

Arnold Magnetic Technologies  
**Precision Rolled  
Strip and Foil**

*Precision*

*Quality*

*Experience*



**ARNOLD<sup>®</sup>**  
**MAGNETIC TECHNOLOGIES**

*Rolled Products*

# Precision

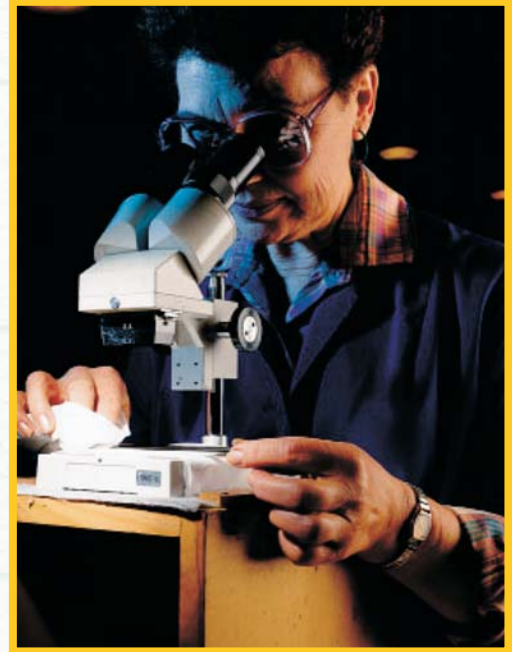
## The Advantage of Arnold Magnetic Technologies

**Arnold Magnetics' Rolled Products Division** was established in 1950 to manufacture foil and precision strip alloys for our in-house production of tape-wound magnetic cores. The need for precise thickness and process control required us to develop specialized processes that were capable of achieving necessary characteristics in a variety of alloys.

Our experience with these techniques and capabilities earned us a reputation as a premier custom processor of a wide spectrum of alloys. Arnold Magnetics' foil and precision strip products are preferred by many companies in aerospace, medical electronics, telecommunications, instruments, sensors, electrical, and many metalworking industries.

To ensure continued conformance with the quality demanded by today's competitive environment, Arnold Magnetics has invested in personnel, training, equipment and quality control programs to meet our customers' requirements.

These processes produce components for such critical applications as springs, strain gauges, shielding, gaskets, brazing, magnetic and electromagnetic sensors, honeycomb structures, implant devices, transformers and motor laminates, and many other precision applications.



*"We judge our performance on how well we satisfy our customers' needs."*

## Capabilities

- Precision thin-gauge alloy foil available in: sheet, strip and continuous coils. Available widths from 16.5" to a minimum of 0.035" (0.9 mm). Minimum thickness of 0.0005" (0.0125 mm) for 4 to 16.5" in width and 0.000085" (2.16 micron) for 4" widths and less.
- Arnold offers wire, rod and bar stock for selected magnetic alloys such as the ductile ARNOKROME™ III alloy developed by Arnold based on the iron-chrome-cobalt alloy system. ARNOKROME™ III is a lower cost, more readily available alternative to CuNiFe, Vicalloy and Cobalt Steels. We also offer Vanadium Permendur soft magnetic bar stock (Fe-V-Co) which, with the highest magnetic saturation available, is particularly useful in pole pieces and guide tubes.
- Rolled Product Piece-Parts Service is the segment of our business that encompasses the value-added operations needed to provide our customers with a one-stop shopping convenience for magnetic components. By combining the unique properties of our proprietary formable magnetic alloys — the Arnokrome™ family of alloys — and a network of local fabricating vendors, we can provide ready-to-install magnetic components and subassemblies. Examples include hysteresis rings, precision laminations, small washer and vane shaped magnets, magnetic clutch and brake discs, level sensor components and gauge vanes.

