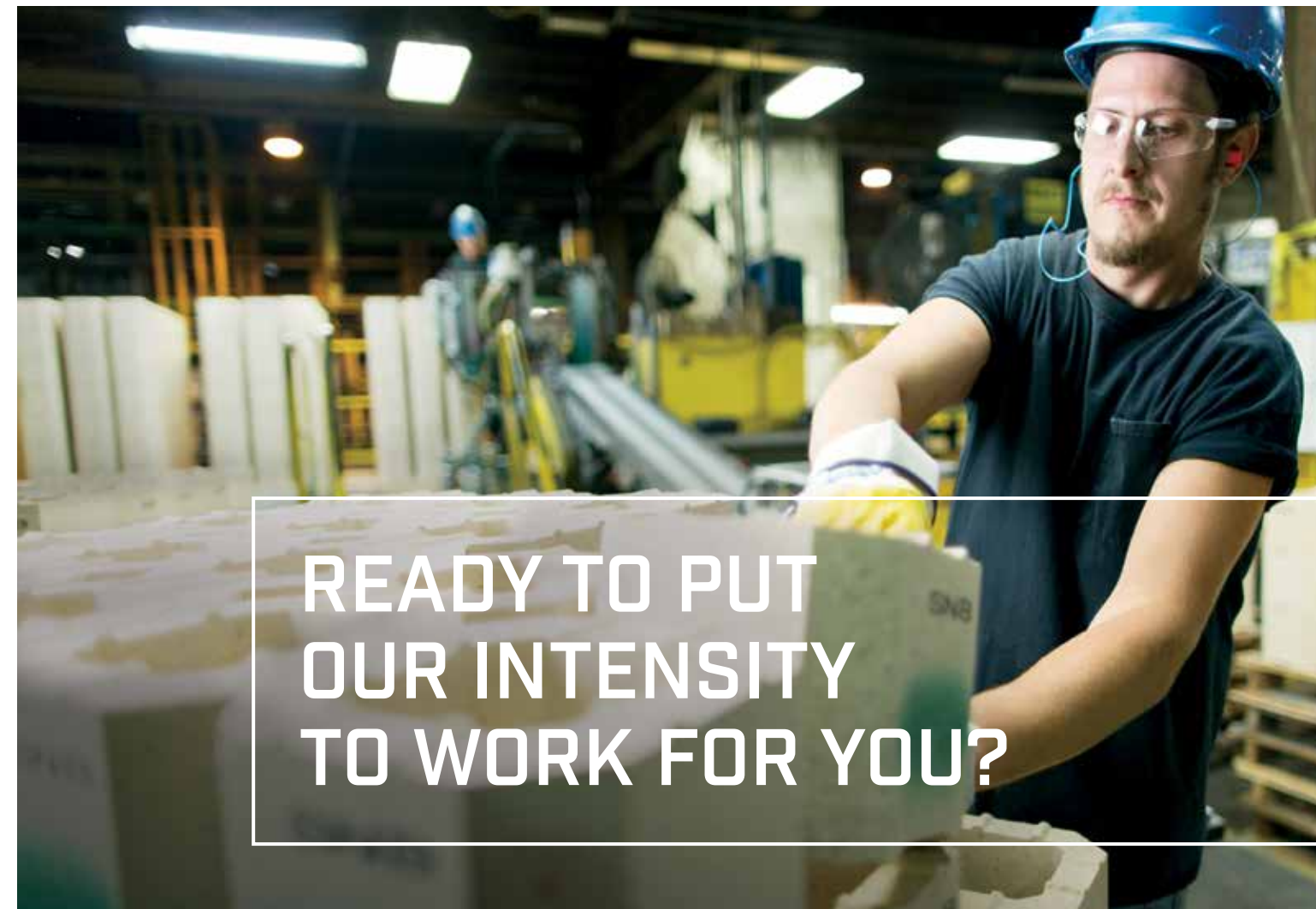


REFRACTORY SOLUTIONS FOR **GLASS**



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 over 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.



HarbisonWalker International (HWI) provides the largest refractory manufacturing capacity to the glass industry in North America.

Over 90 years of research and development in the glass market have enabled us to pioneer innovative glass solutions.

Our refractory products provide a competitive edge. We are the only manufacturer to offer CENTAUR technology, a combo-cast block that provides the highest-performing protection while remaining economical. We also introduced JADE®, the first high-thermal shock resistant brand for hot repairs. JADE® continues to help customers save energy in electric furnaces.

Our dedicated glass application specialists build custom solutions, troubleshoot issues, develop technical papers, conduct refractories training, and offer a variety of consultation services.

Our Value-Added Service (VAS) team can provide a wide range of support, from simple consultation to on-site installation services. We have equipment-rental services and a full range of inventory solutions. We can also provide priority access to our Advanced Technology and Research Center (ATRC) testing services. Our role can be customized to your needs. We can step in as simply a product supplier, or we can take the job all the way through installation. You decide.



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 TZB®, VISION®, SERV®, ZIRMUL®, and JADE®.

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**.



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

Strategically located 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.



APPLICATIONS



ART GLASS

CONTAINER GLASS

FIBERGLASS

FLOAT GLASS

TECHNICAL GLASS





Who else but HarbisonWalker International for your most intense and challenging applications? From art glass and container glass to fiber, float, and technical glass, we provide solutions that keep your business moving. Whether it's our people or our products, we're intensely focused on meeting today's demands for strength, wear resistance, and insulating properties. So name your refractory requirements. And then count on HWI to deliver superior performance.

CROWN SERV® 30 RESERV® 50 TIGER® 33 RC VISTA® NIKE S75	SUPER- STRUCTURE BACKUP NIKE S65W KX-99® CLIPPER® DP	SUB-LAYER (MONOLITHIC) TZ® 748 RAM SHAMROCK® 296	CARRIER COURSE CLIPPER® DP CRYLA® XXL KX-99®	SIDEWALLS JADE® 50 DCX SERV® 50 DCX JADE® 95 DC SERV® 95 DC CENTAUR	STACK SERV® 52 XL JADE® 95 DC SERV® 95 DC RESERV® 50 JADE® 52 XL
SUPER- STRUCTURE RESERV® 30 RESERV® 50 SERV® 30 VISTA® TIGER® 33 RC TZB® TAYLOR ZIRCON®	TOP PAVING RESERV® 30 SERV® 30 RESERV® 50 SERV® 52 XL	SUB-PAVING TZB® VISION® ZIRMUL SERV® 30 RESERV® 30	BOTTOM INSULATION GREENLITE® DC GREENTHERM LOTHERM® DC	SIDEWALL BACKUP JADE® 52 XL SERV® 52XL RESERV® 50	

CROWN NIKE S75 HF NIKE S75 GEM® NIKE S65W	SUB-LAYER (MONOLITHIC) TZ® 748 RAM	SIDEWALLS TIGER® Z95
SUPER- STRUCTURE SERV® 30 VISTA® GEM® TZB® NIKE S65W	SUB-PAVING TZB®	SIDEWALL BACKUP SERV® 95 JADE® 95 JADE® 52 XL SERV® 52XL RESERV® 50
SUPER- STRUCTURE BACKUP KX-99® CLIPPER® DP	CARRIER COURSE CLIPPER® DP KX-99® CRYLA® XXL BOTTOM INSULATION LOTHERM® DC GREENTHERM GREENLITE® DC	STACK RESERV® 50 SERV® 30 TZB®

