

Where complex needs meet unique solutions

A COMPANY BUILT TO EXCEED EXPECTATIONS



THE INDUSTRY LEADER IN ENERGY EFFICIENCY

Merkle International combines the latest advancements in technology with internal developments to provide energy-efficient equipment for many types of high-temperature industrial furnaces. This equipment includes suspended refractory systems, batch-charging equipment and accessory furnace products. For example, Merkle supplied the first insulated suspended walls to the glass industry in the mid 1980s.



THE BEST TEAM IN THE BUSINESS

Each member of the Merkle staff is highly qualified by education, training and experience. Combined backgrounds encompass expertise in engineering, management, maintenance, production, quality control and purchasing.

Additionally, members of the Merkle team hold numerous patents in the high-temperature industrial furnace field. Merkle staff members contribute to the industries we serve through our development of comprehensive solutions for our customers.



A WORLDWIDE CLIENT BASE

The superiority of Merkle suspended refractory systems and furnace equipment is recognized worldwide.

ONGOING SUPPORT

Merkle offers follow-up inspections and support across the globe. Service and preventive maintenance agreements, which can include annual on-site visits to your company, are also available. The timely introduction of new products is the key to your success. We're ready to listen to your needs—no matter how complex—and discuss the most effective solution.

OUR MISSION

Merkle International strives to provide high-quality, cost-effective suspended refractory systems and related furnace equipment solutions to diverse industries—including glass, iron, lime, cement, aluminum, coke calcining, steel, lead and copper. No matter the material, we provide our clients full-circle, integrated solutions for their production needs.

COMMITTED TO QUALITY

Quality is the heart of our business. Our customers can be sure they're receiving:

QUALITY DESIGNS

- All Merkle designs are customized to our customers' particular needs, as carefully assessed by our team of engineers.

QUALITY MATERIALS

- Materials supplied by Merkle must meet strict quality specifications.
- Experienced quality technicians approve all materials prior to shipment.
- All suppliers undergo an extensive qualification process.

QUALITY PROJECT MANAGEMENT

- Materials are supplied on time, per agreed freight terms, with appropriate packing and labeling.
- All materials are packaged to Merkle specifications to reduce the risk of damage during shipment.