## Efficient, Effective Processing

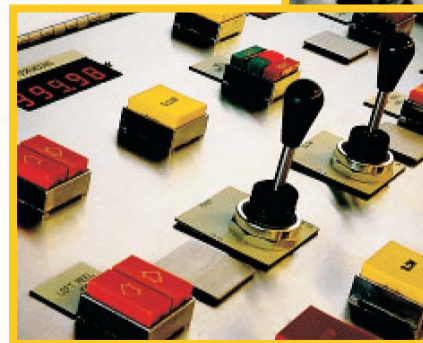
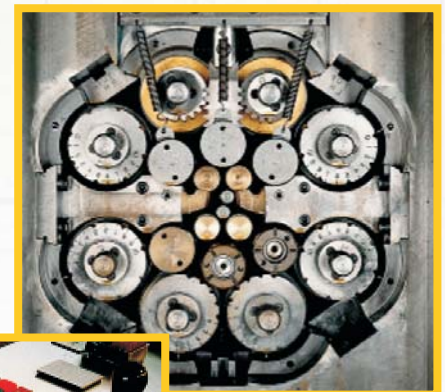
All precision cold rolling at Arnold Magnetics is done on Sendzimir-type cluster mills. These "Z" mills use small-diameter work rolls to obtain efficient reduction of very thin materials.

Our mills also use computerized closed-loop gauge-control systems with the ability to preview, adjust and review the thickness of material during processing for uniformity throughout the coil length. In addition to recording each reduction on gauge charts, we have enhanced our mills to provide complete computerized statistical process control data including histograms, X- and R bar charts, and Cpk data.

Our precision rolling mill capabilities range from 4"-wide foil mills which can roll as thin as 0.000085" to our 17.5"-wide precision strip mills with minimum thickness of 0.0005". Tolerances can be held as tight as 10 millionths of an inch in our narrow foil materials.

We evaluate each customer's application to determine the proper combination of rolls for the material and specifications. All rolls are rotary diamond lapped to produce a roll surface that will achieve the specified thickness reduction and defect-free strip surface finishes.

Similar attention is devoted to the overall mill environment, maintaining precise temperatures and controlling dust for optimum accuracy in our rolling process. This attention to detail extends to all processes within Arnold Magnetics' precision rolling mill — including annealing, slitting, heat treatment, coating and packaging.



## Complete or Selected Services

In addition to providing a wide range of exotic alloys and more common metals and processing them for our customers, Arnold Magnetics also processes customer-owned materials for conversion to final form.

Customer conversion can include all available processes or a single procedure, such as heat treatment or slitting. Arnold Magnetic Technologies also offers processing to specifications more exacting than our standard tolerances on an order-by-order basis.

# Quality

## Total Management for Your Satisfaction

At Arnold Magnetic Technologies, we judge our performance on how well we satisfy our customers' needs. Customers who need ultraprecise foil, require the utmost attention to quality — and Arnold Magnetics delivers in practice as well as in policy.

Quality assurance is a company wide commitment from the president on down. The Quality Steering Committee has established a detailed written program with policies and procedures for continued quality improvement.

All managers, supervisory and operating personnel receive extensive training in quality management and statistical process control. They also are thoroughly trained in the operation of process performance monitors.

We support our quality procedures with a complete range of mechanical, metallurgical, electrical and magnetic testing equipment to measure material properties. And we maintain all the calibration standards and devices needed to ensure the highest accuracy in testing.

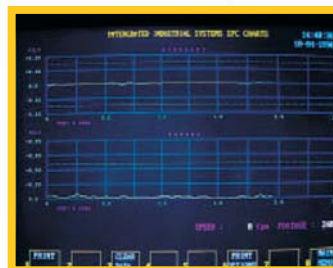
## Actions to Meet Our Commitment

Quality results begin with a quality facility, since minor contamination can cause a major deviation from specifications.

Contamination restrictions prevent the intrusion of unwanted pollutants. Arnold Magnetics' precision rolling mill environment is filtered continuously, and conditions are monitored to maintain an ideal atmosphere.

Special walls enclose the areas where the thinnest-gauge foils are produced, and environmental filtration assures surface quality and product integrity.

All equipment components — mills, furnaces, slitters, etc. — are monitored continuously to ensure that they are operating at peak efficiencies. Specialized oil-cleaning systems have been incorporated to assure maximum particle removal and purity.



## Meeting the Toughest Standards

Every order we process is evaluated individually to determine the correct procedures to attain the required specifications that deliver the highest possible level of quality. Using appropriately conditioned work rolls, the material is rolled to final thickness using our closed-loop gauge-control system that measures, corrects and verifies thickness several hundred times per minute. We monitor every process carefully and make detailed documentation available for verification of the results. In-process monitoring includes on-line CRT monitors and printed reports, real-time data strip chart for each rolling, and complete SPC data on all rolling processes.

