

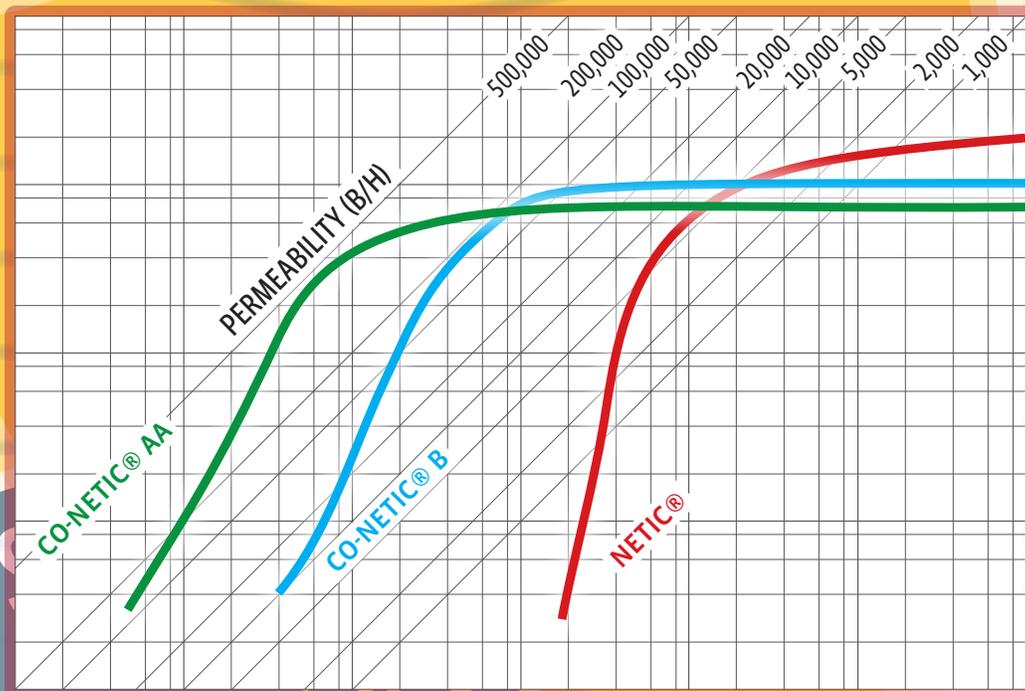
MAGNETIC SHIELD CORP.

Since 1941



NETIC®

MAGNETIC SHIELDING ALLOYS



MAGNETIC SHIELD CORPORATION
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Our Lab Kits include Co-NETIC® and NETIC® Material Samples



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NETIC® ALLOYS

HIGH MAGNETIC SATURATION INDUCTION

MAG(NETIC) SHIELDING FROM THE 1950s TO PRESENT

One of Magnetic Shield Corporation's first trademarked brands was appropriately named NETIC® as a form of the word Mag(netic). The brand was developed in the 1950s to market a well-known high iron shielding alloy used during WWII. And, as space travel technology developed, our NETIC® and Co-NETIC® materials became the standard alloys for testing certain parameters of space travel. Over the last six decades, NETIC® has proven itself to reduce interference of high powered fields radiating from strong power sources in transportation, aerospace, military and satellite applications.

Later on, as electrical power and signal strengths were reduced using lower voltages and amperages, other compositions of NETIC® were used more and more frequently. Our Co-NETIC® brand, melted with a different composition of elements and metallurgical properties, offers excellent shielding for low-intensity fields where high initial permeability and high attenuation are required. The latter has become a prominent alloy in effective shielding, and remains our primary shielding alloy used in today's low field shielding applications. However, NETIC® alloy still has a place in our electrically dependent society. NETIC® remains one of the best alloys for use in high intensity flux fields which saturate our other shielding alloys like Co-NETIC® and MuMETAL®.