CROWN VEGA	TOP PAVING VISION® VISION® TILE	BOTTOM INSULATION LOTHERM® DC GREENTHERM GREENLITE® DC
SUPER- STRUCTURE AZTECH DC TIGER® 33 RC VISTA® TZB®-S GEM® NIKE S65W HORIZON DC	SUB-LAYER (MONOLITHIC) TZ® 748 RAM TZ® 717-W RAM ZIRMUL® 160 PATCH SUB-PAVING VISION® TZB® ZIRMUL®	SIDEWALLS/ THROAT TIGER® AZS 41 VF TIGER® AZS 33 VF SIDEWALL BACKUP VISION® TILE
SUPER- STRUCTURE BACKUP CLIPPER® DP KX-99® KALA®	CARRIER COURSE CLIPPER® DP KX-99® CRYLA® XXL NIKE S65W XXL	HOT OVERCOATS HORIZON® JADE® 52 XL VISION® TILE ZIRMUL®

BOROSILICATE SPECIALTY

CROWN NIKE S75 HF NIKE S75 GEM® NIKE S65W	TOP PAVING VISION® SUB-LAYER (MONOLITHIC) TZ® 748 RAM	BOTTOM INSULATION LOTHERM® DC GREENTHERM
SUPER- STRUCTURE AZTECH DC TIGER® 33 RC VISTA® TZB® NIKE S65W	SUB-PAVING TZB® CARRIER COURSE CLIPPER® DP KX-99® CRYLA® XXL	SIDEWALLS/ THROAT TIGER® AZS 41 VF TIGER® AZS 33 VF
SUPER- STRUCTURE BACKUP NIKE S65W KX-99® CLIPPER® DP		SIDEWALL BACKUP VISION® TILE ZIRMUL®



**A CLEAR
COMPETITIVE EDGE.**
FOR ALMOST
100 YEARS,
WE'VE PIONEERED
REFRACTORY
GLASS SOLUTIONS
THAT CONTINUE
TO SHATTER
INDUSTRY
EXPECTATIONS.



REGENERATOR CHECKER PACKS

Fuel-fired furnaces in the glass industry typically utilize checker brick to improve efficiencies by taking advantage of the excellent heat exchange properties inherent in ceramic materials. As the furnace exhausts through the checker pack, the bricks are preheated by the waste gases, providing a source of energy to preheat the combustion air when the cycle is reversed. Regenerator efficiencies can be affected by a variety of factors, from pack design to regenerator size. The materials utilized in regenerators must be able to withstand many different forms of attack, including corrosion by alkalis, silica, and sulfates, as well as thermal shock and creep. The selection of refractory materials is critical to the operation and life cycle of the regenerator.

TOP CHECKERS

This zone has an atmosphere laden with alkali vapors and solid batch carryover (CaO, SiO₂). High temperature cycling and oxidizing/reducing effects are also considered.

TUFLINE® 98 DM

High alumina (corundum) with excellent thermal shock resistance

NARMAG® 98B

Burned 98% MgO with a forsterite bond

NARMAG® VZ

Mag-zircon composition with a forsterite bond

MIDDLE CHECKERS

This zone has temperature fluctuations that are considered relatively mild. Solid carryover is low and less reactive because of the lower temperature. The atmosphere is rich in alkali vapors and some deposition can occur.

SUPER NARMAG® B

Burned 98% MgO with improved creep resistance

CONDENSATE ZONE CHECKERS

This zone has lower temperatures, but ranges may be wide where cold incoming air enters the checker setting. A large amount of condensation of volatile constituents is present from the exhaust gas. Plugging may occur from the entrapment of solid dust and fragments from higher up in the setting. Reducing conditions can also affect refractory selection.

SUPER NARMAG® B (GAS FIRED)

Burned 98% MgO with improved creep resistance

NARMAG® VZ (OIL FIRED)

Mag-zircon composition with a forsterite bond

NARMAG® 50 DBRG

50% MgO direct-bonded magnesite chrome

LOWER CHECKERS, RIDER TILE AND ARCHES

This zone has temperature cycling and sulphate condensate that can be an issue. In addition, creep resistance is critical in this application due to the increased load on the refractory.

NIKE S65W

65% Al₂O₃ for increased resistance to condensate

UFALA® XCR

60% Al₂O₃ with increased creep resistance

KALA®

Unique 50% Al₂O₃ that has superior resistance to thermal cycling and creep

KX-99®

Conventional high-fired superduty fireclay



Various checker designs are available to suit your needs, including conventional settings, HPC (chimney type), and the HYDE Checker. All modular checker settings available from HWI can be designed with horizontal clean-outs where appropriate. In addition, all modular checker settings are color coded to height groupings to provide excellent stability.

A large industrial facility, likely a power plant, with a worker in a yellow hard hat and red shirt in the foreground, looking over rows of large, rectangular components (regenerator walls and crowns) stacked in the background.

REGENERATOR WALLS & CROWNS

TZ[®] 150 PATCH

A multipurpose high-strength patch for hot and cold repairs. For regenerator and port applications, this product is ideal for patching rat holes, thin spots, and open holes in the crown, as well as providing a monolithic seal layer.

UFALA® XCR
60% Al₂O₃ with increased creep resistance

Regenerator target walls experience extreme conditions from batch carryover. Issues are most severe in end-port furnaces and the first two or three ports in side-port furnaces.

A high-alumina, fused mullite brick with excellent refractoriness and creep resistance

Sintered AZS with high resistance to alkali attack

High alumina with high strength and good creep resistance

High alumina with excellent alkali resistance

Mag-zircon composition with a forsterite bond

Burned 98% MgO with improved creep resistance

This section of the regenerator is exposed to lower temperatures, with relatively minor thermal cycling. It's position is roughly 2-10 feet (1-3 meters) below the top checkers. The most important requirement for the refractory selection is resistance to creep.

Burned 98% MgO with improved creep resistance

60% Al_2O_3 with increased creep resistance

60% Al_2O_3 for increased resistance to condensate

Unique 50% alumina brick with outstanding alkali and creep resistance

A multipurpose high-strength patch for hot and cold repairs. For regenerator and port applications, this product is ideal for patching rat holes, thin spots, and open holes in the crown, as well as providing a monolithic seal layer.

Like the lower checkers, this section is exposed to temperature cycling and sulphate condensate that can be an issue. In addition, creep resistance is critical in this application due to the increased load on the refractory.

60% Al_2O_3 with increased creep resistance

Conventional high-fired superduty fireclay

Conventional superduty fireclay

Unique 50% alumina brick with outstanding alkali and creep resistance



HWI BOTTOM CONCEPTS

The HWI BOTTOM CONCEPT, which has been used in thousands of furnaces, was first introduced in the early 1970s. Today’s design utilizes the same core products: VISION®, TZB®, and TZ® 748 RAM, with a Clay Flux and Insulating Package.

VISION®

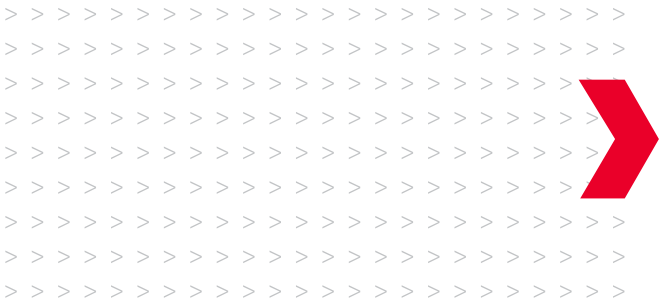
A sintered AZS material is chosen over Fused Cast AZS due to its engineering properties, including linear thermal expansion, higher electrical resistivity, no glassy phase, uniform density, and a lower k-factor. VISION® and the HWI bottom concept offer glassmakers the best of both worlds: good corrosion resistance, less heat lost out of the bottom, and added protection from metal drilling.

