Ferrite Magnets

FB Series

Product Guide

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Contents Update : MAY 2014

Ferrite Magnet

FB Series

Introduction

From the birth of the FB1A material in 1959 to the latest materials, the development history of TDK ferrite magnets has been in synchronization with the advancement of magnetic application technologies.

Quickly and accurately responding to market demands with active involvement of new markets together with our customers -- that's our basic stance throughout the 50 years of TDK ferrite magnet development history.

One of our latest achievements is the high-power La-Co-free material shown as an orange line at the bottom right. Eliminating rarer elements such as La (lanthanum) and Co (cobalt), we realized the world's highest-level performance close to that of the La-Co-added FB9 material.

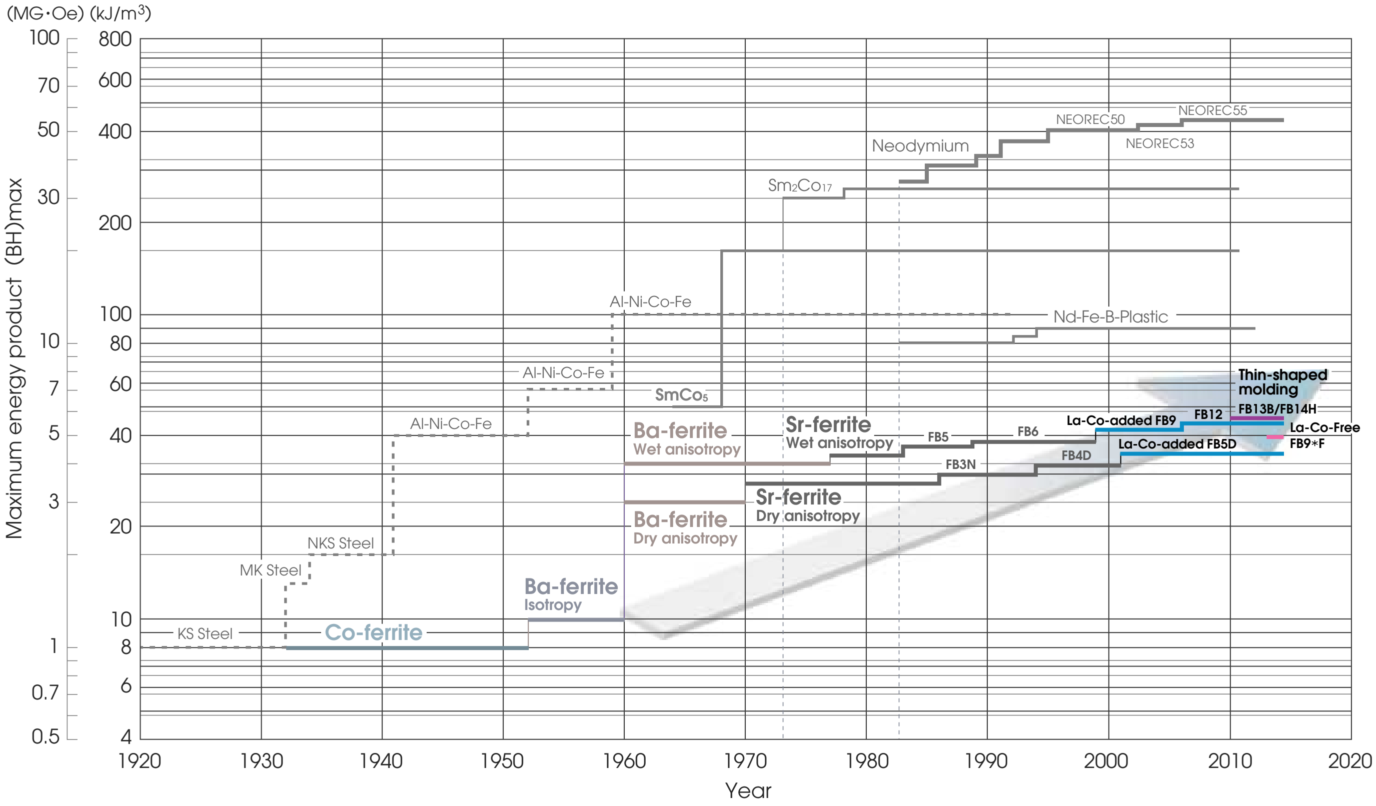
We also established the world's first thin-shaped molding system which allows 1.5mm-thick skew forms. We used this innovative original process for the FB12 material, one of the optimum materials in the FB series magnetic characteristics distribution map.

The purple line at the bottom right shows the result. This new material provides freedom in designing shapes for motor's optimum magnetic efficiency as well as the property superiority which exceeds the FB12 material.

TDK also established the "in-market-service" system in which we responds to customers' orders and requests for technical services through our production bases and service offices inside/outside Japan.

We are committed to supporting your rapid and optimized magnet application design and development as a "concept-in" company, providing our extensive expertise concerning magnetic circuit design as well as quality and high-performance magnets.

