



REFRACTORY SOLUTIONS FOR **ALUMINUM**



HarbisonWalker International

Every day around the world, HarbisonWalker International's people and products stand up to the challenges and pressures of every job. And for 150 years, we've been the gold standard for refractory products. We deliver one of the industry's widest, deepest lines of solutions. Our world-class products perform to the highest degree. And by bringing intensity, reliability, and passion to work every day, we're able to provide superior value to our customers and their businesses. Get to know the experts who anticipate, respond, and deliver like no one else. We're nearly 2,000 people with one goal: to keep your business moving forward.



YOUR WORLD-CLASS ALUMINUM ALLY



HarbisonWalker International (HWI) has been serving the aluminum industry for close to a century, and today it is one of the top refractory suppliers to some of the world's largest aluminum producers. When you choose HarbisonWalker International, you're choosing quality without compromise.

Every order is backed by application specialists who form close partnerships with our customers. We design custom solutions, manage inventory, and offer dedicated testing. Our partnerships result in energy savings, increased campaign life, and efficiency within the plant. We stay at the forefront of emerging technology and offer training to all of our customers.



MADE FROM A DIFFERENT MOLD.

Meet our problem-solving, fly-into-action, whatever-it-takes people who are driven to minimize your downtime. We're beyond responsive. We're beyond reliable. Here's how:

- Dedicated personnel ready to respond 24/7/365**
- 30 North American global sourcing centers, which shipped over 130,000,000 pounds last year—most with same-day or next-day delivery**
- 17 manufacturing facilities in North America, as well as one in the United Kingdom and one in Indonesia**
- Supply partners in China and Europe to support the full range of customer needs**
- HWI associates and partners strategically located around the world—and ready to take your call**

With the right mix of products and technology, HarbisonWalker International has one of the best operations in the world to deliver what you need, when you need it. No one produces more tonnage in the United States, and our manufacturing footprint spans the globe.

What sets the people of HWI apart? We have a burning desire for answers, excellence, and accuracy. We're thorough and meticulous. And absolute accountability is baked into our DNA.

PRODUCTS THAT PASS THE TEST. EVERY DAY.

Have high expectations for your refractory products? We do too. Our products set benchmarks for the industry, including ARMORTECH, DV-38®, VERSA-TECH, CRYLA®, and KALA®

The competitive edge you're looking for starts with us—and with your dedicated HWI application specialist. They're experts who will understand every inch of your process and who will work intensely to optimize your refractory performance.

With the right products identified, we deliver with lightning speed—the products you need, when you need them. Our 30 global sourcing centers across North America are strategically placed. We ship around the world at a moment's notice. And we stock our most popular products so that you can have them the same day or the next day. Let us work with you to reduce your potential for downtime.

Want to save time and money? Want to improve your productivity? Talk to your HarbisonWalker International sales representative today. Don't have one? Call **1-800-492-8349**.



APPLICATIONS

PRIMARY ALUMINUM

SECONDARY ALUMINUM

DIE CASTING





PRIMARY ALUMINUM

Primary aluminum producers need anode baking furnace refractory solutions that improve production processes, increase overall output, and reduce the cost of making high-quality primary aluminum for use in transportation, construction, and packaging industries worldwide.

PRIMARY ALUMINUM REFRACTORY SOLUTIONS

As a primary supplier to some of the world's largest aluminum producers, HarbisonWalker International has the process knowledge, proven refractory products, and solutions that deliver energy savings, increased campaign life, and efficiency within a primary aluminum plant.

Our customized refractory linings are used in all key primary aluminum production areas: carbon anode baking furnaces, pot linings, casthouse furnaces, and metal transportation. Our proven refractory product line of brick and monolithics provides the highest performance in the most severe environments.

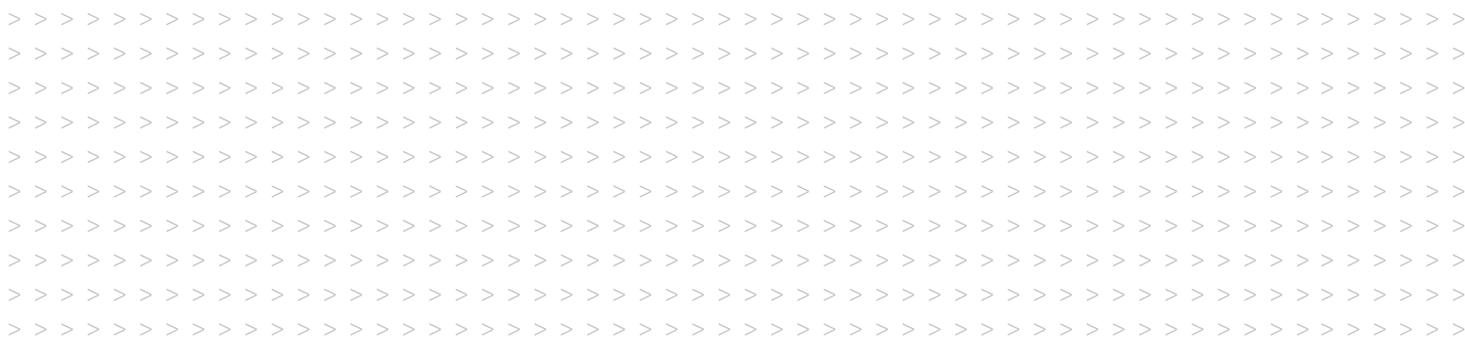
PROVEN PRIMARY ALUMINUM PRODUCTS

CRYLA®

A 46% alumina brick designed from high purity raw materials low in alkali content. This brick can be used for anode baking furnace fluewalls and offers an economical solution to extended service life over superduty materials.

