Anisotropic magnets: See Technical Information/ Preferred Direction **page 65.**

B curve: See Technical Information/Hysteresis Loop - Demagnetisation Curve **pages 68-69.**

Calibrating: Usually the magnetic flux is determined to a tolerance of about ±10%. For more exact technical applications, the magnetic flux must be set to tighter tolerances.

Coercivity (coercive field strength) H_{cB}: See Technical Information/Hysteresis Loop - Demagnetisation Curve **pages 68-69.**

Coercivity (coercive field strength) H_{cJ}: See Technical Information/Hysteresis Loop - Demagnetisation Curve **pages 68-69.**

Curie temperature: Above the curie temperature of a ferromagnetic material, it becomes paramagnetic, i.e. it loses its magnetisation entirely. Usually, the maximum operating temperature of magnetic materials is much lower than their curie temperature.

Curvature (knee): See Technical Information/ Hysteresis Loop - Demagnetisation Curve, Operating point **page 69.**

Demagnetisation: Demagnetisation can be caused by temperature effects, an opposing magnetic field, or ionising radiation.

Demagnetisation curve: See Technical Information/Hysteresis Loop - Demagnetisation Curve **pages 68-69.**

Earth's magnetic field: The earth's magnetic field ranges between 0.03 - 0.05 mT.

Energy product $(B \cdot H)_{max.}$ [kJ/m³]: See Technical Information/Hysteresis Loop - Demagnetisation Curve **pages 68-69.**

Field lines: Field lines are a visual representation of a magnetic field's magnitude and direction. The field line density indicates the magnetic flux density. The magnetic flux between two adjacent field lines is constant.

Field strength, magnetic, H [kA/m]: See Technical Information/Hysteresis Loop - Demagnetisation Curve **pages 68-69.**

Flux density, magnetic, B [mT]: See Technical Information/Hysteresis Loop - Demagnetisation Curve **pages 68-69.**

Flux, magnetic, Φ: See Field lines

Hysteresis loop: See Technical Information/Hysteresis Loop - Demagnetisation Curve **pages 68-69.**

Induction, magnetic, B [mT]: See Flux density, magnetic, B [mT]

Initial curve: See Technical Information/ Hysteresis Loop - Demagnetisation Curve **pages 68-69.**

Irreversible losses: Irreversible losses occur when the operating point is not on the linear part of the demagnetisation curve.
See Technical Information/Hysteresis Loop - Demagnetisation Curve **pages 68-69.**
Irreversible losses are also possible wherever the actual demagnetisation curve differs from the theoretical, linear behaviour. Some irreversible losses are inevitable with rises in temperature and in external fields. By a one-time stabilisation, magnets can be set to a constant value. The disadvantage is that the induction is lowered.

Isostatic pressing: See Material Specification

Isotropic magnets: See Technical Information/ Preferred Direction **page 65.**

J curve: See Technical Information/Hysteresis Loop - Demagnetisation Curve **pages 68-69.**

Length-to-diameter ratio h: D: See Technical Information/Hysteresis Loop - Demagnetisation Curve **pages 68-69.**

Magnetising: See Technical Information/Magnetising field strengths **page 67.**

Magnetism: Magnetism is associated with moving electrical charge. Magnetic moments are generated by the motion of electrons around the nucleus in atoms, and also from the internal spin of the electrons. Together they make up the magnetic moment of the atom, adding vectorially. If they sum to zero, the material is called diamagnetic. For paramagnetic, ferromagnetic, antiferromagnetic, und ferrimagnetic materials, the moments sum to a quantity different from zero.

1. **Paramagnetism:** Paramagnetism occurs in materials whose atoms have at least one electron shell that is not completely filled. Examples are O, Al, Pt, Ti, various transition metals, rare earth metals, and actinides. These atoms possess a permanent magnetic moment. Neighbouring atoms are not coupled to each other. In an external magnetic field, the atoms align their magnetic moments in the direction of the external field. Here $1 + 4 \cdot 10^{-4} > \mu r > 1 + 10^{-8}$.

2. **Ferromagnetism:** Ferromagnetism occurs in materials whose atoms have a particular electron shell occupation and also a particular relationship between their interatomic spacing distance and their atomic radii. Examples are Fe, Co, Ni, and compounds such as Alnico. Neighbouring atomic magnetic moments couple parallel to each other and form domains with a total magnetic moment of a certain size and orientation. Here $5 \cdot 10^5 > \mu r > 100$.

3. **Antiferromagnetism:** Antiferromagnetic materials also form domains. However, they have two different sublattices, whose magnetic moments are antiparallel. That is, they are of equal magnitude and opposite direction. These materials behave like paramagnetic substances. Examples are a-Mn, FeO, Fe_2O_3, FeS, CoO.

4. **Ferrimagnetism:** Domains with magnetic moments from different sublattices, pointing in opposite directions, characterise ferrimagnetism. The magnetic moments are of different magnitude, so the material behaves like a ferromagnet. (Cubic ferrites, such as MnO·FeO, are soft magnetic materials, whereas hexagonal ferrites such as $BaO \cdot 6Fe_2O_3$, are hard magnetic materials).