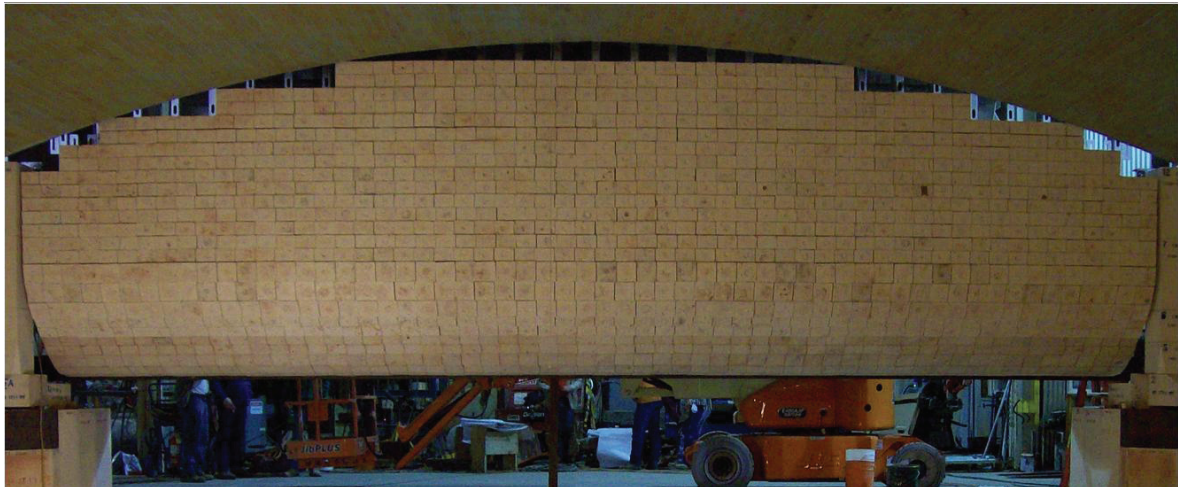


Strut-Air® Suspended Refractory Wall

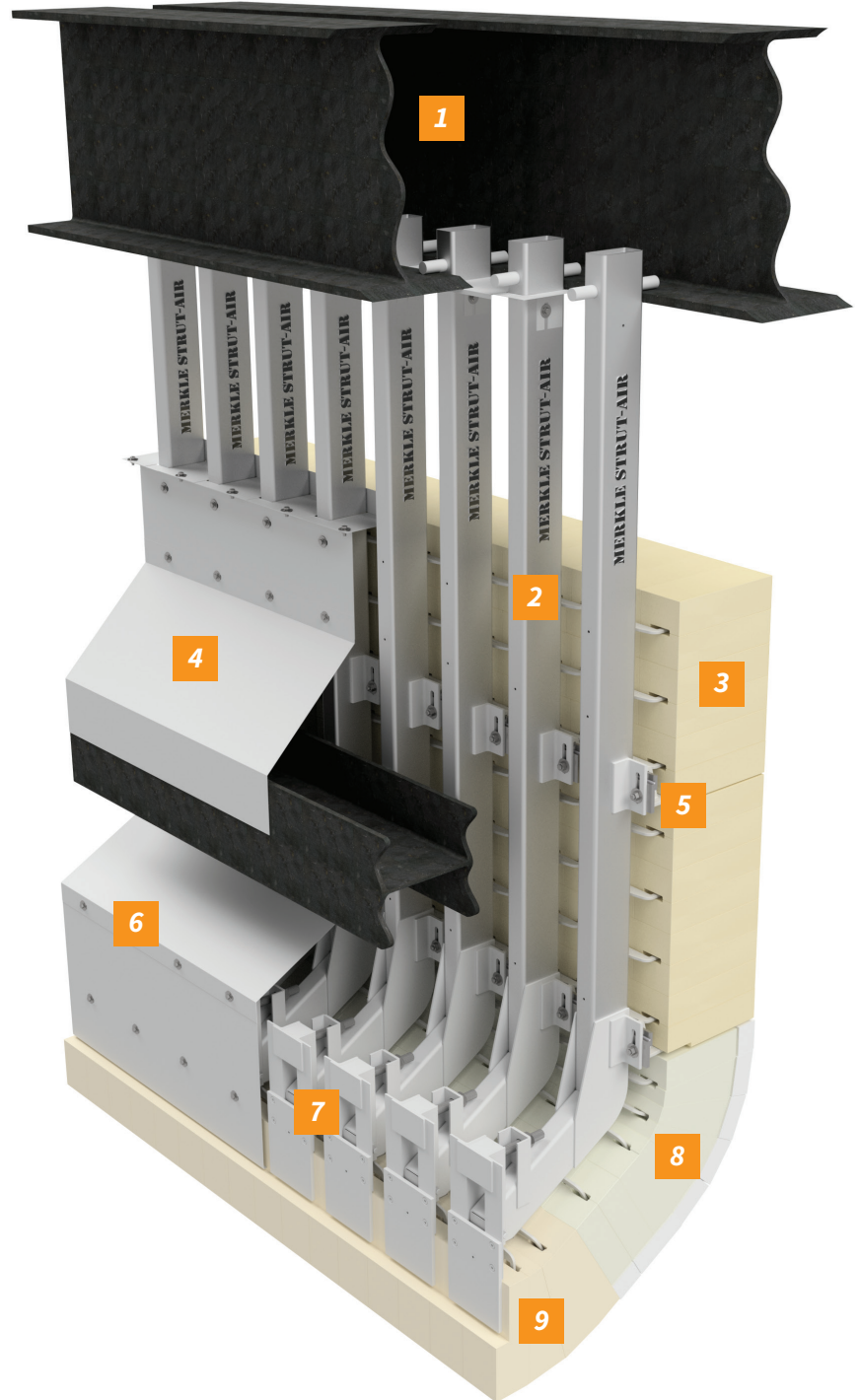


► Walls can be built out of alumina-zirconia-silica (AZS) materials to withstand long, intense campaigns, often over 15–20 years.

- Once a furnace that could endure an entire decade of glass making was little more than a wish. Today, furnaces routinely operate through campaigns of 15–20 years.
- Careful selection and placement of refractories—silica, mullite, bonded alumina-zirconia-silica (AZS) and fused cast AZS, often in combination—ensures the best value for an entire campaign.
- The nose angle of Strut-Air suspended walls can be sloped to the angle that best accommodates customer production needs.
- Strut-Air’s direct cooling of wall castings permits the use of insulation to reduce energy costs.
- Our installation packages give customers superior benefits, as they save energy, reduce thermal shock and are always long lasting.
- All Merkle International Strut-Air projects offer a flexible design, enabling unique customer solutions, no matter how complex the need.



1. **Box girder** – This double-beam functions as both the supporting steel and the cooling air distributor. These elements can be supplied by Merkle International or fabricated locally.
2. **Strut-Air tube** – This is the heart of the Strut-Air system. It delivers cooling air directly to the metalics while supporting the refractory.
3. **Upper refractory** – The materials used in the upper wall can differ from those in the lower wall, depending on the customer's requirements.
4. **Pressure enclosure** – The pressure enclosure maintains a pressure higher than that of the furnace, to reduce stinging-out and rat-holing.
5. **Support metalics** – Merkle can supply support metalics in various grades, depending on the process requirement.
6. **Lower pressure enclosure** – The batch-shedding design allows fugitive batch dust to slide back to the furnace instead of accumulating on top of the wall.
7. **Starter-plate and rocker assembly** – The lower portion of the tubes is designed to enable stable installation while absorbing thermal shocks and refractory variability.
8. **Nose refractory** – Materials in the nose are chosen to match customers' needs for longevity, defect tolerance and other factors, to deliver the best value. This rendering shows a two-piece construction.
9. **Starter bricks** – These courses receive the most thermal shock and exposure to batch dust. Therefore, proper material selection is key.



