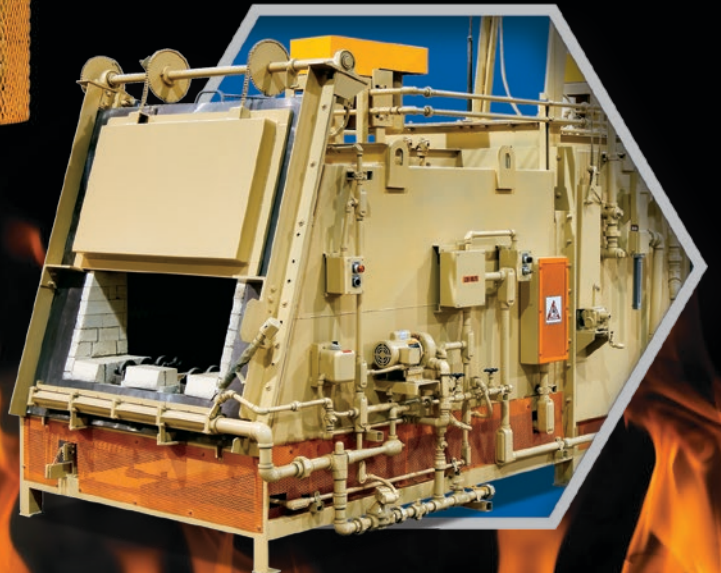


LINDBERG/MPH

HEAT TREAT SOLUTIONS



Mission

Our mission is to develop, build and deliver the best-in-class thermal processing solutions and services.

Quality

Each Lindberg/MPH employee has the responsibility to ensure that the agreed upon expectations of their customer, internal or external, are met consistently each time. Those employees in leadership positions have the additional responsibility to ensure that the resources required for the individual to meet the customer's expectations are made available. Once complete, each piece of equipment is thoroughly inspected and tested. It doesn't leave our facility for yours, until it's right. Guaranteed.

Tradition

Lindberg/MPH is a long-established leader in providing thermal processing solutions, with equipment installed in more than 30 countries. Lindberg/MPH has roots dating back to 1912 and has served a variety of industries ever since, including: aerospace, automotive, ceramic, electronic, fabricated metals, machinery and powdered metals. With this rich history, more than 75,000 installations worldwide, a modern facility and a skilled and dedicated work force, Lindberg/MPH has the experience, capacity and know-how it takes to solve your most demanding thermal processing challenges.

1-Year Warranty

At Lindberg/MPH we stand by the quality and dependability of our equipment. We are proud to offer a 1-year warranty on new equipment purchases. This 1-year warranty covers all materials for all components (less wear items); components covered include, but are not limited to: recirculation, exhaust, & combustion blowers; burner, burner controls, & all gas train components; temperature controllers, high-limit instruments, & recorders; PLC's, HMI touch screens, & related components; disconnect switches; power distribution blocks; terminal blocks; transformers; fuse blocks; selector switches & push buttons; pilot & beacon light assemblies; process & purge timers; SSR & SCR's; contactors; relays; alarm horns; pressure switches; limit switches; vent fans; power supplies; variable frequency drives; etc. as applicable to the equipment quoted; labor is included for defects in workmanship.

Thermal Product Solutions

Lindberg/MPH is owned by Thermal Product Solutions ("TPS"), a leading American manufacturer of custom industrial ovens used for heat treating, finishing, drying, curing, manufacturing automation and process control. TPS is a global leader in thermal processing products and test solutions with brands including BlueM, Gruenberg, Tenney, Lindberg/MPH and Wisconsin Oven. For more information on equipment solutions from TPS visit the website at www.thermalproductsolutions.com.



TPS
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PACEMAKER FURNACES

The Lindberg/MPH Pacemaker® is a highly productive and efficient integral-quench furnace available in either gas-fired or electric models. It is the centerpiece of a complete heat-treating system. All Pacemaker models feature obstruction-free work chambers, large capacity recirculation fans, and strategically located heat sources to ensure rapid heat transfer, low energy use and excellent temperature and carbon uniformity. A size and configuration is available to fit your needs.

The metallurgical properties obtained with a heat-treating system depend on precise control of the time/temperature/atmosphere relationship. Heating rate, temperature uniformity, efficient energy usage, atmosphere control and quench capability are critical to reliable and economical production of heat-treated parts. You'll find outstanding control of all these critical aspects with a Pacemaker furnace.