TZ® 748 RAM

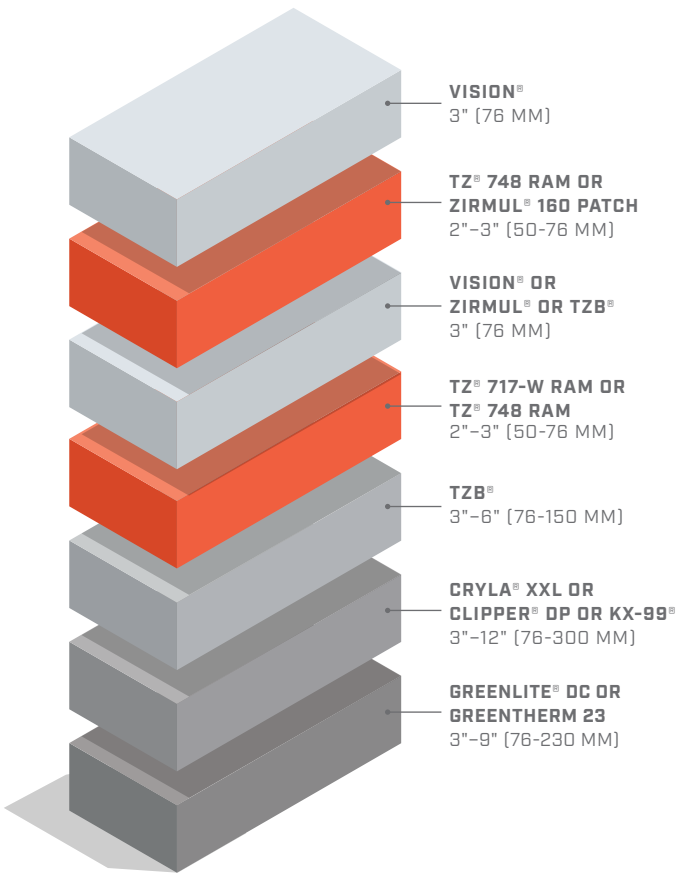
A leader in the marketplace for its glass-corrosion resistance and its ability to encapsulate metal. A zircon seal layer protects the furnace from glass following the metal as it drills.

INSULATION PACKAGE

Clay Flux and Insulating Packages are available in two design options: standard brick series and large blocks. CLIPPER® DP and KX-99® are the options for standard series superduty fireclay and high fired super duty, respectively. CRYLA® XXL and CRYLA® DC provide a solution when large or specialty shapes are preferred. GREENTHERM 23 is available in standard brick series, while GREENLITE® DC is the option for large or specialty shapes.



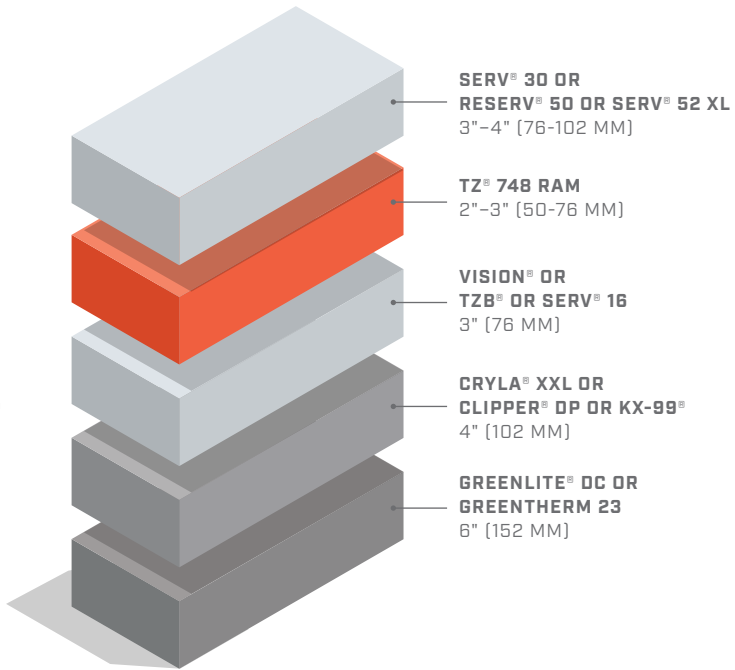
SODA-LIME GLASS



HWI’s bottom design always features VISION® for the top paving, laid with ZIRMUL® 362 mortar, and multiple monolithic layers for corrosion resistance or metal encapsulation. TZ® 717-W RAM is used for its excellent metal encapsulation properties, which protect the bottom from metal drilling at a lower temperature. TZ® 748 also encapsulates metal while providing superior glass-corrosion resistance. With little or no cullet and glass corrosion as the failure mechanism, customers choose ZIRMUL® 160 Patch as the upper monolithic layer.



WOOL GLASS (C-GLASS)



Top paving in wool furnaces is typically 30–50% chrome-alumina materials in order to provide optimum corrosion resistance. Staying true to the HWI design, backup courses include zircon ram and additional sub-paving layers of AZS, zircon, or chrome-alumina.

FOREHEARTHS

HarbisonWalker International has a long history of supplying quality specialty shapes to the glass industry for forehearth. In fiberglass furnaces, the SERV® products are the industry leader for glass-contact materials. In all soda-lime superstructure applications, the NIKE S65W products are world renowned for their excellent alkali resistance. HWI is proud to promote the newest addition to solutions for forehearth in the soda-lime furnace: TAYCOR® M DC. This product is a 99% alumina shape that rivals the performance of fused cast refractories while permitting novel design solutions for the forehearth.

WOOL “C” GLASS FOREHEARTH

BAFFLE BLOCKS
TAYLOR ZIRCON® GC
AZTECH DC
ZIRMUL® DC

SUPER-STRUCTURE
TAYLOR ZIRCON® GC
AZTECH DC
ZIRMUL® DC
TZB®
TIGER® 33 RC

BURNER BLOCKS
KX-99®
CLIPPER® DP

PAVING
SERV® 30
SERV® 16
VISION®

SIDE RAILS
SERV® 52 XL
SERV® 30

TEXTILE “E” FIBERGLASS FOREHEARTH

SUPER-STRUCTURE
NIKE S65W
GEM® GC
NIKE S75

BURNER BLOCKS
GEM® GC
NIKE S65W DC

BAFFLE BLOCKS
GEM® GC
NIKE S65W DC

SODA-LIME GLASS FOREHEARTH & DISTRIBUTOR

COVER BLOCKS
NIKE S65W GC
NIKE S65W DC

SKIMMERS & MANTLES
TAMAX® GC

BURNER BLOCKS
NIKE S65W GC
NIKE S65W DC
TAMAX® GC

GLASS CONTACT
TAYCOR® M DC
TIGER® AZS 33 VF

SODA-LIME GLASS (COLORANT) FOREHEARTH

COVER BLOCKS
AZTECH DC
ZIRMUL® DC

SKIMMERS & MANTLES
AZTECH DC
ZIRMUL® DC

BURNER BLOCKS
AZTECH DC
ZIRMUL® DC

GLASS CONTACT
TIGER® AZS 41 VF
TIGER® AZS 33 VF

INSULATION

HarbisonWalker International has a variety of insulating products to lower thermal conductivity and improve your operation. Our INSWOOL® ceramic fiber blanket products provide excellent handling strength and low heat storage, are easy to install, and are resistant to thermal shock. The INSWOOL® ceramic fiber blankets are offered in temperature classifications up to 2600°F. Our insulating firebricks (IFBs) are manufactured with a porous structure that also produces low thermal conductivity and good thermal shock characteristics, resulting in excellent insulating properties. The IFBs have excellent strength at operating temperatures and resistance to corrosive alkali environments. The IFBs are offered in a variety of temperature grades and densities.

