	11.4-11.7	≥ 1592	≤ 150
N35SH	11.7-12.1	≥ 1592	≤ 150
N38SH	12.2-12.6	≥ 1592	≤ 150
N40SH	12.6-12.9	≥ 1592	≤ 150
N42SH	12.9-13.2	≥ 1592	≤ 150
N45SH	13.2-13.7	≥ 1592	≤ 150

Family UH

Grade	Br [kGs]	Hcj [kA/m]	T [°C]
N25UH	9.8-10.2	≥ 1990	≤ 180
N28UH	10.4-10.8	≥ 1990	≤ 180
N30UH	10.8-11.2	≥ 1990	≤ 180
N33UH	11.4-11.7	≥ 1990	≤ 180
N35UH	11.7-12.1	≥ 1990	≤ 180
N38UH	12.2-12.6	≥ 1990	≤ 180
N40UH	12.6-12.9	≥ 1990	≤ 180

Family EH

Grade	Br [kGs]	Hcj [kA/m]	T [°C]
N25EH	9.8-10.2	≥ 2388	≤ 200
N28EH	10.4-10.8	≥ 2388	≤ 200
N30EH	10.8-11.2	≥ 2388	≤ 200
N33EH	11.4-11.7	≥ 2388	≤ 200
N35EH	11.7-12.1	≥ 2388	≤ 200
N38EH	12.2-12.5	≥ 2388	≤ 200
N40EH	12.5-12.8	≥ 2388	≤ 200
N42EH	12.8-13.2	≥ 2388	≤ 200

Family AH

Grade	Br [kGs]	Hcj [kA/m]	T [°C]
N28AH	10.4-10.8	≥ 2624	≤ 230
N30AH	10.8-11.3	≥ 2624	≤ 230
N33AH	11.3-11.7	≥ 2624	≤ 230
N35AH	11.7-12.2	≥ 2624	≤ 230
N38AH	12.2-12.5	≥ 2624	≤ 230
N40AH	12.5-12.8	≥ 2624	≤ 230

N M H SH UH EH AH

Colours identify material families, not pull force. The number denotes an energy grade; the suffix distinguishes coercivity and temperature classes. Check the temperature limit of the selected product; N50/N52/N54 in this catalogue are limited to 60°C.

Catalogue limits are not a guarantee for every geometry. Coating, magnetic circuit and actual magnet temperature matter. Colour halves illustrate magnetization, not two separate magnets.

Coatings: selection and limitations

Coating / encapsulation	Purpose	Limitations
Ni-Cu-Ni (standard)	General-purpose metallic finish for dry indoor use.	Do not assume protection during permanent immersion. Damage exposes the core.
Ni-Cu-Ni-Au (gold)	Thin decorative gold finish over a nickel-based coating.	Can wear off; gold colour does not prove biocompatibility or suitability for medical use.
Ni-Cu-Ni-Cr (chrome)	Metallic finish used where surface wear matters.	Not a guarantee of water resistance; check the individual specification.
Ni-Cu (copper)	Copper-coloured finish, mainly decorative.	May darken and wear; not a substitute for an environmental barrier.
Epoxy (resin)	Polymer barrier for applications exposed to moisture.	Protection depends on an intact coating; scratches and impacts can expose the core.
Rubber coated	Protects the mating surface and can increase friction.	Adds a gap and can reduce pull force; friction and sealing depend on the actual construction.
Plastic overmolding	Encapsulation can isolate the magnet from its surroundings.	Wall thickness adds a gap. Do not assume a watertight assembly without a product specification.

General selection guide, not the coating specification of the calculated magnet. Check the product card. No coating changes the NdFeB grade or increases its temperature rating. Coating thickness, added gaps and friction require product-specific data; this table does not change the calculation.

DHIT technology: coatings and working conditions

Scope and limitations

Friction, steel-thickness response, housing gains, ageing, irreversible thermal loss and market comparisons are illustrative scenarios, not measured product specifications. Catalogue fitting is not independent validation. Axial field thresholds are not safe clearances for medical implants. Consult the implant manufacturer; do not use these tables to assess personal safety. Impact energy is an idealized mechanical scenario, not an injury prediction. The basic temperature table shows reversible force change (Br squared); the extended table adds an unvalidated irreversible-loss scenario. Above Tmax, neither table authorizes operation.

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