The Pacemaker furnace saves you money when heat treating large volumes of material per hour with exceptional uniformity and low maintenance. Add Lindberg/MPH's companion equipment for a complete, highly productive heat treat system featuring low maintenance and ease of use. Applications include: hardening, carburizing, carbonitriding, carbon restoration, sintering, brazing, annealing and normalizing.

Material Handling Systems

Lindberg/MPH offers Pacecar material handling units in either uni- or multi-directional models. The Pacecar provides efficient load retrieval and transfer between furnaces, washers and load tables. Also available are fully automatic, material-transfer systems that provide unmanned operation supervised from a remote control station.

Companion Washers

Companion immersion/oscillation spray washers are available in fuel-fired or electric configurations.

Companion Draw Furnaces

Lindberg/MPH offers draw furnaces in fuel-fired or electric configurations for preheating, tempering and stress relieving. They can also be used for solution heat treating and aging aluminum.



ASSOCIATED EQUIPMENT

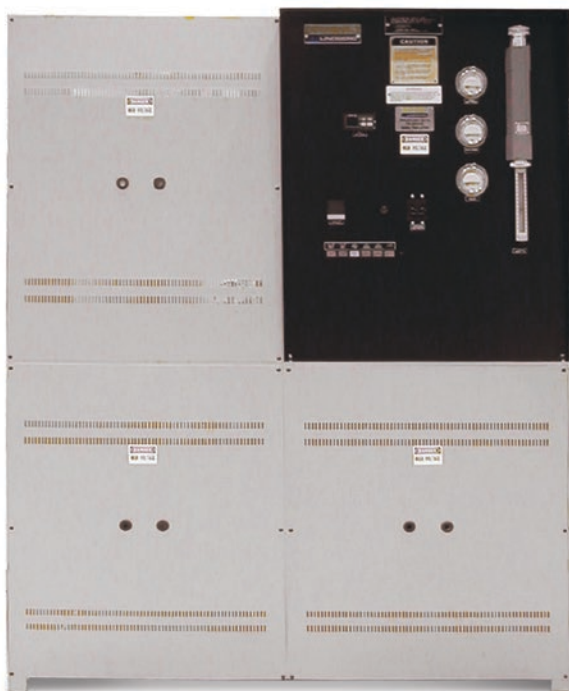
Lindberg/MPH's dedication to being a total solutions provider can be seen in the associated heat treat equipment we offer.

Afterburners

Lindberg/MPH afterburners are used in a wide variety of applications to thermally oxide exhaust effluents. In most processes, after-burning of the exhaust is often sufficient to meet local environmental emission regulations. These units feature Moldatherm lightweight insulation and efficient burners for low cost operation.

Ammonia Dissociators

Lindberg/MPH's HYAM® system provides a dry hydrogen-nitrogen mixture ideal for many metallurgical processes. Dissociating anhydrous ammonia into the components of hydrogen and nitrogen produces atmosphere. This is done by passing ammonia over a heated nickel catalyst which provides a dry hydrogen-nitrogen mixture. HYAM generators are available in sizes from 150 to 6,000 cfh.



Endothermic Generators

Lindberg/MPH's HYEN® generators provide protective atmosphere that is considerably less expensive than a nitrogen based atmosphere due to the availability of natural gas or propane and the efficiency of Moldatherm insulation used in the generators. Gas-fired or electric-powered models are available in sizes from 500 to 6,000 cfh.



Exothermic Generators

Lindberg/MPH's HYEX® generators provide a low cost protective atmosphere that consists of products of combustion. Air/gas ratios can be varied to create a lean, non combustible atmosphere or a rich, combustible reducing atmosphere. These gas fired generators provide years of trouble-free operation. Sizes available from 500 to 15,000 cfh.

PIT FURNACES

Lindberg/MPH offers a wide variety of pit furnaces in fuel fired or electric powered configurations that are easy to operate and control. These units have rugged, reinforced shells and high quality insulation. They are engineered to provide long service life, ease of maintenance and optimum thermal efficiency.

