



# WAM<sup>®</sup> AL TECHNOLOGY

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## FOR

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## ALUMINUM



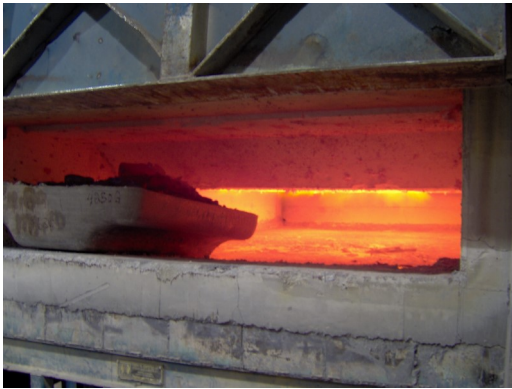
Global **Refractory** Solutions



# WAM<sup>®</sup> AL TECHNOLOGY

## REDUCE COST IMPROVE QUALITY MINIMIZE MAINTENANCE

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The WAM<sup>®</sup> AL technology consists of a family of products that address the diverse refractory needs of the aluminum industry. Each product incorporates properties that allow it to solve specific application issues associated with a variety of metal contact processes.

All products within this family are comprised of high purity synthetic materials with only trace amounts of silica ( $\text{SiO}_2$ ) and other oxidizing compounds, which contribute to undesirable corundum formation. Each WAM<sup>®</sup> AL product exhibits excellent resistance to molten aluminum as a result of its unique chemical formulation.

This base technology is the building block for the family of products that allows for complete furnace lining designs which:

- **Reduce energy consumption**
- **Minimize required maintenance**
- **Increase furnace performance**
- **Lessen the total cost of ownership for your refractory linings**

## BEAT THE CORUNDUM CONUNDRUM

Corundum forms as a result of aluminum metal reacting with the refractory. When excessive corundum forms, it reduces energy efficiency, furnace throughput, increases maintenance, and ultimately causes metal loss. Corundum growth can be minimized by limiting available oxygen sources, including components of refractory linings. This, in combination with managing heat sources, maintenance, and metal quality, can reduce your costs to produce.

Traditional refractory linings developed for the aluminum market can contain as much as 20%-30% silica. WAM<sup>®</sup> AL products contain less than 0.3% silica, reducing the possibility of corundum formation as a result of metal interaction with the refractory lining.

Operators can improve operational efficiency, reduce maintenance costs, and shorten cleaning outages. The WAM<sup>®</sup> AL family of products has been developed with installers in mind, so no special installation methods or equipment are required.

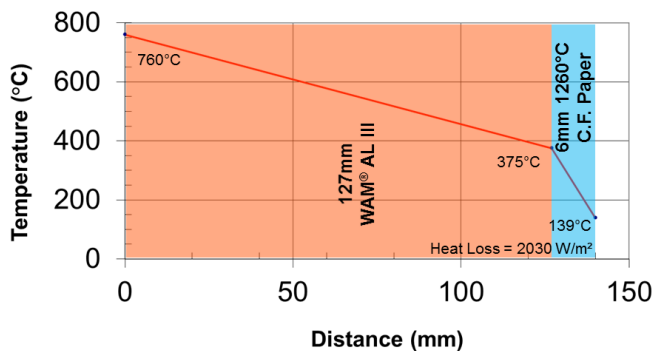


# IMPROVE YOUR BOTTOM LINE

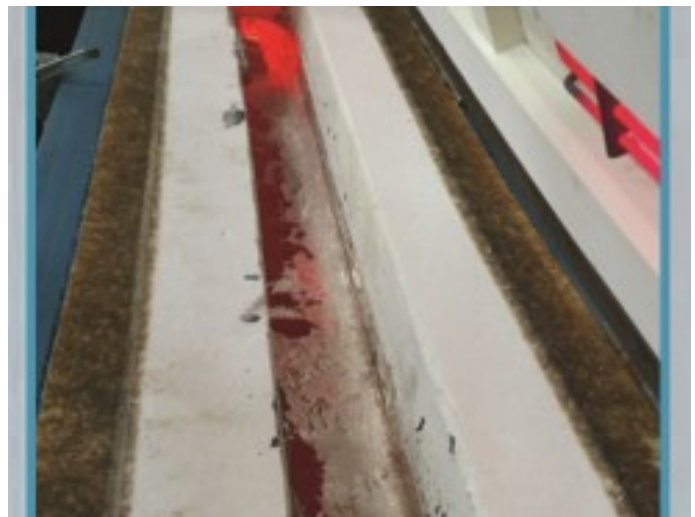
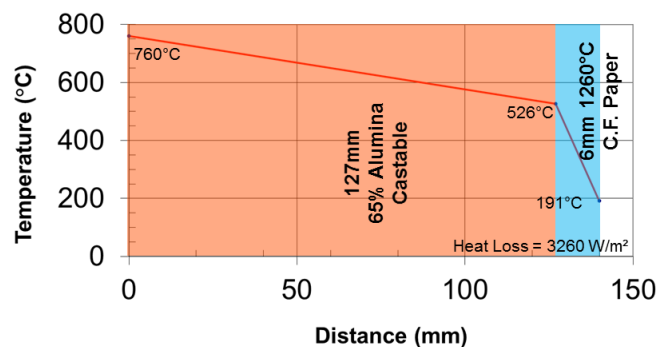
The total cost of a refractory is the sum of the cost to purchase the refractory, install the refractory, and maintain the refractory. The patented refractory technology in the WAM® AL family of products helps to inhibit the formation of corundum, which extends refractory life and reduces maintenance cost.