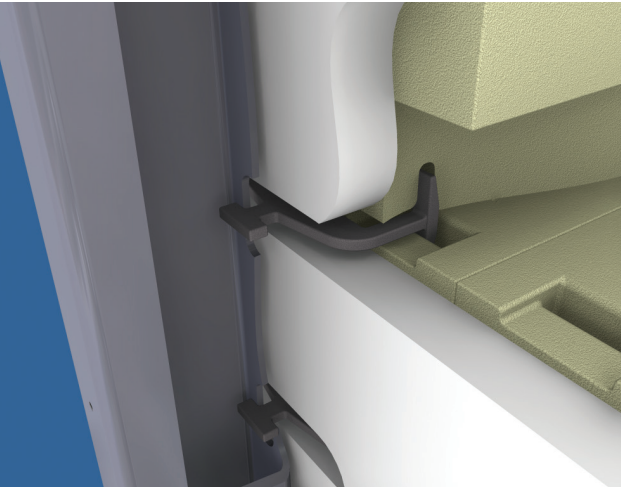


Insulated Strut-Air

Years ago, glass manufacturers issued Merkle International a challenge: design an insulated Strut-Air system to reduce the amount of energy needed to produce one ton of glass.

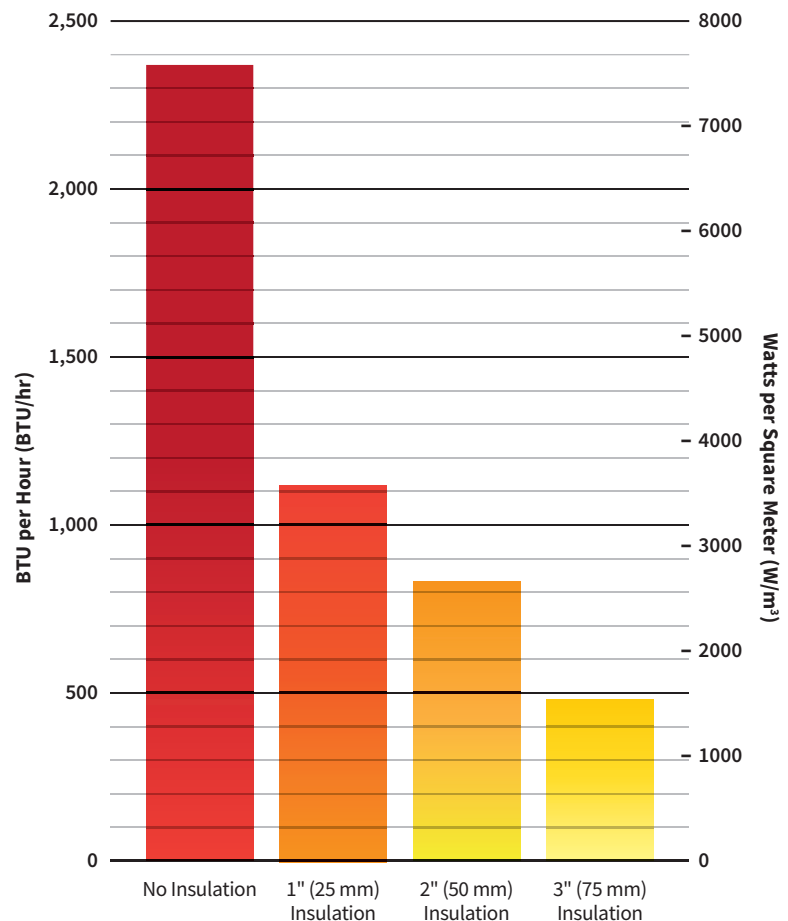
After numerous years of experience, Merkle has learned that for most feeder wall applications, two inches (50 mm) of ceramic fiber is the optimum insulation. This can reduce heat loss by more than 66 percent, from 2,350 to 780 BTUs per square foot (7410 to 2450 W/m²).

Depending on current energy costs, Merkle's Strut-Air insulation package can pay for itself in 9–18 months, saving more than 10 times its original cost over a 10+-year campaign.



► The Strut-Air system's unique structure allows direct cooling of the metallics, even when the wall is insulated.

Energy Loss



Based on 80° F (27°C), still air.

Modu-Lok®

- A recognized Merkle product since our founding in 1971, the Modu-Lok system is based on a proven flat-crown design and has successfully operated in campaigns lasting over 42 years.
- The design can be as simple as two shapes with no openings, or can include integral lintels, bricked stack linings, thermocouple blocks or auxiliary openings.
- The support brick is heavily treaded on all four sides to support the maximum number of filler brick, sealing the crown.
- The Modu-Lok design can operate with no insulation, up to 84% insulation or with insulation up to 140-mm thick.