So which alloy is best for your application? One of the key factors to a successful solution is knowing your application's interference field strength as measured in Gauss, then choosing the correct shielding alloy. As a leading shield fabricator and worldwide material distributor, Magnetic Shield Corporation carries a full inventory of NETIC®, Co-NETIC® AA, Co-NETIC® B and MuMETAL®. Whether your application requires one square foot of our material, or you require one prototype shield for experimentation, we are here to help. We also offer a variety of services, including custom fabrication of parts and multi-layer test chambers, made to your specifications or drawings.

Thousands of solutions have been engineered and millions of shields have been produced using our NETIC® shielding alloy. And, starting with our shielding alloys is easy – many designers use one of our Magnetic Shielding Lab Kits to rapid prototype, experiment or test solutions for problem-solving of magnetic interference (See our Lab Kit brochure for a list of included NETIC® sample materials).

In addition to NETIC®, we offer Co-NETIC® AA Perfection Annealed, Co-NETIC® Stress Annealed and Co-NETIC® B, which are used for similar, but different applications. Depending on source field intensity (H_0) and amount of reduction (attenuation) required, the right shielding alloy can be selected. The differences in these alloys are:

Co-NETIC® AA Perfection Annealed is our most popular product as it is stocked fully annealed to perfection, ready to use, and provides maximum attenuation without further processing. Available as flat sheet, it is used worldwide for rooms, doors, walls or flat rigid shields. Both sheet and foil are final annealed to exacting specifications in a quality controlled environment which builds grain structure, an important mechanical property for ultimate shielding performance. Co-NETIC® AA Perfection Annealed alloy is available in foil & sheet stock gauges from .002" to .062" thickness [0,05mm to 1,57mm].

Co-NETIC® Stress Annealed sheet material is stress relieved for further fabrication, stamping, severe forming or welding. Perfection Anneal is required after processing to maximize shielding efficiency. Our Stress Annealed alloys are designed to provide you with fabricated cylinders, cans, boxes or enclosures (3D shields). During fabrication, a material's grain structure is weakened. After final fabrication processes are completed, grain structure is then modified by controlled atmospheric Perfection Annealing to relieve stress in the material, resulting in larger grain structure, softer temper, and ultimate shielding performance. When we fabricate and Perfection Anneal your custom magnetic shields, you will be using the most economical material with high permeability and highest attenuation.

Co-NETIC® B is used when higher saturation and high permeability are both necessary, and multiple layers of Co-NETIC® and NETIC® are not possible due to space limitations. Co-NETIC® B alloy is formulated to be a cross between Co-NETIC® and NETIC®; generally providing properties of both, yet at lower intensity. In certain applications Co-NETIC® B may be used to lower overall cost, but only when high initial permeability of Co-NETIC® AA Perfection Annealed alloy is not necessary.

AVAILABLE PRODUCT TYPES:

| Product type | Available Thickness | | Available Sizes (inches) | | Anneal type |
|--------------|---------------------|------------------|--------------------------|---------------|-------------|
| | inches | [mm] | width | length | |
| NETIC® Foil | .004 | [0,10] | up to 15" | sold per foot | Stress |
| NETIC® S3-6 | .014 to .095 | [0,36] to [2,41] | up to 30" | up to 120" | Stress |
| NETIC® ET | .010 to .015 | [0,25] to [0,37] | up to 36" | up to 120" | Stress |

Stress Annealed NETIC® alloy typically requires full-anneal after fabrication or welding to provide maximum shielding performance.

NETIC® PRODUCT RANGE TODAY

As our "work horse" brand, NETIC® is considered a universally strong shielding alloy, far superior in shielding strength due to its consistent quality, material composition and finishing characteristics. NETIC® is used primarily in strong fields where high magnetic saturation is required (high intensity, strong fields). We have found certain standard sizes of electro-tin plated and un-plated NETIC® alloy work for most applications. NETIC® is readily available from stock in three forms:

NETIC® S3-6 – Our proprietary brand which is sold for commercial use in shielding any low-frequency, high intensity field (strong flux field). Used for either fabricated or flat shields, it may be re-annealed for better performance. NETIC® S3-6 is an uncoated, high iron shielding alloy, and is prone to oxidation – typically it is painted or plated to prevent further oxidation. It is frequently used in conjunction with a second layer of Co-NETIC® or MuMETAL® as layering has proven to solve intense source field electro-magnetic interference. If used in combination, the NETIC® layer is placed closest to the source of interference, with Co-NETIC® or MuMETAL® layer closest to the component being shielded. NETIC® S3-6 alloy is available in foil & sheet stock gauges from .004" to .095" thickness [0,10mm to 2,41mm].