HPV®-ESX CASTABLE

Designed to be used for port blocks on carbon anode bake furnaces that are exposed to thermal cycling, HPV®-ESX castable is a fused silica based castable possessing high strength and excellent abrasion resistance.





ABOVE: HWI's KALA® brick installed in a carbon anode baking furnace at a large smelting facility.

VERSA-TECH MW 55 AR PLUS

A unique 55% alumina, low cement castable for flue caps utilizing HarbisonWalker International's proprietary Middleweight technology. Great strength at only 125 pcf density allows this alkali resistant product to offer thermal efficiency without sacrificing durability.

ULTRA-GREEN® 45SR

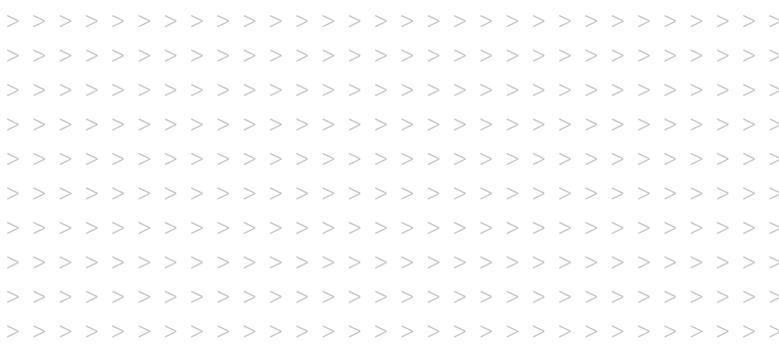
Ideal for anode baking furnace flue caps, our 45% ultra-low cement castable combines excellent strength and corrosion resistance. Designed to be crack free after many thermal cycles.



KALA®
THE MOST WIDELY USED BRICK
IN THE THE NORTH AMERICAN
ALUMINUM ANODE BUSINESS

KALA®, our premier 50% alumina brick, is designed to economically extend service life of combustion flues in carbon anode baking furnaces. The 50% alumina content enables the brick to resist deformation that normally results from high temperature firing practices and from over temperature excursions. Made from high purity materials with ultra-low alkali content, this brick exhibits superior resistance to subsidence at elevated temperatures. What's more, KALA® brick has higher thermal conductivity than superduty brick, allowing for more efficient heat transfer from combustion chamber of the flue to baking pit contents.

In proven laboratory and field tests, KALA® brick substantially outperformed standard superduty materials when subjected to major wear factors in carbon baking applications. A creep resistance test conducted by an international research institution reported that KALA® brick outperformed competitive 50% alumina brick.





SECONDARY ALUMINUM

Secondary aluminum producers need refractory solutions to respond to the increased demand for high-quality, low-cost, and environmentally sound recycled aluminum used in the automotive, transportation, packaging, construction, and aerospace industries.

SECONDARY ALUMINUM REFRACTORY SOLUTIONS

HarbisonWalker International addresses the increased demand for recycled aluminum with advanced solutions that increase production efficiency and service life of your continuous high-temperature operation.

We offer a full portfolio of firebrick linings, including our industry standard ALCOR® 32 and DV-38®, as well as monolithic refractory options to perform in the most severe conditions in the secondary aluminum process.



PROVEN SECONDARY ALUMINUM PRODUCTS

ALCOR® 32

This premium aluminum resistant brick has a dual penetration inhibitor to offer top notch resistance to aluminum and chemical attack. Tight sizing control makes sure courses are level to provide excellent wall builders. Also available in waffle brick for additional wall stability.

DV-38®

A high fired 80% alumina, phosphate bonded brick for use in aluminum contact. This brick is ceramically bonded and delivers outstanding impact and abrasion resistance for charging zones, such as the hearth and ramp.

GREENGUN®-85 P PLUS

This 85% alumina, phosphate bonded material offers the advantages of a gunned lining with the excellent physical properties of plastic refractories. GREENGUN® is cement free and offers alkali, thermal shock, and abrasion resistance. This advanced material is designed to be installed rapidly, hot or cold, to minimize turnaround time.



ABOVE: HWI refractory solutions perform in the most severe conditions in the secondary aluminum process.

ARMORKAST 80AL ADTECH®

An 80% alumina, low cement castable workhorse. Excellent aluminum resistance and strengths make this a go-to product for many aluminum contact applications. Available in coarse grain for impact and thermal cycling or self-leveling with smooth surface finish.

VERSAFLOW® FAMILY

A robust alumino-silicate product line offering chemistries from 45-80% alumina. These economical products can offer a wide range of properties tailored to your secondary aluminum needs. All 16 products also offer the flexibility to be hand cast or pumped.

THOR® 60 ABR ADTECH®

This 60% silicon carbide based, low cement castable was designed to handle thermal cycling and abrasion needs around furnace doors and trough impact pads. Being naturally aluminum resistant, this product is a great problem solver for tough applications.



ARMORTECH®

**THE NEXT GENERATION OF ALUMINUM
RESISTANT REFRACTORY CASTABLES**

ARMORTECH® 65AL is a 65% alumina, low cement, high strength castable capable of vibration or pump casting. An advanced non-wetting package delivers ultimate molten aluminum resistance, while still offering high hot strengths and excellent abrasion resistance.

