

Basic Precautions before Using Magnets

Proterial, Ltd.

Please read and understand the following precautions before using a magnet safely. When you fail to follow the precautions, bodily injury or property damage may occur and/or the original function of the magnet may not be obtained.

Precautions in General

- (1) Never bring a magnet near a person with a pacemaker or other electronic medical equipment because normal operation of the equipment may be affected and the person may be exposed to a life threatening risk.
- (2) Never swallow a magnet. If swallowed, there is a risk of suffocation or perforation of the stomach or intestines due to magnetic attractive force with other magnets or magnetic materials. Consult a doctor immediately if a magnet is swallowed. Keep a magnet out of the reach of a child or a mentally impaired person.
- (3) Never drink water or other liquid that contacts with a magnet. The constituents of a magnet may dissolve in the water or other liquid.
- (4) If you have a metal allergy, your skin may get rough and become red by contacting with a magnet. To avoid such symptoms, you must avoid skin contact with a magnet.
- (5) Never bring a magnet near magnetic recording media (for example, a magnetic tape, a floppy disk, a pre-paid card, a ticket, a credit card, or an ATM card). It may cause damage to the media and loss of data.
- (6) Never bring a magnet near an electronic device, video equipment, communication equipment, etc. such as an electronic clock, a cathode-ray tube(CRT), or a mobile phone, to prevent a malfunction or failure.
- (7) Never bring a magnet without magnetic shields in an airplane to prevent a malfunction or a breakdown.

Precautions in Design

- (1) Magnetic characteristic values in anisotropic magnets are greatly depending on the easy magnetizing direction. Consider the anisotropic direction when designing.
- (2) Magnetic characteristic values shown in the catalog are not guaranteed values. Magnetic characteristic values may vary as a result of the size or the shape, etc. Confirm the design work beforehand with a prototype sample.
- (3) Demagnetization is greatly related to the magnet shape, the operating point, and the exposed temperature. Refer to the temperature characteristic curves to avoid demagnetization during assembling or operation.
- (4) When the customer magnetizes a magnet, apply enough magnetic field to fully magnetize corresponding to the material and the coercive force. When the applied magnetic field is not strong enough, the designed magnetic characteristic may not be obtained. Consult us about the required magnetic field for full magnetization.
- (5) Avoid exposing a magnet to the following environments. In such environments, the deterioration of corrosion resistance, magnetic characteristics, and/or strength of a magnet may happen. The critical condition depends on the material and the surface treatment of each magnet. Please consult us about rust prevention beforehand.
 - (a) Corrosive gas atmosphere (Cl₂, NH₃, SO_x, and NO_x, etc.)
 - (b) Conductive environments (in water containing electrolytes, etc.)
 - (c) Hydrogen atmosphere
 - (d) Acid, alkaline, or organic solvents, etc.
 - (e) In oil or water
 - (f) High temperature and/or humidity environments
 - (g) Radiation environments exceeding the background level.

- (6) Never cut, machine or grind a magnet or disassemble a magnetic circuit. These operations may cause deterioration of the magnet characteristics, chips and/or cracks, etc. We do not guarantee the magnet quality in such cases.
- (7) A magnet is hard, and fragile. When it is exposed to vibration or shocks such as an automotive use, design the proper structure to avoid displacement of a magnet even if the magnet is broken.
- (8) When you use an adhesive agent, verify the type, quantity, gluing conditions, strength, and other characteristics of the adhesive agent, including surface condition of the magnet(cleanliness, surface roughness etc.), and its reliability.
- (9) When a magnet is used on the surface of a high-speed rotation body, such as a rotor, design properly to ensure safety even if the magnet is broken.
- (10) Processes such as press fitting or thermal insertion may be the cause of a crack or fracture of a magnet and other components, and deterioration of magnetic characteristics. Verify the process with samples beforehand.
- (11) Flux leakage of the magnetic circuit may influence other equipment. Design the magnetic circuits to reduce flux leakage when possible.

