Application

Magnets are simple elements that help make solving tasks easier, more efficient, and more reliable.

If drilling is not allowed for fastening, for instance, so as not to damage corrosion protection layers, a retrofit/portable installation is desired, or only a temporary fix is required, this product group offers a large selection of suitable magnets.

Designs

There are seven different magnet types based on a conceptual classification with respect to the shape and function:

Button-type magnets and U-magnets as well as retaining magnets that are disc-shaped or rod-shaped form the largest group along with screws with retaining magnet. The name retaining magnet bears such elements that are used for direct fastening. Raw magnets generally help to structure application-specific magnetic systems.

Structure

Apart from button-type magnets/U-magnets and raw magnets, magnetic systems can also be used. Due to their structure, they have only one magnetic contact surface. Through magnetic return plates, the entire magnetic energy is concentrated on the attracting surface and the spatial effect of the magnetic field is restricted in order to prevent any magnetization of the environment.

Materials of the magnet

Within various designs, various materials of the magnet are available to choose from. In order to meet application-specific conditions in as far as possible, the most important characteristics of the respective materials of the magnet are given in the following table.

Materials of the magnet in comparison

Description	Hard ferrite (HF)	AlNiCo (AN)	SmCo (SC)	NdFeB (ND)
Magnetic force	strong	medium	strong	very strong
Max. working temperature *	≈ 200 °C	≈ 450 °C	≈ 200 °C	≈ 80 °C
Magnetic force on heating	lower	constantly good	lower	lower
Corrosion resistance	very good	very good	good	nickel plated - good
Made from	Iron oxide	Aluminum, nickel, cobalt and iron	Samarium and cobalt	Neodymium, iron and boron
Production method	Sintering	Sintering, casting	Sintering	Sintering
Mechanical properties	very hard, brittle	very hard, tough	very hard, brittle	very hard, brittle
Machineability	not possible	diamond grinding possible	not possible	not possible
Demagnetisation capability	moderate, by demagnetising fields	easy, by demagnetising fields	very difficult, only by large demagnetising	difficult, only by large demagnetising
Price	very reasonable	high	very high	reasonable

* The max. temperature used is only a guide value because it also depends on the dimensions of the magnet.

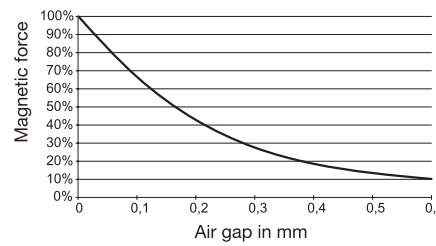
Magnetic force

In addition to their shape and material, the actual achievable magnetic force of the magnets depends on several other factors.

Influence factors

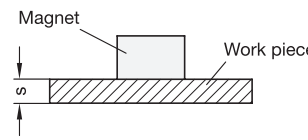
Air gap

An air gap or materials, which are not magnetically permeable between the workpiece and the magnet, have an insulating effect on the magnetic flux. The magnetic force is reduced depending on the distance.



Workpiece thickness

A minimum thickness of the workpiece should be maintained in order to not restrict the magnetic flux and therefore the magnetic force.



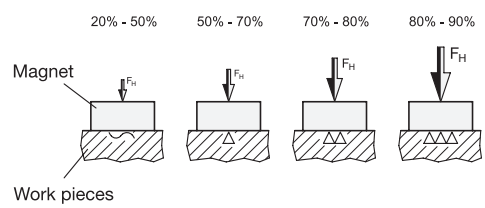
Material

Steel and ferrous materials with a low proportion of carbon and alloyed materials promote the magnetic flux. Similarly, non-hardened workpieces conduct the magnetic flux better, which enables greater magnetic forces.

100%	technical pure iron	86%	C60, X6Cr17
95%	St37, C15	84%	42CrMo4
94%	St44-2, 34CrNiMo6	75%	St50
93%	St52-3	72%	X155CrMo12
92%	90MnV8	65%	X210CrW12
90%	C45	50%	20MnCr5
87%	Ck45	30%	GG

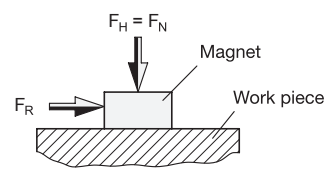
Workpiece surface

Excessive roughness or unevenness have the same effect as an air gap. They reduce the magnetic force.



Displacement force

The displacement force corresponds to the frictional force and depends on the coefficient of friction between the magnet and the workpiece, as well as the magnetic force of the magnet.
Due to their higher coefficient of friction, rubberized magnet systems have greater displacement forces.



The nominal magnetic forces stated in the tables in the standards are minimum values, which are achieved at room temperature, vertical „pull-off“ and full contact of the magnets with low carbon steel workpieces and a minimum thickness of 10 mm.