ARMORTECH® 65AL C is a coarse aggregate castable that gives improved performance where high temperature impact, thermal cycling, and severe mechanical abuse has been identified as a significant wear factor.

ARMORTECH® 65AL ON-LINE is a fast-curing castable capable of pumping installation, a four to six hour cure, and accelerated dryout to quickly bring a furnace lining back on line and in service.

ARMORTECH® 65AL SHOT-TECH is an aluminum resistant, low-cement, shotcrete mix that employs a quick set time and rapid dryout capabilities that make it ideal for quick turnarounds.

The ARMORTECH® products have repeatedly recorded zero penetration, zero reaction, and the best metal adherence rating achievable in a variety of industry standard aluminum contact tests. Even at elevated temperatures, the enhanced matrix and state-of-the-art technology in these products give them aluminum resistance and unmatched physical properties.



DIE CASTING

Aluminum die casting manufacturers need refractory solutions that help produce consistent, high-quality, cast products for a wide variety of industries including automotive, consumer electronics, and healthcare.

DIE CASTING REFRACTORY SOLUTIONS

Refractory choices are critical to product consistency in die casting. HarbisonWalker International provides tailored solutions for refractory linings to ensure that furnaces operate at the specified temperature to produce a quality part with tight tolerances and good surface finishing.

We provide several products to meet your hot-chamber and cold-chamber die casting manufacturing needs, including our popular castable EXPRESS® ARMORKAST 80 AL MAX, which was designed to produce a smooth, hot face surface.



FEATURED DIE CASTING PRODUCTS

ARMORTECH MW 65 AL

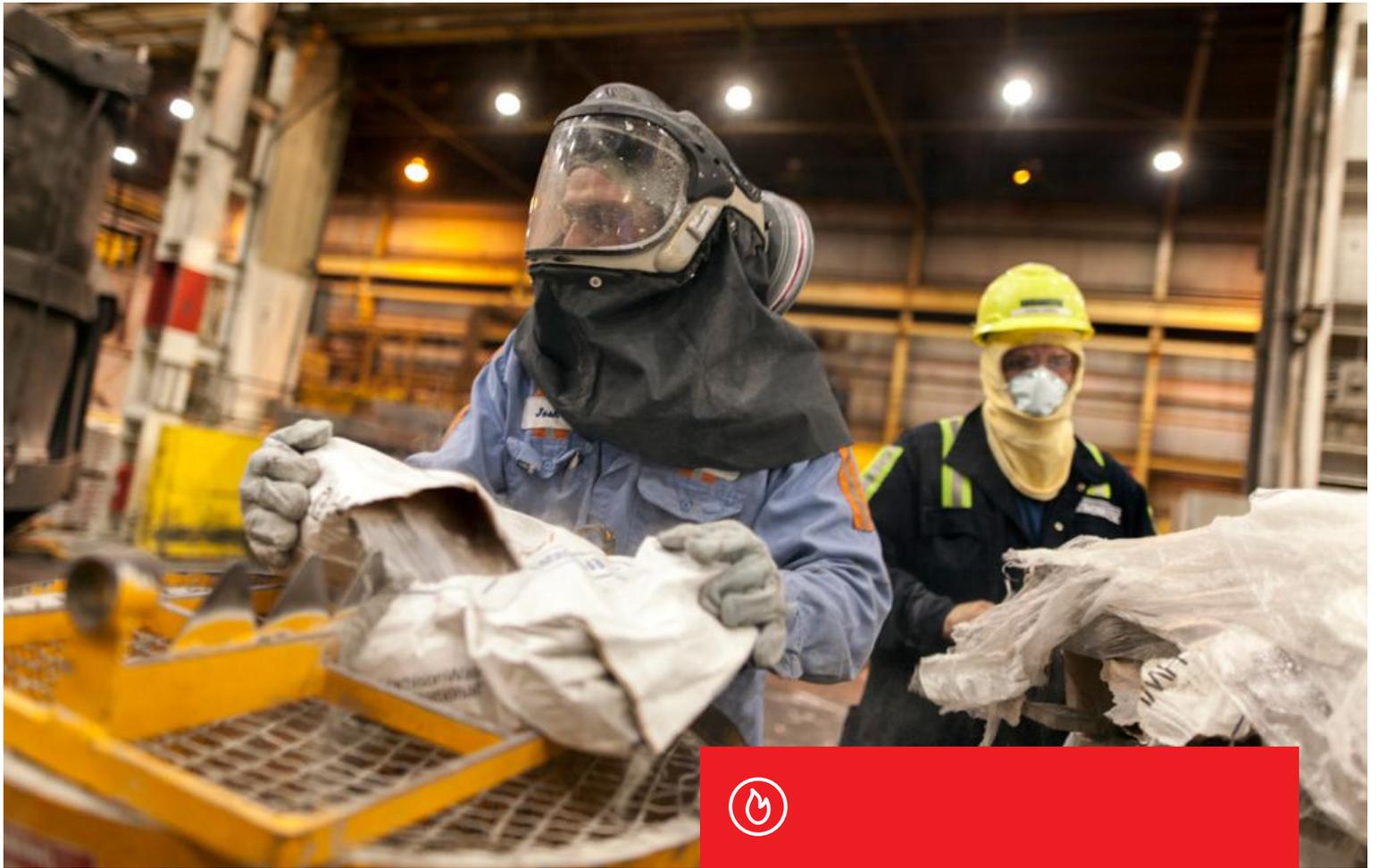
This 65% alumina, low cement castable combines the advanced aluminum resistance of ARMORTECH with HWI's unique lightweight GREENLITE® aggregate to offer a semi insulating, aluminum resistant product. Unusually high strengths for an insulating, non-wetting product make this an excellent product for crucibles and diecast holders requiring additional thermal efficiency.