Modu-Lok Suspended Roof

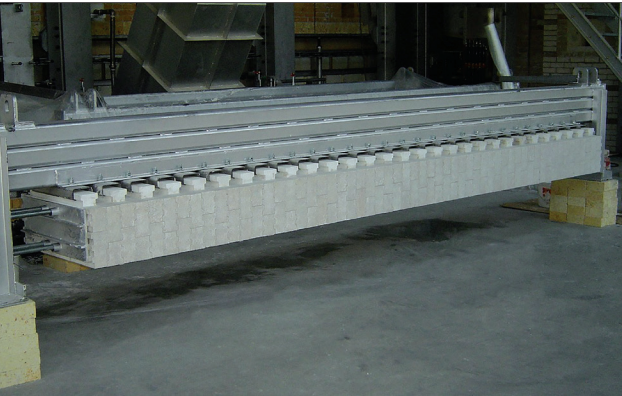
The Modu-Lok system is designed for high-temperature flattop container and fiberglass furnaces. Materials are chosen to suit the particular application, and Merkle International's independence from other refractory manufacturers allows flexibility in the selection of refractory material.

- The half-inch structural, load-bearing treads on Modu-Lok shapes provides sturdy linings with maximum insulation coverage:
 - With hangers on 8-inch centers, the Modu-Lok roof allows for 75-percent insulation coverage.
 - With hangers on 12-inch centers, the Modu-Lok Roof allows for 84-percent insulation coverage.
 - With hangers on 16-inch centers, the Modu-Lok Roof allows for 88-percent insulation coverage.
- Two refractory shapes can build most roofs—often with complex configurations.
- Stack linings can be incorporated into the roof by using both Modu-Lok's T and MT shapes.
- Merkle's proprietary M203-C casting allows for movement along the I-beam of the refractory in the lower portion of the casting.
- The M203-C casting and M303 metallic are clear of insulation, which extends service life.



- ▶ *Modu-Lok roof installation is fast and accurate. Once the junior beams are set, the brick crew can quickly install the refractory. The creation of round roofs is also possible with the Modu-Lok system.*
- ▶ *Flat roofs can incorporate lintels like the one shown above.*
- ▶ *Various grades of refractory can be supplied to match the furnace campaign. Modu-Lok roofs in fiberglass furnaces often last 40 years.*