BRICK

IFB
GREENTHERM 23
GREENTHERM 25
GREENTHERM 26
GREENTHERM 28
GREENTHERM 30

ALUMINA-SILICA
LOTHERM® RK
GREENLITE® HS

ALUMINA
NA-33 HF
KORUNDAL® LW

PRE-CAST BLOCKS

ALUMINA-SILICA
LOTHERM® DC
GREENLITE® DC

BOARD

2300°F (1260°C)
INSBOARD 2300 HD
INSBOARD 2300 LD
INSBOARD 2300-45
INSBOARD S 2300

2600°F (1426°C)
INSBOARD 2600 HA
INSBOARD 2600 HD
INSBOARD 2600 HT

3000°F (1649°C)
INSBOARD 3000

ROPES

CERAMIC FIBER
INSWOOL® 3-PLY TWISTED
INSWOOL® HIGH DENSITY
INSWOOL® ROUNDED BRAID
INSWOOL® SQUARE BRAID

PAPER

2300°F (1260°C)
INSWOOL® 2300
INSWOOL® UG
INSWOOL® S

2600°F (1426°C)
INSWOOL® 880

3000°F (1649°C)
INSWOOL® 3000

BLANKET

2300°F (1260°C)
INSWOOL® HP
INSWOOL® S

2600°F (1426°C)
INSWOOL® HTZ

3000°F (1649°C)
INSWOOL® 3000



SHAPED PRODUCTS

Material	Product	Chemical Composition, wt. %									Bulk Density lb/ft³ (g/cm³)	Apparent Porosity (%)	k @ Mean Temp BTU-in/ft²-hr-°F, (W/m²-K)		Thermal Expansion % @ 2552°F (1400°C)	CMOR lb/ft² (N/mm²)	Recommended Mortars	
		Al₂O₃	ZrO₂	SiO₂	MgO	Fe₂O₃	TiO₂	Cr₂O₃	CaO	Other			2000°F (1093°C)	2500°F (1371°C)				
ALUMINA-SILICA	TAMAX® SC	83.0	-	15.5	-	0.4	0.6	-	-	0.5	154 (247)	23.0		11.8 (1.7)	12.0 (1.7)	0.90	1500 (10.3)	-
	TAMAX® GC	75.2	-	23.2	-	-	0.5	-	-	1.1	146 (234)	25.1		11.8 (1.7)	12.0 (1.7)	0.90	1500 (10.3)	ZIRMUL® 362 / TASIL® 302
	NIKE 575	75.0	-	24.0	-	0.5	0.1	-	-	0.5	167 (268)	16.0		12.1 (1.7)	13.4 (1.9)	0.66	1800 (12.4)	ZIRMUL® 362 / TAYCOR® 342
	GEN®	74.6	-	24.2	-	0.1	0.1	-	-	0.6	165 (265)	15.0		12.9 (1.9)	13.7 (2.0)	0.75	2500 (17.2)	ZIRMUL® 362 / TAYCOR® 342
	NIKE 575 HF	74.0	-	24.4	0.3	0.6	0.2	-	-	0.3	165 (264)	16.9		12.0 (1.7)	13.3 (1.9)	0.68	1700 (11.7)	ZIRMUL® 362 / TAYCOR® 342
	GEN® GC	73.0	-	26.0	-	0.1	0.2	-	-	0.3	155 (248)	18.4		12.9 (1.9)	13.7 (2.0)	0.75	3000 (20.7)	ZIRMUL® 362 / TAYCOR® 342
	TAMAX®	70.3	-	28.0	0.1	0.4	0.7	-	-	0.5	154 (247)	17.5		11.8 (1.7)	12.0 (1.7)	0.90	2500 (17.2)	ZIRMUL® 362 / MEXI-KOMO®
	TAMUL®	68.0	-	28.0	-	0.9	2.6	-	-	0.5	153 (245)	19.1		11.1 (1.6)	11.8 (1.7)	0.90	1700 (11.7)	ZIRMUL® 362 / MEXI-KOMO®
	TAMUL® F	68.0	-	28.0	-	0.9	2.6	-	-	0.5	151 (242)	20.1		10.9 (1.6)	11.7 (1.7)	0.90	2100 (14.5)	ZIRMUL® 362 / MEXI-KOMO®
	NIKE 565W GC	66.0	-	32.0	-	0.5	-	-	-	-	150 (240)	22.0		13.5 (1.9)	16.4 (2.4)	0.81	1500 (10.3)	ZIRMUL® 362 / MEXI-KOMO®
	NIKE 565W DC	66.0	-	32.0	-	0.5	-	-	-	1.5	156 (25)	18.5		13.6 (2.0)	16.6 (2.4)	0.82	2500 (17.2)	ZIRMUL® 362 / MEXI-KOMO®
	TAMUL® GC	65.8	-	31.2	-	0.8	1.7	-	-	0.4	143 (229)	26.0		10.9 (1.6)	11.8 (1.7)	0.90	1200 (8.3)	ZIRMUL® 362 / MEXI-KOMO®
	NIKE 565W	64.8	-	33.5	-	0.9	0.2	-	-	0.6	159 (253)	15.7		13.5 (1.9)	16.4 (2.4)	0.81	1600 (11.0)	ZIRMUL® 362 / MEXI-KOMO®
	NIKE 60 AR	63.0	-	35.0	0.07	0.9	1.0	-	-	0.3	158 (253)	14.0		13.2 (1.9)	14.3 (2.1)	0.81	2100 (14.5)	ZIRMUL® 362 / MEXI-KOMO®
	UFALA® XCR	60.3	-	36.8	0.1	1.1	1.3	-	-	0.4	158 (253)	15.0		12.5 (1.8)	13.4 (1.9)	0.74	2200 (15.2)	ZIRMUL® 362 / MEXI-KOMO®
ALUMINA-ZIRCONIA-SILICA (AZS)	UFALA®	59.0	-	36.7	0.1	1.3	2.6	-	-	0.3	155 (248)	15.0		12.5 (1.8)	13.4 (1.9)	0.80	2300 (16.6)	ZIRMUL® 362 / MEXI-KOMO®
	KALA®	49.6	-	46.5	0.1	1.3	2.3	-	-	0.2	151 (242)	14.1		14.6 (2.1)	14.6 (2.1)	0.80	2000 (13.8)	TASIL® 301, 317
	CRYLA® DC	50.6	-	43.6	0.2	1.2	1.2	-	1.0	1.2	144 (231)	15.0		10.5 (1.5)	10.9 (1.6)	0.70	1600 (11.0)	TASIL® 301, 317
	CLIPPER® DP	43.0	-	52.0	0.3	1.3	2.3	-	-	1.3	142 (227)	14.5		9.7 (1.4)	10.2 (1.5)	0.70	1300 (9.0)	TASIL® 301, 317
	KX-99®	42.1	-	53.0	0.2	1.3	2.2	-	-	1.2	142 (227)	13.5		10.7 (1.5)	11.1 (1.6)	0.70	1700 (11.7)	TASIL® 301, 317
	EMPIRE® S	37.6	-	56.3	0.4	1.7	2.0	-	0.3	1.7	134 (213)	19.0		9.5 (1.4)	9.9 (1.5)	-0.30	1100 (7.6)	TASIL® 301, 317
	AZTECH DC	42.7	34.9	21.2	-	0.1	0.1	-	-	1.0	194 (314)	16.9		11.9 (1.7)	15.4 (2.2)	-	3000 (20.7)	ZIRMUL® 362
	HORIZON DC	42.3	34.8	21.1	-	0.1	0.1	-	0.8	0.8	196 (314)	14.7		13.8 (2.0)	16.4 (2.4)	1.80	1900 (13.1)	ZIRMUL® 362
	VISION® DC	42.3	34.8	21.1	-	0.1	0.1	-	-	1.5	198 (317)	14.1		15.2 (2.2)	16.2 (2.3)	1.81	3000 (20.7)	ZIRMUL® 362
	VISION®	59.4	25.9	13.9	-	-	-	-	-	0.8	202 (323)	11.0		10.9 (1.6)	12.0 (1.7)	0.82	4800 (33.1)	ZIRMUL® 362
	VISION® TILE	55.6	26.0	14.3	-	-	-	-	-	3.1	190 (304)	15.5		15.2 (2.2)	16.2 (2.3)	0.82	4000 (27.6)	ZIRMUL® 362
	VISTA®	57.8	24.6	14.6	-	-	-	-	-	3.0	189 (303)	14.0		15.2 (2.2)	16.2 (2.3)	0.81	5100 (35.2)	ZIRMUL® 362
	ZIRMUL®	70.0	19.3	10.4	-	-	-	-	-	0.3	197 (316)	17.0		13.5 (1.9)	14.3 (2.1)	0.94	2000 (16.0)	ZIRMUL® 362
	ZIRMUL® DC	66.1	19.9	13.4	-	-	-	-	-	0.1	192 (312)	17.2		13.5 (1.9)	14.3 (2.1)	0.94	2200 (16.0)	ZIRMUL® 362
	ZIRMUL® GC	69.0	19.0	11.0	-	-	-	-	-	1.0	190 (308)	18.5		13.5 (1.9)	14.3 (2.1)	0.94	1500 (10.3)	ZIRMUL® 362
ALUMINA-ZIRCONIA-SILICA (AZS)	ZIRMUL® SC	70.0	19.5	10.2	-	-	0.1	-	-	0.2	193 (309)	18.0		13.5 (1.9)	14.3 (2.1)	0.94	2600 (17.9)	-
	ZRX®-F	50.9	19.5	28.4	0.2	0.4	0.3	-	-	0.3	172 (276)	16.7		11.7 (1.7)	12.2 (1.8)	0.82	3400 (23.4)	ZIRMUL® 362
	ZRX®	52.2	18.0	27.2	0.3	-	0.6	-	-	0.2	177 (284)	15.5		11.6 (1.7)	12.1 (1.7)	0.80	2500 (17.2)	ZIRMUL® 362
	TAYCOR® M DC	99.3	-	0.1	-	0.1	0.6	-	-	0.5	194 (311)	17.2		-	-	-	2300 (15.9)	TAYCOR® 342
	TUELINE® 98 DM	97.6	-	0.12	0.16	0.09	0.05	-	-	1.98	204 (327)	14.6		24.8 (3.6)	24.2 (3.5)	1.05	2000 (13.8)	TAYCOR® 342
HIGH-PURITY ALUMINA	PRISM® DC	96.3	-	0.1	0.8	0.1	0.6	-	2.5	0.2	181 (290)	23.0		19.5 (2.8)	19.7 (2.8)	1.10	4100 (28.3)	ZIRMUL® 362 / TAYCOR® 342
	KORUNDAL 95	95.0	-	4.5	-	0.1	-	-	-	0.4	204 (327)	13.0		-	-	-	3600 (24.8)	ZIRMUL® 362 / TAYCOR® 342
	KORUNDAL XD®	90.0	-	9.7	0.1	-	-	-	-	0.3	191 (306)	15.4		19.6 (2.8)	19.7 (2.8)	0.93	2200 (15.2)	ZIRMUL® 362 / TAYCOR® 342
	TZB®	-	66.0	32.0	-	-	0.6	-	-	2.0	235 (377)	17.8		16.3 (2.3)	17.5 (2.5)	0.65	3000 (20.7)	TZ® 702, 352
	TZB®-S	-	66.0	32.0	-	-	-	-	-	2.0	228 (374)	19.9		16.3 (2.3)	17.5 (2.5)	0.65	1200 (16.6)	TZ® 352
BASIC	TAYLOR ZIRCON® GC	-	64.7	34.0	-	-	-	-	-	1.3	223 (357)	21.1		16.3 (2.3)	17.5 (2.5)	0.65	2700 (18.6)	TZ® 352
	SUPER NARMAG® B	0.2	-	0.4	98.0	0.5	-	-	0.9	-	186 (298)	14.6		33.0 (4.7)	32.9 (4.7)	1.90	2300 (15.9)	NARMAG® HS
	NARMAG® 98B	0.2	-	0.2	98.1	0.6	-	-	0.9	-	183 (293)	15.8		30.6 (4.4)	28.4 (4.1)	1.92	2100 (14.5)	NARMAG® HS
	NARMAG® VZ	0.3	12.0	6.5	80.0	0.4	-	-	0.7	-	194 (311)	13.5		24.7 (3.5)	25.0 (3.6)	1.70	1800 (12.4)	NARMAG® HS
	NARMAG® 50 DBRG	9.0	-	1.6	50.6	13.1	-	24.9	0.8	-	200 (320)	17.5		21.0 (3.0)	21.0 (3.0)	1.40	900 (6.2)	NARMAG® HS

