

What Are Permanent Magnets Used For?

Modern permanent magnet has plenty of uses. And the permanent magnet used on compass is the traditional type. You would be surprised by the uses of magnets around us. For example, every time you use your IPHONE, magnets are being utilized in permanent magnet vibration motor, speaker and sensor to perform certain operations. Then our IPHONE have vibrant state, quality sound and different intelligent functions.

Types of Permanent Magnet Uses:

Based on how magnetic force is applied, there are four basic methods to categorize permanent magnets' uses

- **Category 1:** The attraction and/or repelling force of magnet. Permanent magnets used on Daily life mainly belong to this category. And it is the simplest use of magnets. This category includes: Magnetic Clasps, Magnetic Name Badge, Magnetic Hook, Pot Magnet, Lifting Magnet, Magnetic Filter, Cow Magnet, Magnetic Packing, Magnetic Toy, Magnetic Acrylic Frame, Magnetic Charge Cable, Magnetic Screen Door Curtain, Magnet System with Rubber Coated, Magnetic separator, Magnetic holding device, Magnetic torque drive, Magnetic bearing device
- **Category 2:** Using magnetic field to convert electric force into mechanical force. This mainly belongs to industrial use. This category includes: Electric motors, Meters, Relays, Loudspeakers, Actuators, linear, and rotational
- **Category 3:** Using magnetic field to convert mechanical force into electric force. This category mainly belongs to industrial use which includes: Generators and alternators, Magnetos, Eddy current brakes
- **Category 4:** Using magnetic field to affect ion beams. Of course it is industrial use. This category includes: Magnetic focused cathode-ray tubes, Ion Pumps, Magnetrons, BWO's, Klystrons Traveling Wave Tubes, Cyclotrons, Cathode-ray tubes

Based on Types of Permanent Magnet, there are five type permanent magnets and its application

- **Sintered Neodymium Magnet**

- **Feature:** very high Hc and Hci, high energy for size, strong magnetic force, more economical than Samarium Cobalt, good in room temperature situations, relatively high price, easily oxidized, temperature coefficient of .13%/ degree centigrade
- **Application:** Microphone assemblies, Magnetic separators, Computer rigid disc drives, Linear actuators, Hammerbank printers, Speakers, DC Motors & Automotive starters, Servo Motors

- **Bonded Neodymium Magnet**

- **Feature:** compared with sintered ndfeb, Strong Mechanical, multi-poles magnetization direction, make to a variety of shapes, good size accuracy
- **Application:** power tools, house electric appliance, office automation, communication tools, auto micromotor

- **AlNiCo Magnet**

- **Feature:** low Hc, higher Br and Bh(max) than ceramic magnet, strong mechanical, very temperature stable, good corrosion resistance, cast AlNiCo can cast to a variety of shapes with minimum reversible temperature coefficient, can work above 600 degrees Celsius, can change magnetization direction, Sintered AlNiCo has better tolerance raw material to make mini size product
- **Application:** compass, electron tubes, radar, traveling wave tubes, separators, holding magnets, watt-hour meters (bearings and dampeners), communications, receivers, telephones, clutches and bearings, magnetos, coin acceptors, instruments, controls, relays, motors, generators, meters, microphones, bell ringers, guitar pickups, automotive sensors, loudspeakers, cow magnets, distributors, process control instruments

- **Samarium Cobalt Magnet**

- **Feature:** expensive material, high Hc and Hci, high Bhmax, strong magnetic force, very good temperature stability
 - **Application:** Computer rigid disc drives, Traveling wave tubes, D.C. Motors, sensors, growing automotive applications and linear actuators.
- **Ferrite Magnet**
 - **Feature:** low magnetic force, compared to Alnico, higher Hc and Hci, can only make simple shapes, fragile material, cheap material, require expensive tooling for every size, temperature sensitive (0.2% °C.)
 - **Application:** DC permanent magnet motors, Separators, Magnetos, lawnmowers, garden tractors and outboard motors, Magnetic Resonate Imaging, MRI, DC brushless motors with controllers, loudspeaker, dental equipment, sensor

Based on functions, there are 7 categories as list below which posted by Karl J. Strnat in his paper:

1. Electro-Mechanical Machines and Devices

a) Electric Motors

Types-DC (commutator and brush less), synchronous, induction start/synchronous run, hysteresis; rotary and linear; continuous, servo, torque, or stepping operation

Geometries — permanent magnet stator (conventional and iron less armatures), permanent magnet rotor; inner or outer rotor; radial or axial field (disc) motors.

b) Generators

Types — Magnetos, ignition or other pulse generators, tachometers, auxiliary exciters, alternators, multiphase synchronous machines, homopolar DC machines.