Magnetic characteristics transition of TDK ferrite magnet

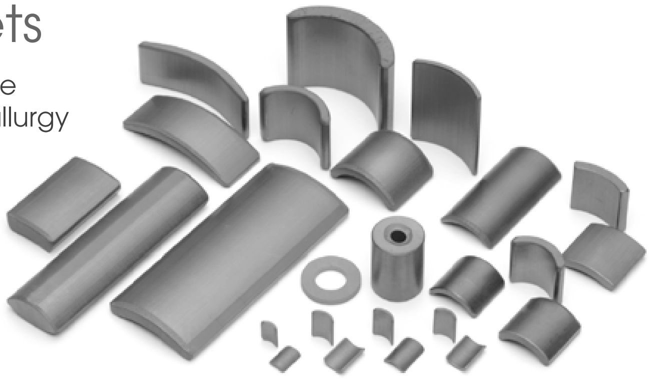


Ferrite Magnet

FB Series

Features of TDK ferrite magnets

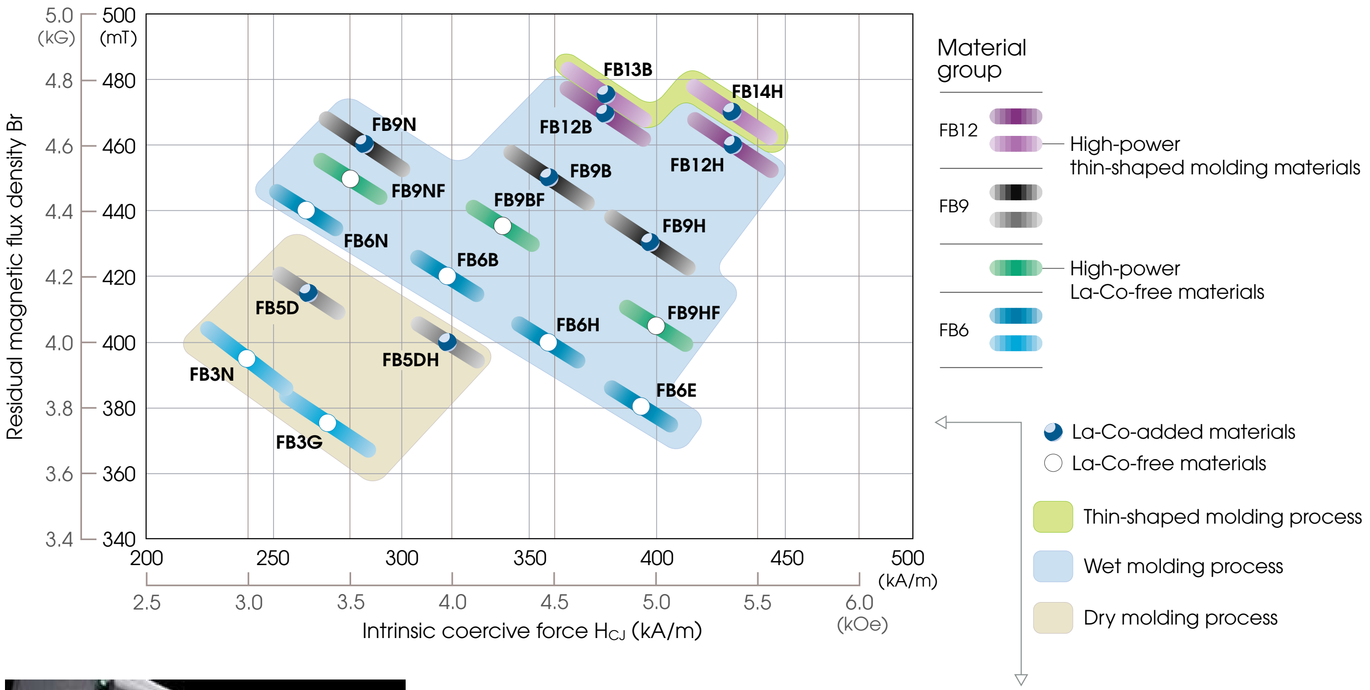
A oxide magnet made by sintering, using advanced fine powder control technologies based on a powder metallurgy method. Not susceptible to weakened magnetic fields, this is our core magnet product with out-standing properties for practical applications that surpass those of conventional metal magnets. Another strong feature is that it can be produced in volume at costs significantly below neodymium magnets.

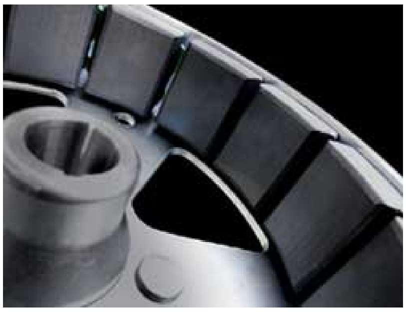


FB13B, FB14H : High-performance / thin-shaped molding materials (Available thickness : 1.0 to 2.0mm)

FB9NF, FB9BF, FB9HF : High-power / State-of-the-art La-Co-free materials

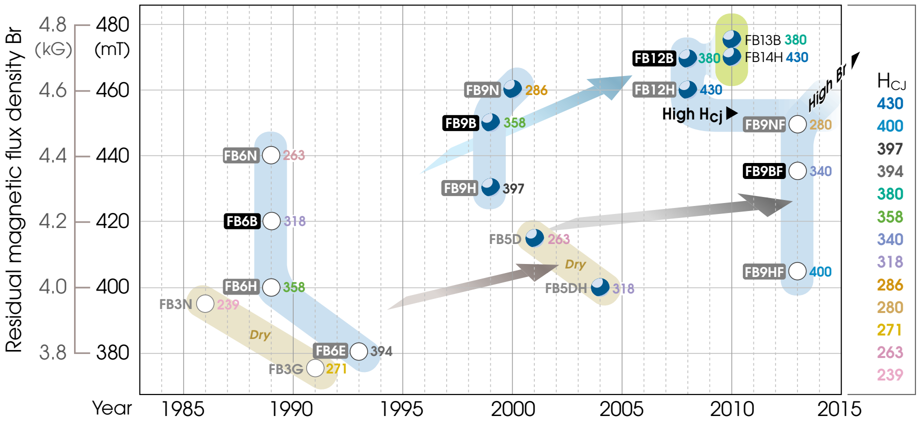
Magnetic characteristics distribution charts of FB Series





High-performance ferrite magnet for outer rotor

Development trends in material group of the FB Series



⚠The details can be found by referring to the appended individual delivery specifications.
All specifications are subject to change without notice.

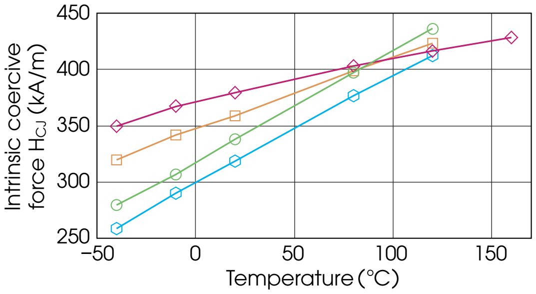
Typical material characteristics

Example of Magnetic characteristics

Type	Material group	Molding process	Material name	Residual magnetic flux density Br (mT)	Coercive force H_{CB} (kA/m)	Intrinsic coercive force H_{CJ} (kA/m)	Maximum energy product $(BH)_{max}$ (kJ/m^3)
High-power La-Co-added	FB12	Thin-shaped	**FB13B**	475±10	340±20	380±20	44.0±1.6
			FB14H	470±10	355±20	430±20	43.1±1.6
High-power La-Co-added	FB12	Wet	**FB12B**	470±10	340±12	380±12	43.1±1.6
			FB12H	460±10	345±15	430±15	41.4±1.6
Higher power La-Co-added	FB9	Wet	**FB9N**	460±10	278.5±12	286.5±12	40.4±1.6
			FB9B	450±10	342.2±12	358.1±12	38.6±1.6
			FB9H	430±10	330.2±12	397.9±12	35.0±1.6
Higher power La-Co-free		Wet	**FB9NF**	450±10	270±12	280±12	38.4±1.6
			FB9BF	435±10	315±12	340±12	36.3±1.6
			FB9HF	405±10	310±12	400±12	31.7±1.6
La-Co-free	FB6	Wet	**FB6N**	440±10	258.6±12	262.6±12	36.7±1.6
			FB6B	420±10	302.4±12	318.3±12	33.4±1.6
			FB6H	400±10	302.4±12	358.1±12	30.3±1.6
			FB6E	380±10	290.5±12	393.9±12	27.5±1.6
La-Co-added	FB9	Dry	**FB5D**	415±10	254.6±12	262.6±20	32.6±1.6
			FB5DH	400±10	278.6±11.9	318.3±15.9	30.3±1.6
La-Co-free	FB6	Dry	**FB3N**	395±15	234.8±12	238.7±16	28.7±2.4
			FB3G	375±15	254.6±16	270.6±20	25.9±2.4

