Product Data Book

Morgan Advanced Materials

THERMAL CERAMICS

THERMAL CERAMICS PRODUCTS OVERVIEW

Thermal Ceramics world leading products offer a diverse, strongly branded product range that combines quality with consistency and reliability. Thermal Ceramics leads the way in bringing technical solutions to all problems of thermal management and fire protection.

Blanket
These highly versatile Superwool®, RCF and PCW fibre blanket products are lightweight, have low thermal conductivity, low heat storage and excellent resistance to thermal shock. They are available in a variety of densities, thicknesses and temperature capabilities.

Bulk
A complete line of Superwool®, RCF and PCW fibres each of which offers its own unique combination of properties. These bulk fibres are produced by varying composition, fibre length, fibre content, fibre diameter and lubricity, available in chopped, un-chopped, lubricated and non-lubricated.

Paper and Felt
Our Paper and Felt sheet products are suitable for a variety of insulation and filtration applications. Many special grades offer properties such as no binder out-gassing, low shot content and high strength.

Modules and Log
A unique solution to high temperature insulation needs in industrial heaters, boilers and furnaces as well as many other applications. Modules and Log fibre products are easy-to-install, our Pyro-Bloc® are a proven furnace insulation that installs faster than any other ceramic fibre module on the market.

Board and Shape Fibre Products
Boards and Shapes are available as flexible or rigid products in a wide range of compositions up to 1600°C (2912°F) and a variety of standard dimensions with tolerances which can be adapted to very demanding applications. The formulations are selected to optimise performances in each application and shapes can be produced according to customer design.

Textiles
Textile products are made from highly textured forms of various fibres in both Superwool® fibre and Kao-Tex® RCF fibres. Yarn made from bulk fibre and organic binders is converted into a wide variety of woven textile forms including cloth, ropes, packing and sleeving.

Mastics
Mastic insulation from Thermal Ceramics complement our full line of refractory and fibre insulation products. This extensive offering includes pumpables, moldable, cements, and coatings, and is manufactured specifically to aid in efficient furnace, kiln, and boiler operations.

Fire Protection
Our FireMaster® passive fire protection products are high performance materials that provide high quality fire-safe solutions that do not age, ensuring reliable fire protection when needed.

Microporous insulation
Microporous insulation high temperature products feature a classification temperature up to 1100°C (2012°F). Our Min-K, WDS, and BTU brands have gained a solid reputation for the energy savings and design optimisations tha are not limited to a certain area of application, but offer a broad range to meet varying demands of many market sectors such as aerospace, power generation, and metals.

Firebrick, Insulating Firebrick (IFB) and Mortars
JM™, K®, TC® and TJM™ insulating Firebricks offer superior insulating properties, minimising energy use, combined with the ability to withstand chemical attack and high heat conditions. Both wet and dry mortars are available that are matched for use with the Thermal Ceramics IFB range.

Insulating, Dense and Special Duty Monolithics
Tri-Mor® Monolithics offer a full range of products for applications requiring high resistance to corrosion, abrasion and reducing atmospheres. They are particularly suited to applications where fast turn around of installation and repairs is important.

Fired Refractory Shapes
Individually crafted fired shapes hold up under harsh conditions. With various alumina-silica, high alumina, alumina-silica-zirconia, magnesia, zirconia, mullite, silicon carbide and fused silica compositions, these materials, marketed as Cerox® and Valcor®, offer excellent hot strengths and resistance to thermal shock and molten metals. We produce two main forms of silicon carbide - self bonded and nitride bonded.

Structural Block insulation
Our TR™ structural block insulation offers a wide range of structural insulation products used in many applications within the energy, industrial, automotive, domestic appliance and construction industries.

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Product Data Sheets: for more information on our products, please refer to the Datasheets section on our website : **www.morganthermalceramics.com**

Safety Data Sheet (SDS): are available for our products by visiting the Datasheets section of the website: **www.morganthermalceramics.com**

Superwool® is a low-biopersistent material.
Denka® is a Polycrystalline (PCW) wool fibre.

Denka and Alcen are registered trademarks of Denka Kagaku Kogyo Kabushiki Kaisha used under licence by Morgan Advanced Materials PLC.

RCF is a refractory ceramic fibre material, also know as (ASW) Alumino Silicate Wool. Morgan brands include Kaowool® and Cera® Products.

SUPERWOOL is a patented technology for high temperature insulation wools which have been developed to have a low biopersistance (information upon request).

SUPERWOOL products may be covered by one or more of the following patents, or their foreign equivalents:

SUPERWOOL products are covered by patent numbers:
US6861381, US7470641, US7651965, US7875566, US8088701, US6861381, and US8088701

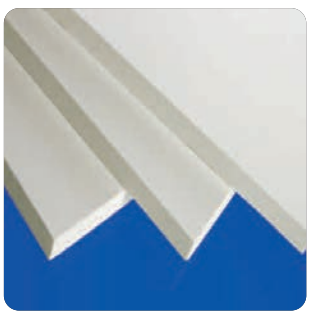
A list of foreign patent numbers is available upon request to Morgan Advanced Materials plc.

Morgan Advanced Materials plc Registered in England & Wales at Quadrant, 55-57 High Street, Windsor, Berkshire. SL4 1LP

UK Company No. 286773

PRODUCT OVERVIEW

Material types	Product form
Fibre Alkaline Earth Silicate Fibre (AES) : • Superwool® Refractory Ceramic Fibre (RCF) : • Kaowool®, Cera® Polycrystalline Fibre (PCW) : • Alphawool®, Denka®	Blanket, Bulk, Module, Log, Board, Shape, Paper, Felt, Mastic, Textile
Fired refractory Firebrick Insulating Firebrick (IFB) : • JM™, K® and TJM™	Bricks, Shapes
Monolithics : • Tri-Mor®, Kaolite®, Firecrete® Firelite®, Kaocrete®, Kao-Tuff®	Cast, Gun, Ram, Vibratory
Crucibles Fired shapes	Various chemistries
Structural Block • Vermiculite, Diatomaceous Silica	Boards, Shapes
Microporous • Min-K® • Porextherm® WDS®	Board, Panel, Flexible



Thermal Ceramics designs, manufactures and installs a broad range of thermal insulation products that reduce energy consumption and emissions in a variety of high temperature processing applications.

Our product offering is extensive and covers application needs from industrial to commercial markets and is organized into the following categories, with available product forms, typical of the high temperature insulation industry.

Fibres

Thermal Ceramics high temperature insulation wool from 600°C to 1300°C (1112°F to 2372°F) includes:

- AES and AMS : **Superwool® fibre**
- RCF : **Cera® and Kaowool®**
- PCW : **Denka®**

In use high temperature insulation wool will:

- Reduce greenhouse gas emissions
- Reduce energy usage
- Improve efficiency of furnaces and process equipment

Superwool fibre

Superwool low-biopersistent fibre has been developed to show improved high temperature characteristics required to act as an alternative to RCF where possible. The Superwool fibre family of products offer a versatile alternative to traditional insulation solutions for commercial, industrial, and transportation applications. Thermal Ceramics Superwool fibre patented technology is available as blanket, bulk, felt, paper, boards, shapes, modules and mastic products.

Benefits:

- Excellent thermal stability and insulation properties
- Low thermal conductivity
- Good resistance to tearing
- Low heat storage capacity
- Inorganic - smoke free
- Flexible, resilient and immune to thermal shock
- Good sound absorption
- Superwool fibres are not classified carcinogenic by IARC or under any national regulations on a global basis. They have no requirement for warning labels under GHS (Globally Harmonised System for the classification and labelling of chemicals). In Europe, Superwool fibre meets the requirements specified under NOTA Q of European Directive 67/548. All Superwool fibre products are therefore exonerated from the classification and labelling regulation in Europe.

Refractory Ceramic Fibre (RCF)

RCF also known as Alumino Silicate Wools (ASW) are predominantly alumina and silica. RCF is a highly versatile material spun or blown into bulk and air-laid into blanket, folded into modules, converted into papers, boards, shapes, textiles, mastics and felts.

Benefits:

- Excellent insulating performance
- Excellent thermal stability: fibres have good resistance to devitrification
- Low heat storage
- The combination of long spun fibres and the needling operation produce, resilient and strong blankets, which resist tearing both before and after heating
- Resistance to thermal shock
- Good acoustic properties
- No smoke emission due to binder burn out

Polycrystalline Wool - (PCW)

Polycrystalline fibre is produced by a sol-gel method from aqueous spinning solutions and is suitable for use at application temperatures >1300°C (2372°F) and in critical chemical and physical application conditions.

Benefits:

- Defined dimensions
- Chemical and thermal stability
- Low thermal mass and good insulating properties
- High tensile strength
- Less than 1% shot content
- Uniform fibre diameters average
- High resilience

Fired Refractories

Firebrick from Thermal Ceramics are available for temperature use up to 1788°C (3250°F) and marketed as SR-90® and SR-99®.

Insulating Firebricks (IFB) are manufactured with very low thermal conductivity and high hot load strengths. JM™, K® and TJM™ branded bricks have the ability to withstand chemical attack and high heat conditions. Both wet and dry mortars are available that are matched for use with our IFB range.

Fired Refractory Crucibles and Shapes are individually crafted as Cerox® and Valcor®. Crucibles and fired shapes hold up under harsh conditions. With various alumina-silica, high-alumina and alumina-silica-zirconia compositions, these materials offer excellent hot strengths and resistance to thermal shock and molten metals. Our Silicon Carbide are produced from two grades of Silicon Carbide - self bonded and nitride bonded.

Monolithics are available in Insulating, Dense and Special Duty. World recognised brands, the Tri-Mor® line of Kaocrete® and Firecrete® dense monolithic has been proven ideal for applications that require strong, easy to place and economical materials. Tri-Mor Kaolite® and Firelite® insulating monolithics provide low thermal conductivity values, ease of installation and superior performance in petrochemical applications.

The Tri-Mor line of special duty monolithics such as Kao-Tuff®, Plascast / Plasgun® and Kao-Tab® feature specifically enhanced properties such as resistance to corrosion, abrasion and reducing atmospheres.

Structural Block insulation is marketed under the TR™ product offering manufactured from vermiculite and diatomaceous silica. The product can be made into exact customer specifications as blocks, boards or shapes.

Microporous

Microporous insulation is available under the Porextherm® WDS® and Min-K®for transportation, industrial and consumer goods markets. Specially formulated and designed for applications such as ladle liner back-up insulation for Iron and Steel and board back-up insulation in Ethylene crackers. These lightweight, high compressive strength materials are the most thermally efficient insulation available.

OUR MARKETS

PETROCHEMICAL

Thermal Ceramics makes critical components for tough assignments in the global petrochemical industry.

TRANSPORTATION

Thermal Ceramics makes high-performance products to exacting standards for aerospace, automotive, marine and rail applications.

FIRE PROTECTION

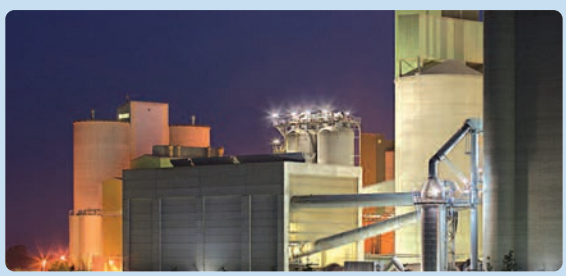
Thermal Ceramics makes high performance fire insulation products under the FireMaster® brand for passive fire protection in marine, industrial, road and rail tunnels, petrochemical and offshore and commercial applications.

INDUSTRIAL

Thermal Ceramics designs and manufactures products for use in a broad range of challenging process and manufacturing environments.

ENERGY

Thermal Ceramics develops products for power distribution and generation from renewable and traditional sources and insulation materials for heat management.



CEMENT

We manufacture and install a wide range of insulation fibre and monolithic products and work with customers to develop the right solution to extend their kiln's life span or speed with advanced technology to reduce downtime.

CERAMICS & GLASS

As a major producer of high temperature insulating products, Thermal Ceramics understands the firing conditions of this industry and the lining requirements placed upon our materials.

IRON & STEEL

Thermal Ceramics is uniquely positioned, technically and geographically, to offer a comprehensive range of advanced refractory engineered solutions for the complete iron and steel process.

ALUMINIUM

Thermal Ceramics play a major role in the production and processing of aluminium, providing the industry with the widest selection of refractories and high temperature insulating materials on the market.

HEALTHCARE

Morgan Advanced Materials produces components used in medical monitoring and diagnostic instrumentation and tools for treatment and surgery.

ELECTRONICS

Morgan Advanced Materials makes components that help the electronics industry in its drive towards higher performance and reliability in smaller, lighter, more robust products.

SECURITY & DEFENCE

Morgan Advanced Materials supplies precision engineered materials, components and assemblies to meet the exacting standards of the international defence and security markets.

Section 01

Blanket products

Blanket products

AES blankets
- Superwool® Plus
- Superwool HT
- Superwool AC2

RCF blankets
- Kaowool®
- Cerablanket®
- Cerachem®
- Cerachrome®

PCW blankets
- Denka®

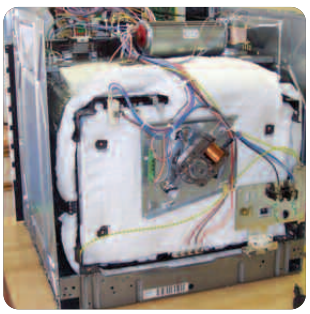
Thermal Ceramics blankets are available in a wide range of chemistries, densities and dimensions.

Blankets are air laid into a continuous mat and mechanically needled for added strength and surface integrity. Blanket can be folded, compressed and encapsulated to produce modules.

High temperature insulation blankets is a material for use in high temperature applications such as the insulating lining of metallurgical ovens and furnaces, petrochemical heaters, and ceramic kilns.

In use high temperature insulation blankets will:
- Contribute to protecting people and property from excessive heat
- Reduce greenhouse gas emissions
- Reduce energy usage
- Improve efficiency of furnaces and process equipment

Common characteristics are:
- Low thermal conductivity
- Excellent thermal shock resistance
- Low heat storage capacity
- Inorganic - smoke free



Typical applications - for high temperature insulation blankets:

- HRSG duct and stack insulation linings
- Chimney insulation
- Process heater linings
- Pipe wrap
- Annealing furnace linings
- Furnace and kiln back-up insulation
- Storage heater insulation
- Domestic oven insulation
- Automotive exhaust heat shields
- Aluminium transfer launder covers
- Welding stress relief

Typical benefits - for high temperature insulation blankets:

- Excellent thermal insulation properties
- Excellent thermal stability: fibres have good resistance to devitrification
- Low thermal conductivity
- Good resistance to tearing
- Low heat storage capacity
- Flexible and resilient
- Immune to thermal shock
- Good sound absorption
- Excellent insulating performance

Superwool® blanket - grades available:

Superwool Plus fibre :
classification 1200°C (2192°F)
Superwool HT fibre :
classification 1300°C (2372°F)

Benefits of Superwool blanket:

- Free of binder or lubricant
- AES fibres are not classified carcinogenic by IARC or under any national regulations on a global basis.

  They have no requirement for warning labels under GHS (Globally Harmonised System for the classification and labelling of chemicals). In Europe, Superwool fibre meets the requirements specified under NOTA Q of European Directive 67/548. All Superwool fibre products are therefore exonerated from the classification and labelling regulation in Europe.

PCW blanket - grades available:

Denka® :
classification 1600°C (2912°F)

Benefits of PCW blanket:

- Produced from high alumina or mullite fibre
- Lowest possible shot content <1% shot

RCF blanket - grades available:

Kaowool® blanket :
classification 1260°C (2300°F)
Kaowool blanket S :
classification 1260°C (2300°F)
Cerablanket® :
classification 1260°C (2300°F)
Kaowool blanket SZr :
classification 1430°C (2606°F)
Cerachem® blanket:
classification 1430°C (2606°F)
Cerachrome® blanket :
classification 1430°C (2606°F)

Benefits of RCF blanket:

- No smoke emission due to binder burn out

Blanket Products - AES fibres - Superwool®

	Superwool Plus					Superwool HT	
Color	white					white	
Continuous Use Temperature, °C (°F)	1000 (1832)					1150 (2102)	
Classification Temperature, °C (°F)	1200 (2192)					1300 (2372)	
Density, kg/m³ (pcf)	64, 80, 96, 128, 160 (4, 5, 6, 8, 10)					64, 96, 128, 160 (4, 6, 8, 10)	
Tensile Strength, kPa (psi), EN 1094-1							
Measured Density,kg/m³ (pcf), 64 (4)	30					30	
80 (5)	45					-	
96 (6)	55					50	
128 (8)	75					90	
160 (10)	90					95	
Chemical Analysis, % weight basis after firing							
Silica, SiO_2	62-68					70-80	
Calcium oxide + Magnesium oxide, CaO + MgO	29-39					18-25	
Other	<1					<3	
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201							
Measured Density,kg/m³ (pcf)	64 (4)	80 (5)	96 (6)	128 (8)	160 (10)	96 (6)	128 (8)
200°C (392°F)	0.06 (0.42)	0.06 (0.42)	0.05 (0.35)	0.05 (0.35)	0.04 (0.28)	0.05 (0.35)	0.04 (0.28)
400°C (752°F)	0.11 (0.76)	0.09 (0.62)	0.09 (0.62)	0.08 (0.55)	0.07 (0.48)	0.10 (0.69)	0.08 (0.55)
600°C (1112°F)	0.18 (1.25)	0.15 (1.04)	0.14 (0.97)	0.12 (0.83)	0.11 (0.76)	0.19 (1.32)	0.14 (0.97)
800°C (1472°F)	0.29 (2.01)	0.24 (1.66)	0.21 (1.46)	0.18 (1.25)	0.16 (1.11)	0.32 (2.22)	0.23 (1.59)
1000°C (1832°F)	0.42 (2.91)	0.36 (2.50)	0.29 (2.01)	0.25 (1.73)	0.23 (1.59)	0.48 (3.33)	0.34 (2.36)
1200°C (2192°F)	-	-	-	-	-	0.69 (4.79)	0.48 (3.33)

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Blanket Products - RCF fibres - Kaowool®

	Kaowool Blanket	Kaowool Blanket S	Kaowool Blanket SZr
Manufacturing locations	NA	AS	AS
Color	white	white	white
Continuous Use Temperature, °C (°F)	1093 (2000)	-	-
Classification Temperature, °C (°F)	1260 (2300)	1260 (2300)	1425 (2600)
Density, kg/m³ (pcf)	64, 96, 128 (4, 6, 8)	64, 96, 128, 160 (4, 6, 8, 10)	64, 96, 128, 160 (4, 6, 8, 10)
Linear shrinkage, %, EN 1094-1, After 24 hrs, isothermal heating			
1000°C (1832°F)	-	1.5	-
1100°C (2012°F)	-	2.2	-
1200°C (2192°F)	-	3.0	1.0
1300°C (2372°F)	-	5.5	2.0
1400°C (2552°F)	-	-	3.0
Tensile Strength, kPa (psi), EN 1094-1			
Measured Density,kg/m³ (pcf), 64 (4)	-	39 (6)	39 (6)
96 (6)	-	78 (11)	78 (11)
128 (8)	-	103 (15)	103 (15)
160 (10)	-	127 (18)	127 (18)
Specific Heat Capacity, kj/kg•K (BTU/lb•F)			
1090°C (1994°F)	1.13 (0.27)	1.13 (0.27)	1.13 (0.27)
Chemical Analysis, % weight basis after firing			
Alumina, Al_2O_3	45	44	34.9
Silica, SiO_2	50-55	56	50
Ferric oxide, Fe_2O_3	1.0	-	-
Zirconia, ZrO_2	-	-	15.2
Titanium oxide, TiO_2	2.2	-	-
Alkalies, $NaO_2 + K_2O$	0.2	0.1	0.1
Other	trace	trace	trace
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201			
Measured Density,kg/m³ (pcf)	128 (8)	64 (4)	128 (8)
200°C (392°F)	-	0.07 (0.49)	0.06 (0.42)
260°C (500°F)	0.06 (0.44)	-	-
400°C (752°F)	-	0.12 (0.83)	0.10 (0.69)
538°C (1000°F)	0.12 (0.87)	-	-
600°C (1112°F)	-	0.2 (1.39)	0.15 (1.04)
800°C (1472°F)	-	0.3 (2.08)	0.20 (1.39)
816°C (1500°F)	0.21 (1.45)	-	-
1000°C (1832°F)	-	0.43 (2.98)	0.27 (1.87)
1093°C (2000°F)	0.3 (2.09)	-	-

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Blanket Products - RCF fibres - Cera®

	Cerachem®	Cerablanket®	Cerachrome®
Color	white	white	blue/green
Continuous Use Temperature, °C (°F)	1315 (2400)	-	1371 (2500)
Classification Temperature, °C (°F)	1425 (2600)	1260 (2300)	1425 (2600)
Density, kg/m³ (pcf)	64, 96, 128, 160 (4, 6, 8, 10)	64, 96, 128, 160 (4, 6, 8, 10)	64, 96, 128, 160 (4, 6, 8, 10)
Linear shrinkage, %, EN 1094-1, After 24 hrs, isothermal heating			
1000°C (1832°F)	-	1.5	1.5
1100°C (2012°F)	-	2.2	2.2
1200°C (2192°F)	1.0	3	2.7
1300°C (2372°F)	2.0	-	3.5
1400°C (2552°F)	3.5	-	4
1500°C (2732°F)	-	-	5
Specific Heat Capacity, kj/kg•K (BTU/lb•F)			
1090°C (1994°F)	1.13 (0.27)	1.13 (0.27)	1.13 (0.27)
Tensile Strength, kPa (psi), EN 1094-1			
Measured Density,kg/m³ (pcf), 64 (4)	30 (4.35)	30 (4.35)	30 (4.35)
96 (6)	70 (10.15)	70 (10.15)	65 (9.43)
128 (8)	90 (13.05)	90 (13.05)	85 (12.33)
160 (10)	110 (15.95)	110 (15.95)	-
Chemical Analysis, % weight basis after firing			
Alumina, Al_2O_3	35	44	43
Silica, SiO_2	50	56	54
Zirconia, ZrO_2	15	-	-
Ferric oxide, Fe_2O_3	-	0.05	0.15
Chromium oxide, Cr_2O_3	-	-	2.8
Alkalies, NaO_2 + K_2O	-	0.2	0.1
Other	trace	0.05	trace
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201			
Measured Density,kg/m³ (pcf)	128 (8)	128 (8)	128 (8)
200°C (300°F)	0.05 (0.35)	0.05 (0.35)	-
260°C (500°F)	0.06 (0.42)	0.06 (0.42)	0.06 (0.44)
400°C (752°F)	0.08 (0.56)	0.08 (0.56)	0.09 (0.62)
538°C (1000°F)	0.11 (0.77)	0.11 (0.77)	0.13 (0.93)
600°C (1112°F)	0.13 (0.90)	0.13 (0.90)	0.13 (0.90)
800°C (1472°F)	0.19 (1.32)	0.19 (1.32)	0.18 (1.25)
816°C (1500°F)	0.20 (1.36)	0.20 (1.36)	0.23 (1.6)
1000°C (1832°F)	0.27 (1.87)	0.27 (1.87)	0.25 (1.73)
1093°C (2000°F)	0.31 (2.17)	0.31 (2.17)	0.34 (2.34)

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Blanket Products - PCW fibres - Denka® Alcen®

	Denka Alcen NBK80	Denka Alcen NBK95	Denka Alcen NBK80-10	Denka Alcen NBK80-13	Denka Alcen Mat B80L
Color	white	white	white	white	white
Classification Temperature, °C (°F)	1600 (2912)	1600 (2912)	1600 (2912)	1600 (2912)	1600 (2912)
Melting Temperature, °C (°F)	2000 (3632)	2000 (3632)	2000 (3632)	2000 (3632)	2000 (3632)
Density, kg/m³ (pcf)	96, 128 (6, 8)	96 (6)	96 (6)	128 (8)	-
Fiber diameter, µm	3-5	3-5	3-5	3-5	3-5
Linear shrinkage, %, EN 1094-1, After 24 hrs, isothermal heating					
1371°C (2500°F)	<1	-	-	-	-
1500°C (2732°F)	-	-	<2.0	<2.0	-
1600°C (2912°F)	1.5	-	-	-	-
Tensile Strength, kPa (psi), EN 1094-1					
Measured Density, kg/m³ (pcf), 96 (6)	-	65 (9.43)	-	-	-
128 (8)	-	85 (12.33)	-	-	-
Specific Heat Capacity, kj/kg•K (BTU/lb•F)					
1090°C (1994°F)	1.13 (0.27)	1.13 (0.27)	1.13 (0.27)	1.13 (0.27)	1.13 (0.27)
Chemical Analysis, % weight basis after firing					
Alumina, Al_2O_3	80	95	80	80	80
Silica, SiO_2	20	5	19	19	19
Other	trace	trace	trace	trace	trace
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201					
Measured Density,kg/m³ (pcf)	96 (6)	-			
260°C (500°F)	0.05 (0.38)				
538°C (1000°F)	0.11 (0.74)				
816°C (1500°F)	0.19 (1.3)				
1093°C (2000°F)	0.3 (2.07)				
1371°C (2500°F)	0.44 (3.04)				

Safety Data Sheet (SDS): are available for all products.
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Blanket Products - Acoustical grades

	Cerablanket® AC1	Cerablanket AC2	Superwool® Plus AC2
Color	white	white	white
Continuous Use Temperature, °C (°F)	1177 (2150)	1177 (2150)	-
Classification Temperature, °C (°F)	1315 (2400)	1315 (2400)	1100 (2012)
Density, kg/m³ (pcf)	48, 64 (3, 4)	48, 64 (3, 4)	48 (3)
Tensile Strength, kPa (psi), EN 1094-1			
Measured Density, kg/m³ (pcf) 64 (4)	0.28 (0.04)	0.42 (0.06)	-
Acoustic performance, per ASTM C522			
Airflow resistivity, Rayls/m	25,000 - 40,000	10,000 - 15,000	10,000 - 15,000
Chemical Analysis, % weight basis after firing			
Alumina, Al_2O_3	45-47	45-47	<0.3
Silica, SiO_2	53-55	53-55	60-70
Calcium oxide + Magnesium oxide, CaO + MgO	-	<0.08	24-40
Other	0-1	0-1	-
Leachable Chlorides, ppm	<10	<10	<10
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201			
Density, kg/m³ (pcf)	48 (3)	64 (4)	48 (3)
200°C (392°F)	-	0.08 (0.56)	0.09 (0.62)
260°C (500°F)	0.08 (0.56)	-	-
300°C (572°F)	-	0.125 (0.87)	0.14 (0.97)
400°C (752°F)	-	0.193 (1.34)	0.22 (1.53)
500°C (932°F)	-	0.285 (1.98)	0.32 (2.22)
538°C (1000°F)	0.19 (1.32)	-	-
600°C (1112°F)	0.23 (1.60)	0.4 (2.78)	0.44 (3.05)
800°C (1472°F)	0.36 (2.50)	-	-
900°C (1652°F)	0.47 (3.26)	-	-
1000°C (1832°F)	0.54 (3.75)	-	-

Blanket Products - Tank Car Blankets

	Kaowool® Tank Car Blanket	Superwoo® Plus Tank Car Blanket
Color	white	white
Continuous Use Temperature, °C (°F)	-	1000 (1832)
Classification Temperature, °C	1260 (2300)	1200 (2192)
Density, kg/m³ (pcf)	64 (4)	64 (4)
Chemical Analysis, % weight basis after firing		
Alumina, Al_2O_3	45	-
Silica, SiO_2	53	62-68
Calcium oxide + Magnesium oxide, CaO + MgO	-	29-39
Other	2	<1
Leachable Chlorides, ppm	-	trace
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201		
Density, kg/m³ (pcf)	64 (4)	64 (4)
260°C (500°F)	0.08 (0.54)	0.07 (0.48)
538°C (1000°F)	0.19 (1.29)	0.14 (1.0)
816°C (1500°F)	0.25 (1.73)	0.27 (1.87)
982°C (1800°F)	-	0.37 (2.55)
1093°C (2000°F)	0.32 (2.19)	0.44 (3.07)

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Blanket Hardware

Features

- Studs and washers available in 304SS, 310SS, 330SS, and Inconel 601 for use up to 1121°C (2050°F)
- Design of Kao-Lok anchor permits quick installation
- Ceramic cone anchor available as closure to increase use temperatures up to 1260°C (2300°F)
- Ceramic Screw features true mullite formulation

Kao-Lok™ Anchors, Washers and Studs are a combination refractory and stainless steel designed to be used with Thermal Ceramics blanket wallpaper furnace linings.

Kao-Lok Studs in lengths of 89mm (3½ in) and longer have five notches which allow adjustment in compressing the blanket when installing the Kao-Lok Washer or the cone anchor. Stud lengths less than 89mm (3½ in) have only two notches.

Kao-Lok Washers are designed so the washer allows for ease of handling. When properly installed, the washer will remain in place on roofs and in severe vibration applications.

Kao-Lok Ceramic Cone Anchors can be used in lengths of 80 and 100mm (3 and 4 in), with or without plug, to service temperatures up to 1260°C (2300°F). The Cone Anchor is made from a 50% Al_2O_3, 47% SiO composition. The void in the cone anchor is normally packed with a Thermal Ceramics Moldable product. A 100mm (4 in) diameter washer with a 41mm (15/8 in) I.D. hole with a stress relief slot is available for use with the cone anchors to cover a larger surface area to spread the weight and load of the insulation materials.

These 38mm (1½ in) square 26-ga thick interference fit washers are very useful when installing ceramic fibre linings using Kao-Lok Studs.

Thermal Ceramic Screw is a <70% mullite formulation which provides an enhanced operating temperature range and provides superior thermal shock resistance.

Anchoring systems designed for fibre furnace linings.

Section 02

Bulk products

Bulk products

AES bulk
- **Superwool® Plus**
- **Superwool HT**

RCF bulk
- **Kaowool®**
- **Cerafiber®**
- **Cerachem®**
- **Cerachrome®**
- **Enfil™ Engineered fibres**

PCW bulk
- **Denka®**

Thermal Ceramics bulk fibres serves as the foundation for our entire line of fibre products.

Bulk consists of a loose mass of randomly orientated normally long, fluffy cotton wool like fibres collected after fiberisation which have not been altered:

- Needled into a blanket
- Converted into paper, boards and shapes
- Woven into yarns to produce textile products
- Blended into liquid binders for pumpables and coatings

Bulk fibres can be engineered by changing length, fibre diameter, shot content and lubricity. They offer unique solutions to many industrial applications such as expansion joint construction and base seals as well as automotive applications in filtration and friction insulation.