NETIC® ET (Electro-Tin Plated) – Our "ET" contains the same chemical composition and shielding efficiency as our field-proven NETIC® S3-6 Shielding Alloy with the addition of electro-tin plating on all surfaces. The NETIC® S3-6 Alloy provides magnetic shielding for electronic and electrical components, while the electro-tin plating adds improved conductivity for better EMI shielding, superior corrosion resistance, and good solderability for ground connections and prototype construction. NETIC® ET is available in foil & sheet stock.

NETIC® with PST – All gauges and types of NETIC® foil are available with double-faced PST (pressure sensitive tape) with release coated liner. Operating temperature range of our standard PST is 32°F to 140°F (0°C to 60°C). 3M brand and other adhesives are available for

custom applications and may be quoted based on your specification. NETIC® S3-6 Shielding Alloy with PST is readily available from stock in .004" [0,10mm] thickness.

SPECIAL NOTE: When space is limited, and to save on costs, our Co-NETIC® B alloy may be used as a single layer in place of a double layer of NETIC® and Co-NETIC®. Co-NETIC® B may be an economical alternative, but only when high initial permeability and highest attenuation are not necessary. Through our research and practical experiences, it has been proven that two separate layers of NETIC® and Co-NETIC® are more effective than a single layer of Co-NETIC® B, with the NETIC® layer placed closest to the source of interference (near the strongest magnetic flux lines).

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FINISHING OF NETIC® SHIELDS

ANNEALING

For optimum magnetic properties, NETIC® S3-6 material should be annealed at 1550°F [843°C]. Time and temperature considerations are less critical than Perfection Annealing of Co-NETIC®. Low cost reducing type furnace atmospheres are adequate for the annealing of NETIC®. If cracked natural or manufactured gas is used, it should be strongly reducing and have a low dew point. With all atmospheres, parts should be cooled sufficiently in the furnace to avoid any oxidation upon removal. After annealing, NETIC® S3-6 should be painted or plated to prevent further oxidation.

PAINTING

Over extended periods, NETIC® material is subject to oxidation. To provide surface protection and proper adhesion, the following painting procedures are recommended:

- Clean parts thoroughly using vapor degreasing, hot alkaline solution, or solvent bath.
- Prepare surface by phosphating, where specified.
- Apply zinc chromate primer.
- Apply finish coat of baked enamel, powder coat, epoxy or other paints as specified.
- If a light oxide appears on NETIC®, it may be easily removed by conventional pickling or sandblasting procedures.

PLATING

Plating is added after anneal. Care must be taken to avoid stressing magnetic shields. To maintain ultimate shielding performance, shields and shielding components cannot be bent after finishing. Cleaning of parts for any plating method is similar to that used for preparing low carbon ferrous materials. Both Co-NETIC® and NETIC® respond to conventional cleaning methods. With proper surface preparation, Co-NETIC® and NETIC® display excellent plated finishes using commercial plating procedures.



NETIC® ET -.015
Sheet No. 1
LOT: NXXA13785A101X

NETIC® ET IS AVAILABLE IN SHEET & FOIL FORMS

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You are invited to call our Engineering Department to discuss your fabrication and finishing requirements. For a prompt and accurate quotation, send a drawing, sketch, or written description to shields@magnetic-shield.com.



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SPECIFICATIONS – CERTIFICATIONS *and* SELECTION GUIDE

NETIC® OR Co-NETIC®?

