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Why We Need to Precisely Specify Stuff

When an object needs to be precisely described to someone who's never seen or heard of it, detailed specifications are required. These stipulations will be vital for many departments within your own organization, as well as your suppliers and maybe even your customers. Lots of people really need to know the details of this thing and you must make sure all of the required particulars are there for their study. For discussion purposes, let's say this thing is a permanent magnet.

The inclusion of all details for a complete description is vital. But don't over do it. It'll cost you time and money and it's bad for the environment. The best specification provides just enough information to guarantee proper function - and no more. For example, the heat capacity of a SmCo magnet is an interesting characteristic, but it is intrinsic to that material and can not be changed without really fouling up the magnetic properties. Ergo there's no need to include it in your specifications.

To fully portray a magnet, there is generally a need to describe the exterior dimensions and attributes, what it's made of, usually its direction of magnetization and often what it's supposed to do.

Radii, especially large ones on small magnets, are difficult to accurately measure. Similarly, tight angle tolerances, especially on small parts, are difficult to measure. A profile of a surface or true position may be better ways to dimension these attributes.

Because they have a tendency to corrode, 99 percent of sintered NdFeB magnets are coated or plated before delivery to the customer. While most other magnet materials do not require coatings for temperature or environmental purposes, some need coating for other reasons. If your magnet requires a coating, you'll probably want to work with your magnet supplier to detail the type, the coating thickness and any tests deemed necessary to confirm product acceptability.

Descriptions such as N40H or Alnico 8 mean different things to different people and in themselves may not guarantee the performance you expect. However, specifying a company and its grade on the print can be problematic as well (especially after that company no longer exists). If you note a company's name and product designation on a descriptive document, be sure that "or equivalent" is noted as well.

Usually the magnet print contains the material specifications, but sometimes a separate engineering text is needed to describe all of the details. Because this is a controlled document, it must be kept current and revision levels must always be used. A part number is not complete without a revision level.

When you have a magnet material that works well for you, you will probably need to list its unit properties. Usually, you'll want to call out B_r (residual induction) or $(BH)_{max}$ (energy product); both are rarely necessary. Historically, typical tolerances for B_r are $\pm$ 5 percent and $\pm$ 10 percent for $(BH)_{max}$. Even when $(BH)_{max}$ is not toleranced, it is often referenced to more easily identify the material. H_c or H_{cb} (normal coercivity) is often toleranced at $\pm$ 5 percent, but a minimum is usually sufficient if B_r or $(BH)_{max}$ is toleranced. Minimum H_{ci} or H_{cj} values (intrinsic coercivity) should be specified in most applications; the exception might be low coercivity materials such as Alnico.

You may find that unit properties only need to be referenced and that the telling specification is your performance-test result. Test a magnet's performance in the manner that best exemplifies its use in the final application. Devices such as motors use the magnet's flux and generally work at a permeance coefficient near the point of maximum energy product. Some common test methods for these magnets are: flux in a fixture that mimics its operational load line, generated voltage in a motor-turned-generator, or the product of intrinsic induction and magnet volume in a Helmholtz pair. Your Hall-effect sensor doesn't care about energy product. It uses flux density, so specify the induction B at the operational position in space. If you specify results from a dedicated fixture, you'll need to completely describe the fixture and probably the testing method.

Most magnets are sold unmagnetized; if you want it magged, be sure and note that. If you're buying an anisotropic magnet, you'll need to identify the direction of alignment and if magnetized, the location of the North and South poles. Always note the direction of magnetization in terms a novice can understand. Unusual directions of magnetic orientation, such as circumferential or diametrical, can be misconstrued and need to be stated very clearly. This information can be provided with circles and arrows and maybe even a paragraph on the print.

Magnetized material requires special packaging. Your production department may request a specific packaging method that will aid them in their work. Your company may encourage the use of returnable dunnage. Consequently, packaging specifications may be necessary.

Note the unit system employed and be consistent throughout. If the flux density specification is in Gauss, the field units should be in Oersteds, just as Tesla should go with Ampere turns per meter. The physical dimensions should be in meters, inches, centimeters or millimeters. If you need 2-inch diameter magnets, the arrival of that envelope full of 2-mm ones could be disappointing.

Assure all pertinent specifications, attachments, supplemental documents and test procedures are controlled by a unique number with a revision level. Referenced lower tier specifications (with the latest revision level) should be included. Your company may have its own operational specifications; make sure they are included as well. Referenced complimentary or supplementary specifications by IEEE, SAE, ASTM, etc. or governmental requirements such as DFAR, MIL standards, Wee or RoHAS must be provided. Your part is described by all of its pertinent specifications; its portrayal is incomplete if any one is missing.

The MMPA 0100-00 specification is a very good general guideline for specifying magnets. But be aware that since the Magnetic Material Producers Association no longer exists, future updates of this document are unlikely.

There are many more possible attributes and test specifications than are mentioned here. As a final check, try to recalibrate your mind and imagine you're a magnet producer. Can you envision any process that allows you to conform to all of the specifications and still supply a lacking product?

After your specifications are complete, show them off. Make sure purchasing, QC et al have the latest revision of all of those documents. Purchasing will assure that suppliers have the latest revisions of all documents and sales will keep your customers informed. Ensure your magnet specifications are complete, current, and available to all who might need them.

Writing, maintaining and distributing all up to date specifications is not a job for the meek, but a complex process necessary to guarantee that you get the magnet you need. If you're a greenhorn, or are not completely confident that your document correctly and completely describes your magnet, then contact your magnet vendor for assistance. He, or she, will be delighted to help.

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