Precautions in Handling and Assembling

- (1) When a magnet is magnetized, a strong attractive force or repulsive force arises between the magnet and other magnetic materials (magnet, yoke, rotor, stator, jig fixture, tool, etc.). A user's hand or finger may be sandwiched between the magnet and other magnetic materials during handling or assembling. Also you may be injured by a loss of balance due to the attractive or repulsive force. Use appropriate jigs and take special care in handling a magnetized magnet. A magnetized magnet should be covered with a non-magnetic material such as wood or thick plastic, and labeled as magnetized.
- (2) The sharp edge of a magnet may injure your finger. Protect fingers when needed.
- (3) When a magnet is magnetized in a solenoid coil, the magnet may fly out from the inside of the solenoid coil unexpectedly. It can be the cause of injury. Use a proper jig fixture and restrain the magnet inside of the solenoid coil for safety.
- (4) When magnetized magnets are stacked, it is difficult to separate them, and chipping or a crack may occur. It is recommended to use spacers between the magnets. The stacked magnetized magnets are similar to one big magnet. Take special care during handling.
- (5) When a magnet is cut, machined or ground, fine magnet powder will be produced. Such fine metal powder of the rare-earth magnet(including bonded magnet) is inflammable, and it may ignite spontaneously. Follow the below notes about fine metal powder.
 - (a) Never bring fire or flammable material near Neodymium or Samarium system magnet powder.
 - (b) Never use vacuum cleaner to avoid electrostatic ignition.
 - (c) Prepare sand or dry-chemical fire extinguisher to extinguish fire just in case of fire.
 - (d) Cover with sand immediately and keep away from flammable material when ignition happens.
- (6) When a magnetized magnet is placed near an opposing or alternating magnetic field, demagnetization may occur.
- (7) A magnetized magnet attracts magnetic particles. Use a clean work place. A precise motor may need wet cleaning after assembly.
- (8) When an adhesive agent is used to glue a magnet to a yoke (or similar material or parts), choose the proper adhesive agent and the bonding method to minimize mechanical stress. Residual stress may cause a crack or a fracture of the magnet with a small mechanical impact.

(9) A mechanical impact may be a cause of a fracture, a crack and chipping of a magnet. Take special care during handling of a magnetized magnet. Such a crack or a chipping may deteriorate the magnetic characteristic, the mechanical strength or the corrosion resistance. A broken piece of magnet may injure your eyes or body.

Precautions in storage

- (1) Store magnets in a place without a mechanical impact.
- (2) Keep the packaging materials of magnets dry.
 - Keep the temperature above the dew point to prevent rust during storage.
 - Avoid water (rain, water used in the factory, etc.) from contacting the packaging material.
- (3) Storage period is recommended to follow the below table 1.
 - If storage period of the magnet has passed (in case ferrite magnet, one year after ex-Works), it is recommended to confirm the appearance and magnetic properties of the magnet before using.
- (4) Verify of magnetized magnets to avoid demagnetization.

Special notes for each Magnet Material

[A]Rare-earth magnet

- (1) The alloy powder of a rare-earth magnet is designated under the Fire Service Law of Japan, as a Class 2 (combustible solid) Type 1 hazardous substance in Japan. Since fine powder produced by friction during the use of a magnet is inflammable, and may ignite spontaneously, never use a magnet in such a way that will generate magnet powder.
- (2) If such powder is produced, never leave the powder in the air, but store the powder in a metal container filled with water. When Neodymium or Samarium magnet powder contacts water, hydrogen may be produced. Take special care to prevent hydrogen ignition.
- (3) Magnetic flux of a Neodymium magnet is deteriorated around and below liquid nitrogen temperature. Consider this when designing a low temperature application.

[B]Ferrite magnet

- (1) Consider the decrease of intrinsic coercivity at low temperature to avoid demagnetization.
- (2) A ferrite magnet is especially hard and fragile. When it is exposed to vibration or impacts, design the structure properly.
- (3) When thermal shock is applied to a magnet, magnet breakage may occur. Never expose a magnet to thermal shock such as a rapid heating or cooling speed.
- (4) If magnets rub against each other during transportation, magnet powder may be seen on the surface.

[C]Bonded magnet

- (1) When a bonded magnet is heated, the magnetic characteristics may be deteriorated. The heat softens and transforms the binder material of the magnets. Mechanical strength may be decreased by the embrittlement phenomenon under high or low temperature. Consult us about the operating temperature.
- (2) Heat may decompose the binder and the coating material and generate hazardous and corrosive gas.
- (3) The swelling phenomenon with moisture absorption or organic solvent may cause a change in dimensions and a decrease of the mechanical strength. Consult us beforehand.
- (4) Some magnetizing and demagnetizing conditions using an air core coil can heat up a magnet, and it may burn your skin.

Table 1 Storage Period

Magnet Material	Coating	Packaging	Stock Period	Temperature	Humidity
Rare-earth magnet	Nickel Coating	Plastic Bag etc. (Typical Packing)	6 months max. after ex-Works (without unpacking)	10 ~ 40 (deg. C)	30 ~ 85 %RH
	Aluminum Coating				
	Epoxy Coating				
	Titanium Nitride Coating				
	Chemical Conversion	Vacuum Packing	3 months max. after ex-Works (without unpacking)		
	M-1 Treatment				
Uncoated					
Ferrite magnet	Uncoated	Corrugated cardboard packing etc.	Indefinite	-10 ~ 40 (deg. C)	30 ~ 85 %RH

Request for prior consultation

Please consult us before designing a new product with a magnet.

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