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Magnet calculation report

MPL 200x30x30 / N38
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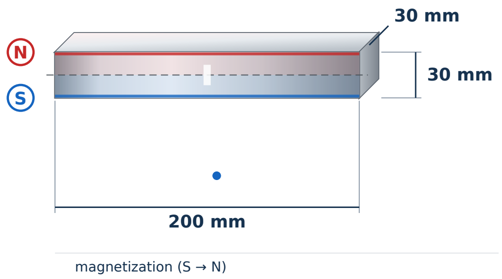

Shape:	block
Dimensions:	200,0 × 30,0 × 30,0 mm
Grade:	**N38**
Br:	12.2-12.6 kGs
Hcb:	860-915 kA/m
BHmax:	287-303 kJ/m³
Temperature:	**≤ 80 °C**

Catalog data

MPL 200x30x30 / N38 - lamellar magnet

Catalog number	**020125**	Induction	**445,15 mT / 4 451 Gs**
GTIN / EAN	**5906301811312**	Coating	**[NiCuNi] Nickel**
Dimensions	**200,0 × 30,0 × 30,0 mm**	Grade	**N38**
Magnetization direction	**through thickness**		

https://dhit.pl/en/product/magnes-neodymowy-plytkowy-200x30x30-n38-osiowy

Calculation result

287,69 kg PULL FORCE model value: 287,6907 kg	**4 451** Gs SURFACE INDUCTION	**1 350,0** g MAGNET MASS	**0,446** Pc PERMEANCE COEFF.

Range resulting from material tolerance: 278,49 – 297,05 kg

Key takeaways for the designer

1. The 287,69 kg figure applies only to ideal conditions: thick, clean steel, full contact, 20 °C.
2. Under shear loading (a vertical wall) the real holding force drops to about 30%.
3. A flat magnet held in air loses its thermal safety margin far sooner than one attached to steel.
4. Always apply the safety factor from the table — at least ×2.0 for workshop assembly.

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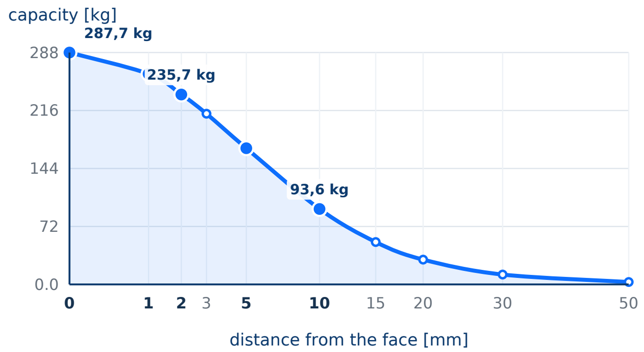
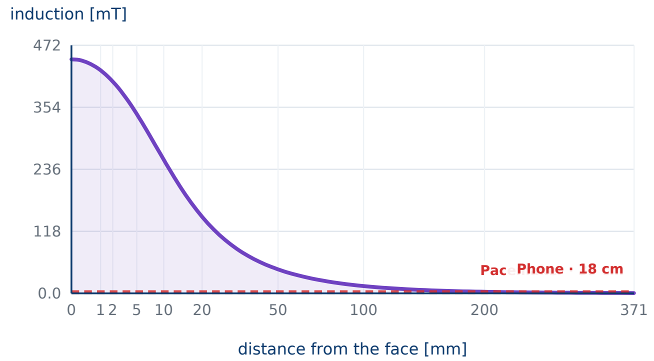


Force vs. distance



Magnetic field map B(z)

Induction measured on the axis, in air, with no steel plate. The horizontal scale is compressed towards the face so as to show both the steep near-surface drop and the reach of the residual field at once. The horizontal reference lines are thresholds that matter for safety.

Model methodology and validation

This report was not produced by an FEM solver and was not copied from a catalogue table. Behind them stands a closed-form analytical model: the on-axis field follows from the potential of a uniformly magnetised body, the pull force from the Maxwell stress equation at the magnet-to-steel boundary. The full set of equations is given below, so every number can be reproduced independently.

Model equations

Rectangular block — on-axis induction, where a = L/2 and b = W/2

$$B(z) = (Br / \pi) \cdot \left[\arctan\left(\frac{a \cdot b}{z \cdot \sqrt{a^2 + b^2 + z^2}} \right) - \arctan\left(\frac{a \cdot b}{(z + H) \cdot \sqrt{a^2 + b^2 + (z + H)^2}} \right) \right]$$

Pull force — Maxwell stress summed across the whole pole face

$$F\,[N] = B_{load}^2 \cdot A / (2 \cdot \mu_0) \quad F\,[kg] = F\,[N] / g$$

Flux concentration factor — thick steel acts as a magnetic mirror: it closes the circuit and raises the gap induction above the value measured in free space

$$B_{load} = B(0) \cdot sf \quad sf = 1 + 1.6 \cdot \exp(-1.2 \cdot \lambda) \quad \lambda = H / D$$