PLASTECH® 85P STD

A 3100°F bauxite based refractory plastic offering excellent abrasion resistance, alkali resistance, and extended shelf life. PLASTECH® reliably offers consistent pliability for 9 months, or 2x longer than conventional plastics.

GREENKLEEN®-60 PLUS

A 60% alumina, andalusite containing castable that has excellent resistance to molten aluminum, thermal shock resistance, and alkali resistance. This product has been a maintenance favorite and problem solver due to its rare combination of properties and versatility.



ABOVE: Diecast manufacturers count on HWI's products to produce consistent results under intense demands.



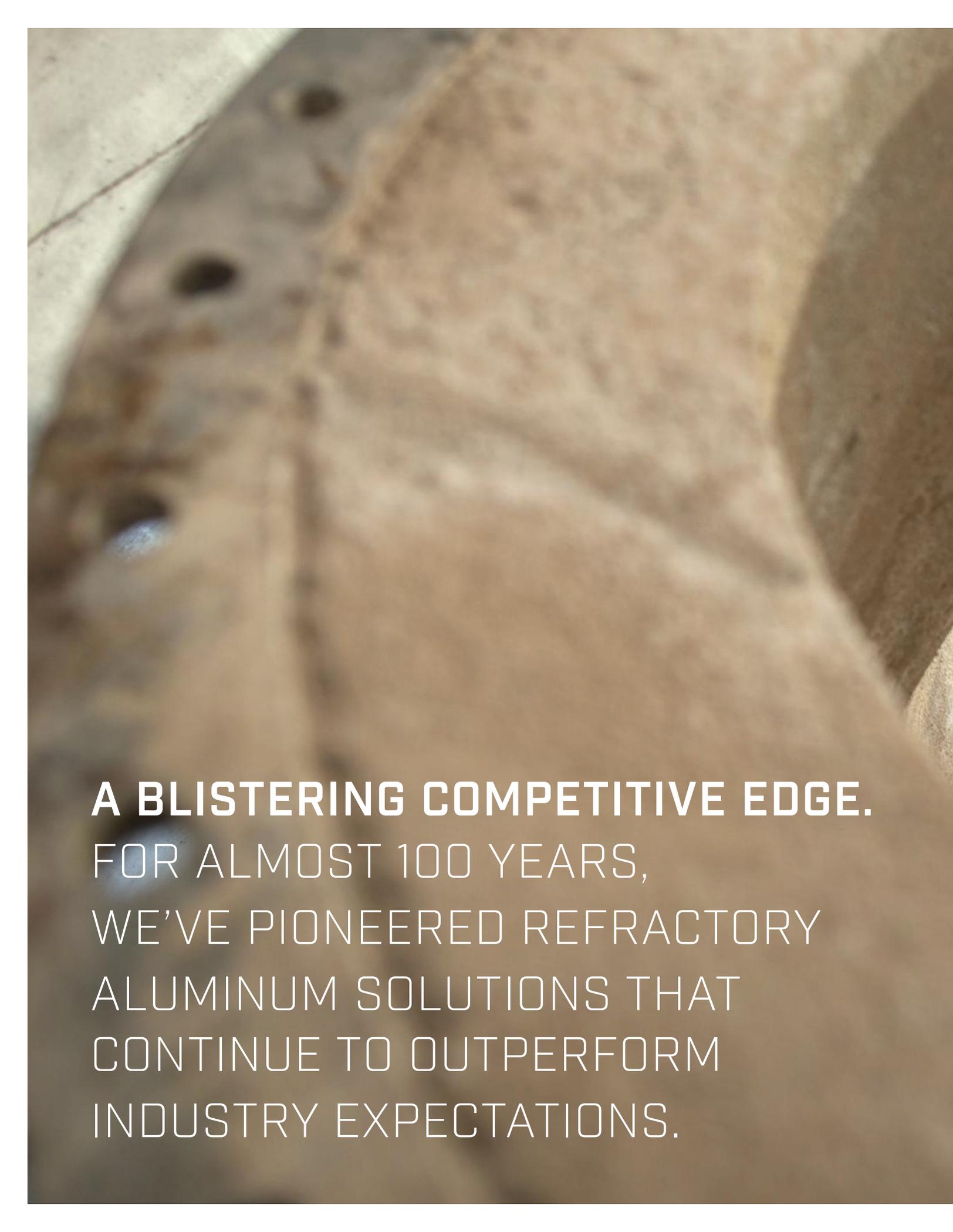
EXPRESS[®] ARMORKAST 80 AL MAX

A LOW CEMENT, 80% ALUMINA CASTABLE
DESIGNED WITH ENHANCED FLOW AND
SELF-LEVELING CHARACTERISTICS.

This dense, aluminum resistant castable offers great strength and aluminum resistance when cast at self-leveling water contents, and even better strengths at vibration cast consistency. EXPRESS[®] ARMORKAST 80 AL MAX also offers a glass-like surface finish, that can be game changing for the intricate forms needed for the diecast industry.

EXPRESS[®] ARMORKAST 80 AL MAX has been a workhorse in jet melters and holding furnaces. Its polished surface also helps to prevent aluminum from freezing and sticking—keeping your furnace build-up free and operating at peak performance.