Rod Overbend Electric Pit

The Rod Overbend (RO) pit furnace gives you flexible, efficient performance in a variety of heat treat applications including annealing, normalizing and hardening at temperatures up to 1850°F (2000°F optional). Add the optional sealed retort and circulating fan for bright annealing, carburizing, carbonitriding and processing of cast irons. Accommodate protective atmosphere processes up to 2150°F with the optional Inconel retort.

Cyclone® Nitriding Furnaces

Lindberg/MPH Cyclone Nitriding Furnaces are available in single or two stage nitriding systems and are designed for applications that require high resistance to fatigue, impact and continuous metal to metal friction. Cyclone nitriding furnaces are available in fuel fired or electric models and reach temperatures up to 1250°F. They offer superior temperature uniformity, clean operation and long service life.

Corrtherm® Pit Furnaces

The Corrtherm pit furnace offers a unique combination of high performance and low maintenance at temperatures up to 1850°F. Thick cross section, low voltage Corrtherm heating elements completely eliminate the need for a retort, even in high carbon atmospheres. The absence of a retort allows for increased part size and improved temperature uniformity. It also eliminates cracking and other maintenance problems inherent with retorts. Applications include: carburizing, carbonitriding, normalizing, annealing and tool steel hardening.

Homocarb® Carburizing Pit Furnaces

These electric powered pit furnaces are designed to work with protective carbonaceous atmosphere. These units are ideal for case carburizing, hardening, annealing and carbon restoration at temperatures up to 1750°F.

Homo® Nitriding Pit Furnaces

These electric-powered pit furnaces are available in single or two stage nitriding systems and are designed for applications that require high resistance to fatigue, impact and continuous metal-to-metal friction. Models with operating temperature of up to 1200°F.

Steam Homo® Pit Furnace

Featuring a compact design, these units are ideal for direct production line installation. A variety of sizes are available for thermal processing at temperatures up to 1250°F. The Steam Homo systems of atmosphere heat treating produces a variety of benefits on parts made from high speed tool steel, cast iron, powdered iron, beryllium powder, structural steel, brasses, bronzes, aluminum and molded rubber. The system produces superior wear and corrosion resistance. It can also be used for porosity sealing and can often reduce or eliminate time consuming finishing operations.

Cyclone® Pit Furnaces

The cyclone pit furnace has been used for tempering, normalizing, solution treatment of aluminum and annealing for many decades. Today, it still sets the standard in the industry for fast heat up and tight temperature uniformity. Cyclone Pit Furnaces come in gas fired or electric models and reach temperatures up to 1250°F (1400°F optional). No other furnace can match its performance in these applications.



BOX FURNACES

Lindberg/MPH has long been a leader in the design and manufacture of thermal processing box furnaces. These furnaces save you money when treating large volumes of material per hour with exceptional uniformity and low maintenance. That's why these box furnaces are used for a wide range of heat treating processes, such as carburizing, carbonitriding, clean hardening and other processes requiring temperatures from 375°F to 2500°F with inert gas or combustible atmospheres.

Rod Overbend Box Furnaces

The Lindberg/MPH Rod Overbend (RO) electric box furnace gives you flexible, efficient performance in a variety of heat treating applications. The fast heating rate, heavy load capability and reliable operation help you achieve fast turnaround and high productivity. The furnace is very simple and economical to operate, and is available in a wide range of sizes. RO box applications range up to 2000°F (1850°F w/fan) with endothermic, exothermic, dissociated ammonia or nitrogen atmospheres and include: annealing, normalizing and hardening.

