Handling Magnetized Magnets

Permanent magnets can be purchased in the following four conditions of magnetization:

1. Unmagnetized
2. Magnetized
3. Magnetized and stabilized
4. Magnetized and calibrated

The first condition: unmagnetized, is the typical state in which magnets are purchased and eliminates the problems associated with shipping and handling magnetized magnets. However, this does require that the purchaser possess adequate magnetizing equipment. Frequently the magnet is built into its final assembly and then magnetized.

For the second condition: the material is magnetized fully, i.e., saturated. The magnet is then appropriately packaged and shipped to the customer. For the third condition: magnetized and stabilized, the fully saturated magnets are subjected to a constant demagnetizing field which causes the output of each magnet to be reduced a certain percentage below its saturated value. Typical values for reduction (or knockdown) are 5% to 15%. The magnets are now “stable” to normal demagnetizing influences. It must be noted that if there is an 8% to 10% range in the saturated output for the group of magnets, their stabilized values will also exhibit an approximate 8% to 10% range.

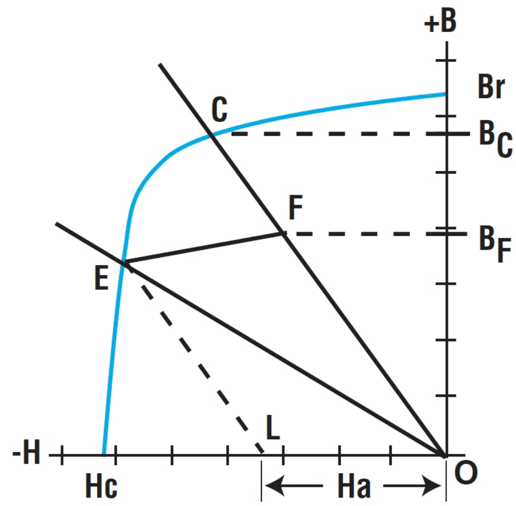
In addition to magnetic stabilization, magnets that are to be used at high temperatures can benefit from thermal stabilization. Magnets are exposed to elevated temperatures either in near open circuit or in fixed permeance coefficient conditions to allow exposure to high temperatures to cause partial knockdown.

If an 8% to 10% output range from the magnets is undesirable, the fourth condition: magnetized and calibrated, should be specified. In this case the saturated magnets are stabilized by varying the demagnetizing field in order to “calibrate” the magnetic output to a very tight range. Values of less than ± 1% can be obtained.

After any magnet is magnetized care must be exercised to prevent physical damage to the magnet. Almost all permanent magnet materials are very brittle and can be easily chipped or broken when they come into contact with a hard surface. This problem is intensified when handling the high magnetic energy rare earth magnets. The force with which two magnetized samarium cobalt or neodymium iron boron magnets come together can cause the magnets to shatter. Therefore, magnets must be mechanically restrained during assembly operations.

When magnets are ordered magnetized they are usually packed together with spacers, end-to-end in a string with opposite (attractive) poles together. Alternatively, they are “keepered” on a steel plate or a steel bar is placed across the magnetic poles. When lower coercivity magnets, such as alnico, are pulled apart or pulled off the steel plate, care must be exercised so that the same orientation poles do not come together as serious loss of magnetic output is possible. This is seldom a problem with the rare earth and ceramic magnet materials because of their high coercive force (resistance to demagnetization) and their straight-line demagnetization curve.

While the lower coercive force allows Alnico type magnets to be more easily demagnetized, the main reason Alnico magnets become partially demagnetized as a result of improper handling is the non-linear characteristic of their normal demagnetization curve, commonly referred to as a normal (B versus H) demagnetization curve with a “knee”. The figure below illustrates the effect of the knee.



Externally applied field, Ha

The externally applied field, Ha in the figure, represents the demagnetizing force that two opposing magnetic poles exert on each other. Line OC depicts the operating slope of a magnet and Bc represents the flux density in the magnet. When opposing poles are brought together, their mutual demagnetizing force causes the flux density in each magnet to decrease to point E. When the magnets are moved apart, the flux density in each magnet does not return to point C, but will instead follow an interior loop (recoil slope) to F on the operating slope line OC. The new flux density in each magnet is Bf.

The two magnets will be demagnetized whether they are brought together in opposition pole-to-pole or in opposition side-to-side, hence one the reason for the need to exercise caution when handling magnetized magnets.

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