A BLISTERING COMPETITIVE EDGE.
FOR ALMOST 100 YEARS,
WE'VE PIONEERED REFRACTORY
ALUMINUM SOLUTIONS THAT
CONTINUE TO OUTPERFORM
INDUSTRY EXPECTATIONS.

ALUMINUM FURNACE REFRACTORIES

Every furnace faces a unique set of operational conditions and process variables. Using a zoned configuration, refractory products can be chosen to resist wear mechanisms found in each zone. Product selection is a balance between performance, price, furnace type, and installation method.

1 RAMPS/SILL

Refractory in the ramp and sill should provide high strength and abrasion resistance due to the harsh mechanical abuse and impact during charging and cleaning. In some scenarios, a product with improved thermal shock and impact resistance may lead to better lining performance.

PRODUCTS

ARMORKAST 80AL C ADTECH®
ARMORTECH 65AL C
VERSAFLOW® 65/AL C ADTECH®
VERSAFLOW® 70AL SC PLUS
THOR® 60 ABR ADTECH®

2 JAMB/LINTEL

The areas around the door opening are subjected to a great deal of mechanical abuse from charging and cleaning practices, as well as, thermal cycling conditions as the door is removed and replaced during operation. Material in these applications should provide high strength and good resistance to thermal shock conditions.

PRODUCTS

VERSAFLOW® 70 C ADTECH®
VERSAFLOW® 57A PLUS
VERSAFLOW® 55/AR C PLUS

3 HEARTH

Like the ramp, impact with cleaning tools and charge media is still present, especially in the case of round top charge melting furnaces. Aluminum resistant products ensure molten metal does not penetrate through the lining.

PRODUCTS

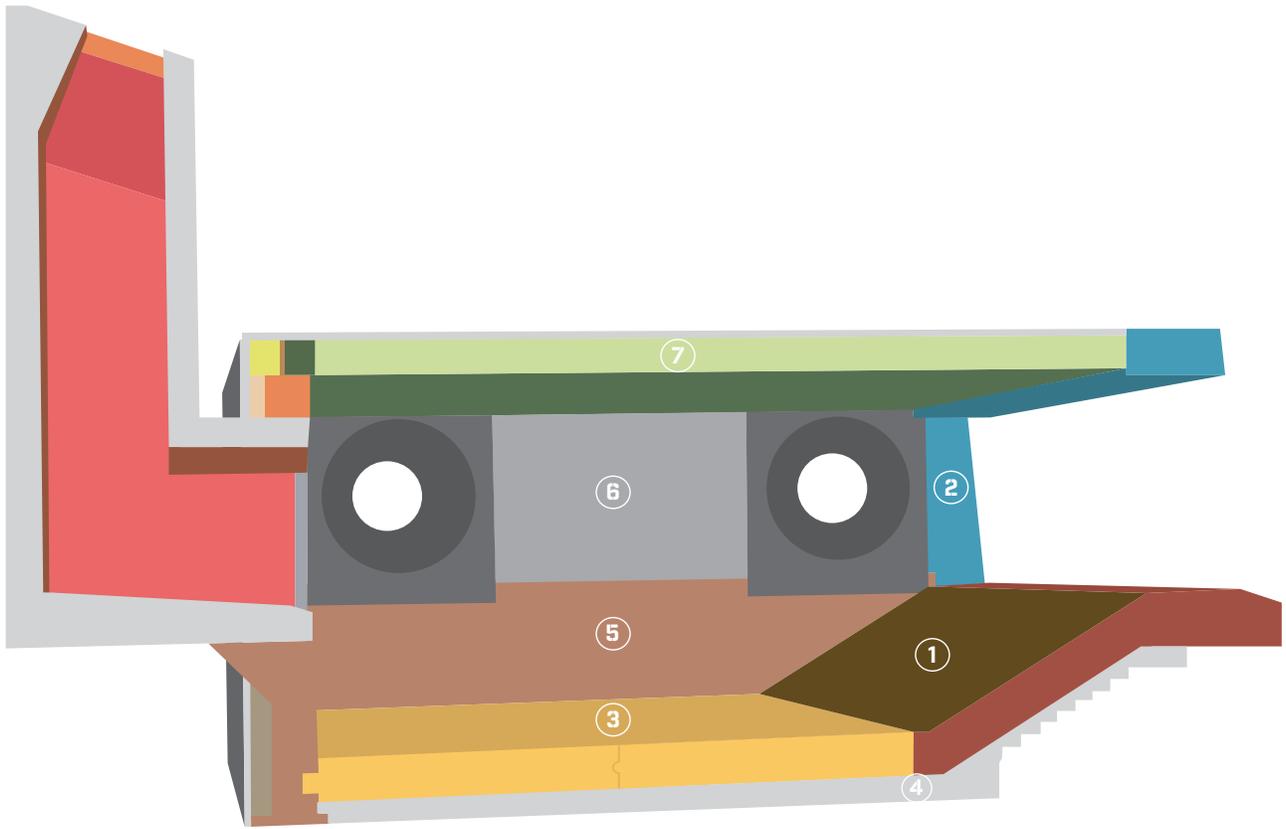
DV-38®
ARMORTECH 65AL C
ARMORKAST 80AL C ADTECH®
VERSAFLOW® 65/AL C ADTECH®

4 SUB-HEARTH/BACK UP

Refractory materials should provide good strengths. Typically an economical, fireclay based or lightweight product. Non-wetting (to molten aluminum) versions are available and preferred for additional integrity.