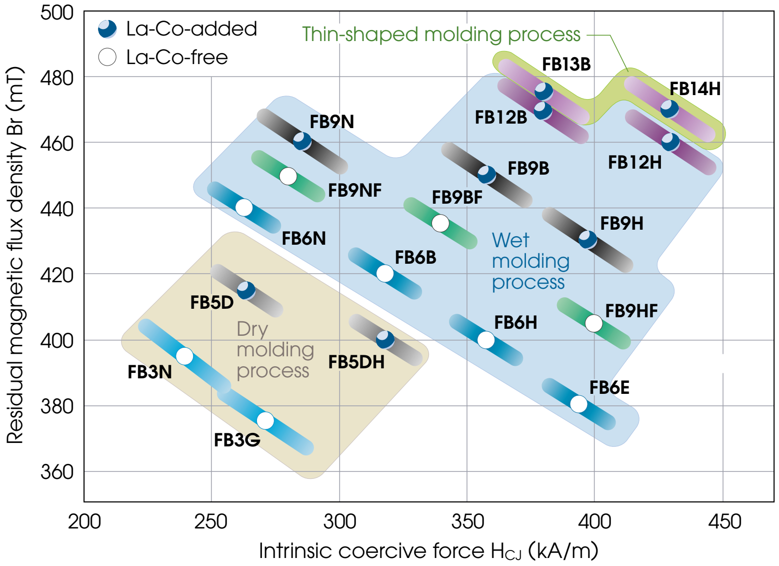
Curie temperature Tc (K)	Recoil permeability μ_{rec}	Magnetizing magnetic field (kA/m)
733	1.05 to 1.10	>1000

Examples of H_{CJ} vs. temperature characteristics of representative materials



Temperature coefficient

La, Co type		La, Co Free	
◇	□	○	⬡
FB12B	**FB9B**	**FB9BF**	**FB6B**
0.11%/K	0.18%/K	0.29%/K	0.30%/K



Physical and mechanical characteristics

Density (Mg/m^3)	Specific heat (J/kg•K)	Thermal expansion coefficient (ppm/K)		Flexural strength (MPa)	Compressive strength (MPa)	Tensile strength (MPa)	Young's modulus (GPa)	Vickers hardness Hv
		C//[*1]	C⊥[*2]					
4.9 to 5.1	837	15	10	70	700	35	200	530

[*1] C// : Measurement value in the direction of easy magnetization
[*2] C⊥ : Measurement value in the direction perpendicular to the direction of easy magnetization

Ferrite Magnet

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Part number structure

Example of a standard-shaped product -1

Segment type

Material code
Shape code : C
Size code (mm) : outer ϕ x Inner ϕ x L
Internal code*
* Includes magnetization direction code

FB9B C 38×30×40 □□□

Example of a standard-shaped product -2

Cylinder type, Circular disc type,
Cylinder type with hole, Ring type,
Cubic/cuboid type, Plate-shaped type,
Cubic/cuboid type with hole,
Plate-shaped type with hole

Material code
Shape and magnetization direction code : D, DH, RH, W, WH
Size code (mm) : Point and description order are specified per shape
Internal code

FB6B D 22×36 □

Details on shape and size are specified in the individual delivery specification.

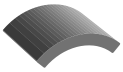
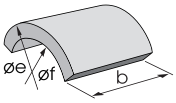
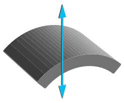
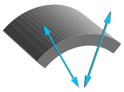
We handle requests for parts in both standard and various special shapes. Please contact for details on shape samples, largest and/or smallest size, etc.

Example of a standard-shaped product

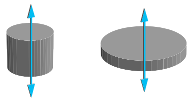
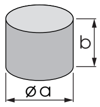
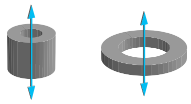
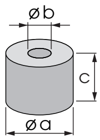
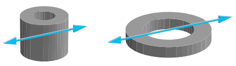
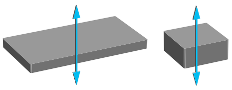
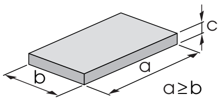
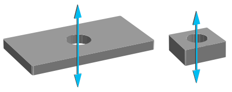
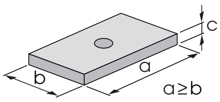
Material code
S : Special shape code
Shape code : C
Shape and magnetization direction code : D, DH, RH, W, WH
Size code (mm) : Point and description order are specified per shape
Internal code

FB9BF S W 40×20×6 □

Example -1

Shape		Shape code	Size description point	Size code	Magnetization direction (specified by internal code)			
Segment type		**C**		**e** x **f** x **b**		Parallel		Radial

Example -2

Shape / Magnetization direction			Shape and magnetization direction code	Size description point	Size code
Cylinder type Circular disc type		Axial direction	**D**		**a** x **b**
Cylinder type with hole Ring type		Axial direction	**DH**		**a** x **b** x **c**
Cylinder type with hole Ring type		Orthogonal to axial direction	**RH**		
Cubic/cuboid type Plate-shaped type		Thickness direction	**W**		**a** x **b** x **c**
Cubic/cuboid type with hole Plate-shaped type with hole		Thickness direction	**WH**		**a** x **b** x **c**