In use high temperature insulation bulk fibres will:

- Contribute to protecting people and property from excessive heat
- Reduce greenhouse gas emissions
- Reduce energy usage
- Improve efficiency of furnaces and process equipment

Typical applications - for high temperature insulation bulk fibres:

- Raw material for the manufacturing of finished products such as boards, paper, shapes, yarns etc
- Reinforcement for insulating concretes and cements
- Chimney fill
- Fire door infill
- Kiln car infill
- Packing expansion joints
- Loose insulating fill for complex spaces and difficult access

Typical benefits - for high temperature insulation bulk fibres:

- Excellent thermal insulation properties
- Excellent thermal stability: fibres have good resistance to devitrification
- Low thermal conductivity
- Low heat storage capacity
- Flexible and resilient
- Excellent insulating performance
- Lightweight

Superwool® bulk - grades available:

Superwool Plus fibre :
classification 1200°C (2192°F)
Superwool HT fibre :
classification 1300°C (2372°F)

Benefits of Superwool bulk:

- Superwool bulk is virtually immune to thermal shock
- No reaction with alumina based bricks in application in the range of typical use temperature
- Low biopersistence
- Excellent thermal insulating performance
- Based on patented technology
- AES fibres are not classified carcinogenic by IARC or under any national regulations on a global basis. They have no requirement for warning labels under GHS (Globally Harmonised System for the classification and labelling of chemicals). In Europe, Superwool fibre meets the requirements specified under NOTA Q of European Directive 67/548. All Superwool fibre products are therefore exonerated from the classification and labelling regulation in Europe.

PCW bulk - grades available:

Denka® Alcen™ bulk :
classification 1600°C (2912°F)

Benefits of PCW bulk:

- Defined dimensions
- Low linear shrinkage
- Low thermal mass and good insulating properties
- Low content of “shot” measured <1%
- High resilience
- Not classified as dangerous under EC Directive 67/548/EEC or according to self-classification guidelines

RCF bulk - grades available:

Kaowool® fibres:
classification 1260 - 1425°C (2300 - 2597°F)
Cerafibre®:
classification 1260°C (2300°F)
Cerachem® :
classification 1427°C (2600°F)
Cerachrome® :
classification 1427°C (2600°F)
Enfil™ ngineered fibres:
classification 1100 - 1425°C (2012 - 2597°F)

Benefits of RCF bulk:

- Excellent resistance to chemical attack
- Unaffected by oil, water or steam
- Very low thermal expansion
- Excellent shock and good corrosion resistance
- Low moisture absorption
- Low electrical conductivity
- Constant coefficient of friction
- Refractoriness: the fibres are stable up to elevated temperatures

Bulk Products - AES fibres - Superwool®

	Superwool Plus						
	103	100	111	112	HM-12	HM-25	HM-50
Manufacturing location	EU	EU	AS, NA, SA	AS, NA, SA	AS, NA, SA	AS, NA, SA	AS, NA, SA
Color	white	white	white	white	white	white	white
Continuous Use Temperature, °F	1832	1832	1832	1832	1832	1832	1832
Continuous Use Temperature, °C	1000	1000	1000	1000	1000	1000	1000
Classification Temperature, °F	2192	2192	2192	2192	2192	2192	2192
Classification Temperature, °C	1200	1200	1200	1200	1200	1200	1200
Specific Heat, BTU/lb•°F @ 1800°F	0.26	0.26	0.26	0.26	0.26	0.26	0.26
Specific Heat, kJ/kg•°C @ 982°C	1.08	1.08	1.08	1.08	1.08	1.08	1.08
Fiber Index, %	-	-	45-70	45-70	50-70	50-70	50-70
Lubrication	Yes	No	Yes	No	No	No	No
Chemical Analysis, % weight basis after firing							
Silica, SiO_2	62-68	62-68	62-68	62-68	62-68	62-68	62-68
Calcium oxide + Magnesium oxide, CaO + MgO	29-39	29-39	29-39	29-39	29-39	29-39	29-39
Other	<1	<1	<1	<1	<1	<1	<1
Leachable Chlorides, ppm	<10	<10	<10	<10	<10	<10	<10

Bulk Products - AES fibres - Superwool®

	Superwool HT						
	73	70	111	112	HM-12	HM-25	HM-50
Manufacturing location	EU	EU	AS, NA, SA	AS, NA, SA	AS, NA, SA	AS, NA, SA	AS, NA, SA
Color	white	white	white	white	white	white	white
Continuous Use Temperature, °F	2102	2102	2102	2102	2102	2102	2102
Continuous Use Temperature, °C	1150	1150	1150	1150	1150	1150	1150
Classification Temperature, °F	2372	2372	2372	2372	2372	2372	2372
Classification Temperature, °C	1300	1300	1300	1300	1300	1300	1300
Specific Heat, BTU/lb•°F @ 1800°F	0.26	0.26	0.26	0.26	0.26	0.26	0.26
Specific Heat, kJ/kg•°C @ 982°C	1.08	1.08	1.08	1.08	1.08	1.08	1.08
Fiber Index, %	-	-	45-70	45-70	50-70	50-70	50-70
Lubrication	Yes	No	Yes	No	No	No	No
Chemical Analysis, % weight basis after firing							
Silica, SiO_2	70-80	70-80	70-80	70-80	70-80	70-80	70-80
Calcium oxide + Magnesium oxide, CaO + MgO	21-28	21-28	21-28	21-28	21-28	21-28	21-28
Other	<3	<3	<3	<3	<3	<3	<3
Leachable Chlorides, ppm	<10	<10	<10	<10	<10	<10	<10

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Bulk Products - RCF fibres - Kaowool®

	Kaowool Bulk Fibres					
	BN	**D**	**A**	**HM-12**	**HM-25**	**HM-50**
Manufacturing location	NA	NA	NA	NA	NA	NA
Color	white/off-white	white/off-white	white/off-white	white/off-white	white/off-white	white/off-white
Continuous Use Temperature, °F	2000	2000	2000	2000	2000	2000
Continuous Use Temperature, °C	1093	1093	1093	1093	1093	1093
Classification Temperature, °F	2300	2300	2300	2300	2300	2300
Classification Temperature, °C	1260	1260	1260	1260	1260	1260
Specific Heat, BTU/lb•°F @ 1800°F	0.26	0.26	0.26	0.26	0.26	0.26
Specific Heat, kJ/kg•°C @ 980°C	1.07	1.07	1.07	1.07	1.07	1.07
Specific Gravity, g/cm3	-	-	2.56	-	-	-
Fiber Index, %	45-55	45-55	45-55	50	50	50
Lubrication	No	No	Yes	No	No	No
Chemical Analysis, % weight basis after firing						
Alumina, Al_2O_3	45	45	45	45	45	45
Silica, SiO_2	50-55	50-55	50-55	50-55	50-55	50-55
Other	-	-	-	-	-	-
Leachable Chlorides, ppm	<10	<10	<10	<10	<10	<10

Bulk Products - RCF fibres - Cerafibre®

	Cerafibre						
	111	**112**	**HM-12**	**HM-25**	**HM-50**	**520**	**10**
Manufacturing location	AS, NA, SA	AS, NA, SA	AS, NA, SA	AS, NA, SA	AS, NA, SA	EU	EU
Color	white	white	white	white	white	white	white
Continuous Use Temperature, °F	2150	2150	2150	2150	2150	1150	1150
Continuous Use Temperature, °C	1177	1177	1177	1177	1177	2150	2150
Classification Temperature, °F	2400	2400	2400	2400	2400	2300	2300
Classification Temperature, °C	1315	1315	1315	1315	1315	1300	1300
Specific Heat, BTU/lb•°F @ 1800°F	0.26	0.26	0.26	0.26	0.26	-	-
Specific Heat, kJ/kg•°C @ 980°C	1.07	1.07	1.07	1.07	1.07	-	-
Fiber Index, %	45-55	45-55	50	50	50	-	-
Lubrication	Yes	No	No	No	No	Yes	No
Chemical Analysis, % weight basis after firing							
Alumina, Al_2O_3	46	46	46	46	46	44	44
Silica, SiO_2	54	54	54	54	54	56	56
Other	trace	trace	trace	trace	trace	trace	trace
Leachable Chlorides, ppm	<10	<10	<10	<10	<10	<10	<10

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Bulk Products - RCF fibres - Cerachem®

	Cerachem						
	111	112	HM-12	HM-25	HM-50	51	50 Chopped
Manufacturing location	AS, NA, SA	AS, NA, SA	AS, NA, SA	AS, NA, SA	AS, NA, SA	EU	EU
Color	white	white	white	white	white	white	white
Continuous Use Temperature, °F	2400	2400	2400	2400	2400	2400	2400
Continuous Use Temperature, °C	1315	1315	1315	1315	1315	1300	1300
Classification Temperature, °F	2600	2600	2600	2600	2600	2600	2600
Classification Temperature, °C	1425	1425	1425	1425	1425	1425	1425
Specific Heat, BTU/lb•°F @ 1800°F	0.26	0.26	0.26	0.26	0.26	-	-
Specific Heat, kJ/kg•°C @ 980°C	1.07	1.07	1.07	1.07	1.07	-	-
Fiber Index, %	45-55	45-55	50	50	50	-	-
Lubrication	Yes	No	No	No	No	Yes	No
Chemical Analysis, % weight basis after firing							
Alumina, Al_2O_3	35	35	35	35	35	35	35
Silica, SiO_2	50	50	50	50	50	50	50
Zirconium oxide, Zr_2O_3	15	15	15	15	15	15	15
Leachable Chlorides, ppm	<10	<10	<10	<10	<10	-	-

Bulk Products - RCF fibres - Cerachrome®

	Cerachrome				
	111	112	HM-12	HM-25	HM-50
Color	blue/green	blue/green	blue/green	blue/green	blue/green
Continuous Use Temperature, °F	2500	2500	2500	2500	2500
Continuous Use Temperature, °C	1371	1371	1371	1371	1371
Classification Temperature, °F	2600	2600	2600	2600	2600
Classification Temperature, °C	1425	1425	1425	1425	1425
Specific Heat, BTU/lb•°F @ 1800°F	0.26	0.26	0.26	0.26	0.26
Specific Heat, kJ/kg•°C @ 980°C	1.07	1.07	1.07	1.07	1.07
Fiber Index, %	45-55	45-55	50	50	50
Lubrication	Yes	No	No	No	No
Chemical Analysis, % weight basis after firing					
Alumina, Al_2O_3	43	43	43	43	43
Silica, SiO_2	54	54	54	54	54
Chromium oxide, Cr_2O_3	3	3	3	3	3
Leachable Chlorides, ppm	<10	<10	<10	<10	<10

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Bulk Products - PCW fibres - Denka® Alcen®

	Denka Alcen
Color	white
Classification Temperature, °C (°F)	1600 (2912)
Melting Temperature, °C (°F)	2000 (3632)
Fiber diameter, µm	3-5
Shot content, %	negligible
Chemical Analysis, % weight basis after firing	
Alumina, Al_2O_3	97
Silica, SiO_2	3
Other	<0.5

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Section 03

Modules and Log products

Modules and Log products

Pyro-Bloc® Modules
- Pyro-Bloc Y
- Pyro-Bloc M
- Pyro-Bloc HS
- Thermo-Bloc®
- Pyro-Bloc Corner-Bloc

Pyro-Log™ and Pyro-Packing™

Folded and Stacked Blanket Modules
- Pyro-Fold™
- Pyro-Stack™
- Z-Blok™
- Z-Max™
- Unibloc®

Veneering Modules

For more than 50 years, Thermal Ceramics' Pyro-Bloc modules have been the industry standard for furnace and boiler linings. The Pyro-Bloc module is a versatile choice for many applications.

In the Petrochemical and Power Generation markets Pyro-Bloc modules are thermal insulation solutions in radiant heater sections and HRSG ductwork and auxiliary burners and in the Ceramics and Glass markets Pyro-Bloc modules are located in the kiln lining and base for kiln cars.

Thermal Ceramics exclusive Pyro-Bloc products have set the standard for quality and versatility in furnace and boiler lining systems. Modules are manufactured from Pyro-Log, a monolithic ceramic fibre that is fabricated into modules that offer superior performance and durability.

Modules

A unique solution to high temperature insulation needs in industrial heaters, boilers and furnaces as well as many other applications.

Logs

An uncompressed monolithic mass of fibre. Pyro-Log fibre is the basic building block for all Pyro-Bloc applications. All Pyro-Log fibre is produced with a special lubricant that allows the fibre to be intensely needled to attain varying densities. At moderate temperatures this lubricant burns out and the fibre becomes rigid enough to stand on.

Typical applications - for high temperature insulation wool - Modules and Log products:

- **Ceramic and glass :** kiln lining, low mass kiln cars, furnace doors
- **Refining :** distillation heater lining
- **Heat treatment / metal working :** linings
- **Non ferrous :** annealing furnace, heat treating furnace
- **Power generation/boilers :** cogeneration ducts, silencers
- **Iron and steel :** walking beam furnace skid rail insulation, re-heat, strip-annealing, rotary hearth and roller hearth furnaces, carbonizing and lift-off furnaces
- **Petrochemical :** process heaters, reformers, ductwork pyrolysis heaters

Superwool®, RCF and PCW Modules and Log:

Pyro-Bloc®
Modules comprise two sections of Pyro-Logs in edge-grain orientation which are held in position with two stainless steel tubes mounted transversely through the modules and remote from the hot face. They are anchored to the furnace casing with the patented Pyro-Bloc hardware in any one of four standard versions, Y, M, T and Eye-bolt.

Lightweight with low heat storage providing a durable service with all the advantages of our standard ceramic fibre blanket products in a pre-compressed modular form and offer non-exposed anchoring, economical installation and a positive mechanical attachment.

Thermo-Bloc®:
Manufactured from two sections of Pyro-Log™ slabs in edgegrain orientation, installed with a pre-studded, external, side-fixed yoke. The Pyro-Log slabs can be held in position by two additional stainless steel tubes mounted transversely through the modules and remote from the hot face. The side fixed yokes fit in these tubes.

Pyro-Log:
High density needled monolithic slabs are the only needled mass of fibre available in standard uncompressed densities up to 240kg/m^3 (15 pcf). Standard thickness availability is 152 and 200mm (6 and 8 in) thick

Vertically-fibreised Pyro-Log fibre is of exceptional uniformity of dimensions and of naturally low shot content.

Z-Blok™ I, II, and III:
Folded modules available in three design configurations; Z-Blok I has a slide channel that runs perpendicular to the folds, it slides onto a disc or clip that has been attached to the steel casing. Z-Blok II features stainless steel suppport beams that impale the module and are oriented at right angles to the module pleats, and Z-Blok III has a C-Channel that runs parallel to the module folds and is typically attached to the steel casing with a welded stud and nut.

Pyro-Fold™ and Pyro-Stack™:
High quality fibre blanket, compressed and banded with plastic strips, including two stainless steel tubes mounted transversely through the strips remote from the hot face. They can be anchored to the furnace casing in any one of four standard versions, Y, M, T and Eye-bolt.

Modules and Log Products - AES fibres - Pyro-Bloc® Superwool®

	Pyro-Bloc Superwool Plus		Pyro-Bloc Superwool HT	
Color	white		white	
Continuous Use Temperature, °C (°F)	1000 (2000)		1200 (2200)	
Classification Temperature, °C (°F)	1200 (2200)		1300 (2372)	
Density, kg/m³ (pcf)	128, 160, 192, 240 (8, 10, 12, 15)		160, 192 (10, 12)	
Specific heat, J/kg•°C (BTU/lb•°F), 1090°C (1994°F)	1.05 (0.25)		1.22 (0.29)	
Linear shrinkage, %, EN 1094-1, After 24 hrs, isothermal heating				
1000°C (1832°F)	<1.5		0.2	
1100°C (2012°F)	-		0.5	
1200°C (2192°F)	-		0.8	
Chemical Analysis, % weight basis after firing				
Alumina, Al_2O_3	trace		trace	
Silica, SiO_2	62-68		70-80	
Calcium oxide + Magnesium oxide, CaO + MgO	29-39		18-25	
Other	<1		<1	
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201				
Density, kg/m³ (pcf)	160 (10)	192 (12)	160 (10)	192 (12)
200°C (392°F)	0.06 (0.42)	0.70 (0.52)	0.07 (0.48)	0.07 (0.49)
260°C (500°F)	0.07 (0.52)	0.08 (0.55)	0.08 (0.57)	0.08 (0.58)
400°C (752°F)	0.10 (0.69)	0.10 (0.69)	0.12 (0.83)	0.12 (0.81)
538°C (1000°F)	0.12 (0.85)	0.13 (0.90)	0.17 (1.18)	0.16 (1.10)
600°C (1112°F)	0.14 (0.97)	0.14 (0.97)	0.20 (1.37)	0.18 (1.24)
800°C (1472°F)	0.18 (1.25)	0.19 (1.32)	0.31 (2.12)	0.26 (1.79)
816°C (1500°F)	0.18 (1.29)	0.20 (1.38)	0.31 (2.19	0.26 (1.84)
1000°C (1832°F)	0.23 (1.59)	0.26 (1.80)	0.44 (3.07)	0.35 (2.46)
1093°C (2000°F)	-	-	0.52 (3.59)	0.40 (2.81)

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Modules and Log Products - AES fibres - Pyro-Log™ Superwool®

	Pyro-Log Superwool Plus		Pyro-Log Superwool HT	
Color	white		white	
Continuous Use Temperature, °C (°F)	1000 (2000)		1200 (2200)	
Classification Temperature, °C (°F)	1200 (2200)		1300 (2372)	
Density, kg/m³ (pcf)	160, 192 (10, 12)		160, 192 (10, 12)	
Specific heat, J/kg•°C (BTU/lb•°F), 1090°C (1994°F)	-		1.22 (0.29)	
Linear shrinkage, %, EN 1094-1, After 24 hrs, isothermal heating				
1000°C (1832°F)	<1.5		0.2	
1100°C (2012°F)	-		0.5	
1200°C (2200°F)	-		0.8	
Chemical Analysis, % weight basis after firing				
Silica, SiO_2	62-68		70-80	
Calcium oxide + Magnesium oxide, CaO + MgO	26-32 / 3-7		18-25	
Others	<1		<3	
Loss of Ignition, LOI, 2 hrs @ 800°C (1472°F)	<0-25		<0-25	
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201				
Density, kg/m³ (pcf)	160 (10)	192 (12)	160 (10)	192 (12)
200°C (392°F)	0.06 (0.42)	0.70 (0.52)	0.07 (0.48)	0.07 (0.49)
260°C (500°F)	0.07 (0.52)	0.08 (0.55)	0.08 (0.57)	0.08 (0.58)
400°C (752°F)	0.10 (0.69)	0.10 (0.69)	0.12 (0.83)	0.12 (0.81)
538°C (1000°F)	0.12 (0.85)	0.13 (0.90)	0.17 (1.18)	0.16 (1.10)
600°C (1112°F)	0.14 (0.97)	0.14 (0.97)	0.20 (1.37)	0.18 (1.24)
800°C (1472°F)	0.18 (1.25)	0.19 (1.32)	0.31 (2.12)	0.26 (1.79)
816°C (1500°F)	0.18 (1.29)	0.20 (1.38)	0.31 (2.19	0.26 (1.84)
1000°C (1832°F)	0.23 (1.59)	0.26 (1.80)	0.44 (3.07)	0.35 (2.46)
1093°C (2000°F)	-	-	0.52 (3.59)	0.40 (2.81)

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Modules and Log Products - RCF fibres - Pyro-Bloc®

	Pyro-Bloc	Pyro-Bloc	Pyro-Bloc
Fiber Grade	**R (Standard)**	**ZR**	**C**
Color	white	white	blue/green
Continuous Use Temperature, °C (°F)	1204 (2200)	1343 (2450)	1371 (2500)
Classification Temperature, °C (°F)	1316 (2400)	1425 (2600)	1425 (2600)
Density, kg/m³ (pcf)	128, 160, 192, 240 (8, 10, 12, 15)	160, 192, 240 (10, 12, 15)	192 (12)
Chemical Analysis, % weight basis after firing			
Alumina, Al_2O_3	47	37.5	43
Silica, SiO_2	53	47	54
Zirconia, ZrO_2	-	15.5	-
Chromium oxide, Cr_2O_3	-	-	3
Other	trace	trace	trace
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201			
Density, kg/m³ (pcf)	160 (10)	192 (12)	192 (12)
200°C (392°F)	0.06 (0.39)	0.06 (0.44)	-
260°C (500°F)	0.07 (0.47)	0.07 (0.50)	-
400°C (752°F)	0.10 (0.69)	0.10 (0.67)	-
538°C (1000°F)	0.14 (1.00)	0.13 (0.90)	-
600°C (1112°F)	0.17 (1.16)	0.15 (1.01)	-
800°C (1472°F)	0.26 (1.82)	0.21 (1.45)	-
816°C (1500°F)	0.27 (1.88)	0.21 (1.49)	-
1000°C (1832°F)	0.38 (2.65)	0.29 (1.99)	-
1093°C (2000°F)	0.45 (3.10)	0.33 (2.28)	-

Modules and Log Products - RCF fibres - Pyro-Bloc®

	Pyro-Bloc HS	Thermo-Bloc™	
Manufacturing location	NA	EU/AS	
Color	white/pale green	white	
Continuous Use Temperature, °C (°F)	1093 (2000)	-	
Classification Temperature, °C (°F)	1200 (2200)	1260 (2300)	
Density, kg/m³ (pcf)	unfired - 481 (30) fired - 368 (23)	160, 192 (10, 12)	
Specific heat, J/kg•°C (BTU/lb•°F), measured @ 1000°C (1832°F)	-	1.13 (0.27)	
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201			
Density, kg/m³ (pcf)	481 (30)	160 (10)	192 (12)
260°C (500°F)	0.08 (0.53)	-	-
400°C (752°F)	-	0.11 (0.76)	0.1 (0.69)
538°C (1000°F)	0.16 (1.13)	-	-
600°C (1112°F)	-	0.18 (1.25)	0.16 (1.13)
800°C (1472°F)	-	0.25 (1.73)	0.23 (1.59)
816°C (1500°F)	0.28 (1.97)	-	-
1000°C (1832°F)	-	0.34 (2.36)	0.31 (2.15)
1093°C (2000°F)	0.42 (2.95)	-	-

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Modules and Log Products - RCF fibres - Pyro-Log™

	Pyro-Log	Pyro-Log	Pyro-Log
Fiber Grade	**R (Standard)**	**ZR**	**C**
Color	white	white	blue/green
Continuous Use Temperature, °C (°F)	1204 (2200)	1343 (2450)	1371 (2500)
Classification Temperature, °C (°F)	1316 (2400)	1425 (2600)	1425 (2600)
Density, kg/m³ (pcf)	128, 160, 192, 240 (8, 10, 12, 15)	160, 192, 240 (10, 12, 15)	192 (12)
Chemical Analysis, % weight basis after firing			
Alumina, Al_2O_3	47	37.5	43
Silica, SiO_2	53	47	54
Zirconia, ZrO_2	-	15.5	-
Chromium oxide, Cr_2O_3	-	-	3
Other	trace	trace	trace
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201			
Density, kg/m³ (pcf)	160 (10)	192 (12)	192 (12)
200°C (392°F)	0.06 (0.39)	0.06 (0.44)	-
260°C (500°F)	0.07 (0.47)	0.07 (0.50)	-
400°C (752°F)	0.10 (0.69)	0.10 (0.67)	-
538°C (1000°F)	0.14 (1.00)	0.13 (0.90)	-
600°C (1112°F)	0.17 (1.16)	0.15 (1.01)	-
800°C (1472°F)	0.26 (1.82)	0.21 (1.45)	-
816°C (1500°F)	0.27 (1.88)	0.21 (1.49)	-
1000°C (1832°F)	0.38 (2.65)	0.29 (1.99)	-
1093°C (2000°F)	0.45 (3.10)	0.33 (2.28)	-

Safety Data Sheet (SDS): are available for all products.
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Modules and Log Products - AES fibres - Folded and Stacked

	Pyro-Fold™, Pyro-Stack™, Z-Blok® Superwool Plus and HT		
	Superwool Plus	**Superwool HT**	**Superwool HT Z-Blok**
Color	white	white	blue / green
Density, kg/m³ (pcf)	128, 149, 171 (8, 9.3, 10.7)	128, 149, 171 (8, 9.3, 10.7)	149, 171 (9.3, 10.7)
Thickness, 25mm (1 in) increments	102 - 305 (4 - 12)	102 - 305 (4 - 12)	102 - 305 (4 - 12)
Continuous temperature use limit, °C (°F)	1000 (2000)	1200 (2200)	1200 (2200)
Classification temperature rating, °C (°F)	1200 (2200)	1300 (2372)	1300 (2372)
Chemical Analysis, %, Weight basis after firing			
Alumina, Al_2O_3	trace	trace	trace
Silica, SiO_2	62 - 68	70 -80	70 - 80
Calcium oxide + Magnesium oxide, CaO + MgO	29 - 39	18 - 25	18 - 25
Other	<1	<1	<1

Modules and Log Products - RCF fibres - Folded and Stacked

	Z-Blok™ I Blanket Modules - Folded			Z-Blok III Blanket Modules - Folded			Pyro-Stack™ Blanket Modules - Stacked			
	Kaowool® S Blanket/ Cerablanket®	**Kaowool SZr Blanket / Cerachem® Blanket**	**Cerachrome® Blanket**	**Kaowool S Blanket/ Cerablanket**	**Kaowool SZr Blanket / Cerachem Blanket**	**Cerachrome Blanket**	**Kaowool S Blanket / Cerablanket**		**Kaowool SZr Blanket / Cerachem Blanket**	
Manufacturing location	EU	EU	EU	EU	EU	EU	EU		EU	
Color	white	white	blue/green	white	white	blue/green	white		white	
Continuous Use Temperature, °C (°F)	-	-	-	-	-	-	1260 (2300)		1425 (2600)	
Classification Temperature, °C (°F)	1260 (2300)	1425 (2600)	1425 (2600)	1260 (2300)	1425 (2600)	1425 (2600)	-		-	
Density, kg/m³ (pcf)	160 (10)	160 (10)	160 (10)	128, 160 (8, 10)	128, 160 (8, 10)	128, 160 (8, 10)	128, 160 (8, 10)		160, 192 (10, 12)	
Specific heat, J/kg•°C (BTU/lb•°F), 1090°C (1994°F)	1.13 (0.27)	1.13 (0.27)	1.13 (0.27)	1.13 (0.27)	1.13 (0.27)	1.13 (0.27)	1.13 (0.27)		1.13 (0.27)	
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201										
Density, kg/m³ (pcf)	160 (10)	160 (10)	160 (10)	128 (8)	128 (8)	160 (10)	128 (8)	160 (10)	160 (10)	192 (12)
400°C (752°F)	0.11	0.11	0.11	0.12	0.12	0.11	0.12	0.11	0.12	0.1
600°C (1112°F)	0.16	0.16	0.16	0.19	0.19	0.16	0.19	0.18	0.19	0.16
800°C (1472°F)	0.23	0.23	0.23	0.27	0.27	0.23	0.28	0.25	0.28	0.23
1000°C (1832°F)	0.31	0.31	0.31	0.36	0.36	0.31	0.38	0.34	0.38	0.31

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Modules and Log Products - RCF fibres - Folded and Stacked

	Pyro-Fold™, Pyro-Stack™, Z-Blok®, Unibloc®		
	Cerablanket® HP	Cerachem® ZR	Cerachrome® ZR
Manufacturing location	NA	NA	NA
Color	white	white	blue / green
Density, kg/m³ (pcf)	128, 149, 171 (8, 9.3, 10.7)	128, 149, 171 (8, 9.3, 10.7)	149, 171 (9.3, 10.7)
Thickness, 25mm (1 in) increments	4 - 12 (102 - 305)	4 - 12 (102 - 305)	4 - 12 (102 - 305)
Continuous temperature use limit, °C (°F)	1204 (2200)	1343 (2450)	1371 (2500)
Classification temperature rating, °C (°F)	1316 (2400)	1427 (2600)	1427 (2600)
Chemical Analysis, %, Weight basis after firing			
Alumina, Al_2O_3	46	35	43
Silica, SiO_2	54	50	54
Zirconia, ZrO_2	-	15	-
Chromium oxide, Cr_2O_3	-	-	3
Other	trace	trace	trace
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201			
Density, kg/m³ (pcf)	149 (9.3)	149 (9.3)	149 (9.3)
260°C (500°F)	0.07 (0.52)	0.07 (0.52)	0.07 (0.52)
538°C (1000°F)	0.14 (1.00)	0.14 (1.00)	0.14 (1.00)

Modules and Log Products - Veneering

	Kaowool®			Pyro-Bloc®			Unifelt®	
	HP Grade	ZR Grade	C Grade	R Grade	ZR Grade	C Grade	3000 (HT)	XT
Manufacturing location	NA	NA	NA	NA	NA	NA	NA	NA
Color	white	white	blue / green	white	white	blue / green	pink	orange
Density, kg/m³ (pcf)	128, 160 (8, 10)	128, 160 (8, 10)	128, 160 (8, 10)	128, 160, 192 (8, 10, 12)	160, 192 (10, 12)	192 (12)	112 (7)	144 (9)
Continuous Use Temperature, °C (°F)	1177 (2150)	1316 (2400)	1343 (2450)	1177 (2150)	1316 (2400)	1371 (2500)	1538 (2800)	1593 (2900)
Classification Temperature, °C (°F)	1316 (2400)	1427 (2600)	1427 (2600)	1316 (2400)	1427 (2600)	1427 (2600)	1649 (3000)	1704 (3100)
Chemical Analysis, %, Weight basis after firing								
Alumina, Al_2O_3	46	35	43	47	37.5	43	72	87
Silica, SiO_2	54	50	54	53	47	54	28	13
Zirconia, ZrO_2	-	15	-	-	15.5	-	-	-
Chromium oxide, Cr_2O_3	-	-	3	-	-	3	-	-
Loss on ignition, L.O.I.	-	-	-	trace	trace	-	5	5
Other	trace	trace	trace	trace	trace	trace	trace	trace
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201								
Density, kg/m³ (pcf)	128 (8)	160 (10)	160 (10)	10 (160)	192 (12)	192 (12)	112 (7)	144 (9)
260°C (500°F)	0.08 (0.57)	0.08 (0.55)	0.08 (0.55)	0.07 (0.52)	0.07 (0.50)	0.07 (0.50)	0.12 (0.86)	0.13 (0.87)
538°C (1000°F)	0.16 (1.14)	0.14 (0.99)	0.14 (0.99)	0.15 (1.04)	0.14 (0.96)	0.14 (0.96)	0.15 (1.06)	0.15 (1.01)
816°C (1500°F)	0.28 (1.93)	0.24 (1.66)	0.24 (1.66)	0.26 (1.81)	0.24 (1.66)	0.24 (1.66)	0.21 (1.45)	0.19 (1.31)