PRODUCTS

H-W® ES CASTABLE C AL ADTECH®
GREENLITE®-45-L AL PLUS
CLIPPER DP®



Zoned refractory lining configuration

5 LOWER WALL / BELLYBAND

Lower walls see some mechanical abuse from cleaning, however, the bellyband is the most corrosive zone in many furnaces. Excellent aluminum resistance and high strength are required for the refractory in this zone.

PRODUCTS

ALCOR®-32
 ARMORTECH 65 AL
 VERSAFLOW® 65/ AL PLUS

6 UPPER WALLS

With exposure to alkali, high temperature, and some mechanical abuse from cleaning/charging practice, materials in the upper wall should be of high refractoriness with good strength and resistance to alkali environments.

PRODUCTS

VERSA-TECH 55 AR HS PLUS
 GREENGUN®-85 P PLUS
 VERSAFLOW® 57A PLUS
 KALA®

7 ROOF

Wear mechanisms for the roof lining are similar to the upper wall, but with far less mechanical damage. Temperature and a potential alkali environment are the key wear factors for the roof.

PRODUCTS

VERSAFLOW® 57A PLUS
 KAST-O-LITE® 20 PLUS

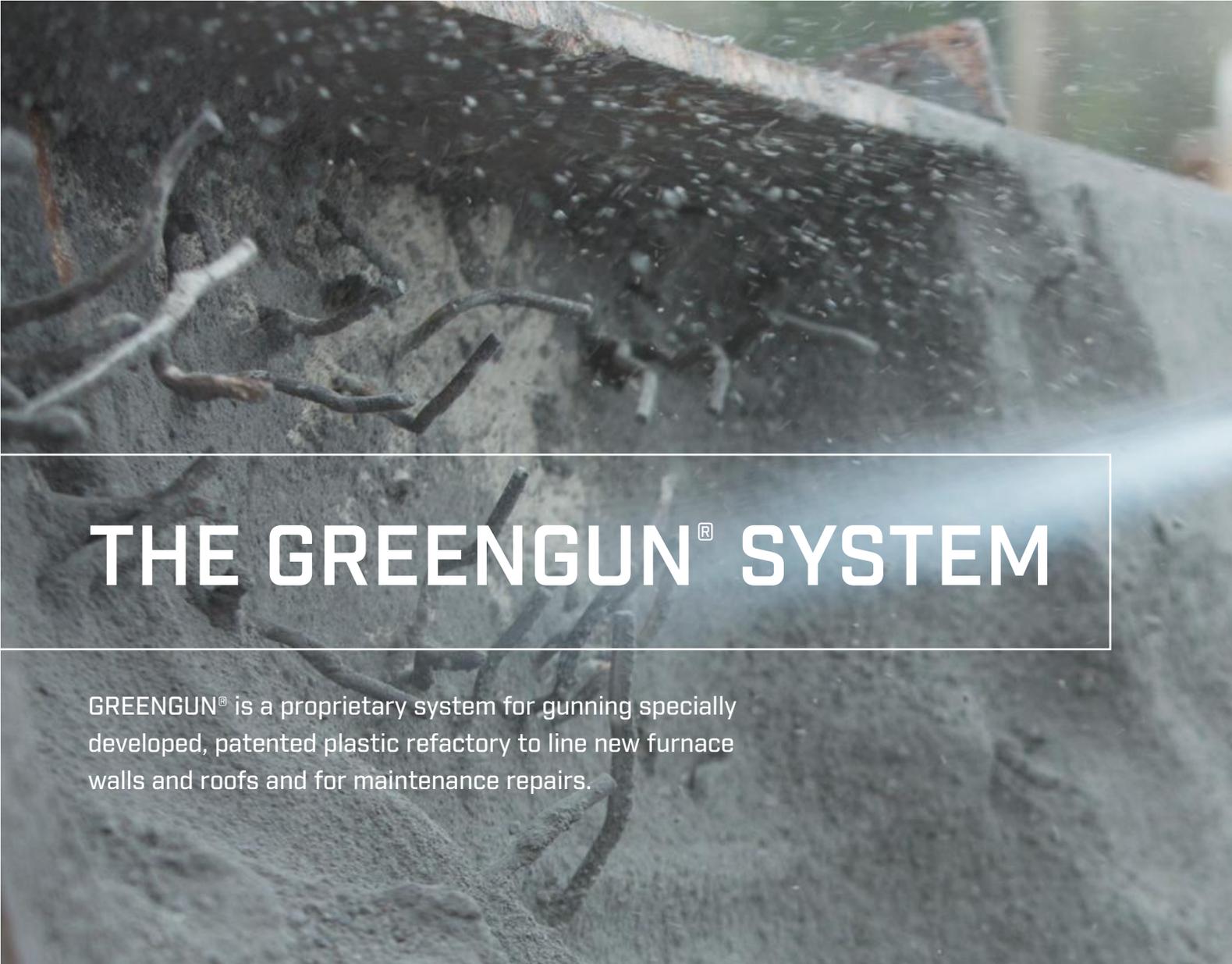
8 DOOR (NOT PICTURED)

HWI's new MIDDLEWEIGHT technology provides a mid-density, thermally efficient refractory castable material. VERSA-TECH MW 55 AR PLUS offers the additional feature of excellent alkali resistance, making it an excellent product consideration for doors and other various applications.