Permeance coefficient — a measure of the self-demagnetisation that follows from the geometry alone; De is the equivalent pole diameter

$$Pc = k \cdot 1.7 / (1 + 0.9 \cdot k) \quad k = H / De$$

Calibration constant — without correction the model underestimates the force systematically, since it omits side-wall leakage flux that also closes the circuit through the plate. The correction was obtained by least-squares regression against 127 dhit catalogue items

$$F\,[kg] = k_{cal} \cdot B_{load}^2 \cdot A / (2 \cdot \mu_0 \cdot g) \quad k_{cal} = 1.4837$$

Model constants and input parameters

Symbol	Meaning	Value
Br	Grade remanence, mid-range	**12,40 kGs (1,240 T)**
Hcb	Induction coercivity, catalogue	**860-915 kA/m**
Hcj	Intrinsic coercivity, guaranteed minimum	**≥ 955 kA/m**
μrec	Recoil permeability	**1,05**
k_cal	Model calibration constant	**1,4837**
Pc	Permeance coefficient of this geometry	**0,446**
sf	Flux concentration factor	**2,005**
A	Pole face area	**60,00 cm²**
ρ	Sintered NdFeB density	**7,50 g/cm³**

Throughout this report the permeance coefficient is quoted to three decimal places. Computation uses the unrounded value, which is why recalculating from the rounded figure may differ in the last digit.

Calibration and goodness of fit

The model has precisely one fitted parameter — k_cal. Everything else is physics without adjustments. It was determined by least-squares regression against 127 dhit catalogue items. That set is a subset of the bare-magnet catalogue described below — the exact list of items remains in the internal fitting documentation.

The source of the calibration set is a bare-magnet catalogue spanning three geometries: discs, blocks and rings. The dimensional range reaches from a few millimetres to about 200 mm, with grades from N35 to N52, including the higher-coercivity variants (H, SH, AH). Across that catalogue the permeance coefficient runs from about 0.10 to about 1.6 with a median near 0.42; roughly one item in ten sits below 0.2, that is among the distinctly flat bodies. The calibration covered all three geometries together under a single shared constant — the model has no separate coefficients for discs, blocks and rings.

After calibration the deviations are distributed with a clear skew — median 0.09%, ninth decile 0.45%, maximum 1.9%. In practice this means that for the great majority of items the model matches the catalogue value to better than half a percent, while cases around two percent are isolated and occur at the extremes of the dimensional range. It is worth remembering what these numbers cover: agreement between model and training set, not the uncertainty of measuring a particular item. The actual product spread is wider and follows from material tolerance and contact quality, as the separate sensitivity tables show.

The calibration constant compensates mainly for side-wall leakage flux, whose share of the total flux grows the flatter the body becomes. For low-permeance geometries the correction therefore contributes the most, and it is there that an uncalibrated model would err furthest. This class of magnet is present in the calibration base, so the size discussed sits inside the fitted range, not outside it.

Assumptions built into the calculation

1. The material is uniformly magnetised throughout its volume, with the magnetisation vector parallel to the stated magnetisation axis.
2. We assume a flat, clean, degreased steel plate at or above the full-flux-utilisation threshold (see the thickness table), working outside saturation.
3. Contact is over the full face, with no gap beyond the thickness of the protective coating.
4. The force is applied perpendicular to the contact face, slowly, without impact and without a twisting component.
5. We assume 20 °C for magnet and steel, with recoil permeability μrec = 1.05.
6. Remanence is taken from the middle of the grade band; what the limits give is shown in the method comparison table.
7. We assume there are no other magnetic sources or ferromagnetic parts in the field beyond the plate described.

Limits of the model

1. Field calculations apply to the axis of symmetry alone. At the pole edge the induction distribution is different — a magnet at the plate edge loses roughly 45% of its force; a separate parameter covers this, not the field equation.
2. Bodies with very low Pc (below about 0.2, that is distinctly flat shapes) have their operating point close to the knee of the demagnetisation curve. The model assumes linearity, valid at 20 °C but unreliable when heated — the actual loss may then exceed the computed one. For such proportions, read this report together with the thermal analysis section.
3. The model's scope is axial magnetisation — for diametric and radial the poles fall differently and we do not generate a report.
4. Closed magnetic circuits — potted assemblies, separators, bars, grippers — route the flux differently. The pot magnet numbers come from a gain factor — an approximation, not a solved magnetic circuit.
5. Hysteresis, eddy currents and dynamic effects of fast separation are not accounted for. An impact raises the pull force above its static value.
6. The calculation excludes flatness and parallelism deviations, and it is precisely these that most often explain a workshop result below the calculated value.

Force and induction vs. distance

Distance	Gauss	mT	kg	lbs	N	Force share
0 mm	4 451	445,1	**287,69**	634,25	2 821,3	100%
1 mm	4 241	424,1	**261,19**	575,83	2 561,4	91%
2 mm	4 028	402,8	**235,69**	519,60	2 311,3	82%
3 mm	3 818	381,8	**211,72**	466,76	2 076,3	74%
5 mm	3 412	341,2	**169,05**	372,70	1 657,8	59%
10 mm	2 539	253,9	**93,64**	206,44	918,3	33%
15 mm	1 902	190,2	**52,54**	115,83	515,2	18%
20 mm	1 457	145,7	**30,82**	67,95	302,3	11%
30 mm	920	92,0	**12,30**	27,12	120,6	4%
50 mm	456	45,6	**3,02**	6,66	29,6	1%