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Modules and Log Products - RCF fibres - Veneering

	Unifelt™ Modules				
	U13	U14	U15	U16	U17
Manufacturing location	EU	EU	EU	EU	EU
Classification Temperature, °C (°F)	1260 (2300)	1425 (2600)	1500 (2732)	1600 (2912)	1700 (3092)
Color	white	white	white	white	white
Density, kg/m³ (pcf)	140 (8.7)	125 (7.8)	120 (7.5)	110 (7)	100 (6.2)
Specific heat, J/kg•°C (BTU/lb•°F), 1090°C (1994°F)	1.13 (0.27)	1.13 (0.27)	1.13 (0.27)	1.13 (0.27)	1.13 (0.27)
Permanent Linear Shrinkage, %, ENV 1094-1					
1200°C (2200°F)	2	-	-	-	-
1300°C (2372°F)	-	2	-	-	-
1400°C (2552°F)	-	-	2	-	-
1500°C (2732°F)	-	-	-	2	-
1600°C (2912°F)	-	-	-	-	2
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201					
Density, kg/m³ (pcf)	140 (8.7)	125 (7.8)	120 (7.5)	110 (7)	100 (6.2)
600°C (1112°F)	0.15	0.15	0.14	0.14	0.14
800°C (1472°F)	0.22	0.21	0.20	0.19	0.19
1000°C (1832°F)	0.29	0.30	0.28	0.27	0.25
1200°C (2192°F)	-	0.29	0.39	0.38	0.35
1400°C (2552°F)	-	-	0.51	0.50	0.48

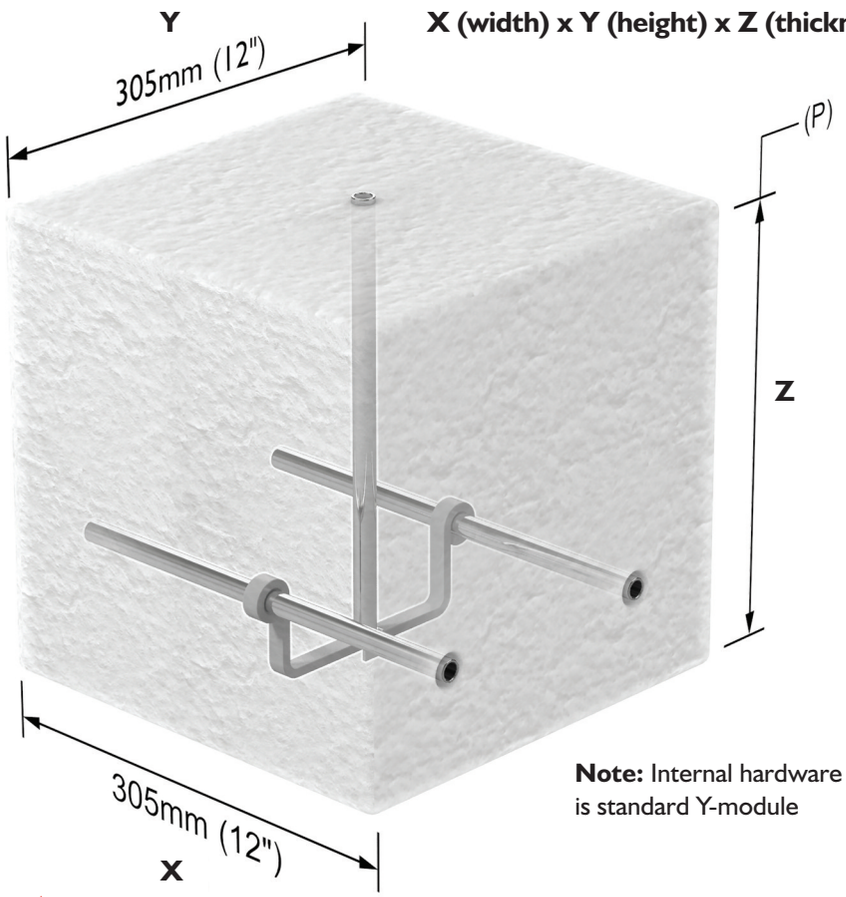
Modules and Log Products - PCW fibres - Veneering

	Pyro-Stack™
	Denka® Alcen™
Color	white
Density, kg/m³ (pcf)	128, 149 (8, 9.3)
Thickness, 25mm (1 in) increments	102 - 305 (4 - 12)
Classification Temperature, °C (°F)	1600 (2912)
Chemical Analysis, %, Weight basis after firing	
Alumina, Al_2O_3	80
Silica, SiO_2	20
Other	trace
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201	
Density, kg/m³ (pcf)	149 (9.3)
260°C (500°F)	0.11 (0.74)
538°C (1000°F)	0.19 (1.31)
816°C (1500°F)	0.34 (2.36)
1093°C (2000°F)	0.53 (3.66)
1371°C (2500°F)	0.73 (5.05)
1482°C (2700°F)	0.81 (5.61)

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

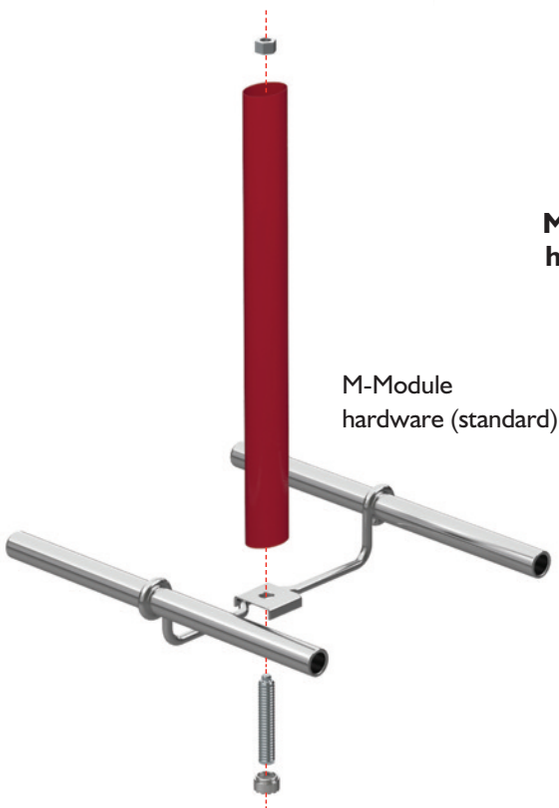
Types of Modules, internal hardware and attachment systems

Pyro-Bloc®
Y Module

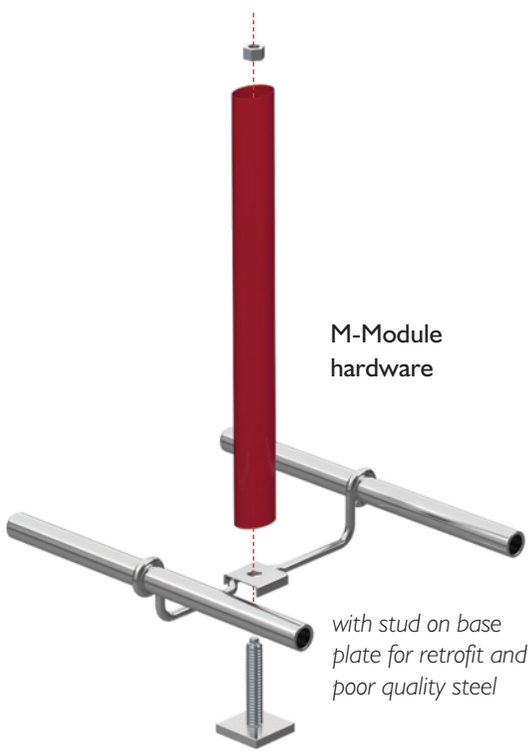


Note: Internal hardware shown is standard Y-module

M Module hardware



M-Module hardware (standard)



M-Module hardware

with stud on base plate for retrofit and poor quality steel

Section 04

Board and Shape fibre products

Board and Shape products

Superwool® Low Biopersistent products
- **Superwool® Plus VF**
- **Superwool Plus Strong VF**
- **Superwool Plus Carton**
- **Superwool HT VF**
- **Superwool HT2 VF**
- **Superwool HT LB**
- **Superwool HT Unifelt Board**
- **Superwool Plus PM**
- **Superwool Plus HT PM**
- **Superwool I-Plus**
- **Superwool I-HT**
- **Superwool Plus**
- **Superwool Plus Blok**
- **Superwool HT Board**
- **Superwool Plus Pyro-Board**
- **Superwool HT SB**
- **Superwool HT WB**
- **Superwool HT Millboard**

PCW
- **Alphawool® VF**

RCF
- **Kaowool® 1260 VF**
- **Kaowool Strong VF**
- **Kaowool 1260 LB**
- **Kaowool 1400 VF**
- **Kaowool 1600 VF**
- **Ceraform® 1400**
- **Kaowool M**
- **Kaowool PM**
- **Kaowool HP**
- **Kaowool HD**
- **Kaowool A**
- **Kaowool HS**
- **Kaowool HS-45**
- **Ceraboard® Board 110 & 115**
- **Kaowool 822 & 830 Millboard**
- **Kaowool HT**
- **Kaowool 2600**
- **Kaowool 80**
- **Kaowool 3000**
- **I-2100**
- **I-2300**
- **I-2600**
- **I-2800**
- **I-A5**
- **Tennaglo™**

Thermal Ceramics' has designed a wide range of products using the vacuum forming technology. This versatile process, flexible in batch size, allows the production of products in different geometries according to customer drawings as well as boards with bespoke specifications and dimensions.

Our board and shape vacuum formed products cover an entire temperature and mechanical strength range. They feature excellent insulating performance, superior high temperature strength and can be custom designed for a broad range of uses.

Manufactured from our bulk fibres these products are available in grades:
- Alkaline Earth Silicate Fibres (AES) - Superwool
- Polycrystalline Fibres (PCW) - Alphawool
- Refractory Ceramic Fibres (RCF) - Kaowool, Cera

Organic and inorganic compositions are available and offer:
- Low thermal conductivity and low heat storage
- Excellent thermal shock resistance
- Wide range of mechanical strengths
- Dimensional stability up to 1600°C (2912°F)
- No off-gassing during initial heat up of inorganic products

Boards
- Wide range of standard thicknesses and sizes
- Can be machined for tighter tolerance

Shapes
- Custom designed for optimized high temperature performance, utilizing decades of application experience
- Can be one-time use product or integral part of design
- Offer superior insulating performance, excellent molten metal resistance, and high strength
- Expertise in embedding hardware into shapes for integrated mounting, support or process specific benefits
- Post-treatment applications of Alfibond® and Minimox™ for many RCF and Superwool grades

Burner blocks and peep frames
- Engineered with light-weight, advanced vacuum forming technology
- Inorganic composition for high temperature strength retention
- Offer easy, low cost installation by embedding mounting hardware

Tennaglo radiant plaques
- Low thermal conductivity and capacity
- Reach surface temperatures of 1600°F (900°C) within 1 minute
- Suitable for use with natural or liquified gases at low or elevated supply pressures

Typical applications - for high temperature insulation wool Board and Shape fibre products:

- Expansion joints, back-up insulation, heat shields and mould base insulation
- Riser sleeves for ferrous and non ferrous molten metals
- Ladle shroud gasket
- Nozzle insulation in continuous casting
- Roller inserts in roller hearth furnace
- Glass casting mould
- Tube insulation end in tube fumes boiler
- Insulation for domestic appliance and heating element supports and linings for domestic boilers
- Tap-hole cones and launder linings for non ferrous molten metals
- Doors and combustion chamber linings for boilers
- Furnace sight holes
- Duct and flue linings

Typical benefits - for high temperature insulation wool Board and Shape fibre products:

- Homogeneous structure
- Thermal stability
- Low thermal conductivity
- Good resistance to tearing
- Low heat storage capacity
- Flexible and resilient
- Immune to thermal shock
- Good sound absorption
- Excellent insulating performance
- Excellent thermal shock resistance
- Low heat storage
- Flame resistant

AES Superwool® Boards and Shapes fibre products - grades available:

Superwool Plus fibre :
classification 1200°C (2192°F)
Superwool HT fibre :
classification 1300°C (2372°F)
Superwool Plus VF :
classification 1200°C (2192°F)
Superwool HT VF :
classification 1300°C (2372°F)

Benefits of Superwool Board and Shape:

- Good erosion resistance and rigidity
- Excellent hardness properties
- Excellent flexural and compressive strength
- Low heat storage, lightweight
- Good cycling performance (standard formula)
- Molten iron and steel resistance
- Good handling strength, easy to cut with standard tools
- AES fibres are not classified carcinogenic by IARC or under any national regulations on a global basis. They have no requirement for warning labels under GHS (Globally Harmonised System for the classification and labelling of chemicals). In Europe, Superwool fibre meets the requirements specified under NOTA Q of European Directive 67/548. All Superwool fibre products are therefore exonerated from the classification and labelling regulation in Europe.

PCW Boards and Shapes fibre products - products available:

Alphawool® VF :
classification 1600°C (2912°F)

Benefits of PCW Boards and Shapes:

- High chemical purity
- Excellent insulating performance
- Low heat storage
- Resistance to thermal shock
- Can be easily cut
- Excellent thermal and chemical stability in industrial process conditions

RCF Boards and Shapes fibre products - grades available:

Kaowool® :
classification 1260 - 1600°C
(2300 - 2912°F)
Cera® :
classification 1260 - 1400°C
(2300 - 2552°F)

Benefits of RCF Board and Shape:

- Good abrasion and erosion resistance and rigidity
- Low heat storage, lightweight
- Can be easily machined, cut and shaped
- Rigid, self supporting

Boards and Shapes fibre products - Blok Superwool®

	Superwool Plus Blok 800	Superwool Plus Blok 1000	Superwool Plus Blok 1100	Superwool Plus Blok 1100 QF	Superwool Plus Blok AL
Manufacturing location	EU	EU	EU	EU	EU
Color	White/Tan	White/Tan	White/Tan	White/Tan	White/Tan
Classification Temperature, °F	1832	2012	2012	2012	1832
Classification Temperature, °C	1000	1100	1100	1100	1000
Density, pcf	19.97	19.97	19.97	19.97	19.97
Density, kg/m³	320	320	320	320	320
Modulus of Rupture, psi,	101.5	116	116	130.5	116
Modulus of Rupture, Mpa,	0.7	0.8	0.8	0.9	0.8
Compressive strength @ 10% deformation, psi	43.5	43.5	43.5	43.5	43.5
Compressive strength @ 10% deformation, Mpa	0.3	0.3	0.3	0.3	0.3
Permanent Linear Shrinkage, %, 24 hours, EU made products per ENV (1094-1)					
1000°C (1832°F)	1.4	-	-	-	1.4
1100°C (2012°F)	-	1.4	1.3	1.3	-
Chemical Analysis, % weight basis after firing					
Alumina, Al_2O_3	13.9	15.1	10.1	16.2	-
Silica, SiO_2	61.2	59.4	59.5	56.5	-
Calcium oxide + Magnesium oxide, CaO + MgO	18.3	19.4	28.2	24.6	-
Ferric oxide + Titanium oxide, Fe_2O_3 + TiO_2	3	3.8	1.2	1.3	-
Alkalies, as Na_2O+K_2O	3.6	2.3	1	1.4	-
Loss of Ignition, LOI, after 2 hours heating, 800°C (1472°F)	5.5	5.0	5.0	5.0	5.5
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201					
200°C (392°F)	0.05 (0.35)	0.06 (0.42)	0.05 (0.35)	0.05 (0.35)	0.05 (0.35)
300°C (572°F)	0.05 (0.35)	0.06 (0.42)	0.06 (0.42)	0.06 (0.42)	-
400°C (752°F)	0.06 (0.42)	0.07 (0.49)	0.07 (0.49)	0.07 (0.49)	0.07 (0.49)
500°C (932°F)	0.07 (0.49)	0.09 (0.62)	0.08 (0.56)	0.08 (0.56)	-
600°C (1112°F)	0.08 (0.56)	0.1 (0.694)	0.09 (0.62)	0.09 (0.62)	0.1 (0.694)
800°C (1472°F)	0.12 (0.83)	0.13 (0.90)	0.12 (0.83)	0.12 (0.83)	0.13 (0.90)
1000°C (1832°F)	-	-	0.16 (1.11)	0.16 (1.11)	-

Safety Data Sheet (SDS): are available for all products.
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Boards and Shapes fibre products - AES fibres - Superwool®

	Superwool Plus Board 75	Superwool Plus Board H	Superwool Plus Board 85	Superwool Plus Board LTI	Superwool Plus Board INO	Superwool Plus Board Aluboard	Superwool HT Board
Manufacturing location	EU	EU	EU	EU	EU	EU	EU
Color	White/Tan	White/Tan	White/Tan	White/Tan	White/Tan	White/Tan	White/Tan
Classification Temperature, °F	1652	1652	1832	2012	2012	1112	2372
Classification Temperature, °C	900	900	1000	1100	1100	600	1300
Density, pcf	19.97	32.45	19.97	21.84	31.20	19.97	22.46
Density, kg/m³	320	520	320	350	500	320	360
Modulus of Rupture, psi, *unfired	116.0	507.5	116.0	217.5	174.0	145.0	203.0
Modulus of Rupture, Mpa, *unfired	0.8	3.5	0.8	1.5	1.2	1	1.4
Compressive strength @ 10% deformation, psi	58.0	159.5	43.5	43.5	43.5	43.5	43.5
Compressive strength @ 10% deformation, Mpa	0.4	1.1	0.3	0.3	0.3	0.3	0.3
Water absorption after 2 hours, %	2	2	2	-	-	-	-
Permanent Linear Shrinkage, %, 24 hours, EU made products per ENV (1094-1)							
600°C (1112°F)	-	-	-	-	-	1.4	-
900°C (1652°F)	1	1.2	-	-	-	-	-
1000°C (1832°F)	-	-	0.9	-	-	-	-
1100°C (2012°F)	-	-	-	1	1.6	-	-
1300°C (2372°F)	-	-	-	-	-	-	1.5
Chemical Analysis, % weight basis after firing							
Alumina, Al_2O_3	15.1	11.2	10.1	4.4	10.6	13.9	1.4
Silica, SiO_2	59.4	70.5	59.5	67	63.5	61.2	77.5
Calcium oxide + Magnesium oxide, CaO + MgO	19.4	15.1	28.2	27.4	23.5	18.3	20.3
Ferric oxide + Titanium oxide, $Fe_2O_3 + TiO_2$	3.8	1.6	1.2	0.6	1.5	3	0.1
Alkalies, as Na_2O+K_2O	2.3	1.6	1	0.6	0.9	3.6	0.7
Loss of Ignition, LOI, after 2 hours heating @ 800°C (1472°F)	5	10	5	5	5	5.5	3
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201							
200°C (392°F)	-	-	-	-	-	-	0.05 (0.35)
300°C (572°F)	-	0.12 (0.83)	0.07 (0.486)	0.08 (0.56)	0.09 (0.62)	0.05 (0.35)	-
400°C (752°F)	0.07 (0.49)	0.13 (0.90)	0.08 (0.56)	0.09 (0.62)	0.11 (0.76)	0.06 (0.42)	0.08 (0.56)
500°C (932°F)	0.09 (0.62)	-	0.08 (0.56)	-	-	0.07 (0.49)	-
600°C (1112°F)	0.12 (0.83)	0.15 (1.04)	0.11 (0.76)	0.12 (0.83)	0.13 (0.90)	0.08 (0.56)	0.11 (0.76)
800°C (1472°F)	0.13 (0.90)	-	0.12 (0.83)	0.15 (1.04)	0.15 (1.04)	0.12 (0.83)	0.15 (1.04)
1000°C (1832°F)	-	-	0.16 (1.11)	-	-	-	0.2 (1.39)
1200°C (2192°F)	-	-	-	-	-	-	0.26 (1.80)

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Boards and Shapes fibre products - AES fibres - Superwool®

	Superwool HT Board C	Superwool HT Board WB	Superwool HT Board SB
Region of manufacture	EU	EU	EU
Color	White/Tan	White / Tan	White / Tan
Classification Temperature, °F	2102	2102	2102
Classification Temperature, °C	1150	1150	1150
Density, pcf	29.95	29.95	23.71
Density, kg/m³	480	480	380
Modulus of Rupture, psi	174	377	203
Modulus of Rupture, Mpa	1.2	2.6	1.4
Compressive strength @ 10% deformation, psi	43.5	87	72.5
Compressive strength @ 10% deformation, Mpa	0.3	0.6	0.5
Permanent Linear Shrinkage, %, 24 hours, EU made products per ENV (1094-1)			
1150°C (2102°F)	1.3	1.3	1.6
Chemical Analysis, % weight basis after firing			
Alumina, $Al2O_3$	7.9	7.9	6.1
Silica, SiO2	73	73	71.9
Calcium oxide + Magnesium oxide, CaO + MgO	16.8	16.8	20
Ferric oxide + Titanium oxide, $Fe2O_3$ + TiO2	1.1	1.1	0.9
Alkalies, as Na_2O+K2O	1.2	1.2	1.1
Loss of Ignition, LOI, after 2 hours heating @ 800°C (1472°F)	5.5	5.5	5.5
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201			
200°C (392°F)	0.06 (0.42)	-	-
300°C (572°F)	-	0.07 (0.49)	0.07 (0.49)
400°C (752°F)	0.09 (0.62)	0.09 (0.62)	0.09 (0.62)
600°C (1112°F)	0.12 (0.83)	0.12 (0.83)	0.12 (0.83)
800°C (1472°F)	0.15 (1.04)	0.15 (1.04)	0.15 (1.04)

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Boards and Shapes fibre products - AES fibres - Superwool® VF

	Superwool Plus VF	Superwool Plus Strong VF	Superwool Plus Carton VF	Superwool HT VF	Superwool HT2 VF	Superwool HT LB VF	Superwool HT Unifelt Board
Region of manufacture	EU	EU	EU	EU	EU	EU	EU
Color	White / tan	White / tan	White / tan	White / tan	White / tan	-	White / tan
Classification Temperature, °F	2192	2192	2192	2372	2642	2012	2282
Classification Temperature, °C	1200	1200	1200	1300	1450	1100	1250
Density, pcf	17.47	23.71	18.10	19.97	20.90	15.60	11.86
Density, kg/m³	280	380	290	320	335	250	190
Modulus of Rupture, psi, *unfired	166.75	291.5	213.2	159.5	271.15	flexible	flexible
Modulus of Rupture, Mpa, *unfired	1.15*	2.01*	1.47	1.1	1.87	flexible	flexible
Modulus of Rupture, psi, fired at 1800°F	166.75	291.5	213.2	159.5	271.15	flexible	flexible
Modulus of Rupture, MPa, fired at 982°C	1.15*	2.01*	1.47	1.1	1.87	flexible	flexible
Modulus of Rupture, psi, fired at 1202°F	75.4	130.5	-	-	-	-	-
Modulus of Rupture, MPa, fired at 650°C	0.52	0.9	-	-	-	-	-
Compressive strength @ 5% deformation, psi	18.85	43.5	-	-	-	-	-
Compressive strength @ 5% deformation, Mpa	0.13	0.3	-	-	-	-	-
Compressive strength @ 10% deformation, psi	23.2	55.1	-	-	-	-	-
Compressive strength @ 10% deformation, Mpa	0.16	0.38	-	-	-	-	-
Permanent Linear Shrinkage, %, 24 hours, EU made products per ENV (1094-1)							
1000°C (1832°F)	-	-	2	-	-	-	-
1100°C (2012°F)	2	2	-	-	-	-	<1.0
1200°C (2192°F)	-	-	-	1.9	1.6	-	-
Chemical Analysis, % weight basis after firing							
Loss of Ignition, LOI, after 24 hours heating @ 800°C (1472°F)	-	-	7	-	-	-	-
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201							
200°C (392°F)	-	-	-	0.05 (0.35)	-	0.03 (0.21)	-
400°C (752°F)	0.08 (0.56)	0.09 (0.624)	0.07 (0.49)	0.1 (0.69)	0.08 (0.56)	0.04 (0.28)	0.1 (0.69)
600°C (1112°F)	0.12 (0.83)	0.12 (0.83)	0.1 (0.69)	0.13 (0.90)	0.12 (0.83)	0.08 (0.56)	0.15 (1.04)
800°C (1472°F)	0.16 (1.11)	0.14 (0.97)	0.15 (1.04)	0.19 (1.32)	0.18 (1.25)	0.15 (1.04)	0.21 (1.46)
1000°C (1832°F)	0.2 (1.39)	0.17 (1.18)	-	0.24 (1.67)	0.25 (1.73)	0.24 (1.67)	0.3 (2.08)
1200°C (2192°F)	-	-	-	0.31 (2.15)	0.33 (2.29)	0.29 (2.01)	-
1400°C (2552°F)	-	-	-	-	0.38 (2.64)	-	-

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Boards and Shapes fibre products - AES fibres - Superwool®

	Superwool Plus	Superwool HT	Superwool Plus PM	Superwool HT PM	I-Superwool Plus	I-Super-wool HT	I-Superwool HT H
Manufacturing location	NA	NA	NA	NA	NA	NA	NA
Color	white	white	beige	white	white	white	beige
Continuous Use Temperature, °C (°F)	1000 (1832)	1177 (2150)	1000 (1832)	1177 (2150)	1000 (1832)	1177 (2150)	1177 (2150)
Classification Temperature, °C (°F)	1100 (2012)	1275 (2372)	1100 (2012)	1275 (2372)	1100 (2012)	1275 (2372)	1275 (2372)
Melting Temperature, °C (°F)	1275 (2372)	-	1275 (2372)	-	1275 (2372)	-	-
Density, kg/m³ (pcf)	320 - 350 (20 - 22)	320 - 350 (20 - 22)	240 - 270 (15 - 17)	224 - 270 (14 - 17)	240 - 270 (15 - 17)	293 (18)	742 (46)
Modulus of Rupture, Mpa (psi), fired at 982°C (1800°F)	2 (300)	1.4 - 1.7 (200 - 250)	1.4 - 1.7 (200 - 250)	1.2 - 1.6 (175 - 225)	-	0.26 (38)	2.86 (415)
Compressive strength @ 5% deformation, Mpa (psi)	0.38 (55)	0.41 (60)	0.10 - 0.17 (15 - 25)	-	-	0.05 (7)	0.41 (60)
Compressive strength @ 10% deformation, Mpa (psi)	0.41 (60)	0.48 (70)	0.16 - 0.28 (23 - 40)	-	-	0.08 (12)	0.67 (97)
Permanent Linear Shrinkage, %, 24 hours, EU made products per ENV (1094-1)							
1500°F (816°C)	2	0.25	-	0.25	2.2	0.51	1
1800°F (982°C)	2.5	0.25	1	0.33	2.3	0.93	2.5
2000°F (1093°C)	-	-	-	-	-	1.5	2.7
2200°F (1204°C)	-	-	-	-	-	1.7	2.8
Chemical Analysis, % weight basis after firing							
Alumina, Al_2O_3	trace	-	trace	-	trace	trace	trace
Silica, SiO_2	67	70-80	67	70-80	70	82	94
Calcium oxide + Magnesium oxide, CaO + MgO	27	18-25	27	18-25	24	16	5
Other	1	<3	1	<3	<1	<1	<1
Loss of Ignition, LOI	4-7	3-6	2-4	2-5	1.3	1.8	3.1
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201							
260°C (500°F)	0.056 (0.39)	0.058 (0.4)	0.058 (0.4)	0.056 (0.39)	0.062 (0.43)	-	-
538°C (1000°F)	0.094 (0.65)	0.089 (0.62)	0.089 (0.62)	0.095 (0.66)	0.095 (0.66)	-	-
816°C (1500°F)	0.150 (1.04)	0.150 (1.04)	0.143 (0.99)	0.151 (1.05)	0.146 (1.01)	-	-
982°C (1800°F)	0.195 (1.35)	-	-	0.192 (1.33)	-	-	-
1093°C (2000°F)	-	0.218 (1.51)	-	0.223 (1.55)	-	-	-

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Boards and Shapes fibre products - RCF fibres

	Ceraboard 100	Ceraboard 115	Kaowool 1260 VF	Kaowool Strong VF	Kaowool 1260 LB VF	Kaowool 1400 VF	Kaowool 1600 VF	Ceraform 400
Manufacturing location	EU	EU	EU	EU	EU	EU	EU	EU
Color	white / tan	white / tan	White / tan	White / tan	White / tan	White / tan	White / tan	Grey
Classification Temperature, °C (°F)	1260 (2300)	1400 (2552)	1260 (2300)	1260 (2300)	1260 (2300)	1400 (2552)	1600 (2912)	1260 (2300)
Density, kg/m³ (pcf)	320	320	260	330	200	260	320	390
Modulus of Rupture, MOR, Mpa (psi), *unfired	1.2 (174)	0.7 (101.5)	1.05 (152.25)	2.37 (343.65)	flexible*	0.99 (143.55)*	0.4 (58)	1.6 (232)
Modulus of Rupture, MOR, Mpa (psi), fired at 650°C (1202°F)	-	-	0.58 (84.10)	1.1 (159.5)	N/A	0.35 (50.75)	0.24 (34.80)	-
Compressive strength @ 10% deformation, Mpa (psi)	0.3 (43.5)	0.3 (43.5)	-	-	-	-	-	-
Permanent Linear Shrinkage, %, 24 hours								
1100°C (2012°F)	-	-	-	-	-	-	-	2.5
1260°C (2300°F)	3.3	-	-	-	-	-	-	-
1400°C (2552°F)	-	3.1	-	-	-	-	-	-
Chemical Analysis, % weight basis after firing								
Alumina, Al_2O_3	37.4	44.4	-	-	-	-	-	46
Silica, SiO_2	60.5	41.7	-	-	-	-	-	37
Zirconia, ZrO_2	-	12.9	-	-	-	-	-	7.6
Calcium oxide + Magnesium oxide, CaO + MgO	0.8	0.5	-	-	-	-	-	0.2
Ferric oxide + Titanium oxide, Fe_2O_3 + TiO_2	0.8	0.3	-	-	-	-	-	0.5
Alkalies, as Na_2O+K_2O	0.5	0.2	-	-	-	-	-	0.2
Loss of Ignition, LOI, after 2 hours heating @ 800°C (1472°F)	4.5	2.5	5 - 7	5 - 7	5 - 7	5 - 7	5 - 7	6
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201								
200°C (392°F)	-	-	0.07 (0.486)	0.06 (0.416)	0.07 (0.486)	0.06 (0.416)	-	0.09 (0.624)
300°C (572°F)	0.07 (0.486)	0.07 (0.486)	-	-	-	-	-	-
400°C (752°F)	0.08 (0.555)	0.08 (0.555)	0.09 (0.624)	0.09 (0.624)	0.09 (0.624)	0.08 (0.555)	0.06 (0.416)	0.1 (0.694)
600°C (1112°F)	0.11 (0.763)	0.11 (0.763)	0.11 (0.763)	0.12 (0.833)	0.11 (0.763)	0.1 (0.694)	0.08 (0.555)	0.12 (0.833)
800°C (1472°F)	0.15 (1.041)	0.15 (1.041)	0.15 (1.041)	0.16 (1.11)	0.15 (1.041)	0.13 (0.902)	0.1 (0.694)	0.16 (1.11)
1000°C (1832°F)	0.2 (1.388)	0.2 (1.388)	-	-	-	0.18 (1.249)	0.14 (0.971)	0.22 (1.526)
1200°C (2192°F)	-	-	-	-	-	0.23 (1.596)	0.2 (1.388)	-
1400°C (2552°F)	-	-	-	-	-	-	0.26 (1.804)	-