Material	PRODUCT	Chemical Composition, wt. %									Bulk Density lb/ft³ [g/cm³]	Apparent Porosity (%)	k @ Mean Temp BTU-in/ft²-hr-°F (W/m-K)		Thermal Expansion % @ 2552°F (1400°C)	CMOR lb/in² [N/mm²]	Recommended Mortars		
		Al₂O₃	ZrO₂	SiO₂	MgO	Fe₂O₃	TiO₂	Cr₂O₃	CaO	Other									
ALUMINA-CHROME	SERV® 95	2.2	-	0.8	Trace	0.2	2.7	92.5	0.1	1.5	247 (3.96)	18.7		270 (3.9)	250 (3.6)		1.10	3800 (26.2)	SHAMROCK® 394
	SERV® 95 DC	5.1	-	-	-	-	1.1	92.2	-	1.6	233 (3.73)	25.0		270 (3.9)	220 (3.3)		0.65	3100 (21.4)	SHAMROCK® 394
	JADE® 95 DC	7.3	-	-	-	-	-	92.0	-	0.7	230 (3.68)	25.0		230 (3.4)	222 (3.3)		-	1300 (9.0)	SHAMROCK® 394
	JADE® 52 XL	42.6	-	2.1	0.4	0.1	-	52.5	0.3	3.8	221 (3.54)	18.4		13.6 (2.0)	13.8 (2.0)		-	1500 (10.3)	SHAMROCK® 394
	SERV® 52 XL	39.4	-	3.0	0.7	0.6	-	54.2	0.5	-	222 (3.56)	17.0		18.0 (2.6)			1.17	4000 (27.6)	SHAMROCK® 394
	RESERV® 30	72.9	-	1.6	-	-	-	24.5	-	1.0	211 (3.38)	15.5		-			-	4200 (29.0)	SHAMROCK® 391, 392
	RESERV® 50	38.2	0.4	4.0	0.9	0.6	-	53.7	0.5	-	218 (3.49)	20.1		18.0 (2.6)	17.0 (2.4)		1.18	3700 (25.5)	SHAMROCK® 394
	JADE® 50 DCX	36.3	-	5.3	0.4	0.2	-	54.9	-	1.6	208 (3.33)	20.0		13.6 (2.0)			-	800 (5.5)	SHAMROCK® 394
	SERV® 50 DCX	41.6	-	2.2	0.1	1.0	-	52.5	0.6	1.8	214 (3.43)	20.5		18.5 (2.7)	20.0 (2.9)		1.06	3500 (24.1)	SHAMROCK® 394
	SERV® 30 DC	62.7	-	3.1	-	-	-	29.6	-	1.6	202 (3.24)	18.1		17.6 (2.5)	19.0 (2.1)		1.16	3100 (21.4)	SHAMROCK® 391, 392
	JADE® 30 DC	65.5	-	3.1	-	<0.1	-	29.6	-	1.6	202 (3.24)	17.7		13.4 (1.9)	13.6 (2.0)		-	1600 (11.0)	SHAMROCK® 394
	SERV® 30	66.8	-	1.3	-	0.2	-	29.3	-	-	201 (3.22)	18.8		22.0 (3.2)	21.5 (3.5)		1.16	2400 (16.6)	SHAMROCK® 391, 392
	JADE® 30	66.8	-	1.3	-	0.2	-	29.3	-	-	203 (3.22)	17.9		13.4 (1.9)	13.6 (2.0)		-	1700 (11.7)	SHAMROCK® 394
SERV® 16	80.4	-	2.0	-	0.1	-	16.0	-	-	204 (3.27)	16.0		26.0 (2.7)	26.0 (2.7)		1.10	3000 (20.7)	SHAMROCK® 391, 392	
SERV® 16 DC	80.4	-	2.0	-	0.1	-	16.0	-	-	204 (3.27)	16.0		26.0 (2.7)	26.0 (2.7)		1.10	3000 (20.7)	SHAMROCK® 391, 392	
CENTAUR 50																			
CENTAUR 95																			
Zoned glass sidewall blocks consisting of JADE® 50 DCX over JADE® 30 DC																			
Zoned glass sidewall blocks consisting of JADE® 95 DC over JADE® 30 DC																			