Shear force (sliding)

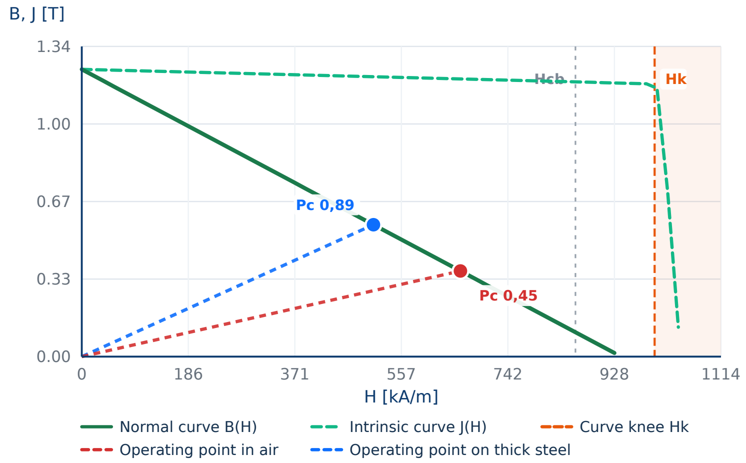
Surface	Friction	kg	N
Bare steel	0,30	**86,31**	846,4
Painted steel	0,20	**57,54**	564,3
Oily surface	0,10	**28,77**	282,1
Rubber coating	0,50	**143,85**	1 410,6

Effect of steel thickness

Thickness	Utilisation	Force
0,5 mm	3%	**9,59 kg**
1,0 mm	8%	**23,97 kg**
2,0 mm	17%	**47,95 kg**
3,0 mm	25%	**71,92 kg**
5,0 mm	42%	**119,87 kg**
8,0 mm	67%	**191,79 kg**
10,0 mm	83%	**239,74 kg**
12,0 mm	100%	**287,69 kg**

Demagnetisation curve and operating point

B(H) is the net induction inside the magnet, J(H) is purely the material polarisation. The operating point lies where the normal curve meets the load line whose slope equals the permeance coefficient: $B = \mu_0 \cdot Pc \cdot H$. The lower it falls, the closer to the J(H) knee the magnet works and the easier flux is lost for good.



Working condition	Pc	Bd [T]	Hd [kA/m]
Operating point in air	**0,446**	**0,370**	660
Operating point on thick steel	**0,892**	**0,569**	508

	Margin to knee Hk/Hd	Irreversible loss risk
Operating point in air	**1,51**	none
Operating point on thick steel	**1,96**	none

Hk = 998 kA/m · Hcj 955–1 051 kA/m · Hcb 940 kA/m

Placing the magnet against a thick steel plate closes the magnetic circuit and roughly doubles the permeance coefficient. The operating point travels up the curve, induction inside the magnet rises and the margin to the knee widens noticeably. This is the physical reason why flat magnets should be stored stuck to steel or in opposite-pole pairs rather than loose.

The proportions of this magnet put the operating point high on the curve with a wide margin to the knee. In typical use the risk of permanent flux loss is negligible; the boundary is the grade's maximum operating temperature.

Force loss vs. temperature

Temperature	Loss	Force	%
20 °C	0,0%	**287,69 kg**	100%
40 °C	-2,2%	**281,36 kg**	98%
60 °C	-4,4%	**275,03 kg**	96%
80 °C	**-6,6%**	**268,70 kg**	93%
100 °C	**-28,8%**	**204,84 kg**	71%

The table above is the short form: it shows only the loss of force following from the change in remanence and serves for a quick estimate. The extended thermal analysis in the next section splits that loss into reversible and irreversible parts, adds the margin to the knee of the J(H) curve and gives the force remaining after a return to room temperature. In selecting a magnet for elevated temperature, rely on the extended table; this one is orientation only.

Extended thermal analysis

Temperature takes force away in two distinct ways that must be told apart. The reversible loss is a drop in remanence of 0.11% per kelvin — it vanishes without trace on cooling. Only when the operating point drops below the knee of the J(H) curve does an irreversible loss appear, and it never returns. Intrinsic coercivity falls with temperature more than five times faster than remanence, so the boundary of safe operation is decided by the magnet's shape, not the grade's stated temperature.

Temperature	Reversible loss	Margin to knee Hk/Hd	Irreversible loss	Force at temperature	Force after cooling	Irreversible loss risk
20 °C	0,0%	1,51	0,0%	**287,69 kg**	**287,69 kg**	none
40 °C	-2,2%	1,36	0,0%	**275,17 kg**	**287,69 kg**	none
60 °C	-4,4%	1,20	0,0%	**262,93 kg**	**287,69 kg**	low
80 °C	-6,6%	1,04	0,0%	**250,97 kg**	**287,69 kg**	moderate
100 °C !	-8,8%	**0,86**	**-22,5%**	**143,78 kg**	**172,86 kg**	**high**

The most important column for durability is 'force after cooling': it shows what remains for good after one overheating episode. The irreversible figures are a model estimate based on the position of the operating point relative to the curve knee, not the result of a thermal endurance test. The true loss is a function of soak time and the actual coercivity of the given sinter batch.