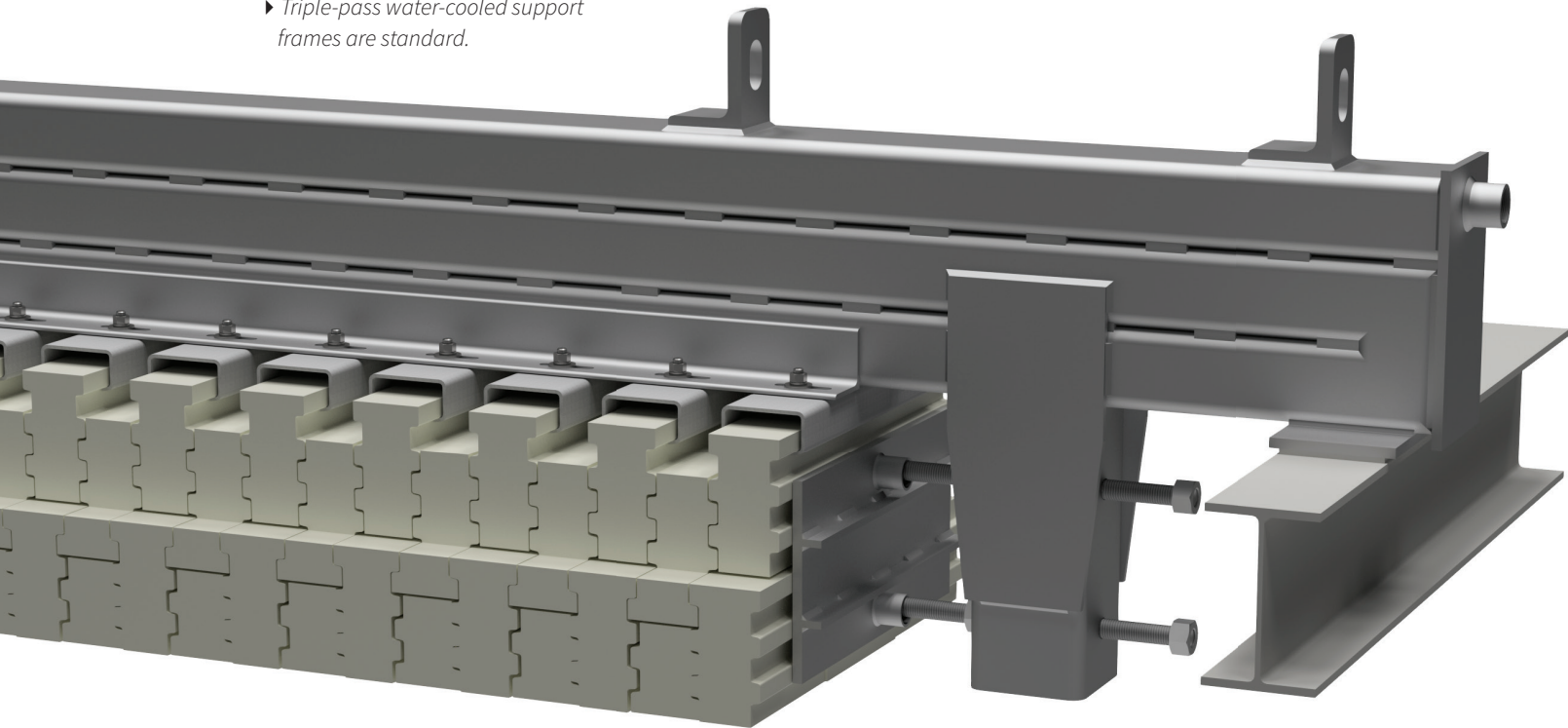
Modu-Lok Covers



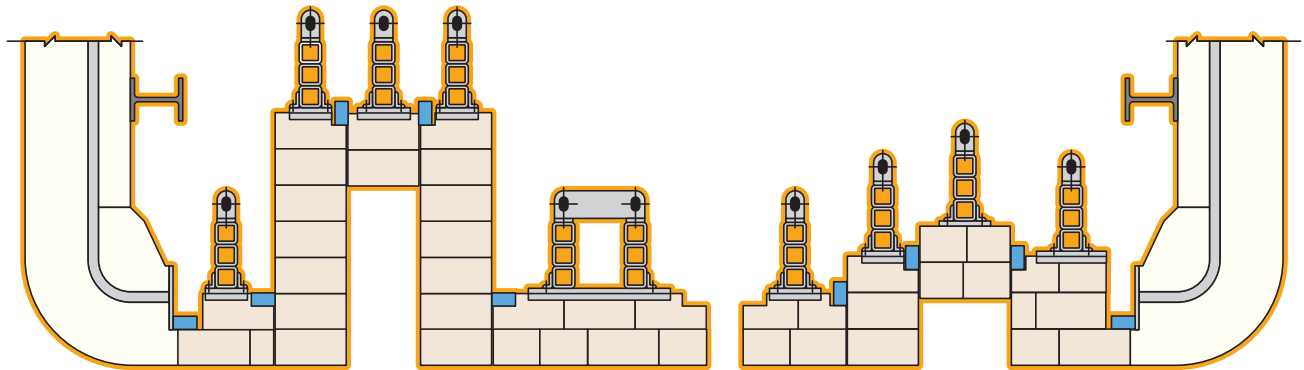
- The Merkle International Modu-Lok system allows for a high degree of design flexibility.
- Installation is simple and accurate, even at times using as few as one parent shape.
- A variety of materials can be used, including silica, mullite, alumina-zirconia-silica (AZS) and high-alumina refractories.
- Our interlocking tread design creates a solid cover and takes advantage of the flexibility of a smaller shape.
- Frames can be water-cooled, air-cooled or uncooled, depending on the location.
- Frames can be supported by a variety of support structures.

▶ *Modu-Lok curtains and covers can be built to the side of the furnace and lifted into place.*

▶ *Triple-pass water-cooled support frames are standard.*



Waist Area Side View



Upstream Waist Wall

Downstream Waist Wall

- ▶ *Modu-Lok waist covers and curtains can be combined to accommodate different waist area process requirements, including multiple coolers, vertical stirrers, horizontal stirrers and still seal to the adjacent waist walls.*

MT Modu-Lok Curtain

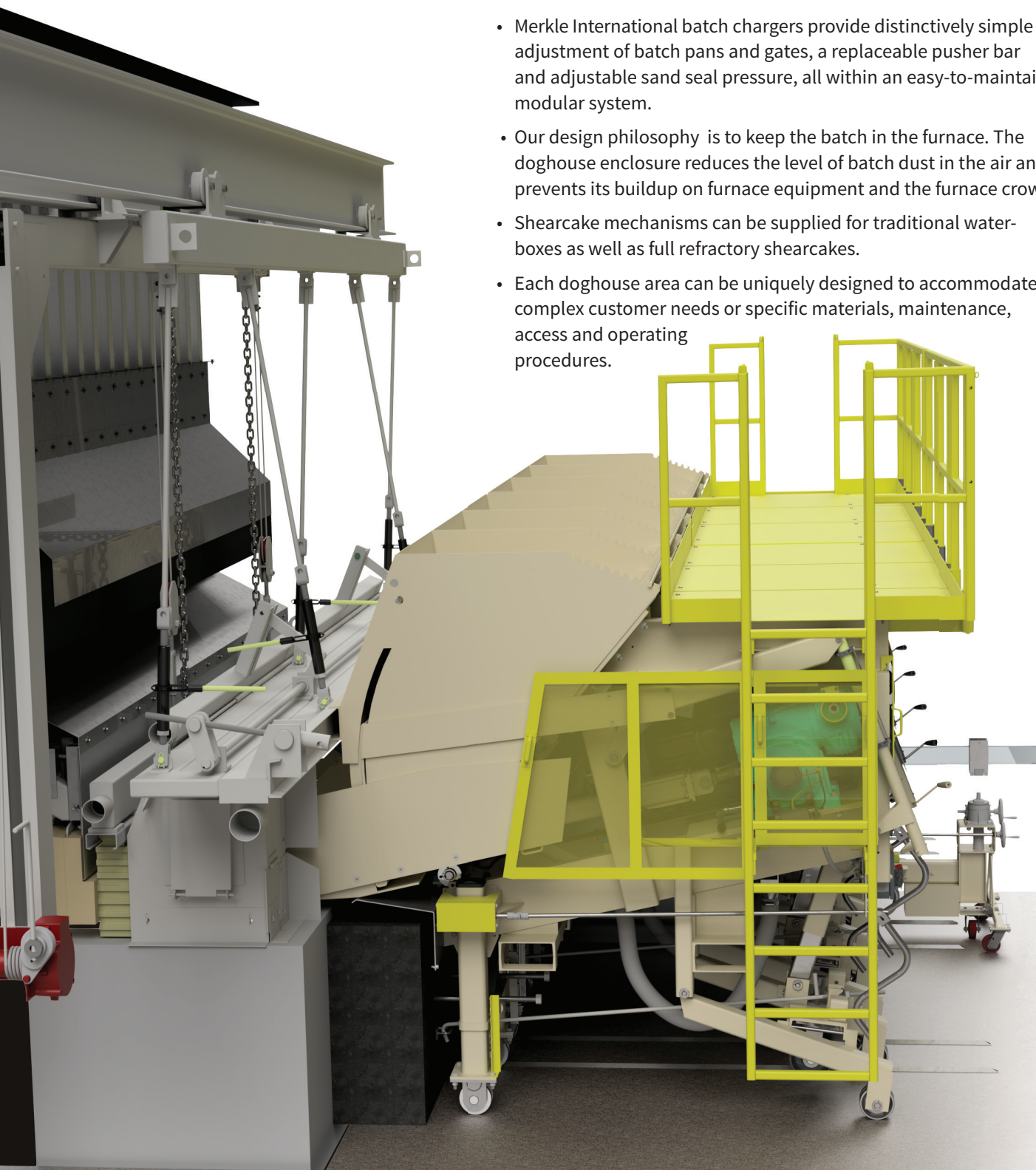
- The MT Modu-Lok design allows construction of independent suspended curtains, lintels or baffles and flat suspended covers. This structure is extremely simple, with the curtains built using only one parent shape.



