

## ENGINEERING REFERENCE

# Material Selection Guide

A practical framework for defining an application and agreeing the evidence needed for a project decision.

**NdFeB Magnets**

High flux density in a compact envelope; The grade's maximum working temperature is not a substitute for a thermal design review

**SmCo Magnets**

Magnet temperatures beyond the practical range of standard NdFeB; SmCo is brittle; impact, edge chipping and press-fit stress need a controlled assembly method

**Ferrite Magnets**

High-volume motors, speakers and sensors; Ferrite needs more volume than rare-earth material for the same magnetic output

**AlNiCo Magnets**

High-temperature sensors, gauges and instrumentation; AlNiCo has lower coercivity than most rare-earth grades and needs a load-line review

**Flexible Magnets**

Large-area, low-profile magnetic attachment; Magnetic pull varies strongly with air gap, steel thickness, pole pitch and contact area

PROJECT CHECKLIST

# Make the review actionable.

## Circuit and geometry

Compare candidate materials at the actual air gap, pole geometry and surrounding steel. Catalogue material properties alone are not a field or force prediction.

## Temperature and demagnetization

Review the magnet-body duty profile and opposing field with the selected material and shape. Do not treat a family temperature class as a guaranteed system limit.

## Surface and attachment

Consider humidity, chemistry, edge exposure, coating allowance, adhesive and mating material together.

## Verification and supply definition

Agree test conditions, traceability, magnetization state, packaging, quantities and the controlled drawing for production.

# Define the next step.

Share your drawing, application conditions and target quantity for a material or assembly review.

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## ABOUT THIS EDITION

New editorial reference edition 2026.09-R1, compiled 2026-09-27. Catalogue data and selection questions are reorganized for clarity. This edition does not record an engineering approval or certify a measured production result.

Source: Empire Magnets existing product catalogue and technical-library archive. For a project-controlled specification, request an engineering review.

## GENERAL ENGINEERING REFERENCE

# Read the properties correctly.

| Property  | Meaning                                                                           |
|-----------|-----------------------------------------------------------------------------------|
| Br        | Remanence: flux density at zero applied field after saturation.                   |
| HcB       | Normal coercivity: opposing field magnitude at $B = 0$ .                          |
| HcJ / Hci | Intrinsic coercivity: opposing field magnitude at magnetic polarization $J = 0$ . |
| (BH)max   | Largest magnitude of $B \times H$ on the second-quadrant demagnetization curve.   |

Definitions: S1. Br is not a finished product surface-field measurement; (BH)max is not a pull-force or torque rating. HcB and HcJ are different properties.

## Conventional unit relationships.

| Input  | Equivalent output                                                     |
|--------|-----------------------------------------------------------------------|
| 1 G    | 0.0001 T                                                              |
| 1 kG   | 0.1 T = 100 mT                                                        |
| 1 Oe   | $1000/(4\pi)$ A/m $\approx 79.5774715$ A/m                            |
| 1 kOe  | $1000/(4\pi)$ kA/m $\approx 79.5774715$ kA/m                          |
| 1 MGOe | $100/(4\pi)$ kJ/m <sup>3</sup> $\approx 7.95774715$ kJ/m <sup>3</sup> |

Conventional magnetic conversions: NIST S2. The energy-product conversion is derived from the G and Oe factors. Displayed decimals are rounded; these relationships do not validate any particular catalogue row.

## Sources.

S1 / Arnold Magnetic Technologies / Magnetic Properties of Permanent Magnets & Measuring Techniques, pp. 4-5

S2 / NIST / Units for Magnetic Properties, one-page table

Source links were reviewed on 2026-09-27. Third-party grade values are not reused in this reference.