The practical consequence: a flat magnet held in air loses its margin far sooner than the same magnet attached to steel. Where the application runs hot, closing the magnetic circuit or thickening the magnet is cheaper than changing grade.

Sensitivity and tolerance analysis

The stated pull force is a nominal value for nominal dimensions and reference conditions. The tables below show the effect of deviations that cannot be avoided in practice: grinding tolerance, coating thickness, steel surface condition and grade.

Effect of ±0.1 mm dimensional tolerance

Dimension	Force change	Induction change	Force within tolerance
Length L	-0,06% … +0,06%	0,00% … +0,00%	**287,52 – 287,86 kg**
Width W	-0,19% … +0,19%	-0,11% … +0,11%	**287,15 – 288,23 kg**
Height / thickness H	-0,09% … +0,09%	-0,12% … +0,12%	**287,42 – 287,95 kg**
All dimensions at limit	-0,34% … +0,34%	-0,01% … +0,01%	**286,72 – 288,66 kg**

For sintered NdFeB after grinding a tolerance of ±0.1 mm is standard. The conclusion is asymmetric: in flat magnets the force is set almost entirely by height, which fixes the permeance coefficient; a diameter deviation makes no difference, as the larger pole area is cancelled by lower induction. With a critical force requirement it pays to tighten the height tolerance and leave the diameter alone.

Effect of coating and surface condition

Contact condition	Equivalent gap	Force	%
Ideal contact, uncoated magnet	0,000 mm	**287,69 kg**	100,0%
NiCuNi coating 15–25 µm	0,025 mm	**287,28 kg**	99,9%
Coating + rolled plate roughness	0,050 mm	**286,60 kg**	99,6%
Oil or preservative film	0,060 mm	**286,33 kg**	99,5%
Powder coating 60–80 µm	0,100 mm	**285,24 kg**	99,1%
Heavy paint or sprayed zinc	0,200 mm	**282,52 kg**	98,2%
Rust film and flaking corrosion	0,400 mm	**277,12 kg**	96,3%
Mill scale, heavy corrosion	0,800 mm	**266,46 kg**	92,6%

Effect of the substrate steel grade

Substrate material	Factor	Force
Soft magnetic iron (ARMCO, DT4)	1,03	**296,32 kg**
S235 / A36 — model reference	1,00	**287,69 kg**
S355	0,99	**284,81 kg**
Carbon steel C45	0,96	**276,18 kg**
Ferritic stainless 430	0,85	**244,54 kg**
Grey cast iron	0,75	**215,77 kg**
Austenitic stainless 304 / 316	0,00	**0,00 kg**

All surface variants are converted to one measure: an equivalent air gap. The result is often counter-intuitive: a magnet with a low permeance coefficient is barely sensitive to a thin gap, because its operating point is governed by its own self-demagnetisation rather than by the gap reluctance. On a slender, high-Pc magnet the identical paint coat already costs well over ten percent of the force. For this reason the table is computed for this specific geometry instead of being copied from a generic one. An important caveat: the figures above describe the effect of the gap alone. Rust, mill scale and heavy paint act through a second mechanism as well — they destroy flatness and reduce full-face contact to a few bearing points. That second effect is usually far more costly than the gap itself and cannot be derived from geometry; on corroded plate the real holding force can drop by half or more.

While the plate is thick enough and does not saturate, the steel grade means little — circuit reluctance is ruled by the magnet's own demagnetisation, so higher steel permeability adds little. Only cast iron and ferritic steel make a noticeable difference — their lower saturation induction limits the flux. Austenitic 304 and 316 are paramagnetic, so a magnet will not attach to them at all. The factors are given as indicative values.

Comparison of calculation methods

The same body computed by different methods gives results spread more than tenfold. The difference is not in the physics but in the assumptions made. The table below shows the whole spread, so it is clear where the figure published by dhit comes from and why it can be lower than others.

Calculation method	Key assumption	Force	Relative to dhit
Maxwell at full remanence	Takes the induction across the whole gap to equal Br. An upper thermodynamic limit that cannot be reached.	374,31 kg	×1,30
Mirror circuit model	Doubles Pc and derives the force from the operating-point induction. Does not account for side-wall leakage flux, so it comes out low.	78,93 kg	×0,27
Analytical model, uncalibrated	The same calculation chain as dhit but without the k_cal constant. It reveals how much the calibration alone adds.	193,90 kg	×0,67
dhit model — published value	Calibrated on the catalogue; the reference conditions are S235, full-face contact and 20 °C.	**287,69 kg**	×1,00
dhit model at the upper Br limit	The method is unchanged, only remanence is taken from the top of the band rather than the middle.	297,05 kg	×1,03
Same size in a higher grade (N42)	A frequent source of discrepancy: foreign catalogues work with N42 by default, not N38.	318,64 kg	×1,11

Calculators from overseas suppliers give values for identical geometry that are most often 60–80% higher. The difference is not an error on either side but the sum of assumptions: grade N42 assumed instead of N38, remanence taken at the top of the band, a lapped rather than rolled plate, zero gap computed on an uncoated magnet, and a field solution that credits leakage flux more favourably than an analytical model. Taken one at a time each assumption is defensible; added together they lead to a number no workshop can reproduce.

dhit deliberately quotes the lower end of that range. The published value is roughly 0.6 of the idealised one — precisely what you would arrive at after applying a safety factor. The figure in this report is therefore already close to what a designer should carry into their calculations.