Material	CASTABLES	Chemical Composition wt. %										Material Required pcf (g/cm³)	Storage Life (months)	Water to Cast (wt. %)	Installation Methods*	MOR after 220°F (105°C)	
		Al ₂ O ₃	ZrO ₂	SiO ₂	MgO	Cr ₂ O ₃	Fe ₂ O ₃	TiO ₂	CaO	Other	lb/ft² (N/mm²)					CS after 220°F (105°C)	
ALUMINA -SILICA	VERSAFLOW® 57A PLUS	609	-	35.6	0.1	-	0.7	0.6	1.8	0.3	156 (2.5)	12	6.5	V, P, S		2200 (15.2)	11,500 (79.3)
	VERSAFLOW® 60 PLUS	602	-	34.2	0.2	-	1.1	2.4	1.6	0.3	148 (2.4)	12	6.6	C, V, P		1600 (11.0)	15,000 (103.4)
	VERSAFLOW® 45 PLUS	446	-	49.4	0.2	-	0.7	2.2	2.4	0.5	132 (2.1)	12	7.5	C, V, P		1050 (7.2)	8500 (58.6)
	KS-4® PLUS	449	-	42.6	0.3	-	2.3	2.3	6.7	0.9	122 (2.0)	12	13.5	C, V		900 (6.3)	4150 (28.5)
	SENTINEL® RC	376	-	42.5	0.9	-	1.5	2.0	14.4	0.8	128 (2.1)	12	11.0	C, V, P		2000 (13.8)	8300 (57.2)
AZS	MARCON® MZA CASTABLE	42.3	34.8	21.1	-	-	0.1	0.1	0.8	0.2	198 (3.2)	12	3.8	V		2000 (13.8)	9400 (64.8)
	ZIRMULCAST	66.1	19.9	13.4	-	-	-	-	-	0.6	190 (3.0)	9	5.5	V, P		700 (4.8)	2700 (18.6)
ZIRCONIUM -SILICATE	TZ® 452 CASTABLE	5.1	58.6	34.1	-	-	-	-	0.6	1.4	214 (3.4)	6	4.7	V		2600 (17.7)	14,000 (96.6)
HIGH- PURITY ALUMINA	GREENCAST® 94 F PLUS	96.4	-	0.1	-	-	0.1	-	3.1	0.3	176 (2.82)	6	6.2	P		2500 (17.2)	10,000 (69.0)
	TAYCOR® 414-FH HYDROCAST	94.8	-	-	0.1	-	0.1	-	4.3	0.1	175 (2.8)	12	10	V		1500 (10.3)	9100 (62.7)
	GREFCON® 98T	98.1	-	0.1	-	-	-	-	1.4	0.1	185 (3.0)	12	5.7	V		1400 (9.7)	12,000 (82.7)
ALUMINA -CHROME	MIZZOU® CASTABLE PLUS	59.2	-	34.9	0.1	-	1.0	2.1	2.3	0.4	141 (2.26)	12	9	C, V		1300 (9.0)	8600 (59.3)
	JADECAST® 95	9.8	-	-	-	86.5	-	-	-	3.7	223 (3.6)	4	5.2	V, P		1100 (9.7)	-
	JADECAST® 50	36.3	-	5.3	0.4	54.9	0.2	0.2	0.7	2.2	212 (3.4)	6	4.7	V, P		1200 (8.3)	3200 (22.1)
INSULATING	JADESHOT 50	39.8	-	4.4	0.5	-	52.5	0.3	0.8	1.3	209 (3.35)	6	5.5	S		720 (5.8)	-
	JADECAST® 30	65.7	-	3.1	-	29.6	-	-	-	1.6	200 (3.2)	4	4.7	V, P		800 (5.5)	3000 (20.7)
	KAST-O-LITE® 23 LI PLUS	30.6	-	55.2	0.2	-	0.9	0.9	10.1	2.1	50 (0.8)	12	5.4	C, G		120 (0.8)	300 (2.1)
Material	KAST-O-LITE® 26 LI PLUS	43.2	-	41.4	0.5	-	1.6	2.2	9.9	1.2	86 (1.4)	12	20	C		700 (4.8)	3500 (24.1)
	KAST-O-LITE® 30 LI PLUS	55.5	-	36.1	0.2	-	0.9	1.3	4.9	1.1	92 (1.47)	12	17	C		500 (3.4)	2200 (15.2)
	MORTARS																
ALUMINA - SILICA	SAIRBOND	40.2	-	52.8	0.2	-	-	1.1	2.1	0.2	3.4	air	12.0	dry	21	400 (181)	
	SAIRSET®	35.0	-	60.0	0.0	-	-	1.0	1.7	0.2	2.1	air	6.0	wet	-	350 to 400 (159 to 181)	
	TASIL® 301 TR MORTAR	50.0	-	45.0	0.1	-	-	1.0	1.1	0.1	2.8	air	3.0	wet	-	450 to 500 (205 to 225)	
	MEXI-KOMO®	50.1	-	45.4	0.2	-	-	1.4	2.1	0.2	2.4	heat	12.0	dry	27	350 to 400 (159 to 181)	
	SATANITE	59.4	-	35.7	0.3	-	-	1.2	2.3	0.1	1.0	heat	12.0	dry	29.1	275 (125)	
AZS	TASIL® 317 MORTAR	51.0	-	44.0	0.1	-	-	1.0	1.0	0.1	2.6	air	12.0	dry	27	350 to 400 (160 to 180)	
HIGH- PURITY ALUMINA	ZIRMUL® 362 MORTAR	50.0	31.0	15.0	-	-	2.5	0.1	0.1	-	1.1	heat	12.0	dry	19	525 (238)	
	TAYCOR® 342 DRY MORTAR	96.0	-	3.0	-	-	-	0.1	0.1	-	0.4	heat	12.0	dry	23	475 (218)	
	GREENSET® 94-P	92.0	-	1.2	0.1	-	6.2	0.1	0.1	0.1	0.2	heat	6.0	wet	-	600 (270)	
	KORUNDAL® BOND	82.8	-	14.5	-	-	-	0.2	0.3	0.1	2.1	air	12.0	dry	24	425 (193)	
	TZ® 352 DRY MORTAR	1.0	60.0	32.0	-	-	4.7	-	-	-	1.0	heat	12.0	dry	14	600 to 650 (270-295)	
ZIRCONIUM - SILICATE	TZ® 702 DRY MORTAR	0.6	66.0	33.0	-	-	-	0.1	0.2	-	0.3	heat	12.0	dry	13	625 (284)	
	TZ® 716 DRY MORTAR	0.7	62.0	35.0	-	-	-	0.1	0.2	-	2.1	air	12.0	dry	19	625 (284)	
BASIC	NARMAG® MORTAR HEAT SET	0.3	-	1.1	95.3	-	-	0.4	-	0.8	1.6	heat	6.0	dry	25	550 (249)	
ALUMINA - CHROME	SHAMROCK® 391-TR MORTAR	67.5	-	2.5	-	28.9	-	-	-	-	1.1	air	3.0	wet	-	625 to 675 (284 to 306)	
	SHAMROCK® 392 DRY MORTAR	67.1	-	-	-	29.8	2.9	-	-	-	0.2	heat	12.0	dry	17	550 (249)	
	SHAMROCK® 394 DRY MORTAR	23.8	-	1.2	-	74.9	-	-	-	-	0.1	heat	12.0	dry	20	625 (283)	
SILICA	SILSET	0.3	-	96.8	0.1	-	-	0.2	0.1	-	2.5	air	12.0	dry	23	350 (159)	
	VEGABOND®	0.6	-	99.0	-	-	-	0.1	0.1	0.1	0.2	heat	12.0	dry	38	350 (159)	

