

Basic Precautions before Using Magnets

Hitachi Metals, 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 equipments because normal operation of the equipments may be interfered and the person may be exposed to a life threatening risk.
- (2) Never swallow a magnet. 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 symptom, you must avoid your skin contact with a magnet.
- (5) Never place a magnet near magnetic recording media (for example, a magnetic tape, a floppy disk, a pre-paid card, a ticket, a credit card, and an ATM card), an electronic clock, and a cathode-ray tube (CRT), etc. It may cause damage to the media and loss of data.
- (6) Never bring a magnet near an electronic device to prevent a malfunction or a breakdown.
- (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 the anisotropic magnets are greatly depending on the easy magnetizing direction. Consider the anisotropic direction at the design work.
- (2) Magnetic characteristic values shown in the catalog are not guaranteed values. The same magnetic characteristic values may not be obtained as a result of the size or the shape, etc. Make sure the design work beforehand with a prototype sample.
- (3) The demagnetization is greatly related to the magnet shape, the operating point, and the exposed temperature. Refer to the temperature characteristic curves to avoid the demagnetization during the assembling or the operating.
- (4) When the customer magnetizes a magnet, apply an enough magnetic field 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 the full magnetization.
- (5) Avoid using and keeping a magnet in the following environments. In such environments, the deterioration of the corrosion resistance, the magnetic characteristics, and/or the strength of a magnet may happen. The critical

condition depends on the material and the surface treatment of each magnet. Please consult us about the 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) Open outdoor locations
- (h) 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 a dropout of a magnet even if the magnet is broken.
- (8) When you use an adhesive agent, make sure the type, the quantity, the gluing conditions, the strength, other characteristics of the adhesive agent, and its reliability.
- (9) When a magnet is used on the surface of the high-speed rotation body such as a rotor, design properly to ensure the safety even if the magnet is broken.
- (10) Process such as press fitting or thermal insert may be the cause of a crack or a fracture of a magnet and the other components, and deterioration of magnetic characteristics. Make sure the process with samples beforehand.
- (11) The flux leakage of the magnetic circuit may influence other equipments. Design the magnetic circuits to reduce the flux leakage.

Precautions in Handling and Assembling

- (1) When a magnet is magnetized, 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 the handling or the assembling. Also you may be injured by loss of balance of the body due to the attractive or repulsive force. Use appropriate jigs and take special care in handling the magnetized magnet. A magnetized magnet should be covered with a non-magnetic material such as wood or thick plastics, and labeled as magnetized.
- (2) Sharp edge of a magnet may injure your finger. Protect fingers when needed.
- (3) When a magnet is magnetized in the winding coil, the magnet may fly out from the inside of the winding coil unexpectedly. It can be the cause of injury. Use a proper jig fixture and keep a magnet inside of the winding coil for safety.
- (4) When magnetized magnets are stacked, it is difficult to peel off, 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 the handling.

- (5) When a magnet is cut, machined or ground, fine magnet powder will be produced. Such the fine metal powder is flammable, and it may ignite spontaneously. Follow the below notes about the fine metal powder:
- (a) Never bring fire or flammable material near the Neodymium or Samarium system magnet powder.
 - (b) Never use vacuum cleaner to avoid the 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 the combustible when the ignition happens.
- (6) When a magnetized magnet is placed near the direct or alternating magnetic field, the demagnetization may occur.
- (7) A magnetized magnet attracts magnetic particles. Use a clean work place. A precise motor may need wet cleaning after assembled.
- (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. The 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 a chipping of a magnet. Take special care during the 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 hurt your eyes or body.

Precautions in storage

- (1) Store magnets in the place without a mechanical impact.
- (2) Keep the packaging materials of magnets to be dry.
- Keep the temperature above the dew point to prevent rust during the storage.
- Avoid water (rain, water used in the factory, etc.) to be splashed on the packaging material.
- (3) Storage period is recommended to follow the below table 1.

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 the fine powder produced by friction during the use of a magnet is combustible, and may ignite spontaneously, never use a magnet in such ways that will give rise to the magnet powder.
- (2) If such powder is produced, never leave the powder in the air, but must store the powder in a metal container filled with water. When Neodymium or Samarium magnet powder contacts water, hydrogen would be produced. Take special care to prevent the hydrogen ignition.
- (3) Magnetic flux of a Neodymium magnet is deteriorated around and below the liquid nitrogen temperature. Consider it to design a low temperature application.

[B] Ferrite magnet

- (1) Consider the decrease of the intrinsic coercivity at low temperature to avoid demagnetization.
- (2) Ferrite magnet is especially hard and fragile. When it is exposed to vibration or impacts, design the proper structure.
- (3) When thermal shock is applied to a magnet, magnet breakage may occur. Never load thermal shock on a magnet such as higher heating or cooling speed.
- (4) The magnet touches it by the transportation situation each other, and magnet powder may be seen in the surface.

[C] Bonded magnet

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

Table 1 Storage Period

Coating	Code.	Packaging	Stock Period	Temperature	Humidity
Nickel Coating	NC	Plastic Bag (Typical Packing)	6 months max after ex-Works (without unpacking)	10 – 40 (deg.C)	30 – 85 %RH
Eco Aluminum Coating	EAC				
Epoxy Coating	E-1, E-2, E-3				
Titanium Nitride Coating	TiN				
Pure Aluminum Coating	PAC	Vacuum Packing	3 months max after ex-Works (without unpacking)	10 – 40 (deg.C)	30 – 85 %RH
Chemical Conversion	F-1				
M-1 Treatment	M-1				
Non Coating	---	Corrugated cardboard packing etc.	---	10 – 40 (deg.C)	30 – 85 %RH
Non Coating (Ferrite magnet)	---				

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