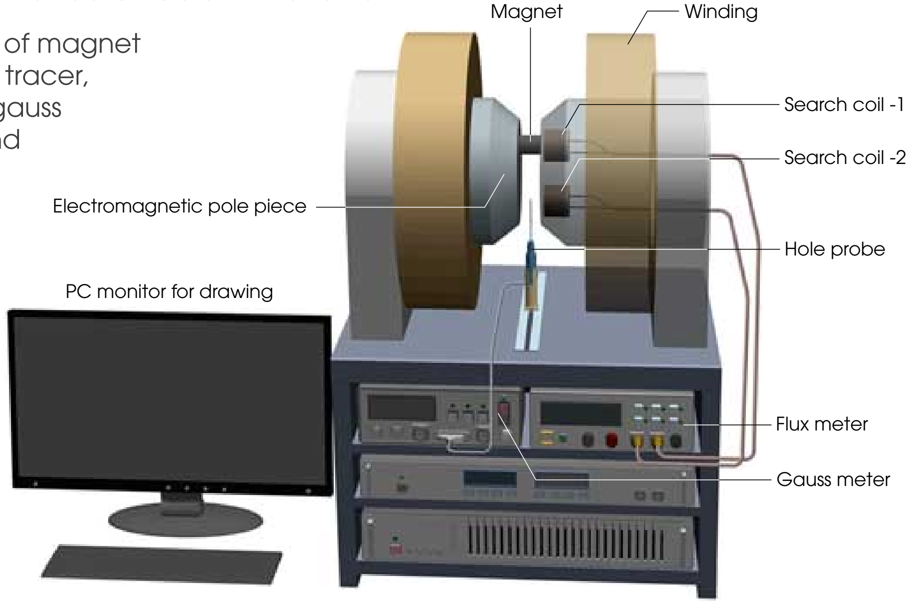
* Cubic/cuboid, plate-shaped type with hole is available only in dry molding material

Measurment method for magnetic characteristics

1. Basic magnetic characteristics of each material

The basic magnetic characteristics of magnet materials are measured via the B-H tracer, which consists of electromagnets, gauss meters, flux meters, hole probes, and so on, using special test pieces manufactured through the same processes as the product.

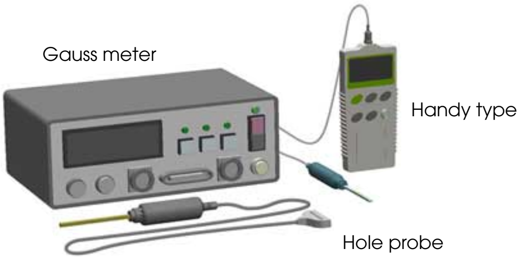
B-H and J-H demagnetization curves are drawn based on the basic data from the B-H tracer, and basic characteristic values such as magnetic flux density Br, intrinsic coercive force H_{CJ} (and H_{CB}), and maximum energy product (BH)max can also be obtained.



2. Magnetic characteristics of each product

The B-H tracer can measure simple block-shaped products. But the consistency (reproducibility) with the measurement results from the individual designs of application products and manufacturing processes of the customers who use the magnets is important for the basic magnetic characteristics of individually-designed products. We therefore follow the conditions and procedures of the simple measurement which our customers and we arranged in advance.

2-1. Tools for simple measurement of magnetic flux density and magnetic flux amount

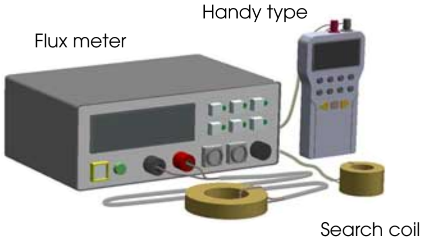


The gauss meter and hole probe are used together to measure magnetic flux density. The measurement accuracy is achieved using probe stands and such, which reduce the unevenness of predetermined measurement conditions (such as the degree of close contact, interval, or parallelization between the hole probe and measured objects).

The flux meter with attached search coils is used to measure the amount of magnetic flux of each product. Measurement values can still differ because of inconsistent speeds of magnet movements and separation distances from the search coils. The assistive tools best suited to each measurement method can ensure accuracy.

In these simple measurement methods, criterial samples are selected from products. Comparative measurement with the samples can avoid errors among measuring instruments.

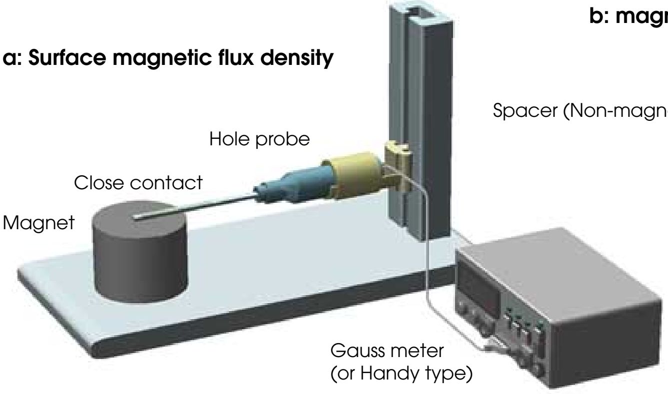
The representative conceptual models are shown in the following page:



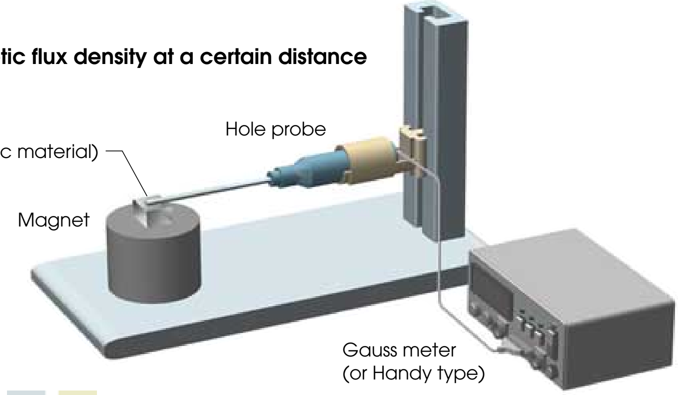
Measurment method for magnetic characteristics

2-2. Measurement of magnetic flux density

a: Surface magnetic flux density



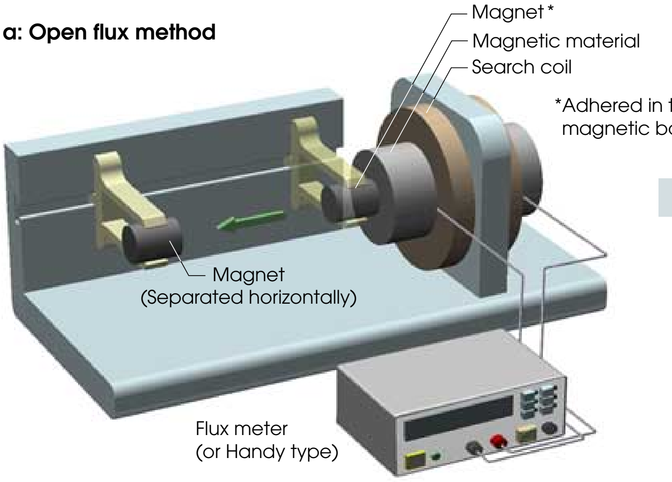
b: magnetic flux density at a certain distance