- **Heat Treatment** — Arnold Magnetics offers a range of intermediate and final annealing and heat treatment in a full selection of protective atmospheres to produce specified mechanical or magnetic properties. Our specialized furnaces permit careful control of temperatures up to 2150° F while maintaining dew points as low as -81° F to ensure atmospheric purity.
- **Surface Cleaning** — Scrubbing with alkali cleaners, the removal of surface contamination and oxidation from rolled strip and foil is monitored and controlled carefully through the final rinse in deionized water to protect the material properties.
- **Slitting** — Our custom-designed slitting equipment can slit our full range of precision-rolled foil and strip thicknesses to widths as narrow as 0.035" at tolerances as close as  $\pm 0.0005$ ". Special sharpening techniques for our slitter knives minimize burr, camber, crossbow and damage to the material while maximizing efficiency in any of several cutting modes.
- **Specialized Coatings** — Arnold Magnetics can apply special coatings to finished foil and strip, including protective plastics, insulators and lubricants, to satisfy your specific application. Tight controls and monitoring maintain uniform thickness of the coating for optimum results in your application. Arnold Magnetics is the premier supplier of thin gauge silicon steel with C-5 coating.
- **Tooling Capabilities** — Arnold Magnetics maintains full toolmaking and design capabilities so your special requirements can be met economically and efficiently. Quality monitoring and control of toolmaking is particularly stringent to assure the quality of output.

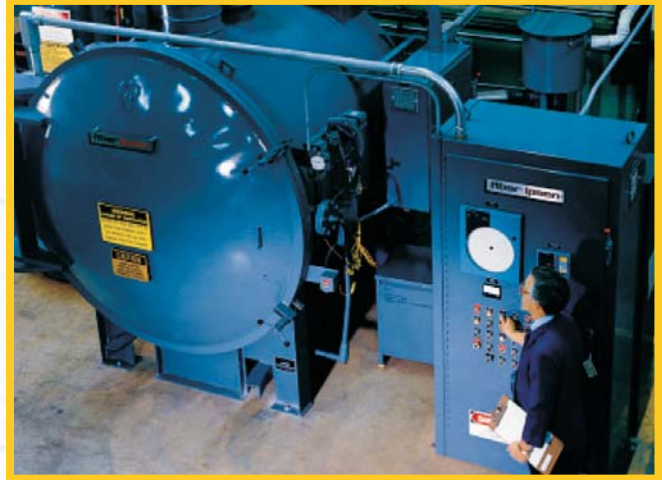


# Experience

## Expertise Built on Years of Application

From its beginning five decades ago, Arnold Magnetic Technologies Rolled Products Division has worked with a broad range of magnetic materials. We are intimately familiar with the magnetic properties of a broad range of materials and with the most efficient and effective means of maximizing their potential.

Our own ARNOKROME™ and ARNAVAR™ alloys are just two examples, and we can customize the properties of Arnokrome to satisfy a wide spectrum of magnetic strip and foil applications. We also work extensively with a number of other alloys, both exotic and traditional, in finished widths up to 16.5". The list of materials processed regularly at Arnold Magnetics includes:



### ■ **Nickel Iron Alloys:**

Moly Permalloy, 4750-49 Ni, Invar® 36, NiSpan-C®

### ■ **Magnetic and Cobalt Alloys:**

Arnokrome™, Vanadium Cobalt Alloys, Arnon™ and 3% Silicon Steel (Thin; Oriented and Non-Oriented)

### ■ **Copper-Base Alloys:**

Beryllium Copper Alloy 25, OFHC Copper, Phosphor Bronze

### ■ **Spring Alloys:**

Arnavar™, Havar®, Elgiloy®

### ■ **Titanium Alloys:**

Titanium (grades 1 through 4), 3A1-2.5V, 15-3-3-3, Bio-Compatible Alloys

### ■ **Nickel Base and High-Temperature Alloys:**

Nickel 201, 233 and 290; Inconel® 600, 601, 617, 625, 718 and X750; Hastelloy® B-2, C-276

### ■ **Ferrous Based:**

Carbon and Low Alloy Steels, Stainless Steels, Pure Iron

Arnold's Rolled Products works extensively with these and a number of other magnetic and non-magnetic alloys to exceed your demanding physical and mechanical requirements.

