

The Alloy Engineering Family of High-Temperature, Corrosion-Resistant Products

Alloy Engineering designs and fabricates a complete line of high-temperature, corrosion-resistant alloy products including:

- Industrial and high-temperature fans
- Muffles
- Rotary retorts, batch and continuous
- Pickling hooks
- Catalyst baskets
- ASME code vessels
- Forced air coolers
- Hydrogen annealing equipment
- Radiant tubes

With headquarters in the Cleveland, Ohio metro area, our nationwide network of highly trained, experienced Alloy Engineering sales engineers stands ready to analyze and satisfy your needs to ensure optimal productivity and minimal cost.

*A VISION OF QUALITY,
DEDICATION, IDEALS.
The stainless steel sculpture
adorning the grounds of the
company's headquarters
facility is symbolic of the
materials used, products
manufactured, and the
'can-do' spirit that is the
essence of Alloy Engineering.*



*Designers and Manufacturers of Heat
and Corrosion Resistant Metal Products*

The Alloy Engineering Company

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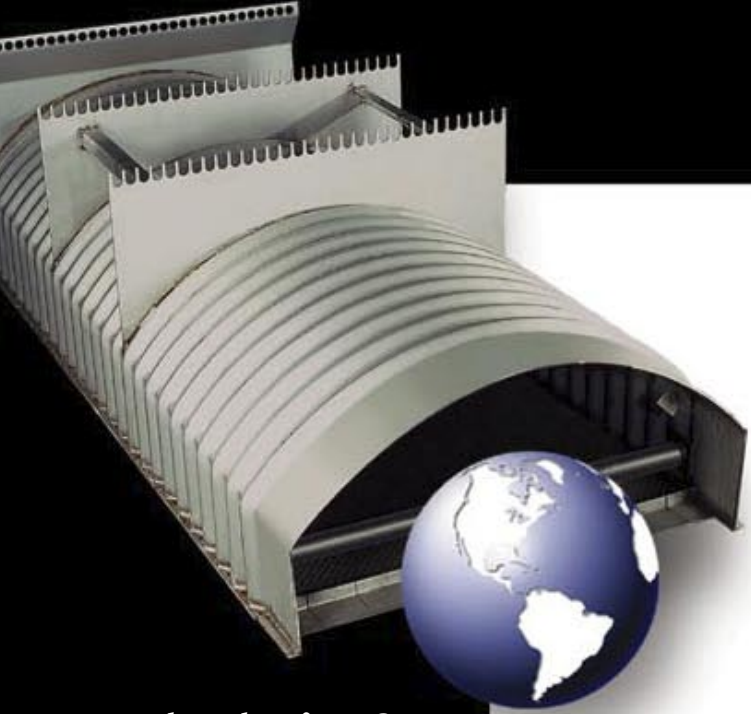
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Science and Art of Atmosphere Furnace **MUFFLES**

Mufl-02
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*Designers and Manufacturers of Heat
and Corrosion Resistant Metal Products*



A Heritage of Quality and Commitment

Since 1943, The Alloy Engineering Company has been recognized as the premier designer and manufacturer of high-temperature furnace muffles. This reputation has been built on a foundation of solid engineering expertise, extensive application experience, and superior fabrication techniques.

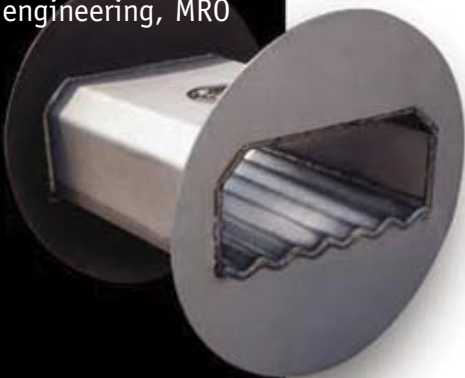
Designing and developing an optimal solution for a specific muffle application is a challenge—part science, part innovative know-how. It is a challenge requiring a knowledgeable melding of engineering and fabrication expertise with an intuitive understanding of furnace parameters in a variety of applications and industries. It is a challenge we readily accept and at which we continuously excel.

Equally important as our technical capabilities is our commitment to the long-term support of customers. We consider ourselves a full partner with customers in a quest to enhance their long-term success by achieving the lowest cost per hour of operation through engineering and material selection. Close liaison before, during, and after a sale ensures long-term high productivity and uptime.

Technologies & Applications

Alloy Engineering muffles are an integral part of furnaces throughout the world for all types of high-temperature processes including sintering, brazing, annealing, hardening, and carburizing. We have designed and installed products for demanding applications throughout industry including:

- Transportation
- Pulp & paper
- Petrochemical
- Primary metals
- Rod, wire, nonferrous mills
- Heat treating
- Powdered metals
- OEM product design
- General manufacturing
- Plant engineering, MRO



Satisfaction Without Question

At Alloy Engineering, we believe that customer satisfaction defines quality. And, delivering, or surpassing, expected muffle performance and life is the essence of customer satisfaction.