- ▶ *A single Modu-Lok curtain can be used to separate sections of the process, such as in the waist area.*
- ▶ *Modu-Lok curtains are built with only one parent shape.*

Doghouse Area

- Merkle International batch chargers provide distinctively simple adjustment of batch pans and gates, a replaceable pusher bar and adjustable sand seal pressure, all within an easy-to-maintain modular system.
- Our design philosophy is to keep the batch in the furnace. The doghouse enclosure reduces the level of batch dust in the air and prevents its buildup on furnace equipment and the furnace crown.
- Shearcake mechanisms can be supplied for traditional water-boxes as well as full refractory shearcakes.
- Each doghouse area can be uniquely designed to accommodate complex customer needs or specific materials, maintenance, access and operating procedures.



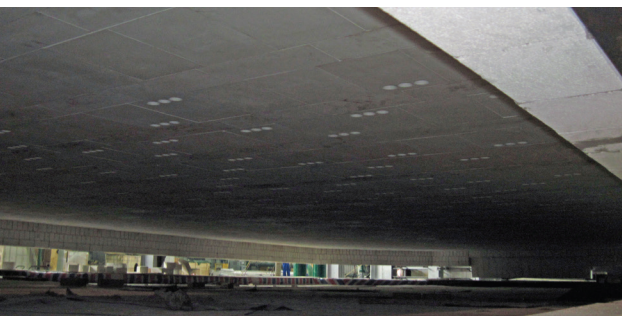
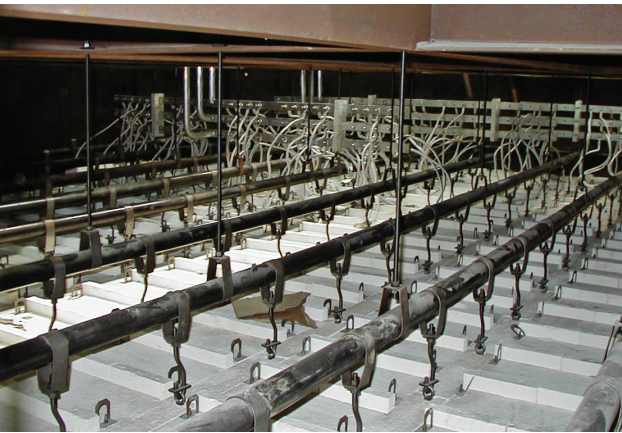
The Merkle Modular Charger

- Our batch chargers offer unique solutions for a wide range of charging challenges.
- The typical modular charger installation includes an even number of units, with an additional unit as a ready spare. The availability of a spare unit minimizes the impact of routine charger maintenance on furnace operation.
- Small, manageable modules move in and out of position more easily than larger machines, resulting in minimal impact and quick change-over—as low as four minutes—when parts need to be replaced.
- Our chargers are built so everything is adjustable from the back of the equipment. They include several practical attributes to make customer installation and use easier.
- Each set of chargers is designed to a specific angle, stroke length range and stroke rate, for customization that matches the most exacting charging requirements.



► The streamlined design of the modular charger allows for a tight fit on the sides. All adjustments are made from the rear of the unit.