Geometries-permanent magnet rotor; radial or axial field; stator winding with or without iron

c) Electro-Mechanical Actuators

Linear — Force motors for valves, etc.; printer hammer mechanisms; computer disc-drive head actuators



(VCM); laser focusing and tracking (optic/magneto-optic recording: audio CDs, video, data); recorder pen positioners. Rotary-Disc drive VCMs; aircraft controlsurface actuators; materials handling robots.

d) Measuring Instruments

Moving-coil (d'Arsonval and long scale geometries) and moving-magnet meters for many functions

e) Electric Current Control

Circuit breakers, reed switches, miniature biased relays, thermostats, automotive ignition, eddy, Current motor overspeed switch, arc blow-out magnets

2. Acoustic Transducers

a) Sound Generators:

Loudspeakers, earphones, telephone receivers, ringers, buzzers, ultrasonic generators

b) Sound Receivers:

Dynamic microphones, ultrasound pickups

c) Other Audio Frequency Transducers

Phonograph pickups

3. Mechanical Force and Torque Applications

a) Contact Holding and Lifting

Machine-tool chucks, grippers, load-lifting magnets (electrically switchable), tool holders, door catches, refrigerator seals, advertising signs, toys, and many more.

b) Traction Devices

Conveyers, separators for ores and other materials, fieldgradient water purifiers, photocopier rollers.

c) Couplings and Brakes

Synchronous torque couplings, linear followers, eddy current and hysteresis couplers and brakes, rotary-to-linear motion converter.

d) Magnetic Bearings and Suspensions



Passive-watt-hour meters, ultra-centrifuges, record player tone-arm support, textile spinning turbines. Partly active servoed systems-gyros, satellite momentum and energy wheels, laser beam scanner, turbo-molecular pumps, electro-magnetic tracked vehicle levitation.

e) Electro-Balances

Modern weighing devices from analytical balances to supermarket scales and truck weigh stations

4. Microwave/MM-Wave Devices, Electron Ion Beam Control

a) Power Tubes

Magnetrons (radar, kitchen ovens); PPM focusing for TWTs and klystrons; crossed-field amplifiers, gyrotrons, etc

b) Waveguide Devices

Biasing ferrite or YIG elements in resonance filters, switches, and isolators

c) Particle Accelerators, Synchrotron Radiation Sources, free Electron Lasers

Lenses, deflecting magnets, wigglers, undulators

d) Mass Spectrometers

Deflecting magnets

e) Cathode Ray Tubes

Ion trap, focusing, pin-cushion correction

5. Sensors, Electric Signal Transducers

a) Transducers Using Permanent Magnetss

Inductive, Hall effect, magnetoresistive, temperature sensitive elements

b) Quantities Measured

Position, velocity, acceleration, fluid and heat flow, pressure, vibration, temperature, etc

c) Use Areas

Automotive, industrial, aerospace, computer peripherals (keyboards, read/write head sensors), office



equipment

6. Medical Electronics and Bioengineering

a) NMR Imaging Devices:

DC field source for MRI tomographs

b) Mechanical Prostheses

Eyelid muscle assist, dental prostheses, stoma seals, valves, heart-assist pumps, artificial limbs

c) Surgical Clamps

For incisions and severed blood vessels

d) Diagnostic Aids

Catheters; sensors/transducers

e) Miniature Hearing Aids

External devices and implants

7. Miscellaneous Applications

a) Magnetic Locks:

Key and cylinder with encoded magnets

b) Magnetic Jewelry:

Necklaces, clasps, earrings

c) Electronic Choke:

Steady bias field for core

d) Magnetic Bubble Memory:

Bias field for bubble element

e) Vacuum Technology:

Ton getter pumps, vacuum gauges.



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