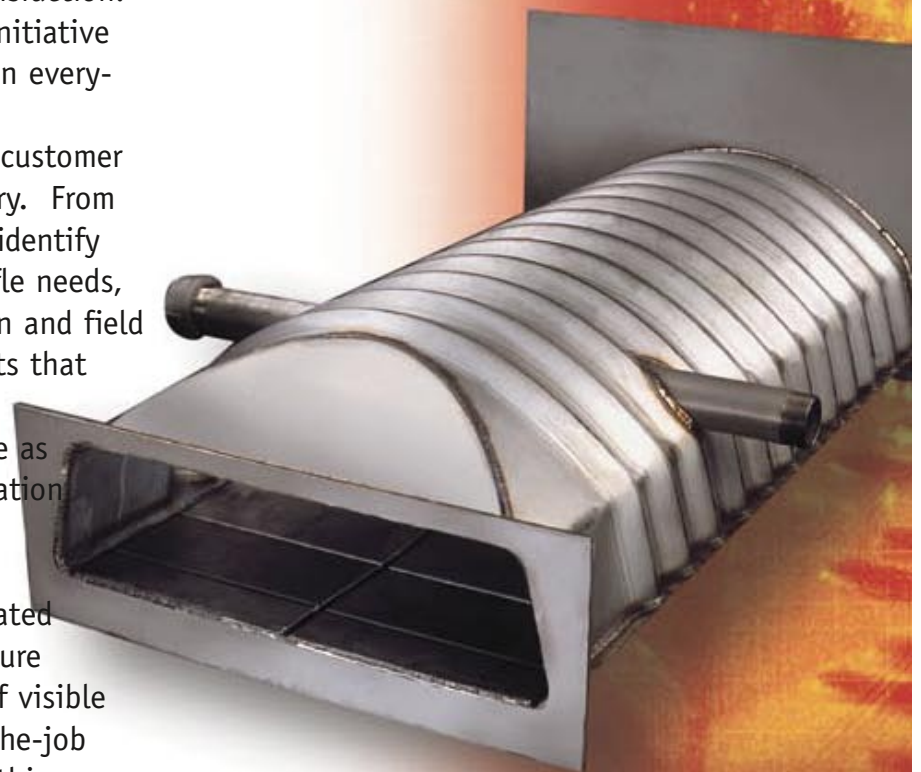
This is the credo that drives our initiative to deliver the highest level of quality in everything we do.

We feel our approach to ensuring customer satisfaction is unequalled in the industry. From initial consultation with customers to identify their production environment and muffle needs, through design, fabrication, application and field support, we focus on providing products that meet, or exceed, expectations.

Assurance of quality—performance as specified—results from constant evaluation and improvement of muffle design and fabrication. All incoming material is certified to be as specified. Our dedicated production-floor quality specialists ensure that all materials and plates are free of visible flaws. We constantly monitor the on-the-job performance of our muffles and relate this to customer expectations.

And we don't stop there. Our suppliers undergo the same rigorous scrutiny that we expect our customers to apply to us. We start by investigating and evaluating supplier in-house process and quality issues.

Our unwavering commitment to keeping customers' needs and desires in focus throughout our operations allows us to deliver an unprecedented level of muffle performance and dependability. Quality and satisfaction without question.



How Does Your Muffle Stack Up?

Our engineers and designers will be happy to provide a comparative analysis of an existing muffle design and an Alloy Engineering muffle. Call us or provide the information needed on our web site—www.alloyengineering.com—and see if an Alloy Engineering muffle should be in your furnace.

Essentials of Performance and Long Life

The Alloy Engineering design team analyzes and evaluates the many factors affecting muffle design, including:

- Furnace chamber
- Product work package
- Furnace support structure
- Process temperature
- Process atmosphere
- Material and ingredient temperature-dependent characteristics
- Muffle design considerations—cross-sectional shape, corrugation design, and wall thickness
- Joint assembly concerns
- Weld joint design
- Forming method
- Quality assurance plan

Innovative Design Solutions

Alloy Engineering muffles are operating throughout the world in some of the most demanding and hostile furnace environments. Our innovative designs, ranging from small units to the world's largest, are specifically designed to address the failure areas common with other muffles. Based on a thorough analysis of application parameters including furnace characteristics, process requirements, and product criteria, Alloy Engineering muffles deliver superior performance and durability with minimum maintenance.

An Alloy Engineering muffle not only performs as required for its design life, but it also significantly reduces overall furnace operating costs. Our engineering team analyzes and evaluates the many factors influencing long-term muffle performance in a hostile, high-temperature furnace environment.