WAM® AL castables exhibit excellent insulating properties and exceptional resistance to thermal shock. Due to excellent corrosion resistance, this family of products increases furnace performance and energy savings compared to typical low cement castables. The WAM® AL family of products provides the lowest total cost of ownership by maintaining their thermal and non-wetting properties.

**WAM® AL III  
Steady State Heat Flow  
with Heat Loss**



**65% Alumina Castable  
Steady State Heat Flow  
with Heat Loss**







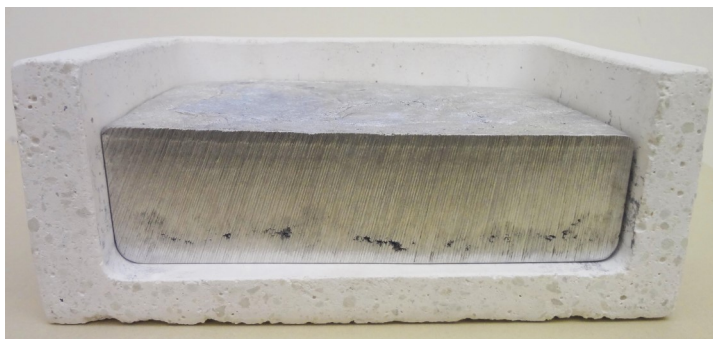
# WAM® AL PRODUCT FAMILY

## AL II - Castable

A medium density, low thermal conductivity castable for metal contact use in holding furnaces, melting furnaces, launders, transport vessels and ancillary metal handling applications.

## AL III - Castable

NEW generation of WAM® AL product that exhibits exceptional thermal shock resistance and improved installation characteristics.



WAM® AL III aluminum contact testing

## AL II HDF - High Density

Dense, low water castable to address the need for high strength in impact areas, ramps, sills, and reverb sidewalls.

## AL III HD - High Density

Dense, low water castable that addresses the most aggressive alkali environments.



WAM® AL III vessel after metal has been removed

## AL II G - Gun Mix

Medium density gun mix for repairing existing metal contact linings.



## AL II HDF G - Gun Mix

Dense gun mix designed to repair existing metal contact linings.