🟦 🟨 Non-magnetic material

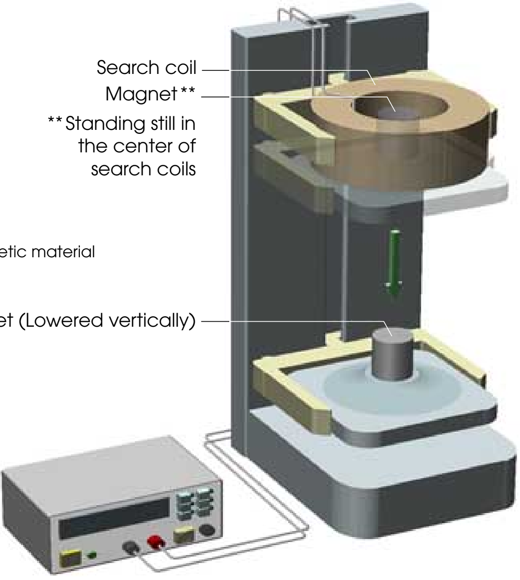
2-3. Measurment of amount of magnetic flux

a: Open flux method



*Adhered in the center of magnetic body

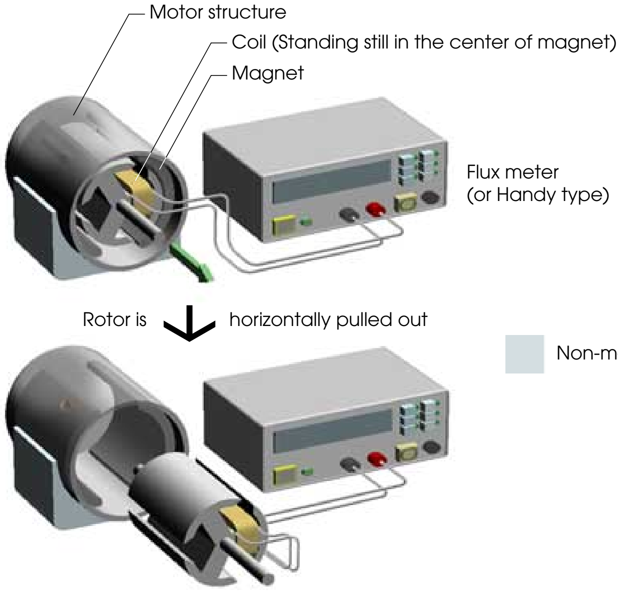
🟦 🟨 Non-magnetic material



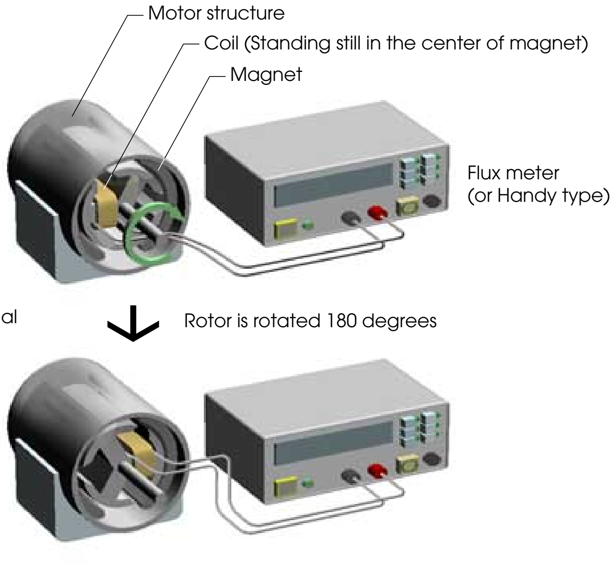
**Standing still in the center of search coils

Flux meter
(or Handy type)

b: Method using magnetic circuits



🟦 Non-magnetic material



Basic Physical Properties of Ferrite Magnets

1. Physical and mechanical characteristics

A ferrite magnet is made from ceramic in which grains generated by a solid-phase reaction are closely bonded. Therefore, while having high environmental resistance, a ferrite magnet exhibits a flexural strength of only around 0.5−0.9×108N/m^2 (5−9kgf/mm^2), and is weak against shock such as being dropped on the floor or collisions with other products. For this reason, handling of a ferrite magnet requires the greatest care. Moreover, consideration is given to the prevention of chipping or breakage when designing the shape, such as eliminating sharp edges to the extent possible.

2. Temperature characteristics

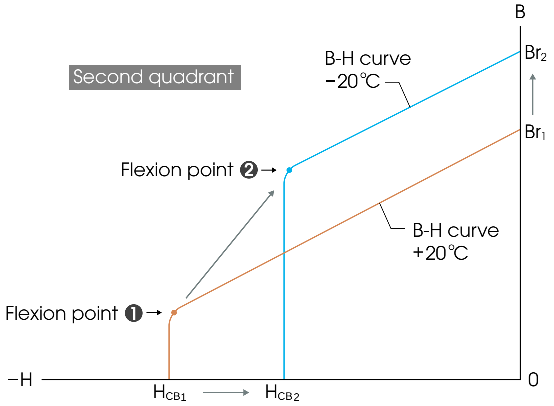
2-1. Shift of the flexion point by temperature changes

Temperature is an important factor in considering the magnetic characteristics of a ferrite magnet. In the case of TDK ferrite magnets, temperature coefficient $\Delta Br/Br/\Delta T$ of residual magnetic flux density Br exhibits a negative characteristic of around −0.18%/K(%/℃). On the other hand, the temperature coefficient of intrinsic coercive force H_{CJ} exhibits a positive characteristic of approximately +0.3−0.4%/K(%/℃) in the case of FB6 series, and +0.18−0.11%/K(%/℃) in the case of high-power materials FB9 and FB12 series.

We will now see how the flexion point where the value of magnetic flux density B shows a sudden drop shifts according to temperature changes, using a material in which the flexion point appears in the second quadrant of the B-H curve at a normal temperature of +20℃ (a material with relatively small intrinsic coercive force H_{CJ}) as a model.