Safe distances (health & safety)

	Gs	cm
Pacemaker	< 5	**39,2**
Hearing aid	< 10	**30,4**
Watch	< 20	**23,4**
Phone	< 40	**17,8**
Payment card	< 400	**5,6**
HDD drive	< 600	**4,2**

Magnetic flux

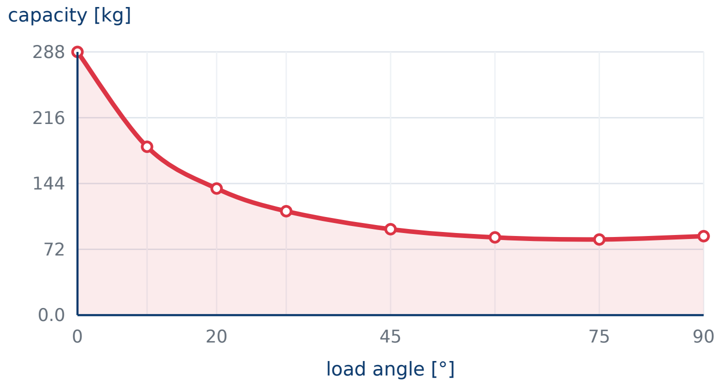
Φ	**221 734 Mx**
Φ (SI)	**2 217,3 µWb**
Bd	**3 696 Gs**
Pc	**0,446**
A	**60,00 cm²**
V	**180,00 cm³**

Attraction dynamics

Release distance	Speed	km/h	Energy	Risk
10 mm	5,06 m/s	18,2	**17,31 J**	**Dangerous**
30 mm	6,05 m/s	21,8	**24,73 J**	**Dangerous**
50 mm	6,20 m/s	22,3	**25,97 J**	**Dangerous**
100 mm	6,27 m/s	22,6	**26,50 J**	**Dangerous**

How fast the magnet will hit the steel plate if you release it from a given distance. From 5 J upwards the risk of crushing a finger is very real – hold the magnet at the side, not in its path.

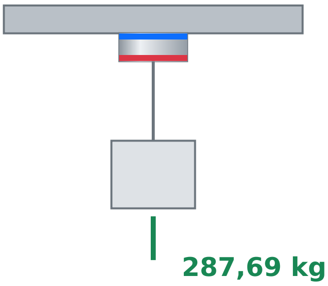
Force vs. load angle



Angle	Capacity	%
0°	**287,69 kg**	100%
10°	**183,99 kg**	64%
20°	**138,33 kg**	48%
30°	**113,59 kg**	39%
45°	**93,89 kg**	33%
60°	**84,95 kg**	30%
75°	**82,70 kg**	29%
90°	**86,31 kg**	30%

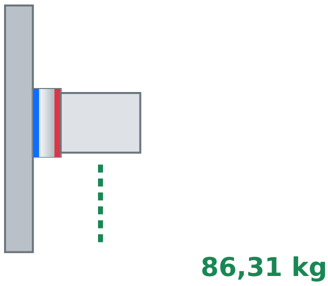
The chart answers how much the magnet actually lifts at a given load direction. 0° is pulling straight off the surface (the catalogue value), 90° is dragging along the plate. The drop is steep — at 30° you have already lost half the capacity.

Typical mounting scenarios



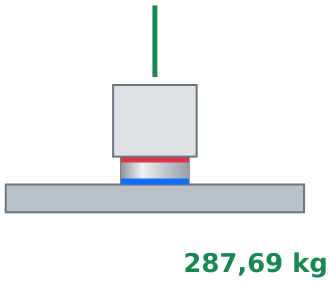
Ceiling

A weight suspended vertically under the magnet gives perpendicular loading and full capacity.



Vertical wall

The load tries to slide the magnet down the plate — only friction acts, capacity falls to about 30%.



Floor / horizontal

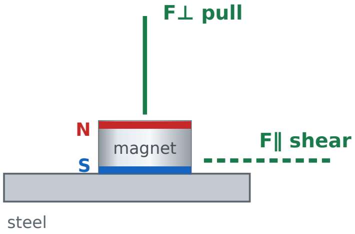
The magnet rests on a horizontal plate and the load pulls upwards: full perpendicular capacity.

How many magnets do I need?

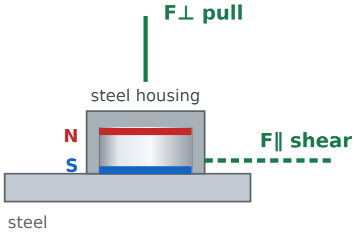
Mass to hold	**10,0 kg**	Load direction	**perpendicular (pull-off)**
Safety margin	**2,0×**	Capacity of one magnet	**287,69 kg**
Magnets required	**1**	Total set capacity	**287,69 kg (28,8×)**

The calculation accounts for the direction of the load and the safety margin you selected. Where a mounting failure would be hazardous, apply a margin of at least 3×.