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Boards and Shapes fibre products - RCF fibres

	Unifelt Board 1300	Unifelt Board 1400	Unifelt Board 1500	Unifelt Board 1600	Unifelt Board 1700
Manufacturing location	EU	EU	EU	EU	EU
Color	White / tan	White / tan	White / tan	White / tan	White / tan
Classification Temperature, °C (°F)	1260 (2300)	1400 (2552)	1500 (2732)	1600 (2912)	1700 (3092)
Density, kg/m³ (pcf)	170 (11)	160 (10)	150 (9.3)	140 (8.7)	130 (8)
Permanent Linear Shrinkage, %, 24 hours					
1100°C (2012°F)	<2	-	-	-	-
1400°C (2552°F)	-	<2	<2	-	-
1500°C (2732)	-	-	-	<2	<2
Chemical Analysis, % weight basis after firing					
Alumina, Al_2O3	47	52	56	62	70
Silica, SiO_2	53	48	44	38	30
Calcium oxide + Magnesium oxide, CaO + MgO	<0.1	<0.1	<0.1	<0.1	<0.1
Ferric oxide + Titanium oxide, $Fe_2O_3 + TiO_2$	<0.15	<0.15	<0.15	<0.15	<0.15
Alkalies, as Na_2O+K_2O	<0.1	<0.1	<0.1	<0.1	<0.1
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201					
200°C (392°F)	0.075 (0.520)	-	-	-	-
400°C (752°F)	0.11 (0.763)	0.11 (0.763)	0.1 (0.694)	0.1 (0.694)	0.1 (0.694)
600°C (1112°F)	0.15 (1.041)	0.14 (0.971)	0.14 (0.971)	0.13 (0.902)	0.13 (0.902)
800°C (1472°F)	0.22 (1.526)	0.21 (1.457)	0.2 (1.388)	0.18 (1.249)	0.18 (1.249)
1000°C (1832°F)	0.31 (2.151)	0.29 (2.012)	0.23 (1.596)	0.27 (1.873)	0.25 (1.735)
1200°C (2192°F)	-	0.39 (2.706)	0.38 (2.636)	0.37 (2.567)	0.35 (2.428)
1400°C (2552°F)	-	-	0.5 (3.469)	0.5 (3.469)	0.48 (3.33)

Safety Data Sheet (SDS): are available for all products.
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Boards and Shapes fibre products - RCF fibres

	Kaowool® M	Kaowool PM	Kaowool HP	Kaowool HD	Kaowool A	Kaowool HS
Manufacturing location	NA	NA	NA	NA	NA	NA
Color	beige	white	beige	beige	beige	beige
Continuous Use Temperature, °C (°F)	1093 (2000)	1177 (2150)	1149 (2100)	1260 (2300)	1149 (2100)	1260 (2300)
Classification Temperature, °C (°F)	1204 (2200)	1260 (2300)	1260 (2300)	1316 (2400)	1260	1316 (2400)
Density, kg/m³ (pcf)	288 - 320 (18 - 20)	256 (16)	320 - 368 (20 - 23)	416 (26)	449 (28)	449 (28)
Modulus of Rupture, MOR, Mpa (psi)	0.69 - 0.90 (100 - 130)	1.38 - 1.72 (200 - 250)	1.38 (200)	1.03 - 1.21 (150 - 175)	1.72 (250)	1.59 - 1.79 (230 - 260)
Compressive strength @ 5% deformation, Mpa (psi)	0.14 - 0.21 (20 - 30)	0.14 - 0.21 (20 - 30)	0.52 (75)	0.34 - 0.48 (50 - 70)	0.69 (100)	0.41 - 0.55 (60 - 80)
Compressive strength @ 10% deformation, Mpa (psi)	0.21 - 0.28 (30 - 40)	0.21 - 0.28 (30 - 40)	0.69 (100)	0.48 - 0.62 (70 - 90)	0.86 (125)	0.55 - 0.69 (80 - 100)
Permanent Linear Shrinkage, %, 24 hours						
1500°F (816°C)	1.2	0.2	0.7	0.1	-	0.8
1800°F (982°C)	2.2	2	1.6	1.4	1.6	1.9
2000°F (1093°C)	2.8	2.4	2.8	2.5	2.8	2.1
2200°F (1204°C)	3.4	3.4	3.8	2.8	3.8	0.2
2400°F (1316°C)	-	-	-	-	-	0.3+
2600°F (1426°C)	-	-	-	-	-	1.1+
Chemical Analysis, % weight basis after firing						
Alumina, Al_2O_3	42	44	41-43	41	43-45	18
Silica, SiO_2	56	56	56-59	53	54-57	81
Calcium oxide + Magnesium oxide, CaO + MgO	-	-	-	5	-	-
Other	-	<1	-	-	<1	-
Loss of Ignition, LOI	4-7	4-7	6-8	5-8	7-9	5-8
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201						
260°C (500°F)	0.072 (0.5)	0.058 (0.4)	0.072 (0.5)	0.086 (0.6)	0.072 (0.5)	0.101 (0.7)
538°C (1000°F)	0.101 (0.7)	0.086 (0.6)	0.101 (0.7)	0.115 (0.8)	0.101 (0.7)	0.115 (0.8)
816°C (1500°F)	0.144 (1)	0.130 (0.9)	0.144 (1)	0.159 (1.1)	0.130 (0.9)	0.159 (1.1)
1093°C (2000°F)	0.216 (1.5)	0.187 (1.3)	0.202 (1.4)	0.231 (1.6)	0.187 (1.3)	0.231 (1.6)

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Boards and Shapes fibre products - RCF fibres

	Kaowool® HS-45	Kaowool HT	Kaowool 2600	Kaowool 80	Kaowool 3000	Kaowool TBM
Manufacturing location	NA	NA	NA	NA	NA	NA
Color	white	yellow	blue	white	pink	white
Continuous Use Temperature, °C (°F)	1316 (2400)	1343 (2450)	1426 (2600)	1621 (2950)	1621 (2950)	1316 (2400)
Classification Temperature, °C (°F)	1371 (2500)	1426 (2600)	1482 (2700)	1649 (3000)	1649 (3000)	1316 (2400)
Density, kg/m³ (pcf)	673 (42)	352 - 400 (22 - 25)	288 (18)	400 (25)	192 (12)	465 (29)
Modulus of Rupture, MOR, Mpa (psi)	3.10 - 3.79 (450 - 550)	1.38 (200)	0.23 (333)	0.52 (75)	0.48 (70)	4.48 (650)
Compressive strength @ 5% deformation, Mpa (psi)	1.38 - 1.72 (200 - 250)	0.52 (75)	0.38 (55)	0.17 (25)	0.14 (20)	-
Compressive strength @ 10% deformation, Mpa (psi)	1.72 - 2.07 (250 - 300)	0.69 (100)	435 (63)	0.34 (50)	0.17 (25)	-
Permanent Linear Shrinkage, %, 24 hours						
1500°F (816°C)	0.5	-	-	-	0.3	-
1800°F (982°C)	0.7	-	-	-	0.1	-
2000°F (1093°C)	0.4	-	-	-	0	-
2200°F (1204°C)	0.6	2.3	-	1.3	0.4	0.1
2400°F (1316°C)	0.8+	2.6	1.7	1.8	0.5	0.5
2600°F (1426°C)	-	3	-	0.1	0.6	-
2800°F (1538°C)	-	-	-	0.3+	1.5+	-
2900°F (1593°C)	-	-	-	-	2.5+	-
Chemical Analysis, % weight basis after firing						
Alumina, Al_2O_3	55	50-52	45	70-72	66	29.9-34.5
Silica, SiO_2	35	47-49	45	25-28	34	62.5-66.2
Zirconia, ZrO_2	-	-	9	-	-	-
Calcium oxide + Magnesium oxide, CaO + MgO	8	-	-	-	-	-
Other	2	-	<1	<1	-	<5
Loss of Ignition, LOI	5-8	5-7	7-10	3-5	7-9	-
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201						
260°C (500°F)	0.144 (1)	0.072 (0.5)	0.072 (0.5)	0.072 (0.5)	0.072 (0.5)	0.098 (0.68)
538°C (1000°F)	0.144 (1)	0.101 (0.7)	0.101 (0.7)	0.101 (0.7)	0.101 (0.7)	0.117 (0.81)
816°C (1500°F)	0.173 (1.2)	0.130 (0.9)	0.144 (1)	0.130 (0.9)	0.144 (1)	0.146 (1.01)
1093°C (2000°F)	0.245 (1.7)	0.187 (1.3)	0.216 (1.5)	0.187 (1.3)	0.202 (1.4)	0.180 (1.25)

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Boards and Shapes fibre products - RCF fibres

	STD -1260 C Board	AZS - 1400 C Board	S - 1260 C Board	HS 45 Board 1260 C	SS 800 1260 C Board	Minimog 1260 C	E 1100 C Board	M 1600 C Board
Manufacturing location	AS	AS	AS	AS	AS	AS	AS	AS
Color	White /Tan							
Continuous Use Temperature, °C (°F)	1100 (2012)	1250 (2282)	1100 (2012)	1100 (2012)	1100 (2012)	1100 (2012)	950 (1742)	1450 (2642)
Classification Temperature, °C (°F)	1260 (2300)	1400 (2552)	1260 (2300)	1260 (2300)	1260 (2300)	1260 (2300)	1100 (2012)	1600 (2912)
Density, kg/m³ (pcf), minimum density	260 (16)	260 (16)	330 (20)	720 (45)	800 (50)	260 (16)	240 (15)	425 (27)
Modulus of Rupture, MOR, Mpa (psi), *un-fired, <25mm (1in)	0.5 (72.5)	0.5 (72.5)	1.0 (145)	3.0 (435)	5 (725)	0.5 (72.5)	0.2 (29)	1.6 (232)
Modulus of Rupture, MOR, Mpa (psi), *un-fired, >25mm (1in)	0.2 (29)	0.2 (29)	0.7 (101.5)	0.2 (29)	5 (725)	0.2 (29)	0.125 (18.1)	1.0 (145)
Compressive strength @ 5% deformation, Mpa (psi), <25mm (1in)	0.075 (108.75)	0.075	0.2 (29)	0.75 (108.75)	1.5 (217.5)	0.075 (108.75)	0.05 (7.25)	0.5 (72.5)
Compressive strength @ 5% deformation, Mpa (psi), >25mm (1in)	0.06 (8.7)	0.06 (8.7)	0.175 (25.38)	-	-	0.06 (8.7)	0.025 (3.625)	0.25 (36.25)
Compressive strength @ 10% deformation, Mpa (psi), <25mm (1in)	0.1 (14.5)	0.1 (14.5)	0.3 (43.5)	1 (145)	2 (290)	0.1 (14.5)	0.075 (10.87)	0.65 (94.25)
Compressive strength @ 10% deformation, Mpa (psi), >25mm (1in)	0.08 (11.6)	0.08 (11.6)	0.275 (39.87)	-	-	0.08 (11.6)	0.03 (4.35)	0.4 (58)
Permanent Linear Shrinkage, %, 24 hours								
1200°C (2192°F)	4	-	4	1	1	3.5	3.5	-
1350°C (2462°F)	-	4	-	-	-	-	-	-
1400°C (2552°F)	-	-	-	-	-	-	-	0.5
Chemical Analysis, % weight basis after firing								
Alumina, Al_2O_3	Min 40	Min 29	Min 44	49 - 54	Min 48	Min 40	Min 30	*Min 70
Silica, SiO_2	Max 60	Max 55	Max 56	33 - 37	Max 40	Max 60	Max 60	Max 25
Zirconia, ZrO_2	-	Min 10	-	-	-	-	Max 19.5	-
Calcium oxide, CaO	-	-	-	9 - 12	Min 10	-	-	-
Loss of Ignition, LOI	Max 10	Max 10	Max 10	Max 10	Max 10	Max 4	Max 4	Max 4
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201								
1000°C (1832°F)	0.21	0.21	0.16	0.22	0.22	0.19	0.23	0.24

* This minimum % includes as - Al_2O_3 + ZrO_2

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Boards and Shapes fibre products - PCW fibres - Alphawool®

	Alphawool VF
Manufacturing location	EU
Color	White / tan
Classification Temperature, °C (°F)	1600 (2912)
Density, kg/m³ (pcf)	250 (15.6)
Modulus of Rupture, MOR, MPa (psi)	0.7 (101.5)
Modulus of Rupture, MOR, MPa (psi), fired at 650°C (1202°F)	0.6 (87)
Permanent Linear Shrinkage, %, 24 hours	
1149°C (2100°F)	<1.5
Chemical Analysis, % weight basis after firing	
Alumina, Al_2O_3	88 - 90
Silica, SiO_2	8 - 10
Other	0 - 4
Loss of Ignition, LOI	<8.0
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201	
400°C (752°F)	0.08 (0.055)
600°C (1112°F)	0.1 (0.69)
800°C (1472°F)	0.13 (0.90)
1000°C (1832°F)	0.16 (1.11)
1200°C (2192°F)	0.19 (1.32)

Safety Data Sheet (SDS): are available for all products.
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Boards and Shapes fibre products - Millboards

	Kaowool®Millboard 822	Kaowool Millboard 830	Kaowool Millboard 1401	Superwool® HT Millboard
Manufacturing location	NA	NA	NA	NA
Color	white	tan	white	white
Continuous Use Temperature, °C (°F)	1093 (2000)	1093 (2000)	1093 (2000)	1177 (2150)
Classification Temperature, °C (°F)	1260 (2300)	1482 (2700) one time	1260 (2300)	1300 (2372)
Melting Temperature, °C (°F)	1760 (3200)	1760 (3200)	1760 (3200)	1400 (2552)
Density, kg/m³ (pcf)	881 (55)	641 (40)	560 - 641 (35 - 40)	1025 (64)
Modulus of Rupture, MOR, Mpa (psi)	-	-	-	3.9 (567)
Compressive strength @ 5% deformation, MPa (psi)	0.34 - 0.51 (50 - 75)	-	0.06 - 0.14 (10 - 20)	251 (36)
Compressive strength @ 10% deformation, MPa (psi)	0.69 - 0.86 (100 - 125)	-	0.38 - 0.48 (55 - 70)	920 (133)
Compressive strength @ 15% deformation, MPa (psi)	1.72 - 2.06 (250 - 300)	-	1.20 - 1.38 (175 - 200)	1570 (228)
Chemical Analysis, % weight basis after firing				
Alumina, Al_2O_3	35	35	36	15
Silica, SiO_2	63	65	60	75
Calcium oxide + Magnesium oxide, CaO + MgO	-	-	-	8
Other	2	-	4	<2
Loss of Ignition, LOI	5-7	12-15	9-11	12
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201				
260°C (500°F)	0.115 (0.8)	0.076 (0.53)	0.088 (0.61)	0.138 (0.96)
538°C (1000°F)	0.128 (0.89)	0.102 (0.71)	0.117 (0.81)	0.164 (1.14)
816°C (1500°F)	0.141 (0.98)	0.131 (0.91)	0.150 (1.04)	0.205 (1.42)
1093°C (2000°F)	0.156 (1.08)	0.166 (1.15)	0.192 (1.33)	0.258 (1.79)

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Section 05

Paper products

Paper products

Superwool® paper
- Superwool Plus
- Superwool Plus Flex-Wrap
- Superwool HT
- Superwool 351-E
- Superwool Plus 351-E
- Superwool 406-E
- Superwool MD
- Superwool Expanding

RCF paper
- Kaowool® 333-E
- Kaowool FlexWrap
- Kaowool 500
- Kaowool 700
- Kaowool 900
- Kaowool 1260
- Kaowool 1260 waterproof
- Kaowool 1400
- Kaowool 1600
- Kaowool 2000
- K-Shield™ BF
- Kaowool 2600
- Kaowool 3000

PCW paper
- Alphawool® 1600

Mineral Fibre and Glass Fibre papers
- Kaowool 400-LS
- E.R. glass
- Green glass
- Thermatex® 500
- Thermatex 850

Thermal Ceramics manufactures a wide range of high temperature rated paper products. We meet requirements ranging from economical mineral wool grades to high purity alumina and alumina-silica grades for demanding applications.

Paper products are specially processed to offer excellent performance in high-temperature applications and offer an alternative to traditional solutions due to its unique properties of high refractoriness and excellent non-wetting characteristics to applications requiring direct contact with molten aluminium and stability and resistance to chemical attack.

Insulating paper conforms easily to complex shapes and can be die-cut and used in a wide range of applications as thermal insulation and are especially suited to use in gaskets and as a parting medium.

Many of our paper products also meet the stringent specification requirements for automotive and aerospace applications.

In use high temperature insulation wool will:

- Contribute to protecting people and property from excessive heat
- Reduce greenhouse gas emissions
- Reduce energy usage
- Improve efficiency of furnaces and process equipment

Typical applications - for high temperature insulation wool paper:

- Gasketing between aluminum and zinc trough sections
- Aluminum furnace tap-out plug cover and parting agent
- Aluminum distributor pan linings, casting and fabrication
- Gaskets for any high temperature application
- Back up lining for metal troughs
- Refractory back up for aluminum melting and holding furnaces
- Insulating thermal break
- Insulating gaskets and expansion joints
- Parting media
- Die cut gaskets for domestic appliances
- Thermal barriers for vehicles (silencers, catalytic exhausts and heat shields)

Typical benefits - for high temperature insulation bulk fibres:

- Excellent thermal insulation properties
- Thermal stability
- Low thermal conductivity
- Low heat storage capacity
- Flexible and resilient
- Excellent insulating performance
- Excellent thermal stability: fibres have good resistance to devitrification
- Low heat storage
- Lightweight

Superwool® paper - grades available:

Superwool Plus paper :
classification 1200°C (2192°F)
Superwool HT paper :
classification 1300°C (2372°F)
Superwool Plus 351-E : expandable up to 400%, classification 649°C (1200°F)
Superwool Plus 406-E : expandable up to 125%, classification 649°C (1200°F)
Superwool Plus 332-E :
classification 704°C (1300°F)
Superwool Plus Flex-Wrap :
classification 1000°C (1832°F)
Superwool Expanding paper :
classification 1200°C (2192°F)
Superwool MD paper Black/White :
classification 1200°C (2192°F)

Benefits of Superwool paper:

- Free of binder or lubricant
- Good resistance to tearing, flexible and resilient
- Immune to thermal shock
- Good sound absorption
- AES fibres are not classified carcinogenic by IARC or under any national regulations on a global basis. They have no requirement for warning labels under GHS (Globally Harmonised System for the classification and labelling of chemicals). In Europe, Superwool fibre meets the requirements specified under NOTA Q of European Directive 67/548. All Superwool fibre products are therefore exonerated from the classification and labelling regulation in Europe.
- Exonerated from any use restriction under annexe V number 7.1 of the German hazardous substances regulation (TRGS 905)

RCF paper - grades available:

Kaowool® :
classification 1176 - 1600°C (2150-3000°F)
Kaowool Waterproof :
classification 1260°C (2300°F)
Kaowool 333-E : expandable up to 400%, classification 1260°C (2100°F)
K-Shield™ BF : low shot, classification 1316°C (2400°F)

Benefits of RCF paper:

- Good resistance to tearing
- High flexibility
- Low shot content
- Precise thickness
- Resistant to thermal shock
- Very low thermal conductivity
- Low thermal mass

Glass fibre paper - grades available:

E.R. Glass :
maximum continuous use 500°C (932°F)
Green Glass :
maximum continuous use 500°C (932°F)
Thermatex® 500 :
maximum continuous use temperature 500°C (932°F)

Mineral fibre paper - grades available:

Thermatex 850 :
maximum continuous use 850°C (1562°F)
Kaowool 400-LS :
maximum continuous use 732°C (1350°F)

Alumina paper - grades available:

Alphawool 1600 :
classification 16400°C (2912°F)

Paper products - AES fibres - Superwool®

	Superwool Plus Paper		Superwool Plus Flex-Wrap	Superwool Plus 332-E	Superwool HT Paper		Superwool Plus MD Black Paper
Region of Manufacture	NA	EU	NA	NA	NA	EU	EU
Color	white	white	white	white	white	white	white, black
Continuous Use Temperature, °F	1832	1832	1832	1300	2102	-	-
Continuous Use Temperature, °C	1000	1000	1000	704	1150	-	-
Classification Temperature, °F	2012	2192	2012	-	2372	2372	2192
Classification Temperature, °C	1100	1200	1100	-	1300	1300	1200
Melting Temperature, °F	2327	-	2327	1800	2552	-	-
Melting Temperature, °C	1275	-	1275	980	1400	-	-
Density, kg/m3 (pcf)	11 - 13	12 - 13	10 - 13	11 - 14	11-14	14	14
Density, kg/m3	176 - 208	190 - 210	160 - 208	176 - 224	176-224	220	230
Tensile strength, psi	<65	>94	>25	-	<50	>65	>94
Tensile strength, Mpa	0.45	>0.65	0.17	-	<0.35	>0.45	>0.65
Permanent Linear Shrinkage, % ENV (1094-1)							
4 hours @ 500°C (932°F)	-	-	-	-	-	-	<2
after 24hrs @ 1000°C (1832°F)	<2	<2	-	-	-	-	<2
after 24hrs @ 1260°C (2300°F)	-	-	-	-	<2	<2	-
Chemical Analysis, % weight basis after firing							
Alumina, Al2O3	trace	-	trace	-	trace	trace	-
Silica, SiO2	60-70	-	60-70	65	70-80	70-80	-
Calcium oxide + Magnesium oxide, CaO + MgO	29-42	-	29-42	30	18-25	18-25	-
Other	1	-	1	5	<3	<3	-
Loss of Ignition, LOI	5-10	8	2-5	0.5 max	5-10	5-10	12
Thermal Conductivity, W/m•K (BTU•in/hr•ft2), per ASTM C201							
200°C (400°F)	-	0.05 (0.35)	-	-	-	0.04 (0.28)	-
260°C (500°F)	0.06 (0.39)	-	0.06 (0.39)	0.05 (0.35)	0.06 (0.39)	-	-
400°C (750°F)	-	0.07 (0.49)	-	-	-	0.07 (0.49)	-
538°C (1000°F)	0.06 (0.65)	-	0.06 (0.65)	0.08 (0.53)	0.06 (0.65)	-	-
600°C (1100°F)	-	0.11 (0.76)	-	-	-	0.10 (0.69)	-
800°C (1472°F)	-	0.16 (1.11)	-	-	-	0.14 (0.97)	-
816°C (1500°F)	0.15 (1.04)	-	0.15 (1.04)	-	0.15 (1.02)	-	-
982°C (1800°F)	0.19 (1.35)	-	0.19 (1.35)	-	-	-	-
1000°C (1832°F)	0.23 (1.6)	0.23 (1.59)	-	-	-	0.19 (1.32)	-
1100°C (2000°F)	-	-	-	-	0.22 (1.52)	-	-
1200°C (2200°F)	-	-	-	-	-	0.25 (1.73)	-

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Paper products - RCF fibres

	Kaowool® 1260 Paper	Kaowool 1400 Paper
Manufacturing Location	EU	EU
Color	white	white
Classification Temperature, °F	2300	2550
Classification Temperature, °C	1260	1400
Melting Temperature, °F	3200	3200
Melting Temperature, °C	1760	1760
Density, pcf	12	13
Density, kg/m³	190	210
Tensile strength, psi	109	109
Tensile strength, kN/m²	750	750
Acoustic absorption coefficient (BS3638), 2.0mm thickness Frequency (Hz)		
100	-	0.05
2000	-	0.26
4000	-	0.5
Chemical Analysis, % weight basis after firing		
Alumina, Al_2O_3	47	48-54
Silica, SiO_2	52	46-52
Other oxides	1	<5
Loss of Ignition, LOI	8	6
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201		
200°C (400°F)	0.06 (0.39)	-
300°C (572°F)	0.07 (0.49)	-
400°C (752°F)	0.09 (0.62)	0.089 (0.62)
500°C (932°F)	0.11 (0.76)	-
600°C (1112°F)	0.13 (0.9)	0.132 (0.92)
800°C (1472°F)	0.2 (1.39)	0.197 (1.37)
1000°C (1832°F)	-	0.293 (2.03)
1200°C (2200°F)	-	0.436 (3.03)

Safety Data Sheet (SDS): are available for all products.
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Paper products - RCF fibres

	Kaowool® 329-E	Kaowool Flex-Wrap Paper	Kaowool 500 Paper	Kaowool 700 Paper	Kaowool 900 Paper	Kaowool 2000 Paper	Kaowool 2600 Paper	Kaowool 3000 Paper	Kaowool 445-E Paper	K-Shield™ BF Paper
Manufacturing Location	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Color	white	white	white	white	white	white	white	white	gray	white
Continuous Use Temperature, °F	1500	2150	2150	2150	2150	2150	2450	2800	2300	2300
Continuous Use Temperature, °C	815	1176	1176	1176	1176	1176	1343	1538	1260	1260
Classification Temperature, °F	1500	2300	2300	2300	2300	2300	2600	3000	-	2400
Classification Temperature, °C	815	1260	1260	1260	1260	1260	1426	1648	-	1316
Density, pcf	11-13	11-13	12-14	11-13	10-12	11-14	10-13	7-10	8-12	8-10
Density, kg/m³	176-208	176-208	192-224	176-208	160-192	176-224	160-208	112-160	128-192	128-160
Tensile strength, psi	25-40	<25	75-100	75-100	75-100	75-100	75-100	25-40	20-30	15-25
Tensile strength, Mpa	0.17-0.28	0.17	0.51-0.68	0.51-0.68	0.51-0.68	0.51-0.68	0.51-0.68	0.17-0.27	0.14-0.21	0.1-0.17
Fired Tensile strength, psi	-	2-3	2-3	2-3	2-3	2-3	2-3	-	-	15-25
Fired Tensile strength, Mpa	-	0.01-0.02	0.01-0.02	0.01-0.02	0.01-0.02	0.01-0.02	0.01-0.02	-	-	0.1-0.17
Chemical Analysis, % weight basis after firing										
Alumina, Al_2O_3	30-40	47	47	47	47	47	35	95	35-45	51
Silica, SiO_2	50-60	53	53	53	53	53	51	5	45-55	49
Zirconia, ZrO_2	-	-	-	-	-	-	14	-	-	-
Titanium oxide, TiO_2	-	-	-	-	-	-	-	-	5-15	-
Other	10-20	trace	trace	trace	trace	trace	trace	trace	-	trace
Loss of Ignition, LOI	0.5	3-7	6-10	6-10	6-10	6-10	6-10	6-10	<3	0.5 max
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201										
200°C (400°F)	-	-	-	-	-	-	-	0.049 (0.34)	0.05 (0.35)	-
260°C (500°F)	0.05 (0.35)	0.06 (0.39)	0.06 (0.39)	0.06 (0.39)	0.05 (0.35)	0.05 (0.35)	0.05 (0.37)	0.05 (0.36)	-	0.05 (0.38)
316°C (600°F)	-	-	-	-	-	-	-	0.06 (0.39)	0.06 (0.45)	-
425°C (800°F)	-	-	-	-	-	-	-	0.06 (0.44)	0.08 (0.54)	-
538°C (1000°F)	0.08 (0.58)	0.1 (0.69)	0.1 (0.69)	0.09 (0.63)	0.09 (0.63)	0.08 (0.56)	0.09 (0.63)	0.08 (0.53)	0.09 (0.63)	0.08 (0.59)
700°C (1300°F)	-	-	-	-	-	-	-	0.10 (0.69)	-	-
815°C (1500°F)	-	0.14 (0.96)	0.15 (1.07)	0.14 (0.96)	0.14 (0.96)	0.11 (0.8)	0.15 (1.02)	0.12 (0.82)	-	0.12 (0.85)
870°C (1600°F)	0.13 (0.91)	-	-	-	-	-	-	0.13 (0.89)	-	-
982°C (1800°F)	-	-	-	-	-	-	-	0.15 (1.05)	-	-
1093°C (2000°F)	-	-	0.23 (1.58)	0.2 (1.38)	0.2 (1.38)	0.16 (1.11)	0.23 (1.57)	0.18 (1.22)	-	0.17 (1.18)
1200°C (2200°F)	-	-	-	-	-	-	0.27 (1.85)	0.2 (1.42)	-	-
1315°C (2400°F)	-	-	-	-	-	-	0.31 (2.16)	0.23 (1.63)	-	-
1370°C (2500°F)	-	-	-	-	-	-	-	0.25 (1.75)	-	-
1426°C (2600°F)	-	-	-	-	-	-	0.36 (2.52)	0.27 (1.86)	-	-
1538°C (2800°F)	-	-	-	-	-	-	-	0.32 (2.22)	-	-

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Paper products - RCF fibres

	Kaowool® 1260 Waterproof Paper	STD Ceramic Fibre Paper	AZS Ceramic Fibre Paper	Ultrafelt® Paper		
Manufacturing Location	EU	AS	AS	EU		
Color	white	white	white	white		
Classification Temperature, °C (°F)	1260 (2300)	1260 (2300)	1400 (2552)	1260 (2300)		
Density, kg/m³ (pcf)	210 (13)	150 (9)	150 (9)	160 (10)	96 (6)	128 (8)
Tensile strength, kN/m² (psi)	750 (109)	88.26 (12.8)	88.26 (12.8)	-		
Permanent Linear Shrinkage, % ENV (1094-1), after 24hrs @ 1100°C (2012°F)	-	2	2	-		
Chemical Analysis, % weight basis after firing						
Alumina, Al_2O_3	47	>42	>32	47		
Silica, SiO_2	52	<56	<52	53		
Zirconia, ZrO_2	-	-	<19.5	-		
Other oxides	1	-	-			
Loss of Ignition, LOI	9	<10	<10			
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201						
200°C (400°F)	0.06 (0.39)	-	-	0.05 (0.35)	-	-
300°C (572°F)	0.07 (0.49)	-	-	-	-	-
400°C (752°F)	0.09 (0.62)	-	-	0.09 (0.62)	-	-
500°C (932°F)	0.11 (0.76)	-	-	-	-	-
600°C (1112°F)	0.13 (0.9)	-	-	0.13 (0.90)	-	-
800°C (1472°F)	0.2 (1.39)	-	-	0.18 (1.25)	-	-
1000°C (1832°F)	-	-	-	0.24 (1.66)	-	-