Material	PATCHES	Chemical Composition wt. %									Material Required pcf (g/cm³)	Storage Life (months)	Shipping Conditions	MOR after Temp. lb/in² (N/mm²)		
		Al₂O₃	ZrO₂	SiO₂	MgO	Cr₂O₃	P₂O₅	Fe₂O₃	TiO₂	CaO				Other	2000°F (1093°C)	2500°F (1371°C)
AZS	ZIRMUL®160 PATCH	56.8	25.9	12.6	-	-	4.4	0.1	0.1	-	0.1	200 (3.2)	12.0	wet	2600 (179)	3100 (21.4)
HIGH-PURITY ALUMINA	SHOTKAST®TAB	96.5	-	0.05	-	-	3.2	0.05	-	0.05	-	170 (2.7)	3.0	wet	-	-
	KORUNDAL® HOT GUN MIX ADTECH®	88.8	-	8.4	0.1	-	-	0.4	0.5	1.6	0.2	141 (2.3)	12.0	dry	500 (3.4)	-
ZIRCONIUM + SILICATE	TZ® 150 PATCH	0.2	63.6	31.3	-	-	4.4	0.1	0.3	0.1	-	230 (3.7)	12.0	wet	3700 (25.5)	3900 (26.9)
SILICA	VISIL® PATCH	0.4	-	99.4	-	-	-	0.1	-	-	0.1	80 (1.3)	12.0	dry	-	-
	CROWNSEAL	0.4	-	98.6	-	-	-	-	-	0.3	0.7	108 (1.7)	6.0	dry	-	-
	SHOTKAST®FS	0.2	-	99.4	-	-	-	0.1	-	0.08	0.22	109 (1.7)	12.0	2-component	1100 (7.6)	-
ALUMINA -CHROME	SHAMROCK 192 PATCH	73.4	-	0.2	-	22.4	3.7	0.1	-	-	0.2	200 (3.2)	8.0	wet	-	5600 (38.6)