Fig.1

Shift of the flexion point by temperature changes



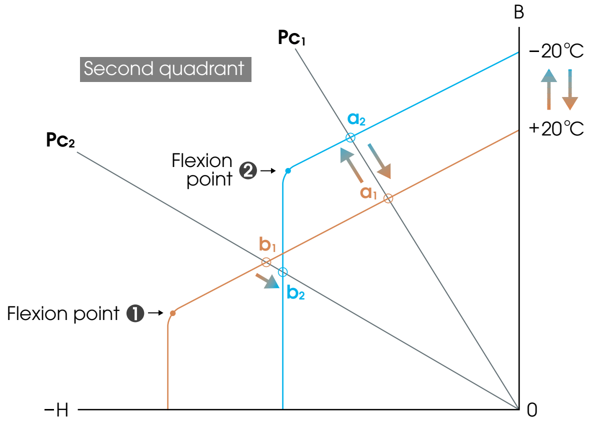
When a ferrite magnet at a temperature of +20℃ is cooled down to −20℃, residual magnetic flux density Br, with a negative temperature coefficient, increases and intrinsic coercive force H_{CJ}, with a positive temperature coefficient, decreases. As a result, the B-H curve becomes vertically long overall, and flexion point ❶ shifts upwards to flexion point ❷ on the B axis side.

2-2. Reversible change and irreversible change (irreversible low temperature demagnetization)

Demagnetization is a basic yet extremely important theme in designing magnetic circuits using ferrite magnets. Demagnetization caused by temperature changes can be examined by adding the permeance coefficient **Pc** line indicating the actual force of the magnet to the flexion point shift model.

Fig.2

Reversible change and irreversible change of the operating point

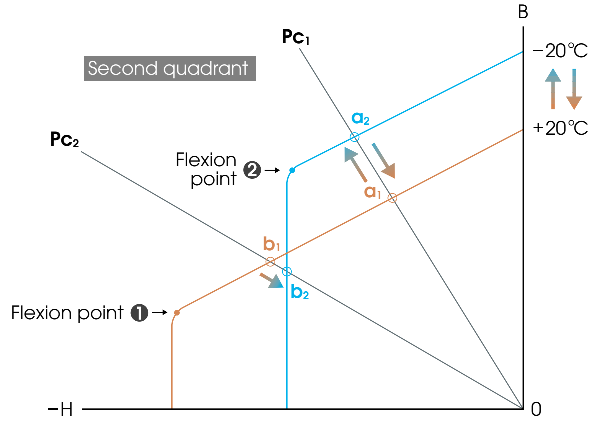


In this figure, the operating point on the B-H curve (in orange) at a normal temperature of +20℃ (the intersection with the permeance coefficient **Pc$_1$** line) is located at **a$_1$**, a position at a sufficient distance from flexion point ❶ on the bottom left.

When this magnet is cooled down, operating point **a$_1$** starts shifting upward on the **Pc$_1$** line to **a$_2$** on the B-H curve at a temperature of −20℃, which is longitudinally deformed (in blue).

In the case of this model, **a$_2$** is located higher than flexion point ❷, and even if the magnet temperature returns to +20℃ from −20℃, it will definitely return to the original point **a$_1$** (reversible change).

Basic Physical Properties of Ferrite Magnets



(Fig.2)

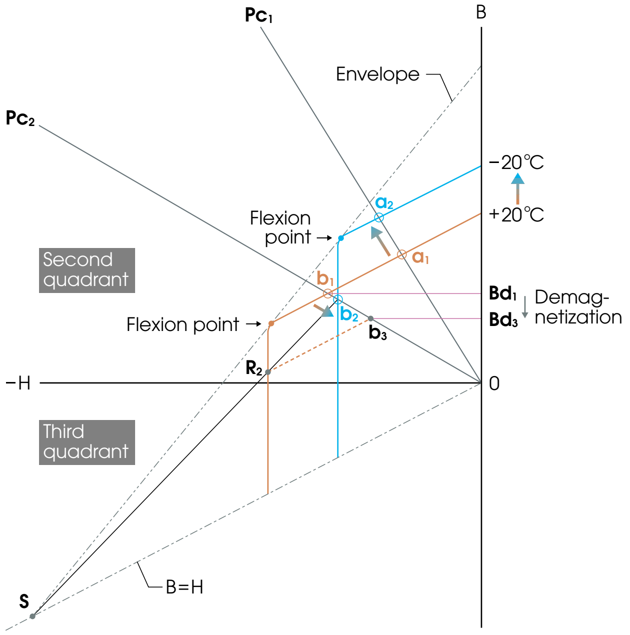
On the other hand, in the case of a magnet with a small permeance coefficient (**Pc_2** line), **b_1**, which is not too far from flexion point ❶, becomes the operating point at a normal temperature of +20°C. When the magnet temperature drops to −20°C, this **b_1** shifts to **b_2** on the B-H curve, which is deformed longitudinally (in blue).

In this model, at -20°C, operating point **b_1**, located above flexion point ❶ at a normal temperature, will drop to point **b_2** below the flexion point, and it will not be able to return to the original point **b_1** even after the magnet temperature returns to the normal temperature (irreversible change).

The amount of demagnetization caused by such an irreversible change can be identified Based on the following Fig. 3.

Fig.3

Method for obtaining the amount of irreversible demagnetization caused by temperature changes



Obtain intersection point **S** of the envelope connecting the flexion points on the B-H curves at a normal temperature of +20°C and a low temperature of −20°C (2-dot chain line) and the line connecting the points where B=H in the third quadrant (1-dot chain line).

Next, connect this intersection point **S** and operating point **b_2** at the low temperature of −20°C with a straight line, and make the intersection point of this line and the B-H curve at the normal temperature (in orange) **R_2**. From this point **R_2**, draw a line (orange short dashed line) with the same inclination as that of the B-H curve at the normal temperature (recoil permeability). By obtaining intersection point **b_3** of this line and the permeance coefficient **Pc_2** line, magnetic flux density **Bd_3** at the operating point when the magnet returns from the low temperature to the normal temperature can be obtained.

The difference between the value of this **Bd_3** and the value of the initial magnetic flux density **Bd_1** at the operating point before the temperature drop, **Bd_1**−**Bd_3**, is the amount of demagnetization caused by the irreversible change that occurs during the process of returning from a low temperature to a normal temperature (irreversible low temperature demagnetization).

2-3. Measures to avoid irreversible low temperature demagnetization

It is clear from the consideration so far that the basic measure for preventing irreversible low temperature magnetization is to design the permeance coefficient so that the operating point will not drop below the flexion point even when the ferrite magnet is placed in a low temperature condition.

In addition, for magnetic circuits of equipment used in a low temperature environment, the application of magnet materials with a high coercive force and a design that provides a sufficient margin to the operating point are recommended.

Basic Physical Properties of Ferrite Magnets

3. Demagnetization by the external magnetic field

3-1. Measures against counter magnetic fields

A ferrite magnet may also experience demagnetization from the effect of counter magnetic fields that are applied externally. Therefore, in applications in which counter magnetic fields are unavoidable, such as applications in motors, it is necessary to select a material with a sufficient coercive force and to support the operating environment, so that the operating point will not drop below the flexion point of the B-H curve due to the effect of counter magnetic fields.