PRODUCTS

VERSA-TECH MW 55 AR PLUS
 KAST-O-LITE® 30 LI PLUS
 GREENLITE®-45-L AL PLUS





THE GREENGUN[®] SYSTEM

GREENGUN[®] is a proprietary system for gunning specially developed, patented plastic refractory to line new furnace walls and roofs and for maintenance repairs.

HarbisonWalker International's GREENGUN[®] is a phosphate bonded alumina gunning plastic, which can be shot hot or cold. It's cement free, aluminum and alkali resistant, thermal shock and abrasion resistant, and installs 3x faster than ramming plastic.

The single-component, plastic refractory is shipped in 2,000 pound or 3,000 pound boxes and does not require any additions or pre-mixing prior to installing. Operators simply rake the material directly from boxes into the BSM gun. GREENGUN[®] is a heat-setting material, so no setting agents are needed at the nozzle.

HarbisonWalker International's patented GREENGUN[®] System combines all the elements to reline or repair your furnace fast and right. We can provide reference for a qualified contractor/installer or provide the material, equipment, and on-site supervision depending on your needs.

GREENGUN[®] has several advantages over conventional placement methods:

- Provides a faster, more efficient installation method
- Installs 3x faster than ramming plastic
- Requires less man power
- Produces long lasting, high-density linings
- Offers a variety of products suitable for multiple applications
- Eliminates the need to build forms
- Reduces downtime and lost production time
- Allows installation at elevated temperatures for hot repairs



The end result is a long lasting, quality installation that costs less than conventional placement methods.

The GREENGUN® System incorporates a special feed wheel allowing for a continuous feed of plastic to the hose; a heavy-duty compressor, which can deliver 750 cubic feet per minute of air to the gun; and a 1-3/8 inch diameter specialized hose for plastic gunning.

GREENGUN® crews typically require three to six people and can install 10-12 tons of plastic in an 8 hour shift.

GREENGUN® was developed and fine-tuned in job situations to reduce the importance of nozzle operator experience. After a brief training session, even a novice, unfamiliar with refractory lining practices can handle the nozzle using simple techniques and common sense.

When placed correctly, GREENGUN® plastic gives a dense, monolithic lining with excellent stability and rapid dryout capability. It is more consistent than manual placement with ramming hammers.

The densely packed monolithic, or one piece, lining has no brickwork or joints for heat or gases to escape. Contraction cuts are made to mitigate cracking and shrinkage of the solid lining. The combination of properties, ease of installation, and potential cost savings contribute to the outstanding success of GREENGUN® in the industry.



SERVICE LIKE YOU'VE NEVER SEEN

GLOBAL SOURCING CENTERS

- 30 North American global sourcing centers providing one of the quickest response times in the industry
- Dedicated sales personnel ready to respond 24/7/365
- Ready-to-ship inventory of our best-selling products
- Usually shipping with same-day or next-day delivery
- Staging and shipping to anywhere in the world
- Inventory solutions tailored to your business

Call **1-800-887-5555** to be immediately connected to the global sourcing center nearest you.

VALUE-ADDED SERVICES (VAS)

Enjoy the utmost in service. HarbisonWalker International's dedicated VAS team provides on-site management, installation, equipment, inventory management, and supervisory services. Benefits include:

- Single-source responsibility that delivers cost savings
- Just-in-time delivery of refractory materials, ensuring the freshest product on the jobsite
- Quick response times, minimizing outages and downtime
- More in-depth knowledge of your business, yielding the best refractory solutions

To learn more, contact us at:
VAS@thinkHWI.com

ADVANCED TECHNOLOGY AND RESEARCH CENTER (ATRC)

HWI has two ATRC centers for learning, testing, exploration, and innovation. Here in the United States, ATRC houses some of the brightest minds in the refractory industry. Our team of research and development experts works directly with our customers to design, test, and trial new products and applications. ATRC China serves as an important raw materials and qualifications lab. Services include:

- Research and development of new applications and products
- Customer-focused product development
- Comprehensive technical analysis
- Quality-assurance testing
- Benchmark and failure analysis of refractory material
- Slag analysis
- Postmortem analysis
- Introductory refractory training to more highly customized education that is specific to your business (at your place or ours)



We're the thought leaders. The researchers. The innovators. The tech geeks. We're the refractory partners who won't melt when the heat is on, who live to solve your greatest challenges. Every day at HWI, we design solutions that help improve efficiencies, make installations easier, extend campaign lives, and save customers millions of dollars. And it all begins with our intensely driven service teams.

GLOBAL PROJECTS AND ENGINEERING

The Global Projects and Engineering Team specializes in greenfield construction, manufacturing and plant modernization, and also services the advanced engineering needs of existing facilities. These services include the following benefits:

- End-to-end delivery of refractories: drawings, products, and installation
- Expertise in all applications, including rapidly advancing technologies such as coal gasification units
- Strong conceptual drawing capabilities with meticulous attention to detail

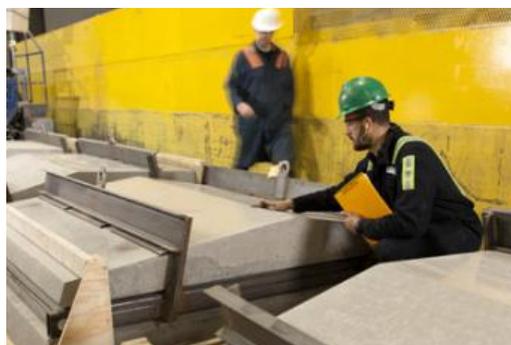
Call **412-375-6920** to mobilize a HarbisonWalker International projects team today