Paper products - PCW fibres - Alphawool®

	Alphawool 1600 Paper
Manufacturing location	EU
Color	white
Classification Temperature, °C (°F)	1600 (2912)
Melting Temperature, °C (°F)	2000 (3632)
Density, kg/m³ (pcf)	150 (9.36)
Fired Tensile strength, Mpa (psi)	0.25 (36)
Fiber diameter, microns	3
Thickness measurement, pressure, kPa (psi)	3 (0.44)
Chemical Analysis, % weight basis after firing	
Alumina, Al_2O_3	88
Silica, SiO_2	9
Other oxides	3
Loss of Ignition, LOI	6
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201	
500°C (932°F)	0.09 (0.62)
800°C (1472°F)	0.11 (0.76)
1200°C (2192°F)	0.17 (1.18)
1400°C (2552°F)	0.26 (1.8)
1600°C (2912°F)	0.32 (2.2)

Safety Data Sheet (SDS): are available for all products. Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Paper products - Mineral fibres and E-Glass

	E.R. Glass	Green Glass	Thermatex® 500 Paper	Kaowool® 400-LS	Thermatex 850 Paper
Manufacturing location	EU	EU	EU	NA	EU
Color	white	green	white	off-white	light green
Continuous Use Temperature, °C (°F)	500 (932)	500 (932)	500 (932)	732 (1350)	850 (1560)
Melting Temperature, °C (°F)	720 (1325)	720 (1325)	700 (1290)	1093 (2000)	>1000 (>1832)
Density, kg/m3 (pcf)	150 (9)	150 (9)	120-150 (9-7)	192-240 (12-15)	180-200 (11-12)
Tensile strength, kN/m2 (psi)	6.3 (0.91)	>6.5 (>0.94)	500 (72.5)	0.28-0.52 MPa (40-75)	longitudinal 1.0 (0.14)/ transverse 0.5 (0.07)
Fired Tensile strength, Mpa (psi)	-	-	-	0.03-0.07 (5-10)	-
Permanent Linear Shrinkage, % ENV (1094-1)					
4 hours @ 500°C	<4	<4	-	-	-
after 24hrs @ 1260°C	-	-	-	-	3.5
Acoustic absorption coefficient (BS3638), 2.0mm thickness Frequency (Hz)					
100	-	-	-	-	0.05
2000	-	-	-	-	0.21
4000	-	-	-	-	0.4
Chemical Analysis, % weight basis after firing					
Alumina, Al_2O_3	14.1	14.6	3.5	15	21
Silica, SiO_2	54.4	49.7	65	43	40
Calcium oxide, CaO	17.4	16.6	-	21	26 (CaO+MgO
Titanium oxide, TiO_2	0.5	0.8	-	-	-
Ferric oxide, Fe_2O_3	0.3	3.7	-	-	6.5
Magnesium oxide. MgO	4.7	8.7	-	-	-
Sodium oxide, Na_2O	0.4	1.5	12	-	-
Boron oxide, B_2O_3	8	3.5	6	-	-
Flourine, F_2	0.2	0.1	-	-	-
Other	0	-	<5	22	8
Loss of Ignition, LOI	-	-	8	5-10	4.5 - 9.0
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201					
100°C (200°F)	-	-	-	-	0.04 (0.28)
260°C (500°F)	-	-	-	0.05 (0.36)	-
300°C (572°F)	-	-	-	-	0.084 (0.58)
500°C (932°F)	-	-	-	-	0.13 (0.9)
538°C (1000°F)	-	-	-	0.08 (0.58)	-
700°C (1300°F)	-	-	-	0.11 (0.77)	-

Safety Data Sheet (SDS): are available for all products.
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Paper products - Expandable

	Kaowool® 333-E Expandable Paper		Superwool® 406-E	Superwool 351-E
Manufacturing location	NA		NA	NA
Color	gray		gray	gray
Continuous Use Temperature, °F	2100		1832	1832
Continuous Use Temperature, °C	1149		1000	1000
Classification Temperature, °F	2300		2012	2012
Classification Temperature, °C	1260		1100	1100
Melting Temperature, °F	3200		2327	2327
Melting Temperature, °C	1760		1275	1275
Density, pcf	15-18		21-25	16-19
Density, kg/m³	240-288		336-400	240-288
Tensile strength, psi	<40		75-100	75-100
Tensile strength, Mpa	<0.28		0.52-0.69	0.52-0.69
Fired Tensile strength, psi	5-10		5-10	5-10
Fired Tensile strength, Mpa	0.03-0.07		0.03-0.07	0.03-0.07
Expansion Characteristics, % increase				
Thickness, in (mm)	1/8 (3.17)	1/16 (1.6)	0.16 (4)	1/8 (3.17)
204°C (400°F)	86	132	-	86
538°C (1000°F)	419	385	82	419
649°C (1200°F)	-	-	107	-
760°C (1400°F)	-	-	98	-
790°C (1454°F)	414	503	-	414
981°C (1798°F)	358	530	-	358
Chemical Analysis, % weight basis after firing				
Alumina, Al_2O_3	42		3-5	trace
Silica, SiO_2	48		55-65	55-65
Carbon, C	5-10		-	5-10
Calcium oxide + Magnesium oxide, CaO + MgO	-		25-37	23-37
Organic binder	6-10		6-12	6-10
Other	10		trace	trace

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Section 06

Felt products

Felt products

Superwool® felt
- Superwool Plus clad
- Superwool HT clad
- Superwool HT felt
- Superwool HT Unifelt™

RCF felt
- Cerafelt®
- Kaoclad™
- Kaowool® 1260 felt
- Kaowool Flexi-Felt™
- Ultrafelt®
- Cerachrome® felt
- K-Shield™ felt
- K-Shield felt LS
- K-Shield felt AG
- Unifelt 1300 / 1400 / 1500 / 1600 / 1700

PCW felt
- Alphawool® Unifelt™

Thermal Ceramics' insulating felt products, obtained by hot pressing are particularly suitable for die-cutting operations. Semi-rigid, it is neither brittle nor dusty. Felt optimises the manufacture of complex, die-cut shapes to close tolerances.

Superwool felt products

Superwool felt is made from Superwool fibres, bonded with an organic binder which begins to burn out at 180°C (356°F). This special binder makes Superwool felt particularly suitable for die-cutting operations. Made from chemically stables fibres, lightweight and very insulating, Superwool felt is a multi-purpose product.

Alphawool and Superwool HT Unifelt

Unifelt demonstrate excellent flexibility with excellent dimensional resilience after compression and make utilisation of the felt or cut pieces very easy to handle compared to rigid products. Unifelt is supplied in a wide range of thickness minimum 6mm to a maximum 50mm (2 in) (combining light weight, high heat resistance, and low thermal conductivity). Unifelt range is produced by vacuum forming and is a "wet felt" material that is impregnated making it more "blanket-like" material.

Cerafelt and Cerachrome felt

Cerafelt and Cerachrome felt are made in a unique manufacturing process which allows a wide thickness and density range. Both products are recommended for high temperature industrial applications such as expansion joints in kilns, furnaces, and boiler walls. When used as a gasket, Cerafelt exhibits excellent resistance to penetration from molten metal both ferrous and non-ferrous. This unique property coupled with its ease of fabrication makes it ideal for ingot stool seals and stopper rod gaskets.

K-Shield felt

The K-Shield felt range of products are manufactured on the same line as the high temperature paper products. This manufacturing process allows excellent, uniform material density and thickness control. In addition, the lightweight, flexible nature of this product allows it to be packaged in roll form. K-Shield felts are made from very clean, high purity ceramic fibres.

Typical applications - for high temperature insulation wool felt products:

- Hot Top insulation for steel ingots
- Back-up insulation for furnaces and launder systems
- Insulating wrap for shrouds/stopper rods in steel manufacture
- Gaskets for low pressure casting systems
- Thermocouple tube protection
- Automotive and aerospace heat shields

Typical benefits - for high temperature insulation wool Board and Shape fibre products:

- Low heat storage
- Resistance to thermal shock
- Can be easily cut
- Flexible and resilient
- Good resistance to tearing
- Good sound absorption
- Excellent insulating performance
- Excellent thermal shock resistance
- Low heat storage
- Flame resistant

Superwool® felt - grades available:

Superwool Plus fibre :
classification 1200°C (2192°F)
Superwool HT fibre :
classification 1300°C (2372°F)
Superwool Wet Felt - Superwool Plus and HT Clad is made from Superwool needled blanket and supplied as a moist sheet
Superwool HT Unifelt™ :
classification 1250°C (2282°F)

Benefits of Superwool Felt

- High temperature resistance with low thermal conductivity
- Particularly suited to cutting operations
- Flexible or semi-rigid, depending on density selected
- High sound absorption properties
- Precise thicknesses
- AES fibres are not classified carcinogenic by IARC or under any national regulations on a global basis. They have no requirement for warning labels under GHS (Globally Harmonised System for the classification and labelling of chemicals). In Europe, Superwool fibre meets the requirements specified under NOTA Q of European Directive 67/548. All Superwool fibre products are therefore exonerated from the classification and labelling regulation in Europe.
- Exonerated from any use restriction under annexe V number 7.1 of the German hazardous substances regulation (TRGS 905)

Alphawool® felt - grades available:

Alphawool Unifelt :
classification 1600°C (2912°F)

Benefits of Alphawool Felt

- High chemical purity
- Excellent insulating performance
- Flexibility, good resilience
- Excellent thermal and chemical stability in industrial process conditions

RCF felt - grades available:

Kaowool® Flexi-Felt™ :
classification 1250°C (2282°F)
Cerafelt® :
classification 1260°C (2300°F)
Kaowool :
classification 1260°C (2300°F)
Ultrafelt®:
classification 1260°C (2300°F)
Unifelt :
classification 1260 - 1700°C (2300 - 3092°F)
K-Shield™ Felt :
classification 1260°C (2300°F)
Cerachrome Felt :
classification 1427°C (2600°F)
RCF wet felt:

- Kaoclad and Kaowool made with ceramic fibre needled blanket and supplied as a moist felt
- Cera-Pak is as cast Ceraform sheets which can be formed in-situ to any shape desired

Benefits of RCF Felt

- High flexibility
- Low shot content
- Precise thickness
- Very low thermal conductivity
- Low thermal mass

Felt products - AES fibres - Superwool®

	Superwool HT			
Manufacturing location	EU	EU	EU	
Color	yellow	yellow	yellow	
Classification Temperature, °C (°F)	1300 (2372)			
Density, kg/m³ (pcf), as supplied dry	4, 6, 8, 10,12, 14, 16, 18 (64, 96, 128, 160, 192, 224, 256, 288)			
Airflow Resistance, cfm/in, wc/ft²/in				
Density, kg/m³ (pcf)	14 (224)	18 (288)	14 (224)	
24°C (75°F)	6.7	4.3	6.7	
538°C (1000°F)	3.3	2.2	3.3	
1093°C (2000°F)	2.4	1.3	2.4	
Sound Absorption Coefficients, 128 kg/m³ (8pcf)				
Thickness, mm (in)	Noise Reduction Coefficient, 4000			
13 (1/2)	85	50	-	
25 (1)	99	80	-	
51 (2)	79	80	-	
76 (3)	83	85	-	
Linear shrinkage, %, EN 1094-1, After 24 hrs, isothermal heating				
Density,kg/m³ (pcf)	128 (8)	128 (8)	128 (8)	
1200°C (2192°F)	<2	<2	<2	
Chemical Analysis, % weight basis after firing				
Silica, SiO_2	70 - 80	70 - 80	70 - 80	
Calcium oxide + Magnesium oxide, CaO + MgO	18 - 25	18 - 25	18 - 25	
Other	<3	<3	<3	
Loss of Ignition, LOI, depending on grade	4 - 12	4 - 12	4 - 12	
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201				
Density, kg/m³ (pcf)	64 (4)	128 (8)	192 (12)	288 (18)
300°C (572°F)	0.07 (0.49)	0.07 (0.49)	0.06 (0.42)	0.05 (0.35)
500°C (932°F)	0.16 (1.11)	0.12 (0.83)	0.09 (0.62)	0.08 (0.56)
700°C (1292°F)	0.28 (1.94)	0.20 (1.39)	0.14 (0.97)	0.11 (0.76)
900°C (1652°F)	0.45 (3.12)	0.32 (2.22)	0.21 (1.46)	0.16 (1.11)
1000°C (1832°F)	0.55 (3.81)	0.38 (2.64)	0.25 (1.73)	0.19 (1.32)
1100°C (2012°F)	0.66 (4.58)	0.45 (3.12)	0.30 (2.08)	0.22 (1.53)

* Noise Reduction Coefficient – The average of the sound absorption coefficients at frequencies of 250, 500, 1000 and 2000 cycles per second.

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Felt products - AES fibres - Superwool®

	Superwool HT Unifelt	Superwool Plus Clad	Superwool HT Clad
Manufacturing location	EU	EU	EU
Color	white / tan	white	white
Classification Temperature, °C (°F)	1250 (2282)	1200 (2192)	1300 (2372)
Density, kg/m³ (pcf), as supplied wet	-	600 - 700 (37 - 44)	700 - 800 (44 - 50)
Density, kg/m³ (pcf), as supplied dry	<190 (<12)	300 (19)	300 (19)
Modulus of Rupture, MOR, MPa (psi)	-	-	>0.5
after 24 hrs. @ 1000°C (1832°F)	-	-	>0.6
Tensile strength, MPa (psi)	-	60 (8700)	65 (9425)
Linear shrinkage, %, EN 1094-1, After 24 hrs, isothermal heating			
1100°C (2012°F)	<1.0	-	<3
1200°C (2192°F)	-	<3	-
1300°C (2372°F)	-	-	<3
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201			
Density, kg/m³ (pcf)	<190 (12)	-	300 (19)
400°C (752°F)	0.10		0.04
600°C (1112°F)	0.15		0.07
800°C (1472°F)	0.21		0.12
1000°C (1832°F)	0.30		0.27
1200°C (2192°F)	-		0.37

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Felt products - RCF fibres

	Cerafelt®
Manufacturing Location	EU
Color	yellow
Classification Temperature, °C (°F)	1320 (2400)
Density, pcf, uncompressed	3, 4, 6, 8, 10, 12, 18, 24
Density, kg/m³, uncompressed	48, 64, 96, 128, 160, 192, 288, 384
Chemical Analysis, % weight basis after firing	
Alumina, Al_2O_3	35.1
Silica, SiO_2	49.7
Zirconium oxide, ZrO_2	14.7
Chromium oxide, Cr_2O_3	-
Other	<0.5
Loss of Ignition, LOI	4-12

Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201

Density, kg/m³ (pcf)	48 (3)	64 (4)	96 (6)	128 (8)	160 (10)	192 (12)	288 (18)	384 (24)
300°C (572°F)	0.11 (0.76)	0.1 (0.69)	0.08 (0.56)	0.08 (0.56)	0.07 (0.49)	0.07 (0.49)	0.07 (0.49)	0.06 (0.42)
500°C (932°F)	0.2 (1.39)	0.17 (1.18)	0.14 (0.97)	0.12 (0.83)	0.11 (0.76)	0.11 (0.76)	0.1 (0.69)	0.1 (0.69)
700°C (1292°F)	0.33 (2.29)	0.27 (1.87)	0.21 (1.46)	0.18 (1.25)	0.16 (1.11)	0.15 (1.04)	0.13 (0.90)	0.13 (0.90)
900°C (1652°F)	0.51 (3.54)	0.41 (2.84)	0.31 (2.15)	0.25 (1.73)	0.22 (1.53)	0.2 (1.39)	0.17 (1.18)	0.15 (1.04)
1000°C (1832°F)	0.75 (5.20)	0.59 (4.09)	0.42 (2.91)	0.34 (2.36)	0.29 (2.01)	0.25 (1.73)	0.21 (1.46)	0.18 (1.25)

	Ultrafelt®	Unifelt 1300	Unifelt 1400	Unifelt 1500	Unifelt 1600	Unifelt 1700	Kaowool® 1260 Felt	Kaowool Flexi-Felt
Manufacturing Location	EU	EU	EU	EU	EU	EU	EU	EU
Color	white	white / tan	white / tan	white / tan	white / tan	white / tan	white	white
Classification Temperature, °F	2300	2300	2552	2732	2912	3092	2300	2282
Classification Temperature, °C	1260	1260	1400	1500	1600	1700	1260	1250
Density, pcf, uncompressed	6, 8, 10	11	10	9	8.7	8.1	8.1 - 11.8	8
Density, kg/m³, uncompressed	96, 128, 160	170	160	150	140	130	130 - 190	128
Chemical Analysis, % weight basis after firing								
Alumina, Al_2O_3	47	47	52	56	62	70	46 - 52	46 - 52
Silica, SiO_2	53	53	48	44	38	30	48 - 54	48 - 54
Other	-	<2	<2	<2	-	-	<0.5	<0.5
Loss of Ignition, LOI	-	-	-	-	-	-	7	7

Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201

Density, kg/m³ (pcf)	128 (8)	170 (11)	160 (10)	150 (9)	140 (8.7)	130 (8.1)	
200°C (392°F)	0.05 (0.35)	0.075 (0.52)	-	-	-	-	
400°C (752°F)	0.09 (0.62)	0.11 (0.76)	0.11 (0.76)	0.1 (0.69)	0.1 (0.69)	0.1 (0.69)	
600°C (1112°F)	0.13 (0.90)	0.15 (1.04)	0.14 (0.97)	0.14 (0.97)	0.13 (0.90)	0.13 (0.90)	
800°C (1472°F)	0.18 (1.25)	0.22 (1.53)	0.21 (1.46)	0.2 (1.39)	0.18 (1.25)	0.18 (1.25)	-
900°C (1652°F)	0.24 (1.66)	-	-	-	-	-	
1000°C (1832°F)	-	0.31 (2.15)	0.29 (2.01)	0.23 (1.60)	0.27 (1.87)	0.25 (1.73)	
1200°C (2192°F)	-	-	0.39 (2.70)	0.38 (2.64)	0.37 (2.57)	0.35 (2.43)	
1400°C (2552°F)	-	-	-	0.5 (3.47)	0.5 (3.47)	0.48 (3.33)	

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Felt products - Wet Felts - RCF

	Kaoclad	
Manufacturing location	EU	
Color	white / buff	
Classification Temperature, °C (°F)	1260 (2300)	1400 (2552)
Density, kg/m³ (pcf), uncompressed		
as supplied wet	700 - 800 (43.7 - 49.9)	700 - 800 (43.7 - 49.9)
as supplied dry	275 (17)	275 (17)
Modulus of Rupture, MOR, Mpa (psi)	0.45 (65.2)	0.45 (65.2)
Tensile strength, Mpa (psi), wet	0.12 (17.4)	0.14 (20.3)
Linear shrinkage, %, EN 1094-1, After 24 hrs, isothermal heating		
Density,kg/m³ (pcf)	275 (17)	275 (17)
1200°C	<0.3	-
1300°C	-	<0.4
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201		
Density,kg/m³ (pcf)	275 (17)	275 (17)
500°C (932°F)	0.1 (0.69)	0.1 (0.69)
750°C (1382°F)	0.14 (0.97)	0.14 (0.97)
1000°C (1832°F)	0.2 (1.39)	0.2 (1.39)

Felt products - Wet Felts - Superwool®

	Superwool Plus Clad	Superwool HT Clad
Manufacturing location	EU	EU
Color	white	white
Classification Temperature, °C (°F)	1200 (2192)	1300 (2372)
Density, kg/m³ (pcf), as supplied wet	600 - 700 (37 - 44)	700 - 800 (44 - 50)
Density, kg/m³ (pcf), as supplied dry	300 (19)	300 (19)
Modulus of Rupture, MOR, MPa (psi)	-	>0.5
after 24 hrs. @ 1000°C (1832°F)	-	>0.6
Tensile strength, MPa (psi)	60 (8700)	65 (9425)
Linear shrinkage, %, EN 1094-1, After 24 hrs, isothermal heating		
1100°C (2012°F)	-	<3
1200°C (2192°F)	<3	-
1300°C (2372°F)	-	<3
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201		
Density, kg/m³ (pcf)	-	300 (19)
400°C (752°F)		0.04
600°C (1112°F)		0.07
800°C (1472°F)		0.12
1000°C (1832°F)		0.27
1200°C (2192°F)		0.37

Felt products - Wet Felts - PCW fibres - Alphawool®

	Alphawool Unifelt™
Manufacturing location	EU
Color	white / tan
Classification Temperature, °C (°F)	1600 (2912)
Density, kg/m³ (pcf), depends on grade of fiber	90 (6) minimum
Modulus of Rupture, MOR, Mpa (psi)	>0.5 (>72)
after 24 hrs. @ 1000°C (1832°F)	>0.6 (>87)
Tensile strength, Mpa (psi)	65 (9425)
Linear shrinkage, %, EN 1094-1, After 24 hrs, isothermal heating	
1600°C (2912°F)	<2
Chemical Analysis, % weight basis after firing	
Alumina, Al_2O_3	93 - 96
Silica, SiO_2	3-5
Other	0-2
Loss of Ignition, LOI	<5
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201	
400°C (752°F)	0.06
600°C (1112°F)	0.09
800°C (1472°F)	0.14
1000°C (1832°F)	0.21
1200°C (2192°F)	0.29
1300°C (2372°F)	0.34
1400°C (2552°F)	0.39

Felt products - RCF fibres

	Cerafelt®	Cerachrome®
Manufacturing Location	NA	NA
Color	yellow	blue/green
Classification Temperature, °C (°F)	1260 (2300)	1427 (2600)
Density, pcf, uncompressed	4, 6, 8, 10, 12, 24	6, 8, 12, 24
Density, kg/m³, uncompressed	64, 96, 128, 160, 192, 384	96, 128, 160, 385
Chemical Analysis, % weight basis after firing		
Alumina, Al_2O_3	46	43
Silica, SiO_2	54	54
Chromium oxide, Cr_2O_3	-	3
Other	trace	trace
Loss of Ignition, LOI	3-9	3-9
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201		
Density, kg/m³ (pcf)	128 (8)	128 (8)
260°C (500°F)	0.07 (0.46)	0.06 (0.43)
538°C (1000°F)	0.14 (0.94)	0.13 (0.87)
816°C (1500°F)	0.23 (1.58)	0.21 (1.49)
1093°C (2000°F)	0.33 (2.29)	0.31 (2.18)

	K-Shield® Felt	K-Shield Felt LS	K-Shield Felt AG
Manufacturing Location	NA	NA	NA
Color	tan	tan	tan
Continuous Use Temperature, °F	2300	2300	2300
Continuous Use Temperature, °C	1260	1260	1260
Classification Temperature, °F	2400	2400	2400
Classification Temperature, °C	1316	1316	1316
Density, pcf, uncompressed	6	6	6
Density, kg/m³, uncompressed	96	96	96
Chemical Analysis, % weight basis after firing			
Alumina, Al_2O_3	51	51	51
Silica, SiO_2	49	49	49
Other	trace	trace	trace
Loss of Ignition, LOI	2-5	2-5	3 (max)
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201			
Density, kg/m³ (pcf)	96 (6)	96 (6)	96 (6)
260°C (500°F)	0.06 (0.41)	0.06 (0.39)	0.06 (0.4)
538°C (1000°F)	0.1 (0.68)	0.09 (0.65)	0.1 (0.72)
816°C (1500°F)	0.16 (1.15)	0.15 (1.02)	0.16 (1.12)
1093°C (2000°F)	0.26 (1.82)	0.22 (1.51)	0.23 (1.58)

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website
www.morganthermalceramics.com

Notes

Section 07

Mastics: Pumpables, Moldables, Coatings, Cements

Mastics: Pumpables, Moldables, Coatings and Cement products

Pumpables

- Kaowool® Pumpable
- Kaowool® Pumpable XTP
- Kaowool® Pumpable HT
- Kaowool® Pumpable HS
- Superwool® Pumpable
- Therm-O-Hot® Patch

Moldables

- Kaowool® Moldable
- Kaowool® Moldable AR
- Superwool® Moldable
- Kaofil®
- Superwool Mastic
- Kaowool Mastic

Coatings

- Kaowool® Sealcoat™ HT
- Superwool® Sealcoat™ HT
- Therm-O-Flake™
- Kaowool Hardener
- Superwool Hardener
- Unikote™
- Kaowool® Rigidizer
- Cera-Preg™
- Kao-Seal®
- Kao-Seal® AHR Blue

Cements

- Kaowool Cement B
- Cera-Kote®
- Kaowool White Cement
- Super STIC TITE™
- Therm-O-Stix™ Adhesive

Thermal Ceramics has a full product offering of fibre base insulation materials available in pumpables, moldables, coatings and cements.

Manufactured specifically to aid in efficient furnace, kiln and boiler operation, these products eliminate hot spots, provide superior maintenance solutions, and make insulation installation quick and easy.

In use high temperature insulation wool will:

- Contribute to protecting people and property from excessive heat
- Reduce greenhouse gas emissions
- Reduce energy usage
- Improve efficiency of furnaces and process equipment

For use in high temperature industrial applications where patching and filling of voids is required, available as pumpables (with pumps), moldables, air-setting cements and coatings.

Typical applications - for high temperature insulation Mastics : Pumpables, Moldables, Coatings, Cements:

- Hot or cold repairs of boiler insulation
- Expansion joints and cracks in anode baking pits
- Insulation of furnace penetrations (e.g. tubes, thermocouples)
- General packing applications
- Coating for metal liners
- Brick lining
- Patching and making good refractory insulating linings
- Adhering to fibre or other refractory substrates or providing a protective coating
- Grouting around insulating bricks
- Filling cup-locks
- Patching and repair or refractory fibre
- Launders and linings of ladles in non-ferrous applications

Typical benefits - for high temperature insulation bulk fibres:

- Ready and easy to use
- Thermal stability
- Good erosion resistance
- Low heat storage capacity
- Flexible and resilient
- Excellent insulating performance

Superwool® mastics, pumpables, moldables, coatings, cement grades available:

Superwool® moldables:
Low biopersistent fibre based mastic for general patching applications and is non-wetting to molten aluminum.

Superwool® Sealcoat HT:
Coating that can be installed by troweling, caulking, or spraying to improve the furnace lining during maintenance or new installation.

Superwool® Mastic:
A moldable form of Superwool® fibre which can be trowelled, hand molded, or injected from a hand held pressure gun. Drying converts the mastic into a strong, hard yet light weight insulating material. Resistance to cracking and spalling is excellent, and the dried material has strong adhesive properties.

Superwool® hardeners: An inorganic liquid hardening agents which, when applied to blanket, modules or board produces a hard surface finish with increased resistance to mechanical abrasion and to gas flow erosion.

Benefits of Superwool® mastic, pumpable, moldable, coating, cement:

- Homogeneous structure
- Highly insulating
- AES fibres are not classified carcinogenic by IARC or under any national regulations on a global basis. They have no requirement for warning labels under GHS (Globally Harmonised System for the classification and labelling of chemicals). In Europe, Superwool® fibre meets the requirements specified under NOTA Q of European Directive 67/548. All Superwool® fibre products are therefore exonerated from the classification and labelling regulation in Europe.

RCF mastics, pumpables, moldables, coatings, cement grades available:

Kaowool® pumpables:
The pumpable materials are designed for hot or cold repairs and grades available for strong and abrasive atmospheres. Temperature limits up to 1538°C (2800°F).

Kaowool® Mastic:
maximum continuous use 1000°C (1832°F). A moldable form of Kaowool® ceramic fibre which can be trowelled, hand molded, or injected from a hand-held pressure gun.

Kaowool® Sealcoat HT:
Coating material designed for improving the lining thermal efficiency during maintenance or new construction.

Kaowool® Rigidizer:
A penetrating liquid coating that increases the surface hardness and surface erosion of fibre products. Classification of 1260°C (2300°F).

Kaowool® White Cement:
classification 1400°C (2552°F). A high temperature, air setting cement for use mainly as a refractory surface coating.

Kaofil®:
classification 1260°C (2300°F). A moldable form of Kaowool ceramic fibre which can be injected into cracks and voids using a hand-held pressure gun. It is very sticky and adheres well to both dense and light-weight substrates.

Kaowool® Hardener:
classification 1260°C (2300°F).
An inorganic liquid hardening agents which, when applied to blanket, modules or board produces a hard surface finish with increased resistance to mechanical abrasion and to gas flow erosion.

Cera-Preg:
classification 1260°C (2300°F). A highly refractory air-setting inorganic surface rigidizer designed for refractory fibre products. It penetrates into the surface of the fibrous body, bonds the fibres together to achieve a harder more abrasive and erosion-resistant surface.