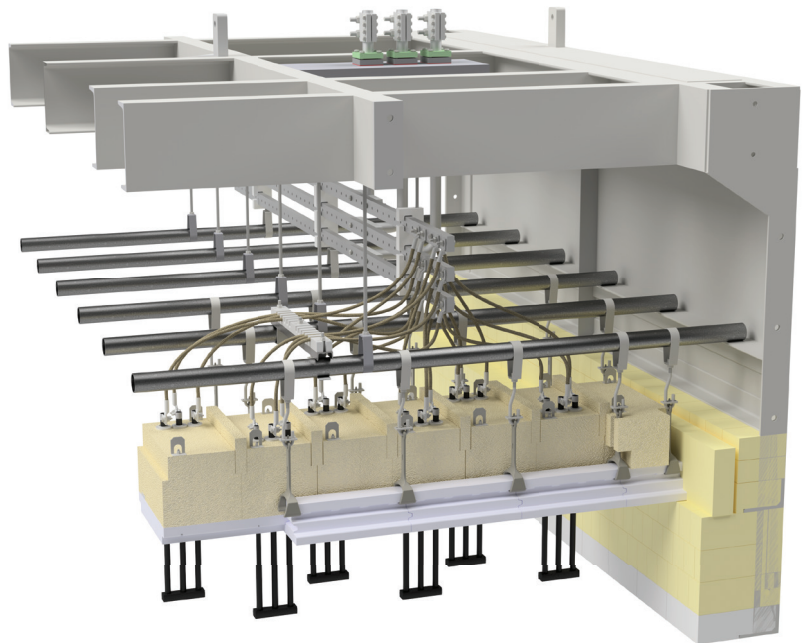


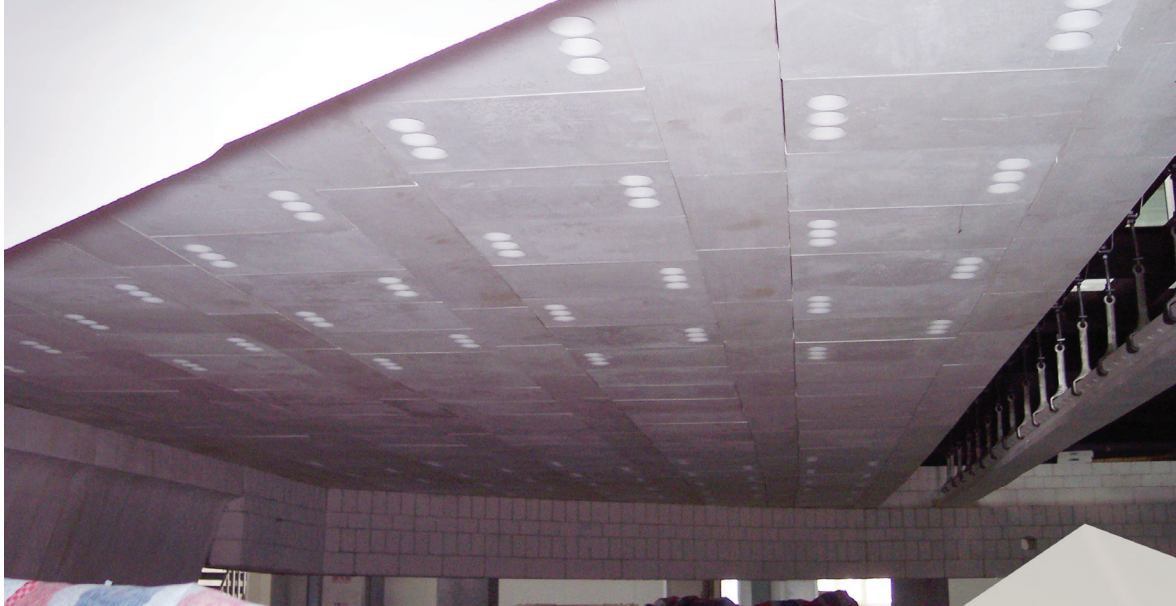


Tin Bath Roof

- The Merkle International Tin Bath Suspended Roof System includes wider modules and hanger tiles, resulting in less tin drip and the elimination of broken module elements.
- Mechanical modules make the system easily replaceable in hot conditions, and they do not delaminate when removed from the bath.
- Mechanical assembly of the modules bonds the hot-face sillimanite to the insulating firebrick (IFB). The mechanically fastened module provides positive attachment of the refractory layers.
- Our simple design allows for faster installation, often within four weeks.
- Our patented SAFER™ system is available on any Merkle roof.
- The electrical distribution system has been simplified by positioning the bus bars parallel to the glass flow. This reduces the amount of cabling required to connect all the elements.
- Merkle International has designed roofs to withstand high design temperatures and to meet varying customer systems, like sidewall doors and internal baffles. Tell us your complex needs and we will develop a unique solution to meet them.