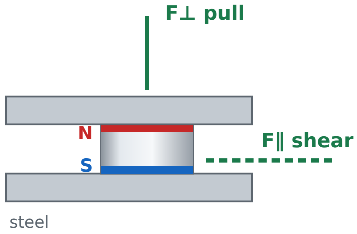
Load direction vs. real holding force



Bare magnet
magnet without housing
F⊥ pull: **287,69 kg**
F∥ shear: **86,31 kg**



Single-sided pot
magnet in steel housing
F⊥ pull: **671,83 kg**
F∥ shear: **201,55 kg**



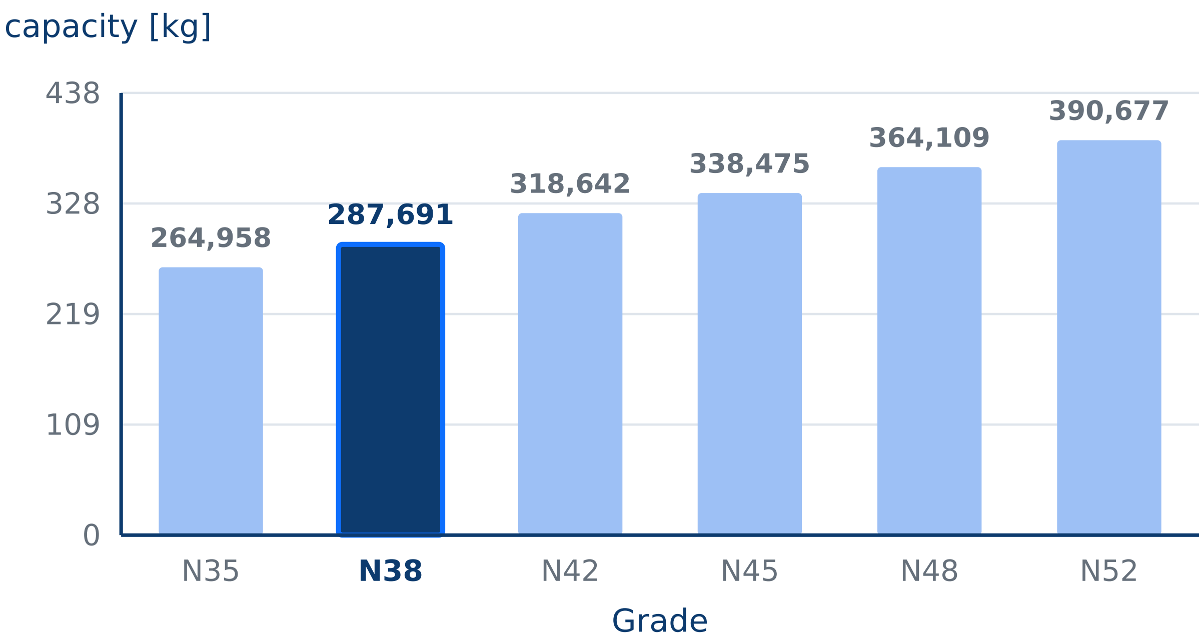
Double-sided pot
two magnets, shared housing
F⊥ pull: **604,64 kg**
F∥ shear: **181,39 kg**

Mounting variant	Perpendicular force (pull)	Parallel force (shear)	Share
Bare magnet	**287,69 kg**	**86,31 kg**	30%
Single-sided pot	**671,83 kg**	**201,55 kg**	30%
Double-sided pot	**604,64 kg**	**181,39 kg**	30%

Perpendicular force is what the catalogue quotes: pulling straight off the face. Parallel force (shear) applies when the load tries to slide the magnet along the plate and is only a fraction of the former. Values for bare steel, friction coefficient 0.30.

Before choosing a mount, establish the direction of the load. At a 100 kg catalogue rating, a vertically hung load means about 30 kg, with no margin applied.

Grade comparison



The same body produced in successive NdFeB grades. A higher grade means more holding force at identical dimensions.

Two magnets — attraction and repulsion

Gap	Attraction	Repulsion
0 mm	287,69 kg	258,92 kg
1 mm	261,19 kg	235,07 kg
2 mm	235,69 kg	212,12 kg
3 mm	211,72 kg	190,55 kg
5 mm	169,05 kg	152,15 kg
10 mm	93,64 kg	84,28 kg
20 mm	30,82 kg	27,74 kg
30 mm	12,30 kg	11,07 kg

Magnet stack

Quantity	Stack pull force	Gain
1	287,69 kg	×1,00
2	277,33 kg	×0,96
3	230,08 kg	×0,80
5	172,76 kg	×0,60
10	140,15 kg	×0,49

Stacking magnets increases the capacity only up to a point. The optimum usually falls at a height of 0.6–0.8 of the diameter — beyond that the force starts to fall even as material is added. Measurements from our own stock confirm it: a ⌀10 mm magnet peaks at a height of 8 mm (3.39 kg), while at 15 mm it holds only 2.61 kg.

The cause of saturation is straightforward: stack height does not change the pole area, and the pole area is what governs the force. Each further magnet raises the permeance coefficient and with it the operating-point induction — but that tends towards the remanence and above a certain height barely increases. At the same time the material added at the end of the stack is ever further from the working face, so more and more of its flux closes sideways rather than through the gap. Above a height of about 0.7 of the diameter both effects overlap and the next magnet contributes almost nothing to capacity, while adding cost, mass and assembly risk.