# STACKMELTER

## STACK

ARMORMAX® 70 SR (upper)  
MATRIFLO 85 ACX  
MATRIFLO 93 AC  
MATRIPUMP 72 ACX  
QUICK CAST® 61 ACX

## BURNERS

KAST TECH 60  
LCF 798A  
MATRIPHOS 85 AC

## ROOF

MATRIPUMP 50  
MATRIPUMP AR 61  
KAST TECH 60

## HEARTH & WALLS

WAM®AL II  
WAM®AL III  
WAM®AL II HDF  
WAM®AL III HD  
QUICK CAST® 61 ACX  
QUICK-FIRE® 88  
MATRICAST 70 AC

## ROOF

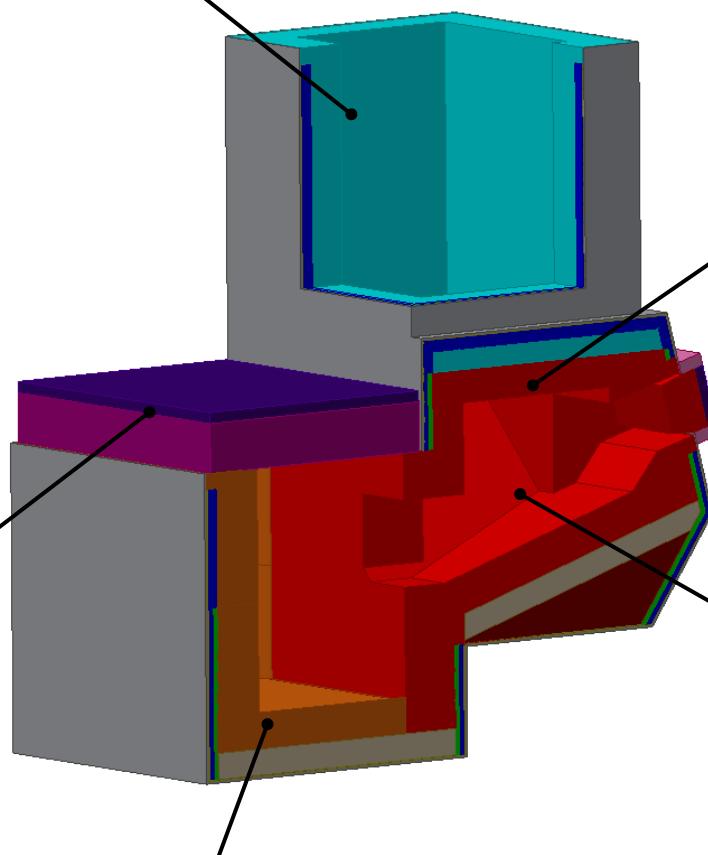
KAST TECH 60  
MATRIPUMP AR 61  
QUICK CAST® 62