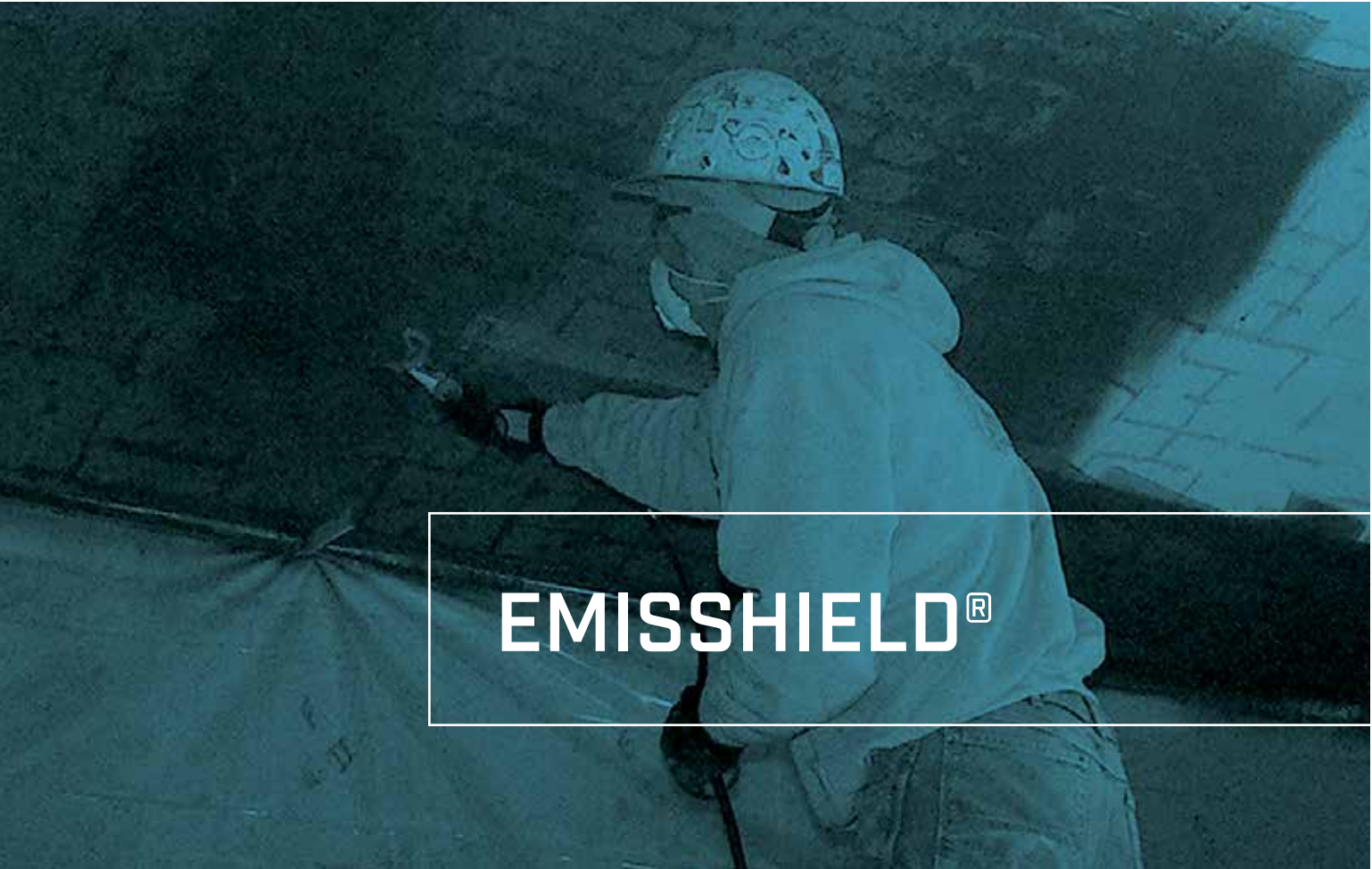
Material	RAMS	Chemical Composition, wt. %										Material Required pcf (g/cm³)	Storage Life (months)	Shipping Conditions	MOR after Temp. lb/ft² (N/mm²)	
		Al₂O₃	ZrO₂	SiO₂	MgO	Cr₂O₃	P₂O₅	Fe₂O₃	TiO₂	CaO	Other				2000°F (1093°C)	2500°F (1371°C)
ALUMINA - SILICA	BRIKRAM 57 RB	57.6	-	36.1	0.3	-	3.9	0.9	0.7	0.3	0.2	160 (2.6)	6.0	wet	-	1300 (9.0)
AZS	ZIRMUL® 260 RAM MIX	67.8	19.3	9.6	-	-	3.0	0.1	0.1	-	0.1	200 (3.2)	12.0	wet	1600 (11.3)	2360 (16.3)
HIGH-PURITY ALUMINA	TAYCOR® 248 RAM	98.2	-	1.0	0.1	-	-	0.1	-	-	0.6	175 (2.8)	3.0	wet	800 (5.5)	-
ZIRCONIUM -SILICATE	TZ® 717-W RAM MIX	1.0	64.5	33.9	-	-	-	0.1	-	0.1	0.4	220 (3.5)	12.0	wet	1900 (13.1)	3400 (23.4)
	TZ® 748 RAM MIX	1.0	63.4	32.7	-	-	2.4	0.1	0.3	-	-	225 (3.6)	12.0	wet	2300 (15.9)	2900 (20.0)
ALUMINA -CHROME	SHAMROCK® 296 RAM	80.1	-	0.1	-	15.1	4.4	0.1	-	-	0.2	200 (3.2)	4.0	wet	3300 (22.8)	4200 (29.0)
	SHAMROCK® 30 RAM	65.1	-	0.1	-	28.2	5.3	0.1	-	-	0.2	200 (3.2)	4.0	wet	-	6000 (41.4)
Material	PLASTICS	Chemical Composition, wt. %										Material Required pcf (g/cm³)	Storage Life (months)	Shipping Conditions	MOR after Temp. lb/ft² (N/mm²) 2500°F (1371°C)	
		Al₂O₃	ZrO₂	SiO₂	MgO	Cr₂O₃	P₂O₅	Fe₂O₃	TiO₂	CaO	Other					
ALUMINA -SILICA	SUPER HYBOND® 60 PLUS	58.9	-	36.9	0.2	-	-	1.2	2.2	0.1	-	158 (2.53)	4.0	wet	700 (4.8)	
	SUPER HYBOND® PLUS	44.0	-	49.9	0.3	-	-	1.4	2.7	0.5	-	146 (2.3)	4.0	wet	600 (4.1)	
ZIRCONIUM -SILICATE	TZ® 951 PLASTIC	2.4	63.0	31.2	-	-	2.1	0.2	0.6	0.4	-	215 (3.4)	25 days	wet	2900 (20.0)	
AZS	ZIRMUL® 960 PLASTIC	58.4	25.0	14.0	-	-	2.2	0.1	0.1	0.1	-	190 (3.0)	1.5	wet	2300 (16.0)	
HIGH-PURITY ALUMINA	PLASTECH® 90P	90.0	-	4.9	0.1	-	4.3	0.1	0.1	0.2	-	197 (3.2)	6.0	wet	1800 (12.4)	
ALUMINA -CHROME	SHAMROCK® 885 PLASTIC	67.5	-	0.2	-	29.7	2.4	0.1	-	-	-	220 (3.5)	4.0	wet	-	

FUSED CAST AZS

HarbisonWalker International and DY have had a joint collaboration to produce the TIGER® product line since 2005. Since the foundation, DY has adopted the special equipment and advanced oxidizing technology on producing high quality fused cast blocks which are used in glass furnaces. The annual production capacity has reached 30,000 tons already.

Products have been exported to more than 50 countries all over the world, including the major glass producers in United States and European Union. The manufacturing facility is ISO 14001:2004, ISO 9001:2008, and OHSAS 18001:2007 Certified.

PRODUCTS		TIGER® AZS 33	TIGER® AZS 36	TIGER® AZS 41
Chemical wt. %	Al ₂ O ₃	50.5	47.4	45.8
	ZrO ₂	33.0	36.0	41.0
	SiO ₂	15.0	14.0	12.0
Bulk Density lb/ft³ [g/cm³]		237 (3.80)	242 (3.88)	248 (3.97)
Apparent Porosity [%]		1.0	1.0	1.0
k @ Mean Temp Btu/ft²/hr [W/mK]	1472°F [800°C] 2°F [800°C]	23.1 (3.35)	23.1 (3.35)	23.5 (3.40)
	2192°F [1200°C]	26.6 (3.85)	26.6 (3.85)	26.5 (3.85)
Thermal Expansion % @2552°F [1400°C]		0.72	0.72	0.71
CCS lb/in² [MPa]		37,700 (260)	37,700 (260)	40,600 (280)
Recommended Mortar		ZIRMUL® 362	ZIRMUL® 362	ZIRMUL® 362



Emisshield® is a high-emissivity ceramic coating that is offered exclusively by HWI for application in glass furnaces. Now in over 100 furnaces worldwide, Emisshield® works hard to minimize heat loss and increase efficiency. HWI also provides in-house installation services for all Emisshield® coatings. This technology has revolutionized the glass industry by providing:

- Lower operating costs
- More even heating
- Increased productivity
- Longer refractory life
- Increased fuel savings
- Decreased NOx
- Reduced carbon footprint

The Emisshield® product was originally developed by NASA to protect space vehicles. In these applications, the coating is designed to modify the surface of the substrate on which it is placed to increase the emissivity and therefore the amount of energy radiated from it. In space applications, temperatures can range from subzero to over 3000°F in a matter of seconds. The Emisshield® coating was designed to maintain adhesion and not lose its emissivity under these conditions. Emisshield® comes in a variety of formulas designed to adhere to various substrates, whether they be refractory or metal alloys. Most versions are applied just 2–3 mils thick—the thickness of a garbage bag—and are capable of operating at temperatures up to 3500°F.

SERVICE LIKE YOU'VE NEVER SEEN

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.

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

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

ADVANCED TECHNOLOGY AND RESEARCH CENTER (ATRC)

HWI has an ATRC center 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. 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)

GLOBAL SOURCING CENTERS

- North American global sourcing centers are strategically located to provide 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 glass 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.

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

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

EDUCATION AND TRAINING

- Ongoing educational seminars at our Advanced Technology and Research Center
- Customized, on-site training for iron and steel customers upon request
- Iron and steel 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 local US 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. And we can take your inventory or new build to the next level. To learn more, talk with a HarbisonWalker International representative at **800-492-8349** or visit **thinkhwi.com**.

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