Benefits of RCF mastic, pumpable, moldable, coating, cement:

- High temperature stability with low thermal conductivity
- Very resistant to thermal shock
- Good workability, ideal plasticity and water retention
- Low drying and firing shrinkages
- High refractoriness and high bonding strength

Mastic products - Pumpables

	Superwool Pumpable
Manufacturing location	EU
Maximum Temperature Rating, °C	1093
Density, kg/m³	
wet, as received	1200
dried, 110°C	550
Modulus of Rupture, MPa	
24 hrs, dried 110°C	0.80
815°C	0.90
1090°C	1.30
Permanent Linear Shrinkage, %	
24 hrs, dried 110°C	-0.3
815°C	-0.4
1090°C	-1.5
Chemical Composition, %	
Alumina, Al_2O_3	10.0
Silica, SiO_2	69.0
Calcium oxide. CaO	18.0
Other	3.0

	Superwool® Pumpable
Manucaturing location	NA
Continuous temperature use limit, °F (°C)	1900 (1038)
Classification temperature rating, °F (°C)	2000 (1093)
Density, pcf (kg/m³)	
dried @230°F (110°C)	26 (897)
wet	75 (1554)
Compressive Strength, psi (MPa), dried @ 230°F (110°C)	
5% @ 1800°F (982°C)	68 (0.47)
10% @ 1800°F (982°C)	142 (0.98)
Permanent Linear Change, %, ASTM C113	
1200°F (649°C)	-0.3
1500°F (816°C)	-1.7
1800°F (982°C)	-1.7
2000°F (1093°C)	-2.0
Chemical Analysis, %, Weight basis after firing	
Alumina, Al_2O_3	5
Silica, SiO_2	64
Calcium oxide + Magnesium oxide, CaO + MgO	29

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Mastic products - Pumpables

	Kaowool® Pumpable	Kaowool Pumpable XTP	Kaowool Pumpable HT	Kaowool Pumpable HS	Therm-O-Hot Patch™
Manucaturing location	NA	NA	NA	NA	NA
Continuous temperature use limit, °F (°C)	1900 (1038)	1900 (1038)	2400 (1316)	2800 (1538)	1800 (982)
Classification temperature rating, °F (°C)	2000 (1093)	2000 (1093)	2500 (1371)	2800 (1538)	1900 (1038)
Density, pcf (kg/m³)					
dried @230°F (110°C)	22 - 26 (352 - 416)	34 - 40 (545 - 641)	23 - 28 (368 - 449)	70 (1121)	22.4 (359)
wet	70 - 75 (1121 - 1201)	70 - 75 (1121 - 1201)	73 - 78 (1169 - 1249)	100 (1602)	60 (961)
Compressive Strength, psi (MPa), dried @ 230°F (110°C)					
5% @ 1800°F (982°C)	45 (0.31)	75 (0.52)	-	-	-
5% @ 2000°F (1093°C)	-	-	-	280 (1.93)	-
10% @ 1800°F (982°C)	68 (0.49)	-	-	-	-
Permanent Linear Change, %, ASTM C113					
1500°F (816°C)	-	-1.0	-0.2	-	-1.5
1800°F (982°C)	-1.0	-	-	-	-
2000°F (1093°C)	-3.0	-2.5	-	-2.2	-
2500°F (1371°C)	-	-	-2.4	+0.4	-
2800°F (1538°C)	-	-	-	-1.1	-
Thermal Conductivity, BTU•in/hr•ft²•°F (W/m•K), ASTM C417					
300°F (148°C)	-	0.5 (0.07)	-	-	-
400°F (204°C)	-	-	-	-	0.76 (0.11)
500°F (260°C)	0.5 (0.07)	-	0.5 (0.07)	-	-
700°F (371°C)	-	0.7 (0.10)	-	-	-
800°F (427°C)	-	-	-	-	0.97 (0.97)
1000°F (538°C)	0.7 (0.10)	-	0.7 (0.10)	-	-
1100°F (593°C)	-	1.1 (0.16)	-	-	-
1200°F (649°C)	-	-	-	-	1.25 (0.18)
1500°F (816°C)	1.0 (0.14)	-	1.0 (0.14)	-	-
1600°F (871°C)	-	-	-	-	1.56 (0.22)
Chemical Analysis, %, Weight basis after firing					
Alumina, Al_2O_3	39 - 43	34	43 - 47	47 - 50	19
Silica, SiO_2	52 - 58	66	50 - 54	47 - 50	46
Calcium oxide + Magnesium oxide, CaO + MgO	-	-	-	-	19
Ferric oxide, Fe_2O_3	-	-	-	0.4 - 0.7	8.9
Other	3 - 5	-	2 - 4	2 - 4	4.4

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Mastic products - Moldables

	Kaowool® Mastic	Kaofil®1380	Kaofil 1260
Manufacturing location	EU	EU	EU
Maximum Continuous Temperature, °C	1000	-	-
Classification Temperature, °C	-	1260	1260
Color	white	white	white
Density, kg/m³			
wet, as supplied	1350	1380	1440
dry, as supplied	670	610	680
Modulus of Rupture, MPa			
dried, MN/m²	-	2.25	-
after 24 hrs, 1000°C	1.98	-	-
Loss of Ignition, LOI, %, after 2 hrs, 800°C	-	4.5	5.5
Permanent Linear Shrinkage, %			
110°C, *dried	1.0	*0.8	*1.0
1000°C, *fired	-	*2.3	*2.7
after 24 hrs, 1000°C	2.0	-	-

	Superfil® Plus Mastic
Manufacturing location	EU
Continuous Use Temperature, °C	1350
Maximum Temperature Rating, °C	1400
Solids, %	46
Density, kg/m³	
wet, as received	1200
dried, 110°C	700
Modulus of Rupture, MPa, dried 24 hours	
110°C	1.35
1315°C	1.10
Permanent Linear Shrinkage, %, dried 24 hours	
1090°C	-1.6
1315°C	-2.2
Aluminum Resistance Cup Test, 7075 Alloy, 815°C, 72 hrs	No penetration
Chemical Composition, %	
Silica, SiO_2	86.0
Calcium oxide. CaO	12.0
Other	2.0
Thermal Conductivity, W/m•K, per ASTM C201	
260°C	0.8
538°C	1.0
816°C	1.4
1093°C	2.0

	Superwool® HT Mastic
Manufacturing location	EU
Temperature Limit, °C	1300
Color	white
Density, kg/m³	
uncompressed	1420
as supplied, dry	730
Modulus of Rupture, MPa	
dried	1.5
Permanent Linear Shrinkage, %	
1100°C	1.0

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Mastic products - Moldables

	Kaowool® Moldable	Kaowool Moldable AR	Superwool® Moldable
Manufacturing location	NA	NA	NA
Continuous temperature use limit, °F (°C)	1900 (1038)	1800 (982)	2000 (1093)
Classification temperature rating, °F (°C)	2000 (1093)	1800 (982)	2100 (1149)
Density, pcf (kg/m³)			
dried	28 - 30 (448 - 480)	55 - 60 (881 - 962)	56 (895)
wet	70 - 75 (1122 - 1202)	100 - 105 (1602 - 1683)	97 (1550)
Compressive Strength, psi (MPa), fired			
5% @ 1800°F (982°C)	-	300 (2.07)	-
5% @ 1800°F (982°C)	-	300 (2.07)	250 (1.7)
Permanent Linear Change, %, ASTM C113			
1000°F (538°C)	-0.1	-2.3	-
1500°F (816°C)	-0.2	-2.3	-
2000°F (1093°C)	-2.7	-3.1	-1.3
Thermal Conductivity, BTU•in/hr•ft²•°F (W/m•K), ASTM C417			
500°F (260°C)	0.5 (0.07)	0.7 (0.10)	-
1000°F (538°C)	0.7 (0.10)	1.0 (0.14)	-
1500°F (816°C)	1.0 (0.14)	1.3 (0.19)	-
Chemical Analysis, %, Weight basis after firing			
Alumina, Al_2O_3	26 - 30	29 - 32	20
Silica, SiO_2	67 - 72	64 - 67	65
Calcium oxide + Magnesium oxide, CaO + MgO	-	-	13
Other	1 - 2	3 - 5	<3

Safety Data Sheet (SDS): are available for all products.
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Mastic products - Coatings

	Superwool® Hardener	Kaowool® Hardener
Manufacturing location	EU	EU
Classification Temperature °C	1260	1260
Colour	Pink (translucent liquid)	White (translucent liquid)
Solids Content, (by weight)	25	28 - 29
Specific Gravity, g/cm3	1.2	1.203
Viscosity, cylinder penetration, mm	-	4
pH Value	4 - 7	9.7
Permanent Linear Shrinkage %		
@ 1100°C	4 - 7	9.7

	Cera-Preg Inorganic Refractory Rigidizer
Manufacturing location	EU
Shelf Life	6 months
Classification Temperature °C	1260
Colour	Grey
Estimated Coverage per litre m^2	
Brushed	1.2
Sprayed	2.4
Solids %	10
Specific Heat (BTU/lb°C)	0.24 - 0.27

	Superwool HT Sealcoat™
Manufacturing location	EU
Continuous Use Temperature, °C	1427
Maximum Temperature Rating, °C	182
Solids, %	46
Density, kg/m^3	
wet, as received	1200
dried, 110°C	730
Modulus of Rupture, MPa, 24 hours, dried	
110°C	1.38
1315°C	1.45
1450°C	-
1530°C	-
1600°C	-
Permanent Linear Shrinkage, %, 24 hours, dried	
815°C	-1.4
1090°C	-1.4
1427°C	-1.5
1450°C	-
1530°C	-
1600°C	-
Aluminum Resistance Cup Test, 7075 Alloy, 815°C, 72 hrs	No penetration
Chemical Composition, %	
Alumina, Al_2O_3	-
Silica, SiO_2	86.0
Calcium oxide. CaO	12.0
Other	2.0
Thermal Conductivity, W/m•K (BTU•in/hr•ft^2), per ASTM C201	
260°C	0.8
538°C	1.0
816°C	1.4
1093°C	2.0

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Mastic products - Coatings

	Kaowool® Sealcoat™ HT	Kaowool Rigidizer	Therm-O-Flake™ Coating	Kao-Seal™	Kao-Seal AHR Blue	Unikote® M Coating	Unikote S Coating	Superwool® Sealcoat™ HT
Manufacturing location	NA	NA	NA	NA	NA	NA	NA	NA
Continuous temperature use limit, °F (°C)	2500 (1371)	-	1600 (871)	200 (93)	-	2500 (1371)	2800 (1538)	2800 (1538)
Classification temperature rating, °F (°C)	2600 (1427)	2300 (1260)	1800 (980)	-	-	2600 (1427)	3000 (1649)	2900 (1593)
Density, pcf (kg/m³)								
dried	32 - 36 (513 - 577)	-	-	-	-	69 (1106)	69 (1106)	32 - 36 (513 - 577)
wet	78 - 82 (1250 - 1314)	75 (1202)	-	-	-	-	-	75 (1200)
Compressive Strength, psi (MPa), fired								
10% @ 2000°F (1093°C)	-	-	-	-	-	-	-	225 (1.55)
Permanent Linear Change, %, ASTM C113								
2000°F (1093°C)	-1.8	-	-	-	-	-0.3 (2375°F)	-0.3 (2375°F)	-1.4
2400°F (1316°C)	-	-	-	-	-	-0.5 (2550°F)	-	-1.4
2600°F (1427°C)	-2.9	-	-	-	-	-	-0.5 (2650°F)	-1.5
2800°F (1538°C)	-	-	-	-	-	-	-	-1.6
Thermal Conductivity, BTU•in/hr•ft2•°F (W/m•K), ASTM C417								
500°F (260°C)	0.6 (0.09)	-	0.88 (0.13) (400°F)	-	-	-	-	0.8 (0.12)
1000°F (538°C)	0.8 (0.12)	-	1.09 (0.16) (800°F)	-	-	-	-	1.0 (0.14)
1500°F (816C)	1.1 (0.16)	-	1.31 (0.19) (1200°F)	-	-	-	-	1.4 (0.20)
2000°F (1093°C)	1.5 (0.22)	-	1.56 (0.23)(1600°F)	-	-	-	-	2.0 (0.29)
Chemical Analysis, %, Weight basis after firing								
Alumina, Al2O3	45 - 48	-	19	-	-	71	76	-
Silica, SiO2	51 - 54	-	50	-	-	24	24	86
Calcium oxide + Magnesium oxide, CaO + MgO	-	-	18	-	-	-	-	12
Other	1 - 2	-	13	-	-	5	-	2
Quantity per Container, gallon (liter); ounce (gram)	1, 5 (4, 19), pail 11, 32 (312, 907) tube	1, 5 (4, 19), pail	40 (18) lb (kg) bag	5 (19), pail 55 (208)drum	5 (19), pail	5 (19), pail	5 (19), pail	1, 5 (4, 19), pail 11, 32 (312, 907) tube

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Mastic products - Cements

	Kaowool® White Cement	Kaowool Cement and Veneering Cement
Manufacturing location	EU	EU
Classification Temperature °C	1400	1260
MeltingTemperature °C	1760	1760
Colour	white	white
Density, kg/m³, as supplied wet	1840 - 1950	1840 - 1950
Compressive strength, KPa	45	45
Specific Heat, kj/kg•K, 100°C - 550°C	1.04 - 1.14	1.04 - 1.14
Permanent Linear Shrinkage %		
1100°C	2.15	2.15
1260°C	3.2	3.2

	Kaowool® Cement B	Cera-Kote™	Cera-Kote 322-D	Cera-Kote 624-A	Super Stic-Tite™	Therm-O-Stix® Adhesive
Manufacturing location	NA	NA	NA	NA	NA	NA
Continuous temperature use limit, °F (°C)	2200 (1204)	2150 (1177)	2200 (1204)	2200 (1204)	-	1200 (649)
Classification temperature rating, °F (°C)	2400 (1316)	2300 (1260)	2400 (1316)	2400 (1316)	1900 (1038)	1200 (649)
Melting point, °F (°C)	3250 (1788)	3200 (1760)	3250 (1788)	3250 (1788)	-	-
Color	white	off-white	white	white	-	-
Density, pcf (kg/m³), dried	-	-	-	-	27 (432)	15 (240)
Bonding Stregnth, psi (kg/m³)	205 (3284)	180 (2883)	255 (4085)	234 (3748)	-	-
Chemical Analysis, %, Weight basis after firing						
Alumina, Al_2O_3	44	39	44	80	-	-
Silica, SiO_2	55	59	55	19	-	74
Other	2	2	2	1	-	26
Quantity per Container, gallon (liter)	1, 5 (4, 19), pail	1, 5 (4, 19), pail	1, 5 (4, 19), pail	1, 5 (4, 19), pail 16 (454) oz (g), bottle	50 (23) lb (kg)bag	1, 5 (4, 19), pail

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Mastic installation equipment

Pumps

HS-100 Extrusion Pump is a modified piston extrusion pump designed to pump Kaowool® or Superwool® Pumpable and Sealcoat products in a fast efficient manner.

The air-operated HS-100 Extrusion Pump is mounted on a platform with wheels for easy movement. Five gallon pails of the Kaowool or Superwool Pumpable materials are positioned in the pump and the extrusion action delivers the product through the supply hose to the application area. The Sealcoat® Nozzle assembly is designed to work in conjunction with the HS-100 Extrusion Pump to effectively apply the Sealcoat products. The special nozzle atomizes the Sealcoat material, providing an efficient wet gunning process for delivering the material onto a variety of insulation, refractory, or metal surfaces.

HS-100 Extrusion Pump *is typically used in the North American market.*

WP4-F Worm Pump is a compact pump unit designed for applying Pumpable and Sealcoat products. It is used for grouting, filling as well as injection works and with additional accessories the WP4-F is ready for spraying respectively coating applications done with paste-like fibrous refractory materials.

The WP4-F is a powerful special-purpose worm pump with a variable frequency drive. The wheel hub design assembly is pivot point to easily tilt the machine backwards and hence for save moving of the machine. The WP4-F is easy to operate, to clean and to maintain. Wedge closings are used to fix the stator - no special tools for changing and cleaning are required. A central lifting eye allows an easy transport, furthermore are the drive and the handles to disassemble. A huge variety of accessories for diverse applications are available: rotor and stator D50 for double output, a safety filling device when filling the hopper with ready-mixed mortars from buckets, an air remote control device with pressure reducer, a cable remote control, filling guns, mortar and air hoses, spray guns, nozzles, etc.

WP4-F Worm Pump available from PMFS GmbH is typically used in the European market.

Caulking Guns and Caulking attachments

The AO-25 Caulking Gun is an air-operated bulk loaded caulking gun for use with Kaowool or Superwool Pumpable, Moldable and Sealcoat products. The gun operates on air pressure of 30 - 90 psi (0.21 - 0.62 MPa)

The CW-1 Caulking Wand attaches to the end of the HS-100 Pump delivery hose for large volume repairs. This is an ideal set-up to apply Pumpable and Sealcoat products to fill gaps in refractory linings and eliminate Hot Spots.

Sealcoat Nozzle, Caulking Wand and Caulking Gun, typicallly these styles are used in the North American market. Check with your regional team for recommended tools.

Section 08

Textile products

Textile products

AES textiles

- **Superwool® Plus**

RCF textiles

- **Kaowool textiles**
- **Kao-Tex™ 1000**
- **Kao-Tex™ 1800**
- **Kao-Tex™ 2000**
- **Kao-Tex™ Styles 2200 and 2500**

Thermal Ceramics' high temperature textile products are used in applications such as the insulating lining of metallurgical ovens and furnaces, petrochemical heaters, and ceramic kilns.

Cloths, threads, ropes and yarns converted into various forms for specialised applications.

In use high temperature insulation wool will:

- Contribute to protecting people and property from excessive heat
- Reduce greenhouse gas emissions
- Reduce energy usage
- Improve efficiency of furnaces and process equipment

Low thermal conductivity, high tensile strength and excellent abrasion resistance are among the outstanding characteristics of textile products.

- Offered with specialised coatings
- Provide excellent thermal protection
- Heat resistant
- Chemically resistant to most elements

Fabrication with other Morgan Advanced Materials products enables custom engineered thermal solutions to be developed to customer specifications.

Typical applications - for high temperature insulation wool textile products:

- Welding curtains in steel fabrication
- Fire blankets for commercial and domestic kitchens
- Smoke and fire curtains in buildings
- Kiln car, expansion joint and door seals in furnaces
- Gaskets in furnaces and domestic appliances
- Flexible expansion compensators in power generation equipment
- Removable, flexible thermal insulation quilts for pipe work and valves in the petrochemical and power generation industry

Superwool® textile - grades available:

Superwool® Plus fibre :
classification 1200°C (2192°F)

Benefits of Superwool® textiles:

- Flexible and easy to use
- Excellent appearance
- Resistant to molten aluminium
- AES fibres are not classified carcinogenic by IARC or under any national regulations on a global basis. They have no requirement for warning labels under GHS (Globally Harmonised System for the classification and labelling of chemicals). In Europe, Superwool® fibre meets the requirements specified under NOTA Q of European Directive 67/548. All Superwool® fibre products are therefore exonerated from the classification and labelling regulation in Europe.

RCF textile - grades available:

RCF textiles :
Classification up to 1371°C (2500°F)

Benefits of RCF textiles:

- High temperature stability
- Lightweight and flexibility in use
- Excellent corrosive attack resistance
- Steel wire and fibreglass reinforced

Superwool® textiles and RCF textiles range includes:

Yarn
Is the base of all the textile range of products. The yarn is reinforced with either a glass filament or a fine inconel wire.

Cloth
Woven from a glass or inconel wire reinforced ceramic fibre yarn.

Cables rope (high density)
Manufactured from ceramic yarn which is either glass filament or inconel wire reinforced. It is composed of 3 pre-twisted strands each containing a predetermined multiple of fibre yarns which form a flexible, high density rope.

Cables rope (low density)
Manufactured from roving which is glass filament reinforced.
It is composed of 3 pre-twisted strands each containing a predetermined multiple of yarns which are twisted together to form a flexible, low density rope.

Rope lagging
Consists of a strip of fibre blanket that is overbraided with a glass yarn producing a highly insulating rope product of medium density, which is also compressible and flexible. Can also be overbraided with either a cotton yarn or a fine inconel wire.

Twisted rope
Consists of a multiple of fibre yarn strands which can be either glass filament or inconel wire reinforced. They are twisted together to give the required final product diameter giving a soft rope product that is easily compressed and particularly suitable as a seal between uneven surfaces.

Webbing
Woven from either glass or inconel wire re-inforced fibre yarn.

Ladder tape
Woven from either glass or inconel wire reinforced fibre yarn. It has a similar weave to cloth on the outer edges, but an open weave in the centre allowing for ease of installation over studs and is ideal as a gasketing material.

Textile products

	Superwool® Plus Textiles			Kaowool® Textiles		
Fibre Type	**Superwool Plus**	**Glas**	**Steel**	**Alumino Silicate**	**Glass Filament**	**Inconel Wire**
Classification temperature rating, °C (°F)	1200 (2192)	500 (932)	1000 (1832)	1260 (2300)	550 (1022)	1100 (2012)
Availability	Twisted Rope · Round Braided Packing · Rope Lagging Square Braided Packing · Braided Sleeving · Webbing			Yarn · Cloth · Cabled Rope (high density) · Cabled Rope (low density) · Rope Lagging · Twisted Rope · Webbing · Ladder Tape		

	Kao-Tex® 1000	Kao-Tex® 1800	Kao-Tex® 2000	Kao-Tex® 2200	Kao-Tex® 2500
Fibre Type	fiberglass	leached silica	ceramic fibre	alumina silica boria	
Classification temperature rating,°F (°C)	1000 (538)	1800 (982)	2000 (1093)	2200 (1204)	2500 (1371)
Availability	Cloth, Tapes, Tubings, Ropes	Cloth	Cloth, Tapes, Ropes	Cloth, Threads, Sleevings, Tapes	

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Notes

Section 09

Heat Shield products

Heat Shield products

- **Shell Tech**
- **Integrated Tech**
- **Flexible Tech**
- **Rigid Box Tech**

By employing a range of materials, Thermal Ceramics can provide heat shields in a wide variety of demanding environments across many markets and demanding applications.

Our Heat Shields are used within transportation and are often incorporated into shipping, aeronautical and automotive design. Depending on the specific application, our material engineers can develop and implement a high performance solution that meets your requirements. This is done by taking the unique properties of high temperature insulation like ceramic fibres and microporous to produce heat shields that are highly adept in extreme environments, whilst retaining characteristics such as light weight and robustness.

Having worked extensively with shipping, aerospace and automotive industries in both commercial and defence spheres, we are ideally placed to provide you with Heat Shields that is on budget, without sacrificing performance.

Common insulation materials used in our Heat Shields:

- Alkaline Earth Silicate Fibres
- Glass Fibres
- Microporous materials

Common materials used for encapsulation:

- Austenitic and ferritic stainless steel
- Inconel
- Titanium

Shell Tech *(picture 1)*
Designed to follow the shape of your equipment, our lightweight Shell Technology provides an elegant fitted solution to your thermal protection needs. Our Shell Technology is made using Superwool® Plus insulating fibre, FireMaster® fibre, silica, glass fibre or microporous insulation material completely encapsulated in stainless steel and custom-shaped to fit your application. This ensures the possibility for the customer to manage the final assembly on site. Shell Technology is made of corrugated SS in a thickness from 0.05 to 0.3mm (0.002 to 0.012in). Ideal where space is at a premium, Shell Technology is easy to fit, and easy to remove for maintenance or other reasons for applications including:

- Aerospace: thrust reverser
- Automotive: exhaust catalyst
- Passenger vehicles: exhaust manifold
- Off-Road vehicles: turbocharged
- Marine and power generation: exhaust manifold

Our heat shields made from our shell technology offer the following benefits to our customers:

- Elegant, fitted, lightweight solution
- Effective lifetime insulation
- Easy to fit and to remove

Integrated Tech *(picture 2)*
For the insulation of large or complex equipment, our integrated technology solutions are custom designed. Our integrated technology is made using Superwool® Plus insulating fibre, FireMaster® fibre, silica, glass fibre or microporous material, completely encapsulated in stainless steel and custom-shaped to fit your application requirements. This ensures that the assembly is made in Morgan Thermal Ceramics, Ecrans Thermiques with the part provided by the customer.

Integrated technology is made of corrugated SS in a thickness from 0.05 to 0.3mm (0.002 to 0.012in) and provides excellent lifetime insulation for applications including:

- Aerospace: helicopter turbine
- Automotive: exhaust catalyst
- Passenger vehicles: exhaust manifold
- Marine and power generation: exhaust manifold

Flexible Tech *(picture 3)*
Our flexible technology provides an effective and versatile solution for thermal protection in a wide range of industrial and other applications. Made from silica or glass fibre encased in silicone and stainless steel fabric, our flexible technology offers heat shielding in continuous operating temperatures up to 600°C (1112°F). A fully flexible jacket, it is lightweight and easy to fit, and to remove if necessary even in a restricted space.

Our flexible technology solutions are suitable for a wide range of applications including:

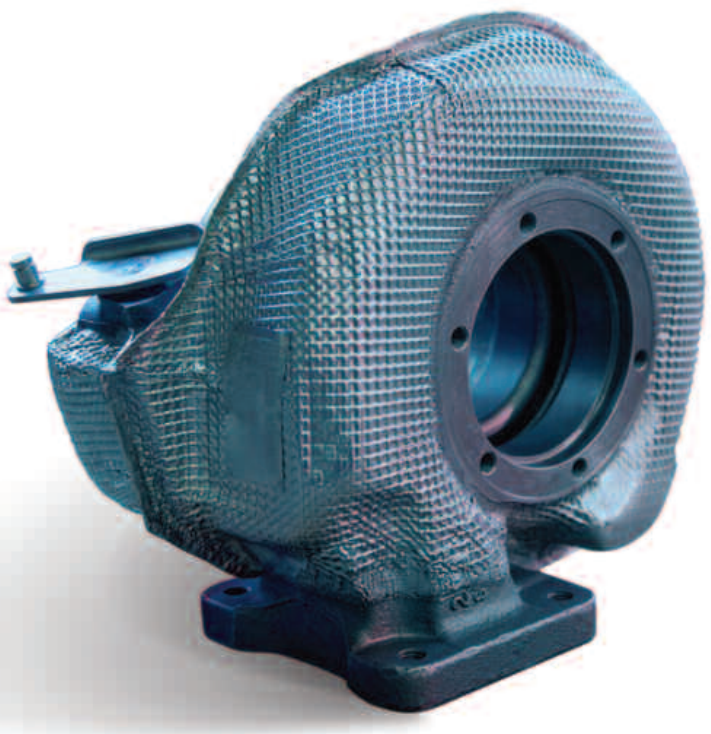
- Automotive: exhaust manifold
- Passenger vehicles: exhaust manifold
- Marine and power generation: exhaust manifold
- Oil and gas: valves & actuators

Rigid Box Tech *(picture 4)*
Our rigid box technology offers effective thermal and fire protection for all types of equipment, in an easy-to-use, SOLAS-approved and jet and hydrocarbon fire approved system.

Rigid box enclosures are custom-built to suit each application using FireMaster® Marine Plus blanket or silica or glass fibre insulation material which is completely encapsulated in austenitic or ferritic stainless steel at our advanced manufacturing facility. Rigid box technology is made of SS in a thickness from 1 to 5mm (0.04 to 0.2in).

Our rigid box technology provides customers with the following benefits:

- SOLAS approved, lifetime insulation
- Jet and hydrocarbon fire approved
- Easy to fit and to remove
- No contact with insulation material
- No tooling required



Section 10

Fire protection products

FireMaster® Fire protection products :

FireMaster Marine Plus blanket
FireMaster Marine Plus water repellent blanket
FireMaster Marine Plus faced blanket
FireMaster RES system
FireMaster MP Panel
FireMaster MarineFlex™ N
FIreMaster MP Shell
FireMaster Cable Wrap system
FireMaster board
FireMaster expanding felt
FireMaster FireBarrier™ 135
FireMaster FlexiJet
FireMaster FastWrap™ XL

FIREMASTER®

FireMaster products are used all over the world to protect people and structures against fire. The wide variety of FireMaster fire protection systems are comprehensively certified and extensively tested to meet national and international standards and have approvals valid worldwide for cellulosic, hydrocarbon and jet fire protection, offering our customers the security of global proven fire performance in various market sectors:

- Commercial Buildings, Hotels, Sports Stadiums and Airport Terminals
- Industrial Plants
- Petrochemical plants, Offshore Platforms and FPSO's
- Cruise Ships, Military Vessels, Mega Yachts and Fast Ferries
- Tunnels and underground construction
- Duct work protection
- Fire doors, OEM and fire stops

Tunnels, construction and industrial

Not only is there a risk to human life but also severe damage to the tunnel structure can occur, requiring extensive repairs or even causing collapse of the tunnel. The resulting disruption of transport links can cause serious economic or social problems such as increased traffic congestion, reduction in tourism or damage to local businesses.

FireMaster products also offer fire, thermal and acoustical fire protection in the construction and industrial markets and due to the lightweight flexible nature of the material, labor is significantly reduced during installation.

Marine, offshore and petrochemical

FireMaster systems have been providing for offshore platforms and chemical process plants fire protection for over 20 years with references in many major projects.

Ductwork

FireMaster duct wrap products are manufactured using Thermal Ceramics patented low biopersistent Superwool® fibres. FireMaster duct wrap products are completely encapsulated in aluminium foil. It is installed onto ductwork using band straps to provide fire protection for up to three hours.

Typical applications - for FireMaster fire protection products:

- 'A' class and IMO HSC steel, aluminium and PVC composite bulkhead and deck insulation in high speed craft
- Upgrading of fire performance of composite panels to meet IMO room corner test requirements
- 'H' class and 'A' class steel bulkhead and deck fire protection for ships and offshore platforms
- Hydrocarbon and jet fire protection of process pipes & vessels
- Infill to fire doors and cladding panels
- Construction joints
- Cellulosic & hydrocarbon fire protection of structural steelwork
- Ductwork and cable tray fire protection
- Fire protection to concrete tunnel linings
- Structural steel fire protection
- Vessel fire protection

FireMaster® product range includes:

FireMaster® Marine Plus blanket
A highly insulating blanket especially developed for fire protection applications that are very space or weight sensitive. Lightweight solution for aluminium structures with **weight savings of 20 - 30%** compared to traditional fibre solutions.

Tested and approved for the fire protection of steel, aluminium and composite structures used in the marine industry and offers substantial weight savings over traditionally-used fibre insulation systems. It is also suitable for use where high insulation performance in fires is required in the offshore, petrochemical and construction industries.

FireMaster Marine Plus water repellent blanket
A flexible, resilient product that is able to provide effective fire protection in standard, hydrocarbon and jet fire applications whilst limiting water ingress through the use of a special additive treatment. Provides excellent resistance to water ingress due to the water repellent treatment being applied throughout the entire blanket thickness. The small amount of additive used ensures the blanket retains the non-combustibility performance of the base blanket. FireMaster blanket has low density thus allowing even hydrocarbon fire protection standards to be met using thin and light specifications significantly contributing to weight savings.

FireMaster Marine Plus faced blanket
A variety of facings designed to give greater flexibility when using blanket in areas where surface protection for the blanket may be required.

- **FireMaster Alu 20R blanket -** factory-applied covering of scrim-reinforced aluminium foil, approximately 20 micron thick, on one side. The blanket has good handling strength and aesthetic appearance when installed.

- **FireMaster Alu 40 blanket -** factory-applied covering of non-reinforced aluminium foil, approximately 30 micron thick, on one side. The blanket is an approved non-combustible product.

- **FireMaster GC blanket -** factory-applied covering of glass cloth applied on one side. The blanket is suitable for applications where aluminium foil would not be appropriate and provides a surface that can be painted if required.