## WALLS / HEARTH / RAMP

WAM®AL II HDF  
WAM®AL III HD  
MATRIFLO 85 ACX  
MATRIPUMP 72 ACX  
MATRIFLO 93 AC

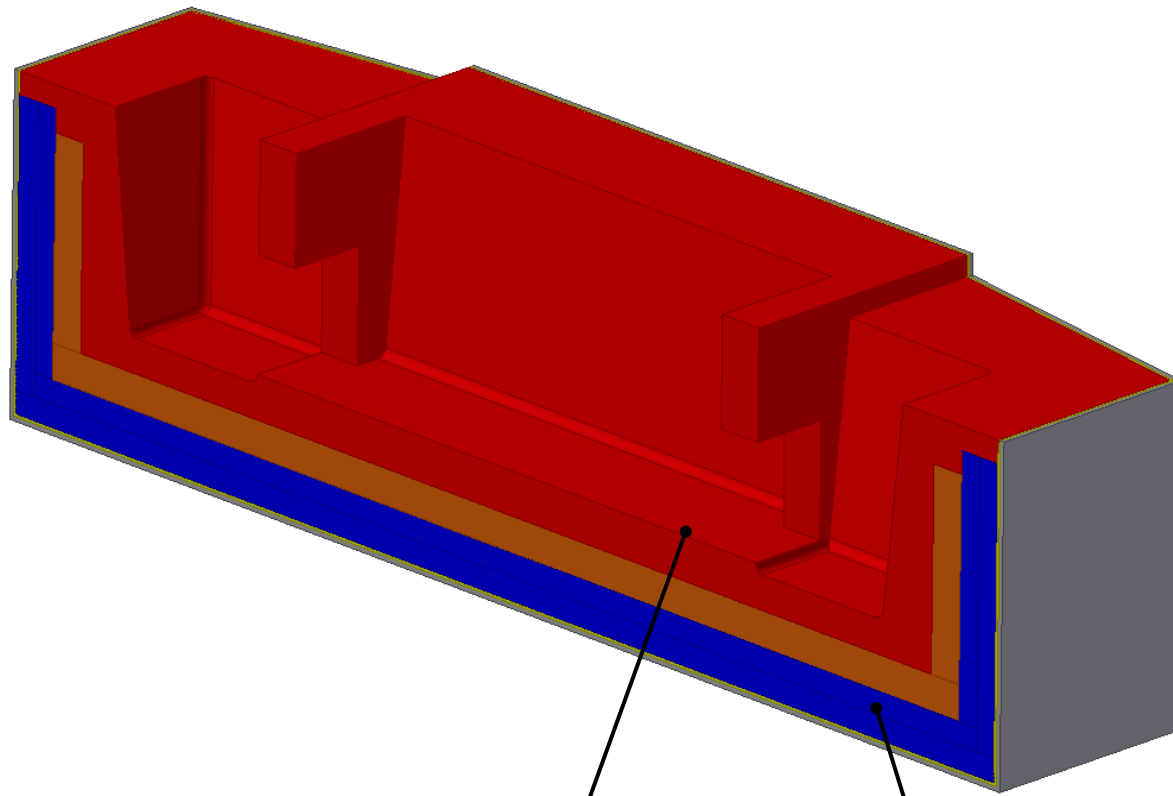
## REPAIRS

WAM®AL II G  
WAM®AL III HDF G  
QUICK-FIRE® 85 G  
BETAGUN® ABR  
QUICK-FIRE® PATCH B





# DIE CASTING HOLDER



## **FURNACE LINING**

**WAM® AL II**

**WAM® AL III**

MATRIPUMP 63 ACX

MTRICAST 70 AC

MATRIFLO 85 ACX

QUICK-FIRE® 88

## **SAFETY LINING**

DRI-LITE® 79AL-M

BETAMAX® 24 LT



# TECHNICAL DATA

## General Technical Data

	WAM® AL II Castable	WAM® AL II HDF Castable	WAM® AL III	WAM® AL III HD
Typical Water Required	18 - 23%	6.5 - 7.5%	17 - 21%	7.6 - 8.4%
Material Required	1.97 g/cm <sup>3</sup> (123 lb/ft <sup>3</sup> )	2.43 g/cm <sup>3</sup> (152 lb/ft <sup>3</sup> )	1.84 g/cm <sup>3</sup> (115 lb/ft <sup>3</sup> )	2.71 g/cm <sup>3</sup> (169 lb/ft <sup>3</sup> )
Maximum Recommended Service Temperature	1430°C (2600 °F)	1700°C (3100 °F)	1200°C (2200 °F)	1650°C (3000 °F)
Installation Method	Vibration Casting	Vibration Casting	Vibration Casting	Vibration Casting

## Chemical Analysis

	WAM® AL II Castable	WAM® AL II HDF Castable	WAM® AL III	WAM® AL III HD
Al <sub>2</sub> O <sub>3</sub>	61.4%	63.5%	75.5%	87.4%
SiO <sub>2</sub>	0.7%	0.2%	0.4%	0.8%
CaO	26.7%	25.4%	22.7%	11.4%
TiO <sub>2</sub>	0.3%	0.1%	-	-
Fe <sub>2</sub> O <sub>3</sub>	0.3%	0.2%	0.2	0.1
MgO	0.3%	0.2%	0.3	-
Alkalis (K <sub>2</sub> O + Na <sub>2</sub> O)	0.3%	0.4%	0.2	0.3
Other	10.0%	10.0%	-	-

## Thermal Conductivity

	WAM® AL II Castable	WAM® AL II HDF Castable	WAM® AL III	WAM® AL III HD
400°C (750°F)	0.76 W/mK (5.3 BTU·in / ft <sup>2</sup> ·hr·°F)	2.06 W/mK (14.3 BTU·in / ft <sup>2</sup> ·hr·°F)	0.82 W/mK (5.7 BTU·in / ft <sup>2</sup> ·hr·°F)	1.75 W/mK (12.2 BTU·in / ft <sup>2</sup> ·hr·°F)
800°C (1470°F)	0.69 W/mK (4.8 BTU·in / ft <sup>2</sup> ·hr·°F)	1.77 W/mK (12.3 BTU·in / ft <sup>2</sup> ·hr·°F)	0.73 W/mK (5.1 BTU·in / ft <sup>2</sup> ·hr·°F)	1.47 W/mK (10.2 BTU·in / ft <sup>2</sup> ·hr·°F)
1200°C (2200°F)	0.76 W/mK (5.3 BTU·in / ft <sup>2</sup> ·hr·°F)	1.87 W/mK (13.0 BTU·in / ft <sup>2</sup> ·hr·°F)	-	1.50 W/mK (10.4 BTU·in / ft <sup>2</sup> ·hr·°F)



# TECHNICAL DATA

## Density

	WAM® AL II Castable	WAM® AL II HDF Castable	WAM® AL III	WAM® AL III HD
110°C (230°F)	2.15 g/cm <sup>3</sup> (134 lb/ft <sup>3</sup> )	2.50 g/cm <sup>3</sup> (156 lb/ft <sup>3</sup> )	2.02 g/cm <sup>3</sup> (126 lb/ft <sup>3</sup> )	2.82 g/cm <sup>3</sup> (176 lb/ft <sup>3</sup> )
815°C (1500°F)	1.97 g/cm <sup>3</sup> (123 lb/ft <sup>3</sup> )	2.43 g/cm <sup>3</sup> (152 lb/ft <sup>3</sup> )	1.84 g/cm <sup>3</sup> (115 lb/ft <sup>3</sup> )	2.71 g/cm <sup>3</sup> (169 lb/ft <sup>3</sup> )
1400°C (2550 °F)	1.97 g/cm <sup>3</sup> (123 lb/ft <sup>3</sup> )	2.37 g/cm <sup>3</sup> (148 lb/ft <sup>3</sup> )	1.71 g/cm <sup>3</sup> (107 lb/ft <sup>3</sup> )	2.63 g/cm <sup>3</sup> (164 lb/ft <sup>3</sup> )