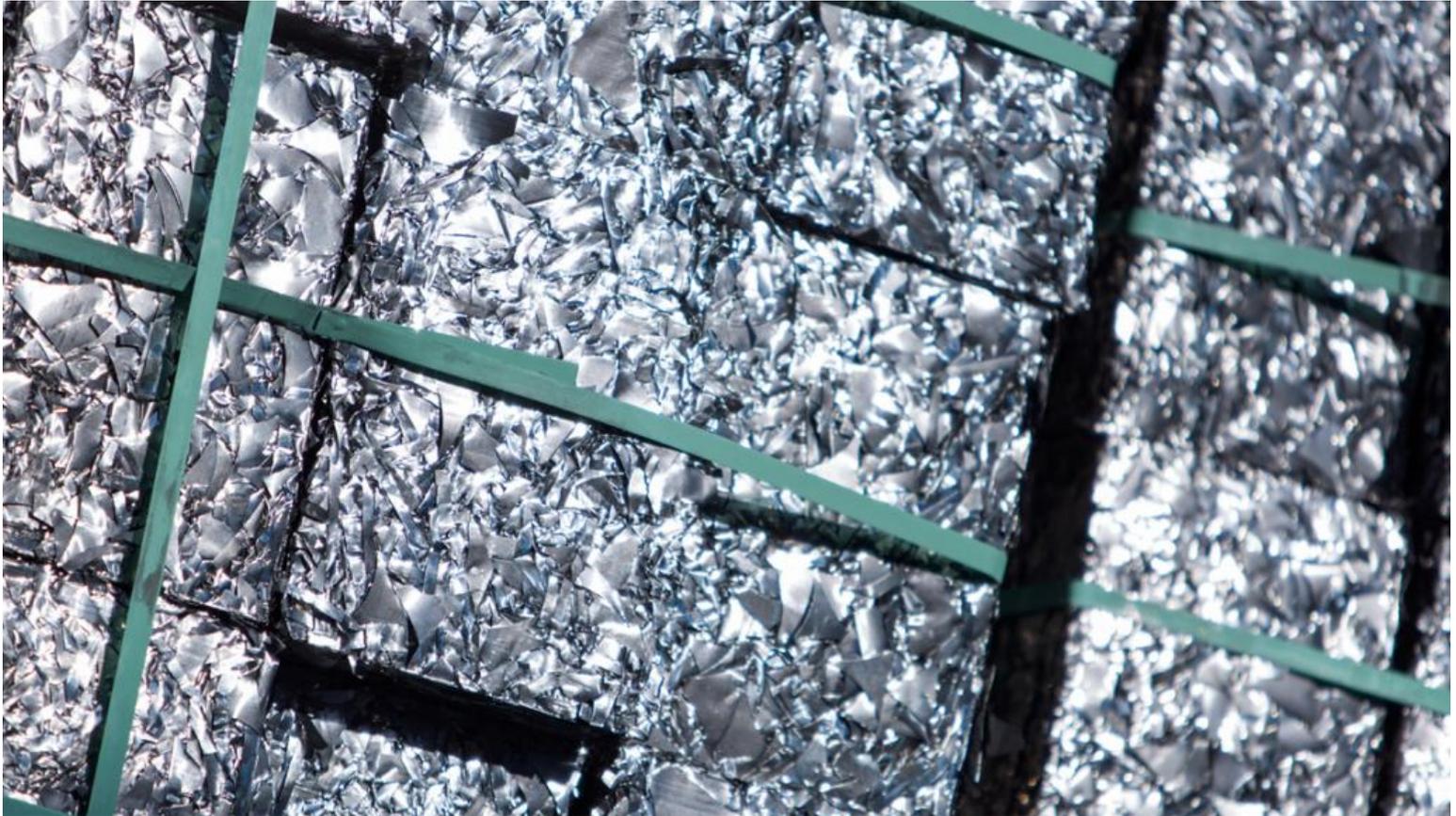
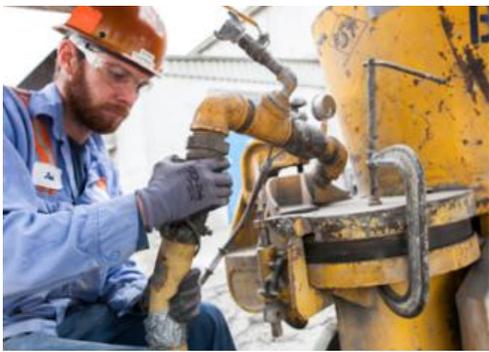
INSTALLATION, SERVICE, AND SUPPORT

- Support from HWI's network of premier independent contractor/installers
- Small emergency repairs to new plant construction
- Skills, resources, and experience to meet demanding specifications and time constraints

EDUCATION AND TRAINING

- Ongoing educational seminars at our Advanced Technology and Research Centers
- Customized, on-site training for aluminum customers upon request
- Aluminum webcasts and video training modules upon request







PUT OUR INTENSITY TO WORK FOR YOU

Every day, our people and products stand up to the challenges of every job. As a global supplier, we'll save you time and money. And our experience in heat containment makes us the safest, most reliable choice for your investment.

We are your one-stop shop for refractory solutions. To learn more, talk with a HarbisonWalker International representative at **800-492-8349** or visit **thinkhwi.com**.



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