FireFelt™
Low density offers a flexible form which is compressible yet resilient but still highly insulating. This offers a key advantage in weight critical applications such as high speed craft fire protection offering lower product densities than alternative materials but without the risk of loss of physical integrity or insulation performance in a fire. A semi-rigid board with higher tensile and compressive strength.

Expanding felt
Immediately expands a minimum of three times its original thickness on heating making it ideal for any application where assured fire protection is required under conditions of movement. Typical applications are construction joint sealing, penetration seals and fire protection applications requiring thin layers of insulation.

FireBarrier™ 135
Cementitious materials designed for a variety of fire protection applications requiring strong and weather resistant exterior finishes, when mixed with water can be applied by spray equipment to a variety of substrates.

- **FireBarrier™ 135** is suitable for cellulosic and hydrocarbon fires and has been fire tested in high-rise hydrocarbon fires of up to 1350°C (2462°F).

Fire protection products - FireMaster®

	FireMaster Marine Plus Blanket			FireMaster Water Repellent Blanket					FireMaster Faced Blanket		
									ALU 20R†	ALU 40†	GC††
Manufacturing location	Global	Global	Global	Global	Global	Global	Global	Global	EU	EU	EU
Colour	white	white	white	white	white	white	white	white	white	white	white
Density, kg/m³ (pcf)	64 (4)	96 (6)	128 (8)	64 (4)	96 (6)	128 (8)	160 (10)	192 (12)	-	-	-
Loss on ignition, %, 5hrs, 1000°C (1832°F)	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	-
Silicone content, %	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<1	<1	<1
Water absorption, %	-	-	-	2.5	2.5	2.5	2.5	2.5	-	-	-
Linear shrinkage, %, after 24hrs, 1000°C (1832°F)	-	-	-	<1	<1	<1	<1	<1	<1	<1	<1
Thermal insulation properties, R value, MK/w											
Blanket thickness, 25mm (1in)	0.78	0.78	0.78	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73
30mm (1.2in)	0.94	0.94	0.94	-	-	-	-	-	-	-	-
35mm (1.4in)	1.09	1.09	1.09	-	-	-	-	-	-	-	-
38mm (1.52in)	-	-	-	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11
40mm (1.6in)	1.25	1.25	1.25	-	-	-	-	-	-	-	-
50mm (2in)	1.56	1.56	1.56	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46
75mm (3in)	-	-	-	2.19	2.19	2.19	2.19	2.19	2.19	2.19	2.19
100mm (4in)	-	-	-	2.92	2.92	2.92	2.92	2.92	2.92	2.92	2.92
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201											
200°C (400°F)	0.06 (0.42)	0.05 (0.35)	0.04 (0.28)	0.07 (0.48)	0.06 (0.42)	0.06 (0.42)	0.06 (0.42)	0.06 (0.42)	0.07 (0.48)	0.06 (0.42)	0.06 (0.42)
300°C (572°F)	-	-	-	0.09 (0.62)	0.08 (0.55)	0.08 (0.55)	0.07 (0.48)	0.07 (0.48)	0.09 (0.62)	0.08 (0.55)	0.08 (0.55)
400°C (752°F)	0.11 (0.76)	0.10 (0.69)	0.09 (0.62)	0.12 (0.83)	0.11 (0.76)	0.10 (0.69)	0.09 (0.62)	0.09 (0.62)	0.12 (0.83)	0.11 (0.76)	0.10 (0.69)
500°C (932°F)	-	-	-	0.17 (1.18)	0.14 (0.97)	0.13 (0.90)	0.12 (0.83)	0.11 (0.76)	0.17 (1.18)	0.14 (0.97)	0.13 (0.90)
600°C (1112°F)	0.17 (1.18)	0.15 (1.04)	0.13 (0.90)	0.22 (1.53)	0.17 (1.18)	0.16 (1.11)	0.15 (1.04)	0.14 (0.97)	0.22 (1.53)	0.17 (1.18)	0.16 (1.11)
800°C (1472°F)	0.26 (1.80)	0.21 (1.46)	0.19 (1.32)	-	-	-	-	-	-	-	-
1000°C (1832°F)	0.38 (2.64)	0.29 (2.01)	0.25 (1.73)	-	-	-	-	-	-	-	-
Acoustic performance											
Classification	Class A*	Class B**	Class C***								
Frequency, MHz, 125	0.15	0.40	0.45	-	0.79	0.09	-	-	-	-	-
250	0.75	0.95	0.90	-	0.29	0.54	-	-	-	-	-
500	1.00	0.95	0.75	-	0.73	0.86	-	-	-	-	-
1000	1.00	0.85	0.65	-	0.92	0.94	-	-	-	-	-
2000	1.00	0.80	0.65	-	0.96	0.94	-	-	-	-	-
4000	0.75	0.65	0.45	-	0.99	0.96	-	-	-	-	-
Overall sound absorption coefficient	1.00	0.80	0.65	-	0.82	0.82	-	-	-	-	-

† white blanket with silver aluminum foil, 1 side
†† white blanket with white glass cloth facing, 1 side

Class A* (Non-faced no surface covering material used)
Class B** (Faced with glass cloth)
Class C*** (Faced with 30 micron reinforced aluminium foil)

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Fire protection microporous products - FireMaster®

	FireMaster MP Panel	FireMaster MarineFlex N
Product Form	Rigid Panel	Stitched Panel
Classification Temperature, °F	1832	1832
Classification Temperature, °C	1000	1000
Denisty, kg/m³ (pcf)	260 (16)	275 (17)
Linear Shrinkage, %, ASTM C365		
1000°C (1832°F), 24 hour full soak	<3.0	<3.0
Cold Compressive strength, MPa (psi), ASTM C165, room temp.	0.28 (40.6)	0.30 (43.5)
Thermal Conductivity, BTU•in/hr•ft²•°F, per ASTM C177		
392°F	0.159	0.180
752°F	0.173	0.194
1112°F	0.201	0.215
1472°F	0.243	0.243
Thermal Conductivity, W/m•K, per ASTM C177		
200°C	0.023	0.026
400°C	0.025	0.028
600°C	0.029	0.031
800°C	0.035	0.035
Chemical Analysis, % weight basis after firing		
Silica, SiO_2	55-75	55-75
Silicon Carbide, SiC	25-40	25-40
Others	3-10	3-10
Loss of Ignition, (dry condition)	<2.5	<2.5

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Fire protection products - FireBarrier® and Firecrete®

	FireBarrier		Firecrete 85	Firecrete 125	FireBarrier 135
	FB 135	FB 100			
Manufacturing location	EU	EU	NA	NA	NA
Maximum continuous use temperature, °C (°F)	1350 (2462)	1100 (2012)	-	-	-
Maximum fire exposure, 2 hours, °C (°F)	-	-	1371 (2500)	1427 (2600)	1350 (2462)
Density, kg/m³ (pcf)	-	950 (59.28	1346 (84)	1970 (123)	1100 (68.67)
Density, kg/m³ (pcf), installed	1550 (96.72)	-	-	-	-
Long Term Density	1180 (73.63)	1050 (65.52)	-	-	-
Dry Density, kg/m³ (pcf)	1100 (68.64)	500 (31.2)	-	-	-
Cold crushing strength, MPa (psi), after 72 hrs curing	3.0 (435)	0.4 (5.8)	-	-	-
Dry Density, kg/m³ (pcf)	4.0 (0.25)	1.0 (0.06)	-	-	-
Modulus of elasticity, MPa (psi), as installed	4.05 (587.25)	-	-	-	-
after curing	4.05 (587.25)	-	-	-	-
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C417					
50°C (122°F)	0.267 (1.85)	-	-	-	0.27 (1.85)-
100°C (212°F)	-	0.82 (5.69)	-	-	-
200°C (400°F)	0.194 (1.34)	-	-	-	0.19 (1.35)
260°C (500°F)	-	-	0.40 (2.8)	0.85 (5.9)	-
538°C (1000°F)	-	-	0.43 (3.0)	0.89 (6.2)	-
300°C (572°F)	-	0.137 (0.95)	-	-	-
400°C (752°F)	-	-	-	-	-
816°C (1500°F)	-	-	0.46 (3.2)	0.94 (6.5)	-
500°C (932°F)	0.169 (1.17)	0.161 (1.12)	-	-	0.25 (1.71)
1093°C (2000°F)	-	-	0.50 (3.5)	0.97 (6.7)	-
600°C (1112°F)	-	-	-	-	-
700°C (1292°F)	-	0.172 (1.19)	-	-	-

Notes

Section 11

Microporous products

Microporous products

Min-K® Flexible
Min-K Board
Min-K Tape
Min-K Composite

WDS® Ultra
WDS High
WDS Shape
WDS Ultra Panel
WDS Nextra Panel
WDS MultiFlex Plus
WDS LambdaFlex®
WDS LambdaFlex Super
WDS Flexipor
WDS MultiFlex HT
WDS Contour
WDS Flexible Pipe
WDS Ultra Shell
WDS Granulate
WDS Protection G-Plus

POREXTHERM

Thermal Ceramics microporous insulation material is an engineered mineral matrix insulation.

We offer two grades of microporous insulation:
- Aerospace marketed as Min-K
- Industrial marketed as WDS

Morgan's microporous insulation grades are specially formulated for the application solutions within the Aerospace and Industrial markets.

- Reduced energy waste with lower heat loss through insulation lining
- Reduced temperature variability by retaining heat in critical operations thus providing more consistent final product
- Reduced insulation thickness by improving lining design which increases capacity
- Reduced cold face temperatures which will eliminate hot spots, minimize metal fatigue and increase operational safety

Thermal Ceramics WDS line of industrial microporous products are one of the most thermally efficient insulations available.

WDS is ideal for high temperature industrial and OEM environments.

WDS® microporous high temperature insulation products feature a classification temperature rating up to 1100°C (2012°F).

Microtechnology is the key to the innovative WDS Technology.

The basic ingredient for the highly efficient insulation effect of our products is a microdispersed silica. This reduces thermal transfer by possible contact between solids to a large extent. In addition, the created micropores minimise heat transfer by convection.

Specially developed infrared opacifiers, reduce heat transport processes by absorption and reflection of radiation.

Typical applications - for Microporous products:

- Heat treatment systems for glass
- Fire protection equipment
- Muffler/Silencer/Manifold within exhaust systems
- Measurement equipment
- Electronic devices and parts
- Heat treatment systems for metals
- Metrology and instrumentation
- Plant construction parts
- Parts in the automotive industry
- Chimneys, pipes and diesel exhaust systems
- Deepwater Oil Production
- District Heat Supply
- Power Plants
- Chemical Plants
- Pipe Insulation

WDS® products have gained a solid reputation for the energy savings and design optimizations that are not limited to a certain area of application, but offer a broad range to meet varying demands of many market sectors.

- Specialty encapsulation technology
- Specialty near-net-shape technology
- Best in class industrial insulation technology
- Customized solution for super-efficient pipe insulation

WDS® technology key facts:
- Perfect and consistent mineral matrix distribution
- Optimised porosity of the interconnecting chain
- Superior mechanical properties
- Quantity and distribution of opacifiers
- Microscopic particles sizes
- Safest products with best performances (for EU only)

Rigid Board products:
WDS Ultra, Ultra Plus, Nextra, High, Shape
- Classification temperature up to 1100°C (2012°F)
- Rigid boards or with a variety of surface encapsulation protections

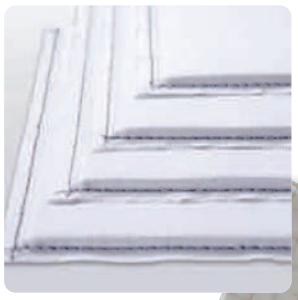
Rigid Hydrophobic Panels:
WDS Ultra Panel, Nextra Panel
- Classification temperatures of 1000°C (1832°F)
- Rigid Panels with a variety of surface encapsulation protections

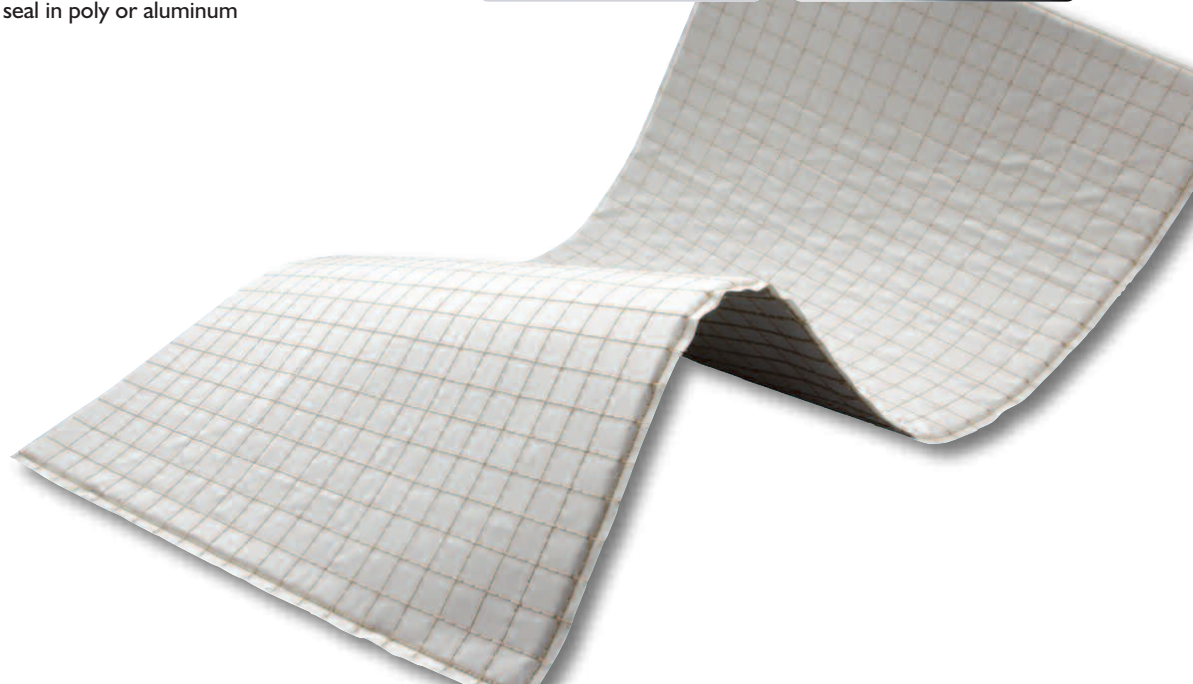
Flexible Stitched and Vacuum Sealed:
WDS MultiFlex Plus, LambdaFlex, LambdaFlex Super, Flexipor, Multiflex HT, Contour, Flexible Pipe
- Classification temperatures up to 1100°C (2012°F)
- Flexible products with a variety of options: stitched textile encapsulation, vacuum seal in poly or aluminum

Pipe Section: WDS Ultra Shell, Nextra Shell
- Classification temperature up to 1000°C (1832°F)
- Flexible pipe insulation design, fully encapsulate, various encapsulation options

Loose Fill: WDS Granulate
- Classification temperature of 950°C (1742°F) this is a pourable, free flowing microporous granulate for filling complex geometries







Microporous products : Rigid Board - WDS®

	WDS Ultra Board	WDS High	WDS Shape
Product Form	Rigid Board	Rigid Board	Rigid Board
Classification Temperature, °F	1742	2012	1832
Classification Temperature, °C	950	1100	1000
Density, pcf, DIN 66133	14.4	16.3	20.3
Denisty, kg/m³ (pcf), DIN 66133	230 (14.4)	275 (16.3)	325
Linear Shrinkage, %, ASTM C365			
950°C (1742°F), 24 hour full soak	<2.0	-	-
1000°C (1832°F), 24 hour full soak	-	3.7	8.7
1000°C (1832°F), 12 hour, single side soak	-	0.6	0.4
Cold Compressive strength, MPa (psi), ASTM C165	0.41 (59.5)	0.39 (56)	0.34 (49.6)
Thermal Conductivity, BTU•in/hr•ft²•°F, per ASTM C177			
392°F	0.154	0.166	0.173
752°F	0.187	0.201	0.215
1112°F	0.236	0.270	0.256
1472°F	0.305	0.381	0.291
Thermal Conductivity, W/m•K, per ASTM C177			
200°C	0.022	0.024	0.025
400°C	0.027	0.029	0.031
600°C	0.034	0.039	0.037
800°C	0.044	0.055	0.042
Chemical Analysis, % weight basis after firing			
Silica, SiO_2	75-85	-	-
Silicon Carbide, SiC	12-20	-	-
Others	3-10	-	-
Loss of Ignition, (dry condition)	<1.5	-	-

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Microporous products : Rigid Panel - WDS®

	WDS Ultra Panel	WDS Ultra Panel HY	WDS Nextra Panel	WDS Nextra Panel HY
Product Form	Rigid Panel	Rigid Panel	Rigid Panel	Rigid Panel
Microporous material grade	Hydrophilic	Hydrophobic	Hydrophilic	Hydrophobic
Classification Temperature, °F	1832	1832	1832	1832
Classification Temperature, °C	1000	1000	1000	1000
Density, pcf, DIN 66133	15.9	15.9	16.2	16.2
Denisty, kg/m³, DIN 66133	255	255	260	260
Linear Shrinkage, %, ASTM C365,				
1000°C (1832°F), 24 hour full soak	<2.5	<2.5	<3.0	<3.0
Cold Compressive strength, MPa (psi), ASTM C165	0.20 (29.0)	0.20 (29.0)	0.22 (31.9)	0.22 (31.9)
Thermal Conductivity, BTU•in/hr•ft²•°F, per ASTM C177				
392°F	0.160	0.160	0.153	0.153
752°F	0.180	0.180	0.173	0.173
1112°F	0.215	0.215	0.201	0.201
1472°F	0.278	0.278	0.243	0.243
Thermal Conductivity, W/m•K, per ASTM C177				
200°C	0.023	0.023	0.022	0.022
400°C	0.026	0.026	0.025	0.025
600°C	0.031	0.031	0.029	0.029
800°C	0.040	0.040	0.035	0.035
Chemical Analysis, % weight basis after firing				
Silica, SiO_2	60-80	60-80	55-75	55-75
Silicon Carbide, SiC	15-30	15-30	25-40	25-40
Others	5-15	5-15	3-10	3-10
Loss of Ignition, (dry condition)	<2.0	<2.0	<2.5	<2.5

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Microporous products : Flexible - WDS®

	WDS MultiFlex Plus	WDS MultiFlex Plus HY	WDS LambdaFlex Super	WDS LambdaFlex	WDS Flexipor	WDS Multiflex HT	WDS Flexible Pipe
Product Form	Flexible Stitched Panel	Flexible Stitched Panel	Flexible Vacuum Sealed	Flexible Vacuum Sealed	Flexible Poly Sealed	Flexible Stitched Panel	Semi-Flexible Vacuum Sealed
Microporous material grade	Hydrophilic	Hydrophobic	-	-	-	-	-
Classification Temperature, °F	1832	1832	2012	2012	2012	1922	1832
Classification Temperature, °C	1000	1000	1100	1100	1100	1050	1000
Density, pcf, DIN 66133	17.2	17.2	25.9	22.8	18.2	17.5	11.8
Denisty, kg/m³, DIN 66133	275	275	415	365	375	280	190
Linear Shrinkage, %, ASTM C365							
1000°C (1832°F), 24 hour full soak	<3.0	<3.0	2	3.6	3.8	0.05	-
1000°C (1832°F), 12 hour, single side soak	-	-	0.6	0.4	0.6	-	0.5
Cold Compressive strength, MPa (psi), ASTM C165	0.30 (43.5)	0.30 (43.5)	0.94 (136.2)	0.41 (60)	0.61 (88.2)	-	1.03 (149.2)
Thermal Conductivity, BTU•in/hr•ft²•°F, per ASTM C177							
392°F	0.180	0.180	0.208	0.166	0.152	-	0.138
752°F	0.208	0.208	0.243	0.194	0.187	-	0.167
1112°F	0.236	0.236	0.305	0.236	0.236	-	0.215
1472°F	0.271	0.271	0.402	0.305	0.305	-	0.278
Thermal Conductivity, W/m•K, per ASTM C177							
200°C	0.026	0.026	0.030	0.024	0.022	-	0.020
400°C	0.030	0.030	0.035	0.028	0.027	-	0.024
600°C	0.034	0.034	0.044	0.034	0.034	-	0.031
800°C	0.039	0.039	0.058	0.044	0.046	-	0.040
Chemical Analysis, % weight basis after firing							
Silica, SiO_2	55-75	55-75	-	-	-	-	-
Silicon Carbide, SiC	25-40	25-40	-	-	-	-	-
Others	3-10	3-10	-	-	-	-	-
Loss of Ignition, (dry condition)	<2.5	<2.5	-	-	-	-	-

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Microporous products : Pipe Section, Granulate - WDS®

	WDS Ultra Shell	WDS Contour	WDS Granulate
Product Form	Pipe Section	Flexible Poly Seal	Loose fill
Classification Temperature, °F	1742	2012	1832
Classification Temperature, °C	950	1000	1000
Density, pcf, DIN 66133	14.4	-	19
Denisty, kg/m³, DIN 66133	230	-	304.6
Linear Shrinkage, %, ASTM C365			
950°C (1742°F), 24 hour full soak	<2.0	-	-
Cold Compressive strength, MPa (psi), ASTM C165	0.41 (59.5)	0.28 (39.9)	-
Thermal Conductivity, BTU•in/hr•ft²•°F, per ASTM C177			
392°F	0.154	-	0.187
752°F	0.187	-	0.243
1112°F	0.236	-	0.340
1472°F	0.305	-	0.472
Thermal Conductivity, W/m•K, per ASTM C177			
200°C	0.022	-	0.027
400°C	0.027	-	0.035
600°C	0.034	-	0.049
800°C	0.044	-	0.068
Chemical Analysis, % weight basis after firing			
Silica, SiO_2	75-85	-	-
Silicon Carbide, SiC	12-20	-	-
Others	3-10	-	-
Loss of Ignition, (dry condition)	<1.5	-	-

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Microporous products : Flexible - Min-K®

	Flexible Min-K 501			Flexible Min-K 1801			Flexible Min-K 1231	Flexible Min-K 1221
Core material formulation	F150			F182			F382	F351
Density, kg/m³ (pcf)	128, 160, 256 (8, 10, 16)			128, 160, 256 (8, 10, 16)			8, 10, 16 (128, 160, 256)	8, 10, 16 (128, 160, 256)
Acoustic performance, Hz, material 6.35mm (0.25 in)								
measured density, kg/m³ (pcf)	128 (8)	256 (16)	-	128 (8)	-	-	-	-
125	0.025	0.027	-	0.028	-	-	-	-
150	0.032	0.025	-	0.028	-	-	-	-
500	0.066	0,060	-	0.052	-	-	-	-
1000	0.272	0.157	-	0.132	-	-	-	-
2000	0.331	0.355	-	0.322	-	-	-	-
4000	0.253	0.306	-	0.258	-	-	-	-
Thermal Conductivity, BTU•in/hr•ft2, per ASTM C177								
measured density, kg/m³ (pcf)	128 (8)	160 (10)	256 (16)	128 (8)	160 (10)	16 (256)	256 (16)	256 (16)
measured thickness, mm (in)	9.5 (0.375)			9.5 (0.375)			12.7 (0.5)	12.7 (0.5)
93°C (200°F)	0.027 (0.19)	0.027 (0.19)	0.18 (0.026)	0.22 (0.032)	0.22 (0.032)	0.21 (0.030)	0.027 (0.19)	0.027 (0.19)
204°C (400°F)	0.24 (0.034)	0.23 (0.033)	0.030 (0.21)	0.034 (0.24)	0.034 (0.24)	0.033 (0.23)	0.027 (0.19)	0.027 (0.19)
316°C (600°F)	0.043 (0.3)	0.037 (0.26)	0.036 (0.25)	0.037 (0.26)	0.037 (0.26)	0.036 (0.25)	0.029 (0.2)	0.029 (0.2)
427°C (800°F)	0.053 (0.37)	0.047 (0.33)	0.045 (0.31)	0.047 (0.33)	0.042 (0.29)	0.040 (0.28)	0.033 (0.23)	0.033 (0.23)
538°C (1000°F)	0.063 (0.44)	0.058 (0.4)	0.053 (0.37)	0.056 (0.39)	0.050 (0.34)	0.045 (0.31)	0.037 (0.26)	0.039 (0.27)
649°C (1200°F)	-	-	-	0.063 (0.44)	0.063 (0.44)	0.050 (0.34)	0.043 (0.3)	0.047 (0.33)
760°C (1400°F)	-	-	-	0.076 (0.53)	0.068 (0.47)	0.059 (0.41)	-	-
1600°F (871°C)	-	-	-	0.092 (0.64)	0.081 (0.56)	0.072 (0.5)	0.063 (0.44)	0.065 (0.45)
1800°F (982°C)	-	-	-	0.108 (0.75)	0.095 (0.66)	0.085 (0.59)	0.086 (0.6)	0.088 (0.61)

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Notes

Section 12

Insulating Firebrick (IFB), Firebrick and Mortar products

Insulating Firebrick (IFB) products

JM™ range
K® range
TJM™ range
Insalcor®
TJM-Ba90
Insulating roof blocks BV
Aluminium industry range

Firebrick products

SR-90®
SR-99®
SR-99LS

Mortar products

High-Temp™
Blakite®
Blakite V
JM3000™
Smoothset™
Air-Set™
K-Bond®
Mul-Set®
Coastal® 90
Coastal 90AS

Market leading brands JM™, K® and TJM™ Insulating Firebricks (IFB), bring unsurpassed performance in a wide variety of markets and offer:

- Geographical manufacturing base
- Extensive range of manufacturing techniques
- Complete range of IFB product with a network of global distribution
- Experienced team dedicated to IFB technical support in the industry

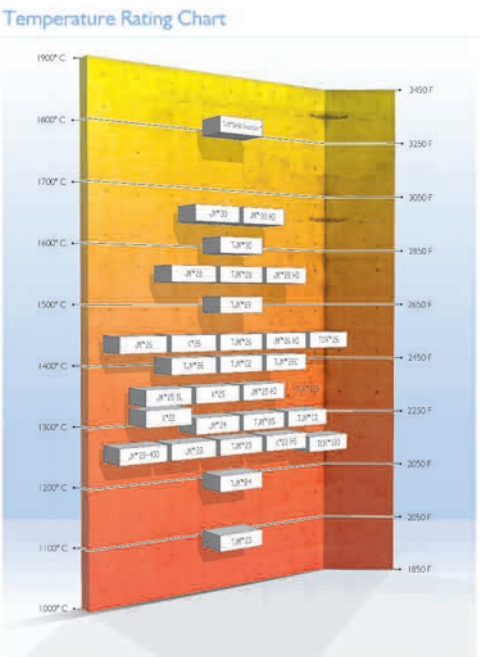
Insulating Firebricks, features include:

- Excellent strength at ambient and elevated temperatures
- High compressive strength
- Every brick ground to precise dimensions
- Very low levels of iron and other impurities (especially for resistance to reducing atmosphere conditions)
- Lower heat storage than denser refractories
- Available in custom designed shapes upon request

Insulating Firebricks, benefits include:

- Energy saving benefits and lower operating costs
- Lightweight, energy-saving nature results in less heat loss and allows for thinner furnace linings

Insulating Firebricks (IFB's) are well established products for solving many problems of high temperature heat containment in industries ranging from ceramic production kilns to anodes for primary aluminium.



Typical applications - for our Insulating Firebrick, Firebrick and mortar products:

Hot face refractory lining or as back-up insulation in:

- **Aluminium**
  Anode bake furnaces and primary electrolytic cells
- **Petrochemical**
  Kilns, flues, refining vessels and heaters and reactor chambers
- **Coke and iron making**
  Blast furnaces, hot blast stoves, hot blast and bustle mains
- **Ceramics**
  Roller, shuttle, tunnel, hobby and laboratory kilns

Insulation range

The 'Insulation Range' comprises both IFB's produced by the **Cast** method at Casalpusterlengo (Italy) and Augusta, Georgia (USA) for service temperatures below 1300°C (2372°F) and those produced by the **Slinger** method at Casalpusterlengo for higher service temperatures. Our Cast IFB's in particular are truly market leading products, offering the lowest thermal conductivity available on the market today for applications above 1000°C (1832°F), delivering big energy savings for customers in the ceramics, petrochemical, aluminium and iron and steel sectors.

Structural range

The 'Structural Range' focuses on the superior physical properties offered by our IFB's manufactured by **Extrusion** at our manufacturing plant in Yixing (China), with products available for a wide range of temperatures, plus our **Pressed** Insalcor® produced at our manufacturing site in Augusta, Georgia (USA) for the very highest temperature applications above 1600°C (2912°F). These products offer superior performance in load bearing applications and in conditions where abrasion from mechanical abuse or flow of hot gases is severe.

Special shapes

In addition to the standard brick sizes, our JM™ and K® insulating firebricks are available in a wide range of special shapes. JM™ in particular can offer joint free large brick and special shapes due to the unique large slab production method. Both JM™ and K® ranges can be mortared together and machined to produce extra large shapes with minimal joints.

Insulating roof block range also includes

JM™ 26 – 30 classification 1430 - 1650°C (2600 - 3000°F)

- **Good thermal insulation**
- **Low thermal mass**
- **Simplified engineering**
- **Easy installation**
- **Low maintenance costs**
- **Accurate dimensions**

Firebrick

Firebricks are made from high-purity refractory clays with graduated additions of alumina for the higher temperature products and have carefully graded organic fillers which burn out during manufacture to give a uniform and controlled pore structure.

Mortars available:

Blakite : classification 1650°C (3000°F). A highly refractory mortar with a high water-retention characteristic. Developed for laying insulating firebricks but is also suitable for use with super-duty and high alumina dense refractory bricks, at operating temperatures up to 1650°C (3000°F).

Blakite V : classification classification 1650°C (3000°F). Standard product with a harder consistency to be used to glue special refractory shapes and steel plates.

JM 3300 : classification 1760°C (3200°F). A very highly refractory air-setting mortar suitable for laying JM 32 insulating firebricks, and high alumina dense refractory bricks.

High-Temp : is a dry heat-setting mortar. Classification temperature 1649°C (3000°F)

Smoothset™ : mortars are an economical, tacky mortar. Excellent for built-up shapes. Available as wet and dry with classification temperature up to 1593°C (2900°F).

Airset™ : wet and dry version mortars are a tacky 1650°C (3000°F) mortar excellent for built-up shapes of IFB or super duty Firebricks.

K-Bond™ : wet and dry version mortars are an extra smooth and creamy consistency. It has a long shelf life and is good for mortaring IFB and Firebrick linings.

Mul-Set™ F : are a high alumina wet and dry version mortar suited for high temperature IFB linings.

Coastal 90™ and Coastal 90 AS™ : are a wet and dry version of extra high alumina mortar. They are ideal for 90% alumina brick constructions.