Max. operating temperature: Maximum temperature at which a magnet with length-to-diameter ratio h : D ⩾ 0.5 may be in operation, under normal ambient conditions. The maximum operating temperature is reduced for smaller length-to-diameter ratios and/or when opposing magnetic fields are present. Our Technical Applications Department is happy to support you with maximum operating temperature calculations.

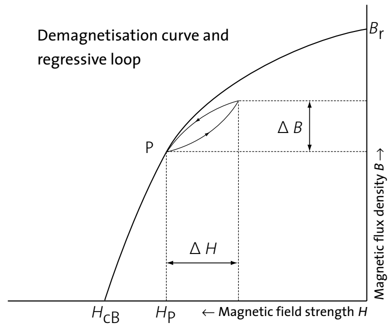
Operating load line: See Technical Information/Hysteresis Loop - Demagnetisation Curve **pages 68-69**.

Operating point: See Technical Information/Hysteresis Loop - Demagnetisation Curve **pages 68-69**.

Passivating (cathodic, sacrificial anode) corrosion protection: Passivating protective coatings such as zinc, chrome, and aluminium, are electrochemically more active than the metal they cover. When new, they bear the corrosive attack alone, acting as sacrificial anodes. As long as they are intact, the covered metal has cathodic corrosion protection, and the component remains fully functional. If small defects and small holes are in the coating, the surrounding sacrificial coating provides protection. Once larger areas of the coating are abraded, the covered metal will corrode.

Permeability μ: The magnetic permeability μ, sometimes referred to as "conductivity", is defined as the ratio of the magnetic induction B to the magnetic field H. The permeability in vacuum is a constant:
μo = 1.256 mT / kA/m. The ratio in matter is the substance's characteristic absolute permeability μ = μr · μo. (μr = relative permeability).
Substances may be diamagnetic (μr < 1), paramagnetic (μr > 1), or ferromagnetic (μr >> 1), with values ranging from 1 to over 100,000.

Permeability, relative permanent μ_{rec}: Permeability μ_{rec} gives the average slope of a regressive loop whose flux point P is normally on the demagnetisation curve. (μ_{rec} = 1/μo · ΔB/ΔH). See Technical Information/Hysteresis Loop - Demagnetisation Curve, Operating point **page 69**.



Polarisation, magnetic, J [mT]: See Technical Information/Hysteresis Loop - Demagnetisation Curve **pages 68-69**.

Preferred direction: See Technical Information/Preferred Direction **page 65**.

Remanence Br [mT]: See Technical Information/ Hysteresis loop - Demagnetisation Curve **pages 68-69**.

Reversible losses: Reversible losses occur when the temperature increases, and then are recovered when the temperature decreases again. Material behaviour in different temperature ranges depends on the temperature coefficient T_k.

Saturation polarisation: See Technical Information/Hysteresis Loop - Demagnetisation Curve **pages 68-69**.

Shearing: Angle of the operating load line, resulting from opening or closing a magnetic loop. See Technical Information/Hysteresis Loop - Demagnetisation Curve, Operating load line **pages 68-69**.

Stabilising: A treatment of a magnet at a defined temperature or a treatment in a magnetic field, to prevent the magnetic flux from being altered by external influences afterward. See also Calibrating.

Susceptibility, magnetic χ: Susceptibility defines the relationship between magnetisation and magnetic field strength. Here $M = \chi \cdot \mu_o H$ and $\mu r = \chi + 1$.

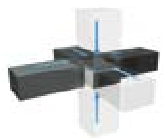
Temperature coefficients: Temperature coefficients describe the temperature-dependent behaviour of permanent magnets. The remanence temperature coefficient of hard ferrite magnets is about -0.19%/K. That is, a temperature rise of 1 Kelvin reduces the remanence by 0.19%. Sm_2Co_{17} magnets have the lowest temperature coefficients, at -0.03%/K.

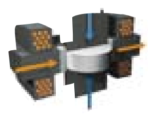
Transverse field pressing: See Material specification.

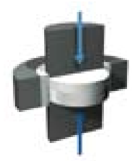
Material specification: Quality specification as in DIN IEC 60404-8-1
Example: NdFeB 200/220 w:
NdFeB = Material designation
200 = Minimum allowed value for the max. energy density; here, 200 kJ/m³
220 = 1/10 of the minimum allowed value for the coercivity H_{cJ}; here, 2200 kA/m
w = code for the manufacturing process; here, die pressed

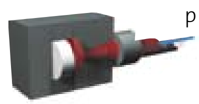
Abbreviations for our manufacturing processes:


w = axially die pressed


h = isostacically or


diametrically die pressed


pw = plastic bonded, compression moulded


p = plastic bonded, injection moulded (isotropic / anisotropic)

Pressing direction
Magnetic field (H)