Additional parameters

36,99 N·m	26,74 J	158,23 kg	470 kPa
ROTATION RESISTANCE TORQUE	DETACHMENT WORK	CAPACITY AT PLATE EDGE	UNIT PRESSURE

A magnet placed right at the edge of the plate loses part of its flux and holds less. The torque needed to turn a magnet resting on steel.

Engineering indicators

Four quantities describing the magnet itself – with no assumptions about the substrate or air gap. They come from the same calculations as the results above.

84 %	**177,62** A·m²	**0,213** kg/g	**26 741** mJ
SHAPE EFFICIENCY	MAGNETIC MOMENT	FORCE PER GRAM	DETACHMENT ENERGY

Shape efficiency: 244 / 291 kJ/m³ – of the material potential used

(BH)d = Bd · Hd, (BH)max = Br² / (4 · μ0 · μrec)

How much of the material's energy potential is used by this shape. The energy product at the operating point (BH)d referred to the material maximum (BH)max. The maximum falls at Pc ≈ 1.05 – the slenderer the magnet, the closer it gets. A low figure does not indicate a defective product – a flat disc is optimal wherever a large contact area and low build height matter.

Consistency test: the computed (BH)max should fall within the catalogue range for the grade. A match confirms that the assumed remanence and recoil permeability are mutually consistent.

Magnetic moment

A parameter influenced by neither the substrate nor the air gap. The product of the magnetisation M = Br/μ0 and the volume of the body. It lets you estimate the field far from the magnet, where only the dipole approximation matters.

Force per gram

The force-to-mass ratio: how much holding power one gram of the product delivers. The taller the magnet at a given diameter, the higher the figure, because Pc increases. It helps judge the cost of force, because price depends mainly on the mass of material.

Detachment energy

That is the energy needed to lift **2 727** g to a height of one metre.

The integral of force over distance from full contact to a 50 mm separation, computed by the trapezoidal rule. This is not the same as force: force decides whether the load is held, energy how hard the magnet is to remove.

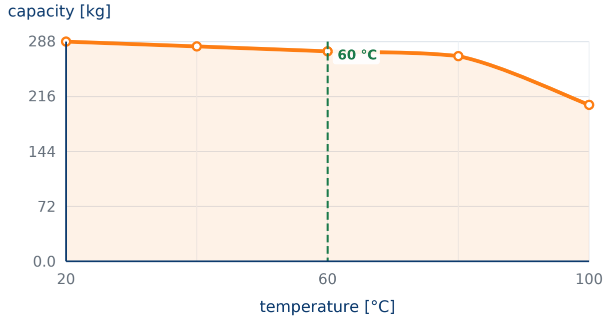
Three levels of the same number

The same geometry is described by very different numbers, depending on who is calculating and why. Below are the three levels you will actually encounter.

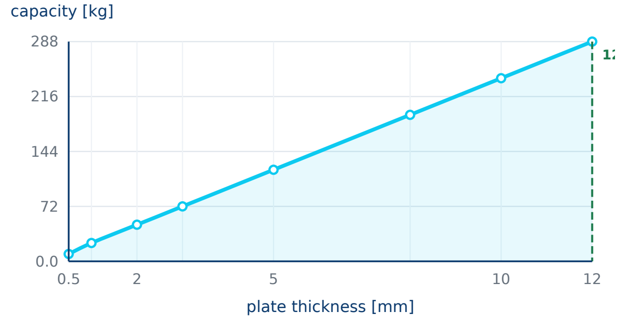
Level	What it is based on	Force
Typical online shop claim	N42 grade instead of N38, remanence at the top of the range, zero air gap, lapped plate	**460,31 – 517,84 kg**
dhit model – ideal laboratory conditions	S235 steel at least 10 mm thick, full contact, 20 °C, uncoated magnet	**287,69 kg**
Value for design calculations	The model divided by a safety factor of 2.0 for workshop mounting	143,85 kg

The 1.6–1.8 factor is not an estimate. It results from the sum of assumptions that inflate results published elsewhere – and because those factors act multiplicatively, the ratio stays valid for any geometry, unlike the absolute value. Base design calculations on the last row only.

Temperature derating curve



Steel thickness effect curve



Ageing and long-term stability

Service period	Flux loss	Force
1 years	-0,2%	**286,54 kg**
5 years	-0,5%	**284,82 kg**
10 years	-1,0%	**281,97 kg**
20 years	-1,8%	**277,43 kg**

Sintered NdFeB in a properly designed magnetic circuit is a stable material — spontaneous flux loss is measured in fractions of a percent per year and all but disappears after the first year. The values given refer to room-temperature operation, a dry environment and unchanged circuit geometry.

Recommended safety factors

Type of duty	Recommended utilisation	Safety factor	Design force
Static load, controlled contact	70%	×1,4	**201,38 kg**
Static load, workshop assembly	50%	×2,0	**143,85 kg**
Shear load (sliding along the plate)	50%	×2,0	**43,15 kg**
Motion, acceleration, opening cycles	40%	×2,5	**115,08 kg**
Vibration, transport, continuous duty	33%	×3,0	**94,94 kg**
Work overhead or lifting	20%	×5,0	**57,54 kg**

It is corrosion, not ageing of the material itself, that governs a magnet's life in practice. The NiCuNi coating stays sealed only while undamaged — a chipped edge, an impact or damp open a path to core corrosion, and a corroded sinter crumbles and loses flux far faster than the table says. The second factor is thermal cycling — every episode that crosses the curve knee removes a permanent share of the strength, and the losses accumulate. The figures given are an estimate based on the operating point position, not the result of long-term testing.