Corrtherm Element Box Furnaces

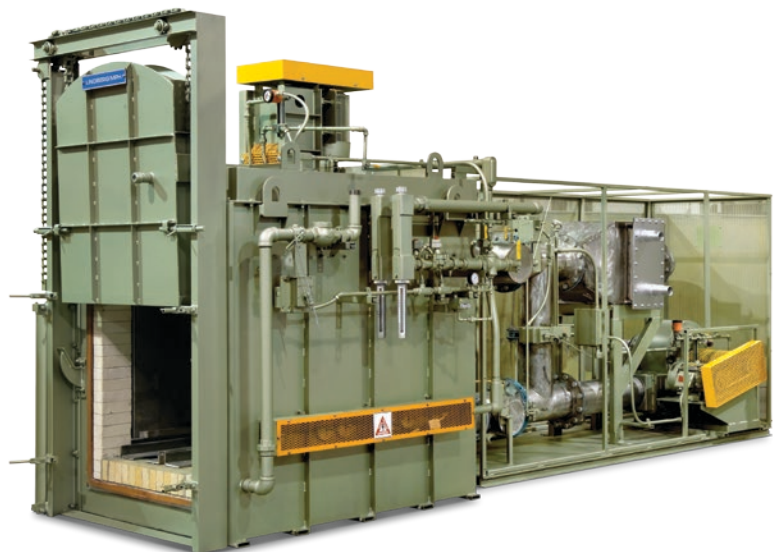
The rugged Lindberg/MPH Corrtherm electric box furnace offers a unique combination of high performance and low maintenance. Thick cross section, low-voltage Corrtherm heating elements completely eliminate the need for a retort, even in high-carbon atmospheres. Because heat is radiated directly to the work, the chamber can have large dimensions without sacrificing temperature uniformity. This allows processing of very large parts with better accuracy than retort-style furnaces. This design has exceptional life, requiring minimal maintenance and avoiding the cracking problems inherent with retorts. These furnaces operate at temperatures up to 1850°F. Applications include: carburizing, carbonitriding, annealing, normalizing and tool steel hardening up to 1850°F.

Silicon Carbide Box Furnaces

The Lindberg/MPH SC (silicon carbide element) box furnace is designed to deliver precision high-temperature uniformity required in the treating of high alloy and high speed tool steels. The SC box applications range up to 2500°F, with endothermic, exothermic, dissociated ammonia or nitrogen atmospheres. Applications include: annealing, normalizing and hardening.

Cyclone Box Furnaces

The rapid, uniform heating of the electric Cyclone furnace has been proven in thousands of installations. The work is brought rapidly to temperature by the unique recirculating convection heating system that forces pressurized air through the load at high velocity. Temperature uniformity is typically $\pm 10^\circ\text{F}$ or better. Overheating by direct radiant heat is avoided because the heat source is in a separate chamber. The Cyclone is very productive for two reasons. First, the cycle time is minimized by the rapid heating capability. Second, very heavy, dense loads can be uniformly treated, maximizing your throughput in a very compact, efficient package. Cyclone applications range from 250-1250°F (1400°F max. optional) and include: tempering, stress relief, aging/precipitation treatments, annealing of copper alloys and solution treatments of aluminum and magnesium.



CONTINUOUS FURNACE SYSTEMS

Lindberg/MPH continuous furnace systems combine modular design with proven components and subsystems that provide exceptional reliability, precision and control to the heat-treating process.

Muffle Pusher Furnaces

Designed for thermal processing that requires controlled atmospheres at process temperatures up to 2100°F (1150°C).

Rotary Hearth Furnaces

Used primarily for gear hardening type applications that require process quenching. Temperature range: up to 1850°F (1010°C).

High-Temperature Walking Beam Furnaces

A popular choice for sintering metallic and ceramic materials under controlled atmosphere. These energy efficient and cost effective furnaces are capable of processing heavy loads at high production rates. Temperature range: up to 3272°F (1800°C) in reducing atmospheres.

High-Temperature Pusher Furnaces

These types of systems are designed for sintering nuclear fuel, fine ceramics, precious metal parts and other controlled atmosphere applications. Temperature range: up to 3272°F (1800°C).

Mesh Belt Conveyor Furnaces

These highly efficient and economical furnaces are designed for atmosphere and nonatmosphere applications at temperatures up to 2100°F (1150°C). Applications include: annealing, tempering, sintering, soldering, brazing and hardening. Belt widths available: 4" to 36". Belt speeds: 10 to 1 ratios as required.

Moldatherm® Conveyor Furnaces

Lindberg/MPH Moldatherm conveyor furnaces provide high yields, maximum energy efficiency and uniform quality, for a wide range of applications at temperatures up to 1100°C. Available in air, inert, or combustible atmosphere models. Built for ease of operations and maintenance, these conveyor furnaces are ideal for firing ceramics, glass and thick film, also for air hardening, soldering and brazing.

Cast Link Conveyor Furnaces

The cast link furnace has an integral chute for quenching under atmosphere. Applications include neutral hardening and carbonitriding. Temperature range: up to 1752°F (954°C).