The formula for calculating the demagnetization ratio from a counter magnetic field is shown below:

The intensity of the counter magnetic field as well as the magnetic characteristics (B-H curve characteristic or minor loop form) and the permeance coefficient of the ferrite magnet used will become the major factor that determines the magnetic flux density at the operating point.

$$\text{Demagnetization ratio affected by a counter magnetic field (\%)} = \frac{Bd_0 - Bd_1}{Bd_0} \times 100$$

Bd_0,Bd_1 : magnetic flux density at the operating point
Bd_0:Condition without effects of a counter magnetic field
Bd_1:Condition with effects of a counter magenetic field

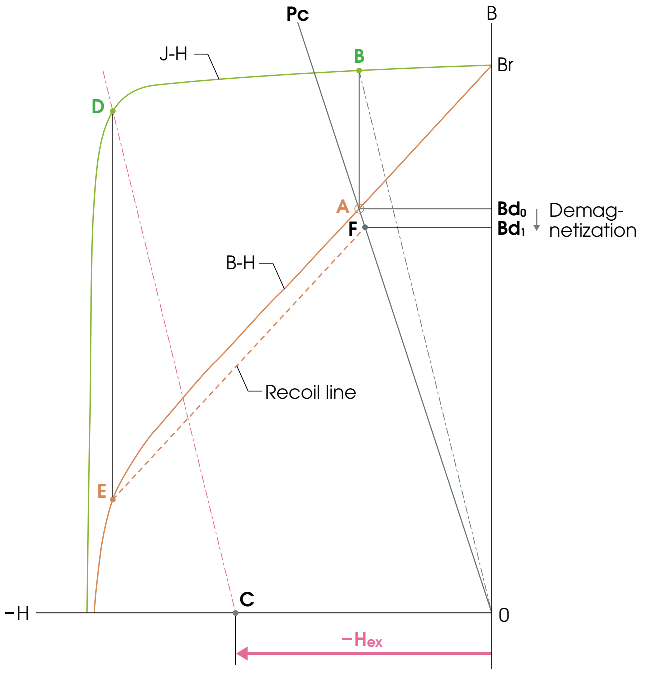


Fig.4

Method for obtaining the amount of irreversible demagnetization caused by a counter magnetic field

3-2. Analysis of the impact of a counter magnetic field

To analyze the impact of a counter magnetic field, a J-H curve (in SI units; 4πI-H curve in CGS units) that shows the strength of magnetization inherent to the magnet is used.

Demagnetization caused by a counter magnetic field will be explained in the following, using Fig. 4 on the top right, which illustrates the correlation between the B-H curve (in orange) and the J-H curve (in green).

Point **A** in the figure is the intersection point of the B-H curve and the permeance coefficient **Pc** line, i.e. the operating point. From this point **A**, a line parallel to the B axis (a line perpendicular to the H axis point **A** as the starting point) starts, and the intersection point of this line and the J-H curve is set as point **B**.

This point **B** indicates the strength of magnetization at the operating point when the counter magnetic field is 0 (the strength of the magnetization inherent to the magnet assuming only the impact of self demagnetizing field = demagnetizing field Hd). In this model, the strength is about the same as residual magnetic flux density Br.

In this model, the strength of magnetization when counter magnetic field $-\mathbf{H_{ex}}$ is applied is indicated by intersection point **D** of the pink 1-dot chain line drawn parallel to the 1-dot chain line **B**0 from point **C** on the H axis and the J-H curve.

Next, draw a perpendicular line from this point **D** to the H axis, and obtain intersection point **E** of this line and the B-H curve (the operating point when receiving the impact of counter magnetic field $-\mathbf{H_{ex}}$).

Now, let us look at the operating point when the impact of counter magnetic field $-\mathbf{H_{ex}}$ is removed by obtaining intersection point **F** of recoil line (orange dashed line) drawn from point E and the permeance coefficient Pc line. As a result, the magnetic flux density before application of counter magnetic field $\mathbf{Bd_0}$ decreases to $\mathbf{Bd_1}$. In other words, a difference between $\mathbf{Bd_0}$ and $\mathbf{Bd_1}$ (irreversible demagnetization amount) is generated by the application of counter magnetic field $-\mathbf{H_{ex}}$ in this magnet.

Basic Physical Properties of Ferrite Magnets

We have considered demagnetization by a counter magnetic field at a normal temperature in the above. However, as has been previously described, when an operating environment in which the temperature of the ferrite magnet drops significantly is expected, it is necessary to take irreversible low temperature demagnetization into consideration as well.

Under such a condition of use, it becomes extremely important to consider the following basic measures against demagnetization according to the actual operating environment:

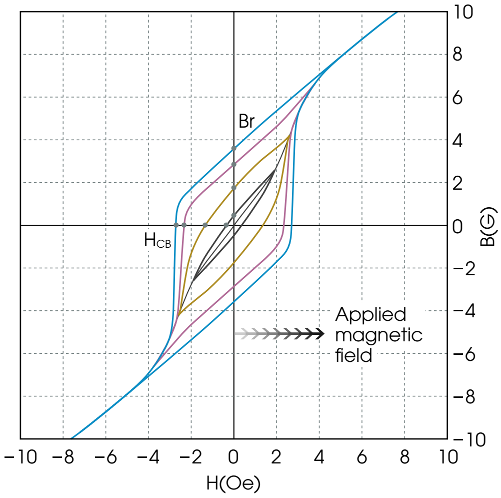
1. using a material with a large intrinsic coercive force H_{CJ}, and
2. giving consideration to the wall thickness, cross section area, and air gap of the magnet to obtain a high permeance coefficient.

4. Magnetization characteristics

If magnetization is insufficient, both residual magnetic flux density Br and intrinsic coercive force H_{CJ} will significantly decrease, which prevents the excellent magnetic properties intrinsic to the magnet from being extracted (Fig.5).

Fig.5

Relationship between the strength of the applied magnetic field and residual magnetic flux density Br and coercive force H_{CB}

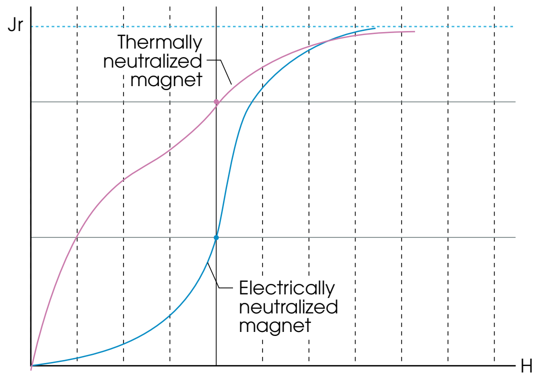


As the above four loops show, when the strength of the applied magnetic field is insufficient and the magnet does not reach a state of magnetic saturation, the rising magnetization curve will drop suddenly if the applied magnetic field is removed, and residual magnetic flux density Br and coercive force H_{CB} will only reach as high as the level corresponding to the strength of the applied magnetic field.