The catalogue capacity is a limiting value for ideal conditions and is not fit for direct use in design calculations. A magnet is a component with wide manufacturing spread and extreme sensitivity to contact quality, so it is designed to a fraction of its nominal value. The table below gives shares proven in workshop practice.

For applications where a mounting failure endangers health, the magnet must never be the sole load-carrying element — an independent mechanical safeguard is required. A magnet is neither a lifting accessory nor lifting equipment and is not certified as such.

How to use this data in practice

1. Establish the load direction first, then look at the kilograms. Shear force is roughly 30% of pull force on bare steel and distinctly less on painted steel — a vertical wall mount is designed from the shear table, never from the catalogue value.

2. Multiply the result by the utilisation share from the safety factor table matching your type of duty. Only the number obtained this way is the design force.

3. Check that the plate is thick enough. Below the full-flux-utilisation threshold the capacity falls in direct proportion to thickness, because thin plate goes into saturation. For this magnet the threshold is 12,0 mm.

4. Determine the operating temperature; do not stop at the ambient. In an enclosure, beside a motor or in a machine standing in the sun, a magnet can be tens of degrees hotter than the shop air.

5. Do not raise the force by stacking magnets — above a height of roughly 0.7 of the diameter the gain essentially stops. It is cheaper and more reliable to increase the diameter or spread the load over several mounting points.

6. Surface preparation matters. Degreasing and grinding off rust usually raises the force more than jumping two grades, at a fraction of the cost.

7. Store flat magnets stuck to steel or in opposite-pole pairs. Kept loose, they work close to the curve knee and lose their thermal safety margin.

8. Where the mounting is critical, verify it by trial on the real material in its real surface condition. A single force-gauge measurement on the real part beats any calculation report, this one included.

Material data sources

The grade data used in the calculations were taken from the sinter supplier's material data sheet; they fall within the ranges defined in the documents listed below. They are given so that any adopted value can be verified against an independent source.

IEC 60404-5:2015 — methods of measuring the magnetic properties of hard magnetic materials in a closed circuit — flux density, polarisation and field strength, plus determination of the demagnetisation curve and recoil line · https://webstore.iec.ch/en/publication/22142

IEC 60404-8-1:2023 — minimum values of the principal magnetic properties and dimensional tolerances of technically important hard magnetic materials, including densities and chemical composition ranges · https://webstore.iec.ch/en/publication/68440

ASTM A977/A977M-07(2020) — hysteresigraph method for high-coercivity materials, covering remanence, coercivity, knee field, energy product and recoil permeability · https://store.astm.org/a0977_a0977m-07r20.html

MMPA Standard No. 0100-00 — industry specification covering the magnetic, thermal, physical and mechanical properties of commercial permanent magnets and typical production tolerances · a Magnetic Materials Producers Association standard, available to association members

dhit grade data sheet — the Br, Hcb, Hcj, BHmax and maximum operating temperature ranges adopted in this report; the model input values come from it. · available on the product page in the dhit catalogue

The listed standards are sources of methodology and reference values; the report is neither an accredited test document nor a certificate of conformity.

Production repeatability

We publish no process capability statistics (Cp, Cpk) for individual sizes, hence the general nature of the notes below. In sintered NdFeB the spread of magnetic properties exceeds the dimensional spread; the industry assumes a remanence tolerance of about ±5% and declares intrinsic coercivity as a minimum. Since force depends on the square of induction, a remanence tolerance of this order means roughly ±10% of force: more than the dimensional tolerance and many times more than the model uncertainty. The conclusion for the designer is unambiguous: when sizing a mount it is material spread, not calculation accuracy, that sets the required safety margin.

A spread of about ±10% in force arising from remanence tolerance is typical of the entire sintered neodymium magnet industry, which is why safety margins are necessary regardless of how accurate the calculation model itself is.

Reference conditions

Magnetization direction: through thickness · The poles fall on the end faces and the field passes along the dimension **30,0 mm**

The pull force was computed for a plate of non-alloy structural steel (S235 / A36) of at least 10 mm thickness, smooth, clean and degreased, with no air gap and force perpendicular to the surface. Austenitic stainless steel (304, 316) is non-magnetic — a magnet will not stick to it.

Values are calculated from a physical model calibrated against 127 measured products. They are estimates for design purposes — always apply a safety margin.

Every value in the report is the result of a model calculation, not a measurement of a specific unit. They are intended for design and comparison. Before using them in a safety-critical design, run a trial on the actual part and apply the margin from the safety factor table.

The report is produced in two language versions. The Polish version sits at the same address without the /en/ prefix and with the Polish route segment, for example https://dhit.pl/raport-magnesu/magnes-neodymowy-walcowy-38x3-5-n38-osiowy/. The calculations, assumptions and all numerical values are identical — only the descriptive layer changes.