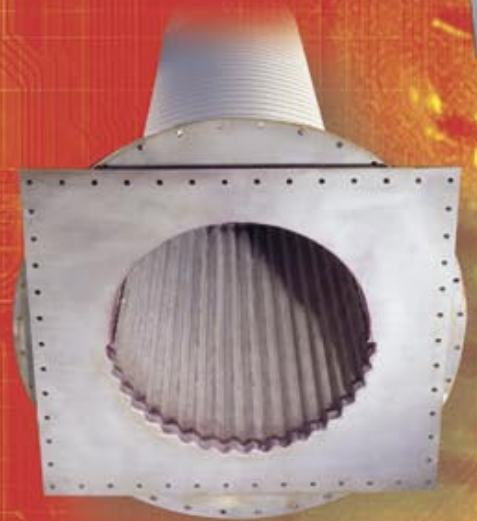
With a thorough understanding of these factors, and their interaction, Alloy Engineering assures you of an optimal solution designed to meet the requirements of your unique application.

We also offer a complete line of accessories tailored to your application including heat retaining baffles, any configuration of atmosphere piping, internal components and control devices.

Our rebuilding service—replacing only the deteriorated sections of a used muffle—can be a cost-effective alternative to complete muffle replacement.



Alloy Engineering Muffles, in a variety of application-specific configurations and with an assortment of accessories, are designed to meet, or exceed, performance requirements, extend component life, and minimize operating and maintenance costs. Consequently, your muffler is the result of a thorough analysis of your requirements and operating environment, and is not an off-the-shelf, performance-compromised design.



Whenever possible, our mufflers incorporate a catenary arch cross section. This design equalizes stress throughout the section to provide the ultimate strength and life at temperature. When furnace physical limitations preclude the use of a full catenary, we can provide a modified catenary section with performance approaching that of a full catenary. Thanks to our manufacturing capabilities, and the skill of our operators, we routinely overcome the challenge of forming the infinitely changing radius of a catenary design





Modified Catenary

Functions of Chemical Elements

Nickel (Ni)	High temperature strength; carburization resistance
Chromium (Cr)	Oxidation resistance
Iron (Fe)	Basic element of all steel
Molybdenum (Mo)	Strengthening agent; resists pitting
Silicon (Si)	High temperature strength; oxidation and carburization resistance
Nitrogen (N)	Strengthening agent
Tungsten (W)	Strengthening agent
Cobalt (Co)	Strengthening agent
Aluminum (Al)	Oxidation resistance
Carbon (C)	Strengthening agent; reduces ductility
Manganese (Mn)	Enhances weldability
Cerium (Ce)	Resists oxidation, prevents flaking of oxide surface

Our state-of-the-art CAD capabilities are constantly upgraded. This system provides powerful 3-D functionality through solid modeling that allows for fast and accurate design and generation of drawings and graphics. As a result, we can quickly respond with a design solution and can seamlessly integrate our product designs with customer system specifications. Our design analysis capabilities include stress, frequency, displacement, buckling, steady state and transient thermal analyses, assembly analysis with gap and contact checks, nonlinear stress, shape optimization, dynamic response, fluid flow dynamics and fatigue capabilities.





FINEX MATT

MAXIMUM
TONNAGE
1050

P1

MAXIMUM
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Controlled Fabrication Excellence

Muffle dependability and long life are as dependent on fabrication excellence as they are on design expertise. Over the years, Alloy Engineering has pioneered the development of rolling, forming and welding techniques to ensure the highest quality, most durable furnace muffles available, anywhere. Whatever the material—stainless or nickel-alloy steels, titanium, aluminum, or special bi-metal composites—we have the specialized equipment, and know-how, to economically produce muffles that will maximize your furnace productivity.

Our production capabilities include a full line of metal bending and forming equipment, including a 1,000-ton press brake that allows us to form large, high-integrity fabrications with a minimum of seams. We have the ability to roll a variety of cylindrical and conical shapes and we can produce corrugated, rolled shapes in a single cost and timesaving operation. Our plasma and oxy-acetylene cutting torches quickly and cleanly slice through

the heaviest of plates, including 1-in. thick stainless steel plate.

We go to great lengths to produce high-quality, high-strength welded seams that are stronger than the parent materials. For instance, all mating edges are beveled to maximize weld penetration and, whenever possible, all seams are welded on both sides for maximum strength. All welders are AWS and/or ASME certified and highly trained and experienced with a variety of materials and techniques.

Critical fabrication operations are performed in work areas with flat, rigid steel-plate flooring to ensure dimensional accuracy and stress-free joints. Our muffles are dimensionally true and free of twist, camber, or other distortions that could affect performance and life.