A uniform standard for the strength of the applied magnetic field necessary for a practical magnetization level for a ferrite magnet cannot be specified, as it depends on elements such as the magnetic properties and shape of the magnet, the form of magnetization, or the magnetizer structure. However, the neutralization method before magnetization also significantly affects changes in the magnetization field and magnetization amount (magnetization characteristics curve).

Fig.5

Difference in magnetization characteristics by neutralization method



As the above Fig. 6 illustrates, the magnetization curve of a magnet that has been thermally neutralized (a neutralization method in which the magnet is heated above the curie temperature) exhibits a steep rise. On the other hand, in the case of a magnet that has been electrically neutralized by applying an alternating magnetic field with gradually-decreasing amplitude to the magnet, magnetization to the practical level tends to be difficult unless a magnetization field is applied that exceeds the magnetization field applied to the thermally-neutralized magnet.

Normally, a magnet reaches a saturation magnetization state when a magnetic field is approximately three times greater than the intrinsic coercive force H_{CJ} value. However, in order to obtain an optimal magnetization state, it is important to conduct sufficient magnetization testing to determine the necessary magnetic field to be applied to achieve a practical magnetization level.

Precautions regarding safety and use

Please read these instructions before using the product.

Safety Precautions

When using magnets, pay great attention to safety after reading the following precautions. Using the product incorrectly may cause the product functions to be damaged or lead to an accident.

In order to use this product even more correctly and safely, please request a delivery specification form from which more detailed product features and specifications can be confirmed.

⚠WARNING

- It is extremely dangerous to bring a magnet close to a person possessing electronic medical equipment such as a pacemaker or other types of electronic medical equipment. It may impair normal operations of the equipment and lead to a fatal accident.
- Be careful not to swallow magnets.If a magnet is swallowed, consult a doctor immediately. Keep the product out of the reach of children.

⚠PRECAUTIONS

The following precautions must be strictly observed to avoid the occurrence of injuries or functional failures.

[**Design**]

- In general, a magnet loses its magnetism when heated. Check the temperature characteristics in the product catalogue and exercise caution to prevent temperatures from become too high during assembly or use.
- The property values in the catalogue are not guaranteed values. The property values may not be obtained depending on the magnet size or other factors. Perform confirmation before starting the design process using a sample, etc.
- Some magnets demagnetize at low temperatures. When using a magnet, be sure to confirm that it has a material property (demagnetization curve) supporting the maximum and minimum temperatures of the environment in which it is used.
- When magnetizing a magnet, the magnetic property may not be achieved as designed if the magnetization method, etc., is inappropriate. Consult with us in advance concerning magnetization.
- Avoid using or storing magnets in a corrosive gas atmosphere, a highly conductive environment (in water containing electrolytes, etc.), a hydrogen atmosphere, in acid or alkali, or in an organic solvent. It will cause corrosion, deterioration of the characteristics or strength of the magnet. Check the delivery specifications concerning the weather resistance and thermal resistance of the product. If a problem is expected, contact us in advance.
- When processing a magnet, magnetization deterioration or magnetization failure may occur. Consult with us concerning processing conditions. When processing a magnet, pay attention so that chipping or cracking would not occur.
- Magnets are hard and brittle; they may crack or fall out when used in places where vibration or shock is applied. When using a magnet in such a location, pay attention to the design so that the magnet will not fall out even if it becomes cracked.
- There is a risk that a magnet will be damaged by a high-speed rotating body such as a motor. When performing design, take preventive measures so that magnet fragments will not scatter even if it is damaged.
- When performing press-fitting processing, magnets or the counterpart material may become damaged depending on the press-fitting conditions. Pay attention to the press-fitting conditions when performing design.
- When using an adhesive agent for bonding a magnet to another magnet, a york, a pole piece, or other objects, check the type, adhesion conditions, environmental resistance, amount, and adhesiveness of the adhesive agent and give adequate consideration to adhesion reliability.

Ferrite Magnet

FB Series

[**Assembly/Handling**]

- Since magnetized magnets have a strong attractive force, there is a risk that your fingers or hands may get caught between two magnets or a magnet and another magnetic substance (metal fragment, knife, scissors, etc.), resulting in injury. There is also a risk that a magnet will break due to a strong shock caused by the attractive force, and scattered fragments of the magnet may enter the eyes. In order to avoid such risks, exercise caution when handling magnetized magnets.
- Pay attention to the sharp edges of magnets; they may cause finger or hand injuries.
- When magnetizing a magnet using an air-core coil, there is a risk that the magnet may jump out of the coil; secure the magnet for safety.
- A magnetized magnet will attract iron powder or magnet fragments. Pay attention to the environment in which the magnets are handled, since there are cases where cleaning becomes necessary after assembly.
- When bonding a magnet, pay attention so that no oil, dirt or other foreign object adheres to the bonding surface. It may decrease the adhesive force, causing the magnet to drop off

[**Storage**]

- Store magnets in places free from impact due to being dropped. Chipping or cracking may be caused by impacts.
- Do not store magnets in places where they are exposed to rain or dust or under conditions in which moisture condensation occurs; surface conditions, physical properties, or magnetic properties may change if stored under such conditions.

[**Other**]

- Keep magnets away from magnetic recording media such as floppy disks, magnetic cards, magnetic tapes, prepaid cards, and train tickets. If a magnet is placed close to a magnetic recording medium, recorded information may be destroyed.
- Keep magnets away from electronic devices; if a magnet is placed close to an electronic device, it may affect its measuring gauge or circuit, resulting in a failure or accident.
- If you are allergic to metals, contact with a magnet may cause your skin to become irritated or turn red. If such symptoms appear, take measures such as wearing protective gloves to avoid direct contact with magnets.
- Do not lick magnets. Never drink fluids that came into contact with magnets.

For Our Customers

- When using magnets, please sufficiently discuss matters in advance with the related departments of our company. In addition, please consult with us when you wish to change the application or assembly method following discussions with the related departments of our company.
- We wish to prevent any safety issues caused by magnet usage methods or magnet application designs through detailed advance discussions with our customers.