Roller Hearth Furnaces

These furnaces are designed for annealing, brazing, sintering, stress relieving, normalizing, tempering, hardening and other applications that require process temperatures up to 2050°F (1121°C). The furnaces can be furnished in various widths and load-handling capabilities. Combination preheat and high heat zones are available for brazing applications.

Kilns

Lindberg/MPH pioneered the first continuous kiln more than 75 years ago and today continues to offer innovative approaches to temperature technology and control. Lindberg/MPH continuous kilns are modular and incorporate proven components and subsystems. They are cost efficient, reliable and produce exceptionally uniform process results. Applications include: binder removal, calcining, catalyst drying, mold dewaxing, mold preheating, metallizing, co-firing, drying, coating, glazing, reduction of ceramic oxides, sintering and more.



TARGETED SOLUTIONS

Lindberg/MPH has proven its leadership in thermal processing by designing and manufacturing nearly every type of furnace and system known. These listings are a sample of the unmatched capabilities of Lindberg/MPH.

Carbottom Furnaces

Lindberg/MPH manufactures fuel fired, electric powered and dual energy carbottom furnaces for batch processing large parts at temperatures up to 2800°F. Applications include: hardening, stress relieving, tempering, normalizing and annealing. These furnaces feature rapid heat-up and cool-down rates.

Gantry Furnaces

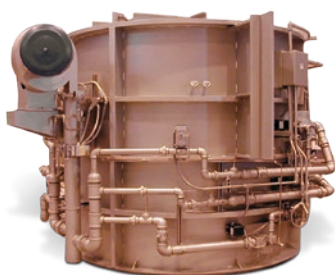
Lindberg/MPH gantry furnaces are used extensively in the aerospace industry for the heat treating of long and massive parts. These systems enable you to harden, wash, temper, quench and atmosphere quench both efficiently and economically.

Drop Bottom Furnaces

The Lindberg/MPH quick quench drop bottom furnace is electrically heated and designed for installation above the floor level. The system's quench tank is mounted on a transfer car that runs on rails. Load positioning and unloading is accomplished using a work table mounted on the transfer car. Loads are raised and lowered by a hoist. Tailored for aluminum solution heat treating and annealing, these furnaces meet stringent MIL specs and aerospace requirements. The system features a variable second quench with total load immersion. Quench media options include glycol and liquid nitrogen.

Bell Furnaces

Lindberg/MPH bell furnaces are available in fuel-fired or electric powered models to operate at temperatures up to 2150°F. A variety of sizes and configurations are available. These furnaces are ideal for annealing and brazing both ferrous and non-ferrous metals.



Forge Furnaces

Gas fired or electrically heated forge furnaces preheat billets in various configurations including slot forge, carbottom and box type. Temperature range up to 2400°F.

Vacuum Furnaces

Electrically heated front-loading, top loading and integral quench vacuum furnaces for processes such as brazing, annealing, carburizing, normalizing, hardening and sintering. Temperature range up to 2400°F.

Periodic Kilns

Gas-fired and electrically heated front-loading periodic kilns for processes such as calcining, firing and curing. Temperatures range up to 3272°F.

Polymer Burn Off Furnaces

Electrically heated front-loading polymer burn off box furnaces with afterburner/catalytic oxidizers for vaporizing residual polymer and cleansing the tooling for continued use. Temperature range up to 1250°F.

Shaker Hearth Furnaces

Electrically heated continuous shaker hearth furnaces with quench tanks for processes such as hardening, carburizing on small screw, springs and balls. Temperature range up to 1900°F.

Pot Furnaces

Gas fired or electrically heated top loading pot furnaces for applications such as hardening, melting and tinning of small parts. Temperature range up to 1850°F.

Ovens

Gas-fired or electrically heated front loading, top loading, bottom loading and continuous ovens for applications such as solution treating, tempering, drying, normalizing, stress relieving, backing and aging. Temperature range up to 1400°F.

Elevator Hearth Kilns

Electrically heated bottom loading elevator hearth kilns for applications such as firing ceramics, tempering glass, sintering and ceramics processing. Temperature range up to 2820°F.

Rotary Drum Furnaces

Gas-fired and electrically heated continuous furnaces with rotating drum retort available for applications such as hardening and annealing of small parts. Temperature range up to 1750°F.