## Modulus of Rupture

	WAM® AL II Castable	WAM® AL II HDF Castable	WAM® AL III	WAM® AL III HD
110°C (230°F)	7.3 MPa (1060 psi)	14.1 MPa (2090 psi)	9.7 MPa (1410 psi)	15.0 MPa (2170 psi)
815°C (1500°F)	3.7 MPa (540 psi)	8.6 MPa (1250 psi)	3.9 MPa (570 psi)	14.3 MPa (2070 psi)
1370°C (2500 °F)	3.9 MPa (570 psi)	7.0 MPa (1020 psi)	4.6 MPa (660 psi)	13.5 MPa (1960 psi)

## Cold Crushing Strength

	WAM® AL II Castable	WAM® AL II HDF Castable	WAM® AL III	WAM® AL III HD
110°C (230°F)	35.5 MPa (5150 psi)	90.2 MPa (13089 psi)	45.2 MPa (6550 psi)	97.9 MPa (14200 psi)
815°C (1500°F)	30.9 MPa (4480 psi)	89.7 MPa (13010 psi)	20.0 MPa (2900 psi)	106.2 MPa (15400 psi)
1370°C (2500 °F)	20.0 MPa (2900 psi)	66.1 MPa (9580 psi)	18.4 MPa (2675 psi)	73.1 MPa (10600 psi)

## Permanent Linear Change

	WAM® AL II Castable	WAM® AL II HDF Castable	WAM® AL III	WAM® AL III HD
110°C (230°F)	0.0%	-0.1%	-0.10%	0.1%
815°C (1500°F)	-0.2%	-0.3%	-0.2%	-0.1%
1370°C (2500 °F)	-0.5%	-0.5%	1.4%	0.0%





# ABOUT ALLIED

Allied Mineral Products is a world leader in the design and manufacture of monolithic refractories and precast shapes. With strong sales and service teams in the foundry, aluminum, steel, heat treat/forge and industrial markets, our success is based on our dedication to *Being There Worldwide with Refractory Solutions*.

Producing quality, consistent products is top priority at Allied and we have the products to meet your refractory needs. Our extensive product line includes innovative refractory technology and longstanding refractory alternatives.

Allied's focus on quality at every stage in the production process is unparalleled. A stringent raw material standard and global quality control testing before and after each batch is produced, provides customers with consistent products. We provide quick response times to any urgent request through flexible manufacturing systems at all our manufacturing facilities.

## Global **Refractory** Solutions



**13 MANUFACTURING FACILITIES**  
OVER 145 INTERNATIONAL SALES REPRESENTATIVES  
**3 RESEARCH AND TECHNOLOGY FACILITIES**  
SALES ACTIVITY IN MORE THAN 100 COUNTRIES  
**6 PRECAST SHAPES FACILITIES**



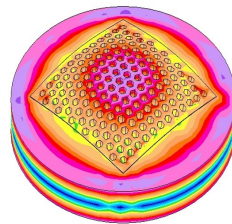
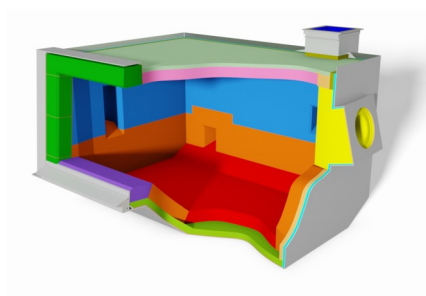
# RESEARCH & ENGINEERING

After gaining a detailed understanding of your specific needs, our team evaluates operating criteria and physical design parameters to create a detailed engineered design encompassing:

- Patented technologies
- Optimized product zoning
- Thermal models to optimize and validate designs
- Proven safety lining system designs
- Unique installation properties and techniques
- Leading edge refractory system designs

We're focused on developing new products, improving existing products and perfecting installation techniques. Our product development and testing is conducted in our state of the art research and technology center. We have an on-site gunning and shotcreting lab allowing extensive testing of installation properties.

As an innovative, technology-driven supplier we're devoted to providing customized refractory solutions for various industry operations. We offer a wide variety of high performance refractory products with superior raw material quality.



FEA Thermal Analysis



Flow Testing



Contact Tests



Strength Tests





°C



NOTES

refractory



$\Sigma$

research



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thermal expansion

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The Allied Difference

Being There Worldwide with Refractory Solutions



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