NETIC® and Co-NETIC® are proprietary alloys, developed by Magnetic Shield Corporation specifically to provide effective magnetic shielding. Both are available in either foil or sheet form in a convenient range of thicknesses. All sizes are available with double-faced Pressure Sensitive Tape (PST) and release coated liner. NETIC®, due to its high iron content, is available with or without electro-tin plating. Typically this alloy is painted or plated after shield fabrication.

In strong fields of high intensity, NETIC® is preferred because of its high magnetic saturation characteristics. In fields of low intensity, Co-NETIC® is used in order to utilize its high initial permeability and corresponding high attenuation characteristics. In some applications, combinations of the two materials may be useful, with NETIC® material always placed closer to the source of magnetic interference.

SHEET OR FOIL?

Sheet materials, supplied as NETIC® or Co-NETIC® in thicknesses ranging from .014 to .125 inches [0,36 to 3,18 mm] are used in applications of high magnetic force where greater alloy thickness is necessary. When production tooling, forming or welding are necessary, Stress Annealed material is used. For maximum performance, annealing is required after fabrication. Co-NETIC® AA Perfection Annealed flat sheet is most popular due to its superior performance and lowest overall cost.

Foils, supplied in thicknesses ranging from .002 to .010 inches [0,05 to 0,25 mm] provide effective shielding with minimum fabrication, avoiding expensive tooling and extended deliveries. Thus, our foil has become the preferred material for many production, prototype and laboratory evaluation projects. Typical applications include shielding hand-held devices, field-sensitive components, printed circuit boards, instruments, signal leads and power cables.

MAGNETIC DATA & SPECIFICATIONS

| | Co-NETIC® AA PERFECTION ANNEALED | Co-NETIC® STRESS ANNEALED* | Co-NETIC® B STRESS ANNEALED* | NETIC® S3-6 STRESS ANNEALED* |
|--|--|--|------------------------------------|------------------------------------|
| Specific Gravity | 8.74 | 8.74 | 8.18 | 7.86 |
| Coefficient of Expansion, per °C x 10 ⁻⁶ | 12.6 | 12.6 | 8.3 | 13.7 |
| Tensile Strength, PSI x 10 ³ | 64 | 85 | 80 | 42 |
| Yield Strength, PSI x 10 ³ | 18.5 | 33 | 27 | 27 |
| Modulus of Elasticity, PSI x 10 ⁶ | 25 | 30 | 24 | 30 |
| Hardness, Rockwell B | 50 Ref. | 70 Ref. | 68 Ref. | 50 Ref. |
| Elongation in 2 inches | 27% | 32% | 32% | 38% |
| Melting Point | 2650°F/1454°C | 2650°F/1454°C | 2600°F/1427°C | 2790°F/1532°C |
| Thermal Conductivity (cal/sec/cm ² /cm/°c) at 20° | .138 | .138 | .037 | .118 |
| Electrical Resistivity Micro-ohm-centimeters | 55 | 55 | 48 | 11 |
| Saturation Induction (Gauss) | 8,000 | After required Perfection Annealing is done, magnetic properties are same as those for AA Perfection Annealed Alloy. | 15,000 | 21,400 |
| Initial Permeability | 30,000 | | 8,000 | 200 |
| Permeability at 40 B | 75,000 | | 12,000 | 300 |
| Permeability at 200 B | 135,000 | | 30,000 | 500 |
| Maximum Permeability | 450,000 | | 150,000 | 4,000 |
| Induction at μ max. | 3,000 | | 7,000 | 8,000 |
| Coercive Force Hc, Oersteds | .015 | | .05 | 1.0 |
| Curie Temperature | 850°F/454°C | 850°F/454°C | 840°F/449°C | 1420°F/770°C |
| Minimum Operating Temperature | 4°K | 4°K | 4°K | 4°K |

Note: Magnetic data is for sheet material measured in a D.C. field.

*Stress annealed material must be annealed after fabrication for optimum magnetic shielding properties.

CERTIFICATIONS

Physical and chemical certification of NETIC® may be provided upon request with your order. RoHS, DFARS, military, aerospace, industrial and OEM certifications are also available.