- ▶ *The roof design of the Merkle tin bath allows for a simple construction, which reduces total installation time.*
- ▶ *Merkle invented the straight hanger and filler rows as well as the first flat roof.*
- ▶ *The simple and effective roof design of the Merkle tin bath includes bus bars that run parallel to glass flow, reducing cables and opening up the bath's upper roof. Merkle sidewalls do not require exposed stainless-steel shelves.*





► Merkle invented the straight hanger and filler rows, as well as the first flat roof. These features result in reduced tin drip and faster installation.

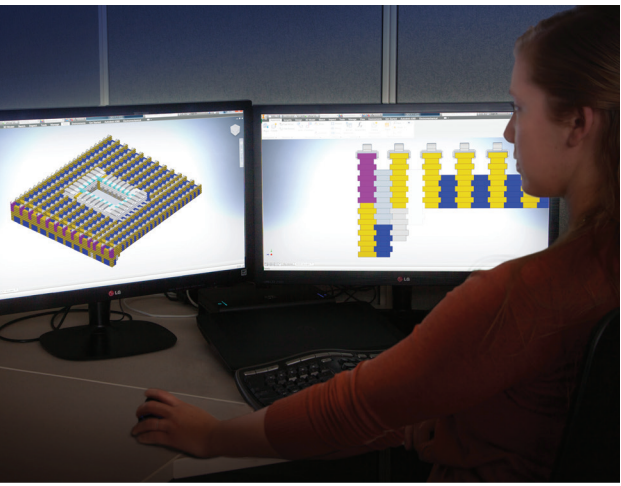
Bay “0” Seal

The Merkle Bay “0” Seal is comprised of a steel frame from which three refractory blocks are supported. This provides a good seal against the entrance lintel of the tin bath, and it can be installed and removed in one piece. The design allows for atmosphere inlets through the side blocks. The Bay “0” Seal refractory can be made from sillimanite or mullite, depending on your preference, and can be configured to fit your specific float furnace.



- Merkle modules are wide, reducing tin drip and eliminating cracks and breaks over the course of the campaign.
- The Bay “0” Seal assembly covers the spout and seals between the tweek and the entrance lintel.

Working with you to forge solutions



INITIAL REVIEW

While many processes may seem similar at first glance, Merkle International will identify your specific requirements and financial considerations, working directly with you to determine the materials best suited for the application, time frame and budget.

TECHNICAL EXCHANGE

Through an open technical exchange, we pinpoint the best material solutions for your needs. We are independent of individual suppliers, so we can pair our extensive experience and knowledge of materials available worldwide to source our designs with the optimum products.

PROJECT MANAGEMENT

Once Merkle is presented with an order, we execute it with efficiency and precision. Our designers dedicate themselves to the details of your application, inspecting all components to ensure they are manufactured to our stringent specifications. Your materials are then carefully packed and shipped according to flexible terms, allowing for your preferred collection method.

BUDGET

Since our founding in 1971, we have remained committed to building lasting relationships with our customers. It's this commitment that drives our promise to continuously deliver the most cost-effective, high-value option available.

The History of Merkle International

OUR FOUNDATION

Merkle and Associates was founded in 1971 by F.P. (Pete) Merkle. The first location was in Palatine, Illinois. In 1978, operations were moved to Galena, Illinois. The company occupied the same office on Perry Street, gradually increasing its space, until late 2013, when it moved to a larger new building.

In 1979, the company name was changed to Merkle Engineers, Inc., and again in 2007 to Merkle International, Inc. to reflect the shift in operations from a largely domestic supplier to an organization with a large portfolio of international customers.

Pete Merkle's early experience was in the glass industry. For 18 years he had serviced this industry with his previous employer and was considered an expert, having developed many successful refractory designs. Founding his own company allowed him to concentrate in glass since his previous employer had been more oriented toward steel and other larger refractory-consuming industries.

CORE OFFERINGS

The company's state-of-the-art and patented Strut-Air feeder wall for the float-glass industry quickly became the application's standard design. It is still the most widely used suspended refractory wall system in the glass industry today. Other successful Merkle systems include Modu-Lok for roofs and walls and Roto-Patch®, which is widely used in the copper industry for making hot repairs while the furnace is still operating.

In the mid-1980s, Pete Merkle had the vision to foresee changes in the dynamics of glass industry furnace design and operation, and the opportunity arose to supply the charger systems that feed the raw material for making glass into the furnace. The

Merkle charging machine was developed with the operator in mind, offering many improvements in adjustment and operating features. The machine is now in use worldwide, with many different models offered.

CONTINUOUS GROWTH

From its modest beginning in 1971, Merkle has grown to become a company known internationally for supplying high-quality, reliable refractory systems and related equipment for all types of industrial furnaces.

Merkle's growth and success are based on our customers' recognition of our quality and service rather than on any specific growth percentage or monetary targets. We believe that, by providing our customers with the best quality and service at a fair price, they will return to us with more business and growth opportunities. The success of this policy is shown by our long list of satisfied repeat customers.

Our employees are encouraged to participate in the ownership of the company by purchasing Merkle stock and sharing in the company's profitability. They are also offered training and other opportunities to enrich their personal and professional lives.

It has traditionally been Merkle's policy to share its success with the community, donating annually to many local and national charities, and participating in a variety of fundraising events.



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