Arnold's own ARNOKROME™ is one example of our capabilities. We can customize the properties of ARNOKROME™ or other alloys to satisfy a variety of mechanical, surface, magnetic, or other requirements.

## Arnold Manufacturing Processes Produce Components for Critical & Diverse Applications

- Hysteresis Drive Couplings
- Springs
- Strain Gauges
- Shielding (Magnetic & EMI)
- Gaskets
- Brazing Alloys
- Magnetic ID Tag Stock
- Battery Components
- Heat Shielding
- Magnetic & Electromagnetic Sensors
- Honeycomb Structures
- Implant Devices
- Transformers
- Motor Laminates (specialized, thin)
- Radiation Windows
- Barrier Membranes
- Sacrificial Wear Surfaces

# Customer Conversion

Conversion of customer-owned materials is an important part of our activity. This representative listing should be viewed as a starting point.

**Nickel Chrome** — Balco\*, Constantan, Karma, Evanohm\* and Monel\*

**Stainless Steels** — AISI Types 301, 302, and 304

**Other Materials** — Amorphous Alloys, Aluminum and Zirconium

As new materials are offered to the marketplace, we evaluate their potential for strip and foil applications. Arnold Magnetics is willing to work with experimental materials as well as prototype work for your special applications.



		STRIP WIDTH			
		0.035 in 0.9 (mm)	4.0 in 101.6 (mm)	4.5 in 114.3 (mm)	16.5 in 419.1 (mm)
THICKNESS	Inches (mm)				
	0.060 1.524				
	0.0005 0.013				
	0.0004 0.010				
0.0001 0.003					

**Notes:**

Some alloys can be supplied at thicknesses less than 0.0001"  
 Maximum starting thickness is normally 0.060"  
 Special arrangements can be made for thicker materials  
 Maximum starting width is 17.5"



# Packaging for Material Protection

Over the years, Arnold Magnetics has developed methods for packing and shipping even the most delicate foils to ensure their safe arrival.

We can provide the packaging you require, including preparation for export as well as domestic shipment. We utilize a range of plastic and steel reel cores for foil rolls and place the filled rolls in carefully designed containers for protection against mishandling in transit.

Wherever your required destination, we have the experience to see that your rolled metal arrives ready for your use.

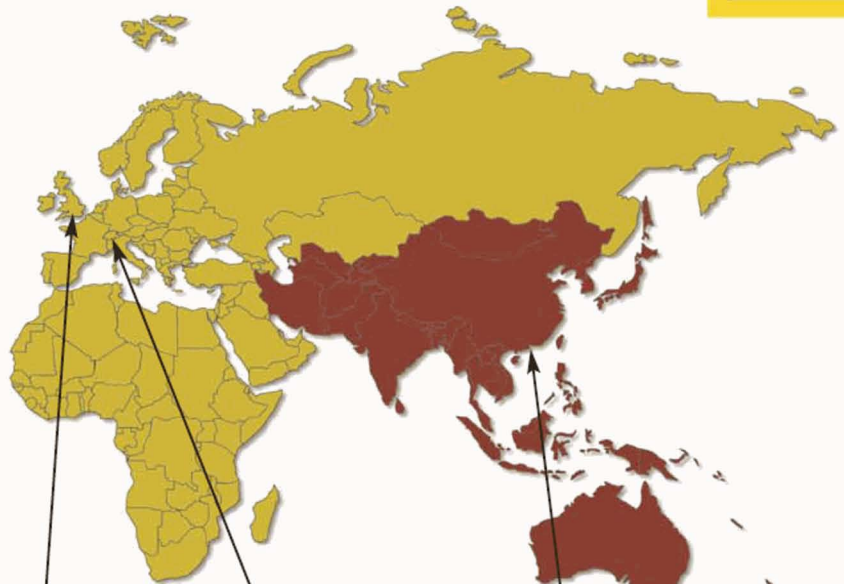


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