Insulating Firebrick products: Insulation range

	TJM™-20	JM™-23-400	TJM-23	JM-23	JM-24	K®-23
ISO 2245 Classification	-	125 0.5L	-	125 0.5L	-	-
Manufacturing Location	Asia	EU	Asia	EU	EU	NA
Product Identification - printed on brick	TJM-20	23-400	-	23	24	23
Classification Temperature, °C (°F)	1100 (2000)	1260 (2300)	1260 (2300)	1260 (2300)	1300 (2372)	1315 (2400)
Density, kg/m³ (pcf), ASTM C-134	500 (31.20)	390 (24.34)	500 (31.20)	480 (29.95)	510 (31.82)	513 (32.01)
Modulus of Rupture, MPa (psi), ASTM C-133	0.7 (101.5)	0.8 (116)	0.7 (101.5)	1 (145)	0.8 (116)	0.79 (114.55)
Cold Crushing Strength, MPa (psi), ASTM C-133	0.8 (116)	0.8 (116)	1 (145)	1.2 (174)	1 (145)	1 (145)
Permanent Linear Shrinkage, % after 24 hrs Soaking (ASTM C-210)						
1070°C (1958°F)	-0.2	-	-	-	-	-
1230°C (2246°F)	-	-0.4	-0.2	-0.2	-0.1	-
1290°C (2354°F)	-	-	-	-	-0.3	-
Reversible Linear Expansion, max. %	0.6	0.55	0.6	0.5	0.6	0.7
Deformation under hot load, % after 90 min. (ASTM C-16 JM brick tested according to ISO 3187)						
1100°C @ 0.034 MPa (2012°F @ 5 psi)	0.1	0.18	0.1	0.1	-	-
1100°C @ 0.069 MPa (2012°F @ 10 psi)	-	-	-	-	0.2	-
1200°C @ 0.034 MPa (2192°F @ 5 psi)	-	-	-	-	0.1	-
Thermal Conductivity, W/m•K (BTU•in/hr•ft²•°F), ASTM C-182						
200°C (392°F)	0.15 (1.04)	-	0.15 (1.04)	-	-	-
260°C (500°F)	-	-	-	-	-	0.13 (0.90)
400°C (752°F)	0.18 (1.25)	0.1 (0.69)	0.18 (1.25)	0.12 (0.83)	0.14 (0.97)	-
540°C (1004°F)	-	-	-	-	-	0.17(1.18)
600°C (1112°F)	0.22 (1.53)	0.12 (0.83)	0.22 (1.53)	0.14 (0.97)	0.16 (1.11)	-
800°C (1472°F)	-	0.15 (1.04)	0.27 (1.87)	0.17 (1.18)	0.18 (1.25)	-
815°C (1500°F)	-	-	-	-	-	0.2 (1.39)
1000°C (1832°F)	-	-	0.32 (2.22)	0.19 (1.32)	0.2 (1.39)	-
1100°C (2012°F)	-	-	-	-	-	0.24 (1.67)
Specific Heat Capacity, kJ/kg•K (BTU/lb•°F), 1000°C (1832°F)	-	1.05 (0.25)	-	1.05 (0.25)	1.05 (0.25)	1.07 (0.26)
Chemical Composition, %						
Al_2O_3	43	37	45	37	44.5	38.3
SiO_2	50	44.4	48	44.4	41.2	44.3
Fe_2O3	1	0.7	1	0.7	0.7	0.3
TiO_2	0.8	0.8	0.8	1.2	0.9	1.6
CaO	0.8	15.2	0.8	15.2	11.6	15
$MgO + Na_2O + K_2O$	1.7	1.1	1.7	1.4	1.1	0.5
CO Attack (popouts after 200 hrs), ASTM C-288	-	Class A	-	Class A	Class A	-

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Insulating Firebrick products: Insulation range

	JM™-25 SL	K®-25	K-26	JM-26	JM-28	JM-30
ISO 2245 Classification	-	-	-	140 0.8L	150 0.9L	160 1.0L
Manufacturing Location	EU	NA	NA	EU	EU	EU
Product Identification - printed on brick	25 SL	25	26	26	28	30
Classification Temperature, °C (°F)	1350 (2450)	1370 (2500)	1430 (2600)	1430 (2600)	1540 (2800)	1650 (3000)
Density, kg/m³ (pcf), ASTM C-134	720 (44.93)	617 (38.50)	617 (38.50)	800 (49.92)	890 (55.54)	1020 (63.65)
Modulus of Rupture, MPa (psi), ASTM C-133	1 (145)	0.95 (137.75)	0.90 (130.5)	1.5 (217.5)	1.8 (261)	2 (290)
Cold Crushing Strength, MPa (psi), ASTM C-133	1.3 (188.5)	1.3 (188.5)	1.3 (188.5)	1.6 (232)	2.1 (304.5)	2.1 (304.5)
Permanent Linear Shrinkage, % after 24 hrs Soaking (ASTM C-210)						
1290°C (2354°F)	-0.5	-	-	-	-	-
1350°C (2462°F)	-	-0.3	-	-	-	-
1400°C (2552°F)	-	-	-0.3	-0.2	-	-
1510°C (2750°F)	-	-	-	-	-0.4	-
1620°C (2948°F)	-	-	-	-	-	-0.8
Reversible Linear Expansion, max. %	0.55	0.8	0.7	0.7	0.8	0.8
Deformation under hot load, % after 90 min. (ASTM C-16 JM brick tested according to ISO 3187)						
1200°C @ 0.069 MPa (2192°F @ 10 psi)	2	0.2	0.2	-	-	-
1260°C @ 0.069 MPa (2300°F @ 10 psi)	-	-	-	0.2	0.1	-
1320°C @ 0.069 MPa (2408°F @ 10 psi)	-	-	-	-	0.2	0.1
1370°C @ 0.069 MPa (2498°F @ 10 psi)	-	-	-	-	-	0.5
Thermal Conductivity, W/m•K (BTU•in/hr•ft²•°F), ASTM C-182						
260°C (500°F)	-	0.15 (1.04)	0.16 (1.11)	-	-	-
400°C (752°F)	0.22 (1.53)	-	-	0.25 (1.73)	0.3 (2.08)	0.38 (2.64)
540°C (1004°F)	-	0.18 (1.25)	0.19 (1.32)	-	-	-
600°C (1112°F)	0.25 (1.73)	-	-	0.27 (1.87)	0.32 (2.22)	0.39 (2.71)
800°C (1472°F)	0.29 (2.01)	-	-	0.3 (2.08)	0.34 (2.36)	0.4 (2.78)
815°C (1500°F)	-	0.2 (1.39)	0.21 (1.46)	-	-	-
1000°C (1832°F)	0.34 (2.36)	-	-	0.33 (2.29)	0.36 (2.50)	0.41 (2.84)
1100°C (2012°F)		0.22 (1.53)	0.24 (1.67)	-	-	-
1200°C (2192°F)	-	-	-	0.35 (2.43)	0.38 (2.64)	0.42 (2.91)
1370°C(2498°F)	-	-	0.27 (1.87)	-	-	-
Specific Heat Capacity, kJ/kg•K (BTU/lb•°F), 1000°C (1832°F)	1.10 (0.26)	1.07 (0.26)	1.07 (0.26)	1.10 (0.26)	1.10 (0.26)	1.10 (0.26)
Chemical Composition, %						
Al_2O_3	48	47	48	58	67.1	73.4
SiO_2	47	38	36	38.8	30.0	24.6
Fe_2O3	0.9	0.2	0.3	0.7	0.60	0.50
TiO_2	0.5	1.4	1.2	0.3	0.5	0.50
CaO	0.1	13.5	12.3	0.1	0.1	Trace
$MgO + Na_2O + K_2O$	1.9	0.5	0.4	1.9	1.0	0.90
CO Attack (popouts after 200 hrs), ASTM C-288	-	-	-	Class A	Class A	Class A

Insulating Firebrick products: Structural range

	TJM™B4	K®-23 HS	TJM-B5	TJM-C1	JM™25 HD	TJM-26C	TJM-B6	TJM-C2
Manufacturing Location	Asia	NA	Asia	Asia	EU	Asia	Asia	Asia
Product Idenitification - printed on brick	-	-	-	-	25-HD	-	-	-
Classification Temperature, °C (°F)	1200 (2200)	1260 (2300)	1300 (2400)	1300 (2400)	1350 (2450)	1400 (2550)	1400 (2550)	1400 (2550)
Density, kg/m³ (pcf), ASTM C-134	800 (49.92)	714 (44.55)	800 (49.92)	1000 (62.4)	880 (54.91)	800 (49.92)	800 (49.92)	1100 (68.64)
Modulus of Rupture, MPa (psi), ASTM C-133	1.2 (174)	1.2 (174)	1.2 (174)	2.1 (304)	2.1 (304)	1.2 (174)	1.8 (261)	3 (435)
Cold Crushing Strength, MPa (psi), ASTM C-133	2 (290)	2.8 (406)	2 (290)	3.5 (507)	2.7 (391)	1.8 (261)	2.5 (362)	4 (580)
Permanent Linear Shrinkage, (ASTM C-210) % after 24 hrs Soaking								
1200°C (2192°F)	-1	-	-	-	-	-	-	-
1230°C (2246°F)	-	-0.1	-	-	-	-	-	-
1300°C (2372°F)	-	-	-0.5	-0.5	-0.5	-	-	-
1400°C (2552°F)	-	-	-	-	-	-0.8	-0.5	-0.5
Reversible Linear Expansion, max. %	0.7	-	0.7	0.7	0.7	0.7	0.7	0.7
Deformation under hot load, % after 90 min. (ASTM C-16) (JM brick tested according to ISO 3187								
1100°C @ 0.034 MPa (2012°F @ 5 psi)	0.2	-	0.2	0.1	-	0.1	-	-
1260°C @ 0.069 MPa (2300°F @ 10 psi)	-	-	-	-	-	0.7	0.3	0.2
Thermal Conductivity, W/m•K (BTU•in/hr•ft²•°F), ASTM C-182								
200°C (392°F)	0.24 (1.67)	-	0.2 (1.39)	0.28 (1.94)	-	0.25 (1.73)	0.28 (1.94)	0.34 (2.36)
400°C (752°F)	0.26 (1.80)	-	0.24 (1.67)	0.3 (2.08)	0.38 (2.64)	0.27 (1.87)	0.29 (2.01)	0.36 (2.50)
540°C (1004°F)	-	0.2 (1.39)	-	-	-	-	-	-
600°C (1112°F)	0.28 (1.94)	-	0.3 (2.08)	0.34 (2.36)	0.39 (2.71)	0.29 (2.01)	0.32 (2.22)	0.38 (2.64)
800°C (1472°F)	0.3 (2.08)	-	-	0.38 (2.64)	0.4 (2.78)	0.32 (2.22)	0.36 (2.50)	0.42 (2.91)
815°C (1500°F)	-	0.23 (1.60)	-	-	-	-	-	-
1000°C (1832°F)	0.34 (2.36)	-	-	0.42 (2.91)	0.41 (2.84)	0.36 (2.50)	0.4 (2.78)	0.46 (3.19)
1100°C (2012°F)	-	0.27 (1.87)	-	-	-	-	-	-
1200°C (2191°F)	-	-	-	-	0.43 (2.98)	-	-	-
Chemical Composition, %								
Al_2O_3	45	38	45	45	48	50	55	55
SiO_2	50	48	48	49	48.6	45	41	41
Fe_2O3	1	0.6	1	0.9	0.7	0.9	0.9	0.9
TiO_2	0.6	1.5	0.6	-	0.5	0.6	-	-
CaO	0.5	11	0.5	-	0.1	0.4	-	-
MgO	0.2	-	0.2	-	-	0.2	-	-
$MgO + Na_2O + K_2O$	-	0.7	-	-	1.9	-	-	-
$Na_2O + K_2O$	1	-	1	1	-	-	0.9	1
CO Attack (popouts after 200 hrs), ASTM C-288	-	-	-	-	Class A	-	-	-

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Insulating Firebrick products: Strucutral range

	JM™-26 HD	TJM™-26	TJM-B7	TJM-28	JM-28 HD	TJM-30	JM-30 HD	TJM-Ba90	Insalcor®
ISO 2245 Classification	-	-	-	-	-	-	-	180 1.3L	180 1.3L
Manufacturing Location	EU	Asia	Asia	Asia	EU	Asia	EU	Asia	NA
Product Idenitification - printed on brick	26-HD	-	-	-	28-HD	-	30-HD	-	-
Classification Temperature, °C (°F)	1400 (2550)	1430 (2600)	1500 (2750)	1540 (2800)	1540 (2800)	1650 (3000)	1650 (3000)	1790 (3250)	1790 (3250)
Density, kg/m³ (pcf), ASTM C-134	920 (57.41)	800 (49.92)	900 (56.16)	900 (56.16)	1000 (62.4)	1100 (68.64)	1190 (74.26)	1314 (82)	1314 (82)
Modulus of Rupture, Mpa (psi), ASTM C-133	2.2 (319)	1.5 (217)	2.5 (362)	1.8 (261)	3.2 (464)	2 (290)	3.5 (507)	2.4 (350)	2.4 (350)
Cold Crushing Strength, Mpa (psi), ASTM C-133	3.5 (507)	2 (290)	3.5 (507)	2.5 (362)	4.2 (609)	3 (435)	5 (725)	6.9 (1000)	6.9 (1000)
Permanent Linear Shrinkage, (ASTM C-210) % after 24 hrs Soaking									
1400°C (2552°F)	-0.3	-0.5	-	-	-	-	-	-	-
1500°C (2732°F)	-	-	-0.5	-	-	-	-	-	-
1510°C (2750°F)	-	-	-	-0.7	-0.5	-	-	-	-
1570°C (2858°F)	-	-	-	-	-	-1	-	-	-
1620°C (2948°F)	-	-	-	-	-	-	-0.6	-	-
1730°C (3146°F)	-	-	-	-	-	-	-	0.4	0.4
Reversible Linear Expansion, max. %	0.7	0.7	0.8	0.8	0.8	0.9	0.9	1.2	1.2
Deformation under hot load, % after 90 min. (ASTM C-16) (JM brick tested according to ISO 3187									
1260°C @ 0.069 MPa (2300°F @ 10 psi)	0.1	0.2	-	-	-	-	-	-	-
1320°C @ 0.069 MPa (2408°F @ 10 psi)	-	-	0.2	0.2	0.13	0.1	-	-	-
1370°C @ 0.069 MPa (2498°F @ 10 psi)	-	-	-	-	-	-	0.1	-	-
1450°C @ 0.069 MPa (2642°F @ 10 psi)	-	-	-	-	-	-	-	0.1	0.1
Thermal Conductivity, W/m•K (BTU•in/hr•ft²•°F), ASTM C-182									
200°C (392°F)	-	0.28 (1.94)	0.32 (2.22)	0.32 (2.22)	-	0.36 (2.50)	-	-	-
260°C (500°F)	-	-	-	-	-	-	-	0.79 (5.48)	0.79 (5.48)
400°C (752°F)	0.33 (2.29)	0.29 (2.01)	0.33 (2.29)	0.33 (2.29)	0.38 (2.64)	0.38 (2.64)	0.47 (3.26)	-	-
540°C (1004°F)	-	-	-	-	-	-	-	0.8 (5.55)	0.8 (5.55)
600°C (1112°F)	0.35 (2.43)	0.32 (2.22)	0.34 (2.36)	0.34 (2.36)	0.39 (2.71)	0.41 (2.84)	0.48 (3.33)	-	-
800°C (1472°F)	0.37 (2.57)	0.35 (2.43)	0.38 (2.64)	0.37 (2.57)	0.4 (2.78)	0.43 (2.98)	0.49 (3.40)	-	-
815°C (1500°F)	-	-	-	-	-	-	-	0.91 (6.31)	0.91 (6.31)
1000°C (1832°F)	0.39 (2.71)	0.39 (2.71)	0.42 (2.91)	0.41 (2.84)	0.41 (2.84)	0.45 (3.12)	0.5 (3.47)	-	-
1100°C (2012°F)	-	-	-	-	-	-	-	1.09 (7.56)	1.09 (7.56)
1200°C (2191°F)	-	0.43 (2.98)	-	0.46 (3.19)	0.42 (2.91)	0.48 (3.33)	0.51 (3.54)	-	-
1370°C (2498°F)	-	-	-	-	-	-	-	1.33 (9.23	1.33 (9.23
Chemical Composition, %									
Al_2O_3	58	55	65	65	67.1	73	73.4	90	77
SiO_2	38.8	41	32	32	30	25	24.6	9	21
Fe_2O3	0.7	0.9	0.8	0.7	0.6	0.6	0.5	0.3	0.4
TiO_2	0.3	0.5	-	0.4	0.5	0.2	0.5	0.2	0.6
CaO	0.1	0.4	-	0.2	0.1	0.1	Trace	0.1	0.1
MgO	-	0.2	-	0.1	-	0.1	-	0.1	-
$MgO + Na_2O + K_2O$	1.9	-	-	-	1	-	0.9	-	0.4
$Na_2O + K_2O$	-	0.9	0.8	0.8	-	0.7	-	0.3	-
CO Attack (popouts after 200 hrs), ASTM C-288	Class A	-	-	-	Class A	-	Class A	-	-

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Insulating Firebrick products: Aluminium range

	TCA™-130	JM™-23	K®-23 HS	K-23	TCA-26	K-26
Manufacturing Location	EU	EU	NA	NA	EU	NA
Product Idenitification - printed on brick	-	-	23-HS	23	-	26
Aluminium Pechiney Order no.	10.4	10.3 – 10.5	10.4	10.3 – 10.5	10.6	10.6
Classification Temperature, °C (°F)	1250 (2282)	1260 (2300)	1260 (2300)	1315 (2400	1430 (2600)	1430 (2600)
Density, kg/m³ (pcf), ASTM C-134	600 (37)	480 (30)	714 (44)	513 (32)	850 (53)	617 (38)
Modulus of Rupture, MPa (psi), ASTM C-133	1.2 (174)	1 (145)	1.2 (174)	0.79 (114)	1.9 (275)	0.9 (130)
Cold Crushing Strength, MPa (psi), ASTM C-133	2.2 (319)	1.2 (174)	1.2 (174)	1 (145)	2.2 (319)	1.3 (188)
Permanent Linear Shrinkage, (ISO 2477:2005) % after 12 hrs Soaking						
1230°C (2246°F)	-0.5	-0.2	-0.1	0	-	-
1350°C (2462°F)	-	-	-	-	-	-
1400°C (2552°F)	-	-	-	-	-0.4	-0.3
Reversible Linear Expansion, max. %	0.55	0.5	-	0.7	0.7	0.7
Deformation under hot load, % after 90 min. (ASTM C-16) (JM brick tested according to ISO 3187						
1100°C @ 0.034 MPa (2012°F @ 5 psi)	-	0.1	-	-	-	-
1200°C @ 0.069 MPa (2192°F @ 10 psi)	-	-	-	-	-	0.2
Thermal Conductivity, W/m•K (BTU•in/hr•ft²•°F), ASTM C-182						
200°C (392°F)	0.14 (0.97)	-	-	-	-	-
260°C (500°F)	-	-	0.17 (1.18)	0.13 (0.90)	-	0.16 (1.11)
400°C (752°F)	0.16 (1.11)	0.12 (0.83)	-	-	0.26 (1.80)	-
540°C (1004°F)	-	-	0.2 (1.39)	0.17 (1.18)	-	0.19 (1.32)
600°C (1112°F)	0.18 (1.25)	0.14 (0.97)	-	-	0.28 (1.94)	-
800°C (1472°F)	0.21 (1.46)	0.17 (1.18)	-	-	0.31 (2.18)	-
815°C (1500°F)	-	-	0.23 (1.60)	0.2 (1.39)	-	0.21 (1.46)
1000°C (1832°F)	0.25 (1.73)	0.19 (1.32)	-	-	0.34 (2.36)	-
1100°C (2012°F)	-	-	0.27 (1.87)	0.24 (1.67)	-	0.24 (1.67)
1200°C (2191°F)	-	-	-	-	0.36 (2.50)	-
1370°C (2498°F)	-	-	-	-	-	0.27 (1.87)
Specific Heat Capacity, kJ/kg•K (BTU/lb•°F), 1000°C (1832°F)	1.05 (0.25)	1.05 (0.25)	-	1.07 (0.26)	1.1 (0.26)	1.07 (0.26)
Chemical Composition, % (NF EN ISO 21587-1:2007 and NF EN ISO 21587-2:2007)						
Al_2O_3	36.5	37	38	38.3	57	48
SiO_2	45	44.4	48	44.3	39.8	36
Fe_2O3	0.7	0.7	0.6	0.3	0.7	0.3
TiO_2	1.2	1.2	1.5	1.6	0.1	1.2
CaO	15.2	15.2	11	15	0.3	12.3
$MgO + Na_2O + K_2O$	1.4	1.4	0.7	0.5	2.1	0.4

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Firebrick products

	SR-90	SR-99	SR-99LS
Manufacturing Location	NA	NA	NA
Color	white	white	white
Hot Face use Temperature, °C (°F)	1704 (3100)	1760 (3200)	1760 (3200)
Melting Temperature, °C (°F)	1915 (3480)	2016 (3660)	2016 (3660)
Porosity, ASTM C 20, %	14 - 22	12 - 19	20
Permeability, $ft^3/hr \cdot ft^2 \cdot in/psi$	35	30	-
Abrasion loss, cm3, ASTM C 704	5 - 10	-	-
Density, kg/m^3 (pcf), ASTM C 134			
fired	2708 - 3029 (169 - 189)	2885 - 3205 (180 - 200)	2885 - 3205 (180 - 200)
kg/229 mm straight (lb/9 in straight)	4.7 (10.4)	5.1 (11.3)	5.1 (11.3)
Modulus of Rupture, MOR, MPa (psi), ASTM C 133			
ambient	8.3 - 19.3 (1200 - 2800)	9.7 - 27.6 (1400 - 4000)	9.7 - 27.6 (1400 - 4000)
Hot Modulus of Rupture, MOR, MPa (psi), ASTM C 583			
1093°C (2000°F)	17.9 (2600)	15.2 (2200)	-
1260°C (2300°F)	13.8 (2000)	11 (1600)	11 (1600)
1427°C (2600°F)	8.3 (1200)	5.5 (800)	5.5 (800)
1538°C (2800°F)	6.2 (900)	4.5 (650)	-
Cold crushing strength, CCS, Mpa (psi), ASTM C 133			
ambient	34.5 - 96.5 (5000 - 14000)	34.5 - 96.5 (5000 - 14000)	41.4 - 103.5 (6000 - 15000)
Deformation under hot load, ASTM C 16, 10 psi (0.07 MPa), %			
1.5 hrs @ 2800°F (1538°C)	+0.5 to -1.0	0 to -2.0	-
Permanent Linear Shrinkage, ASTM C 210, 24 hours, %			
3000°F (1649°C)	-0.1 to +0.4	0 to -0.3	-
5 hrs @ 3200°F (1760°C)	1.5	-	-
Thermal Conductivity, $W/m \cdot K$ ($BTU \cdot in/hr \cdot ft^2$), ASTM C201			
260°C (500°F)	3.55 (24.6)	5.61 (38.9)	5.61 (38.9)
538°C (1000°F)	3.1 (21.5)	4.42 (30.7)	4.42 (30.7)
815°C (1500°F)	2.8 (19.4)	3.68 (25.5)	3.68 (25.5)
1093°C (2000°F)	2.55 (17.7)	3.11 (21.6)	3.11 (21.6)
1371°C (2500°F)	2.38 (16.5)	2.75 (19.1)	2.75 (19.1)
Chemical Analysis, % weight basis after firing			
Al_2O_3	90.3	99.2	99.5
SiO_2	9.1	0.4	0.1
Fe_2O3	0.1	0.1	trace
TiO_2	trace	trace	trace
CaO	0.1	0.1	trace
$MgO + Na_2O + K_2O$	0.1	trace	trace
$Na_2O + K_2O$	0.2	0.2	0.2

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Mortars

	High-Temp	Smoothset Wet	Smoothset Dry	Air-Set Wet	Air-Set Dry	Air-Set 3000 EG Wet	K-Bond Wet	K-Bond Dry	Mul-Set F Wet	Mul-Set F Dry	Coastal 90	Coastal 90 AS	Coastal 95
Manufacturing Location	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Material Grade	Dry, heat setting	Wet, air setting	Dry, heat setting	Wet, air setting	Dry, heat setting	Wet, air setting	Wet, air setting	Dry, heat setting	Wet, air setting	Dry, heat setting	Wet, air setting	Dry, heat setting	Wet
Classification Temperature, normal oxidizing conditions, °C (°F)	1649 (3000)	1566 (2850)	1593 (2900)	1649 (3000)	1649 1649 (3000)	1649 (3000)	1649 (3000)	1649 (3000)	1760 (3200)	1760 (3200)	1788 (3250)	1816 (3300)	1788 (3250)
Quantity required kg.1000 (lb/1000) bricks NF1 size	98-113 (220-250)	-	-	180 (397)	140 (308)	113-145 (250-320)	160 (353)	130 (286)	160 (353)	140 (308)	109-145 (240-320)	204-249 (450-550)	109-145 (240-320)
Net material required, kg/1000 Bricks													
Lb required to brush coat 1 ft^2	-	0.49	0.45	0.49	0.45	0.45	0.49	0.45	0.49	0.45	-	-	-
Kg required to brush coat 1m^2	-	2.4	2.2	2.4	2.2	2.4	2.4	2.2	2.4	2.2	-	-	-
Shelf life, months	12	3-6	12	6-12	12	6-9	9-12	12	6-12	12	6-12	12	6
Brick type recommended use with	IFB	IFB	IFB	JM-25SL, JM-25HD, JM-26, JM-26HD, JM-28, JM-28HD, JM-30, JM-30HD, TJM-28, TJM-30, TJM-B6, TJM-B7, TJM-C1, TJM-C2	JM-25SL, JM-25HD, JM-26, JM-26HD, JM-28, JM-28HD, JM-30, JM-30HD, TJM-28, TJM-30, TJM-B6, TJM-B7, TJM-C1, TJM-C2	JM-25SL, JM-25HD, JM-26, JM-26HD, JM-28, JM-28HD, JM-30, JM-30HD, TJM-28, TJM-30, TJM-B6, TJM-B7, TJM-C1, TJM-C2	JM-23-400, JM-23, JM-24, JM-25, JM-26SL, JM-25HD, JM-26, JM-26HD, JM-28, JM-28HD, JM-30, JM-30HD K-23, K-23HS, K-25, K-26 TJM-20, TJM-23, TJM-26C, TJM-26, TJM-28, TJM-30, TJM-B4, TJM-B5, TJM-B6, TJM-B7, TJM-C1, TJM-C2	JM-23-400, JM-23, JM-24, JM-25, JM-26SL, JM-25HD, JM-26, JM-26HD, JM-28, JM-28HD, JM-30, JM-30HD K-23, K-23HS, K-25, K-26 TJM-20, TJM-23, TJM-26C, TJM-26, TJM-28, TJM-30, TJM-B4, TJM-B5, TJM-B6, TJM-B7, TJM-C1, TJM-C2	TJM-30, JM-30, JM-30HD, TJM-Ba90, Insalcor	TJM-30, JM-30, JM-30HD, TJM-Ba90, Insalcor	Firebrick	Firebrick	High Alumina Firebrick
Water %, recommended													
trowel	26	-	29	-	31	-	-	20	-	22	-	23	-
dip	44	-	50	-	52	-	-	33	-	37	-	45	-
Chemical Analysis, % weight basis after firing													
Al_2O_3	45	36	38	41	40	44	47	47	66	66	88	88	95.4
SiO_2	50	57	58	53	53	50	47	48	28	24	9	9	0.7
Fe_2O3	1.3	0.9	1	1.4	1.4	0.8	0.9	0.9	1.2	1.2	0.3	0.2	0.1
TiO_2	2.2	1.7	1.9	2	1.9	1.9	0.7	1.1	2.2	2.2	0.3	0.1	-
CaO + MgO	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.9	0.2	0.2	0.1	0.1	0.04
$Na_2O + K_2O$	0.6	4	2.8	2.1	3.7	2.6	4.3	2.1	2.2	3.2	2.2	2.2	-

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Mortars

	JM-2600	TJM Mortar	TJM Mortar A	Blakite	JM 3300	Triset	Triset D
Manufacturing Location	EU	EU	EU	EU	EU	EU	EU
Material Grade	Wet, air setting	Wet, air setting	Wet, air setting	Wet, air setting	Wet, air setting	Wet, air setting	Dry, air setting
Classification, ASTM C-199	Medium Duty	-	-	Super Duty	Super Duty	-	-
Classification Temperature, normal oxidizing conditions, °C (°F)	1430 (2600)	1540 (2800)	1650 (3000)	1650 (3000)	1760 (3200)	-	-
Maximum service temperature, °C (°F)	-	-	-	-	-	1700 (3092)	1700 (3092)
Quantity required kg.1000 (lb/1000) bricks NF1 size	180 (397)	200 (441)	200 (441)	200 (441)	200 (441)	-	-
Net material required, kg/1000 Bricks	-	-	-	-	-	175 / 200kgs	175 / 200kgs
Brag weight, dry material, kg	-	-	-	-	-	25 PD	25
Brick type recommended use with	JM-23-400, JM-23, JM-24, JM-25 K-23, K-23HS, K-25, K-26 TJM-20, TJM-23, TJM-26C, TJM-26, TJM-B4, TJM-B5	JM-23-400, JM-23, JM-24, JM-25 K-23, K-23HS, K-25, K-26 TJM-20, TJM-23, TJM-26C, TJM-26, TJM-B4, TJM-B5	JM-25SL, JM-25HD, JM-26, JM-26HD, JM-28, JM-28HD, JM-30, JM-30HD, TJM-28, TJM-30, TJM-B6, TJM-B7, TJM-C1, TJM-C2	JM-23-400, JM-23, JM-24, JM-25, JM-26SL, JM-25HD, JM-26, JM-26HD, JM-28, JM-28HD, JM-30, JM-30HD K-23, K-23HS, K-25, K-26 TJM-20, TJM-23, TJM-26C, TJM-26, TJM-28, TJM-30, TJM-B4, TJM-B5, TJM-B6, TJM-B7, TJM-C1, TJM-C2	TJM-30, JM-30, JM-30HD, TJM-Ba90, Insalcor		
Water %, recommended							
trowel	-	-	-	-	-	-	12 - 16
Modulus of Rupture, MOR, MPa (psi), ASTM C 133							
dried @ 100°C (212°F)	12 (1740)	-	-	20 (2900)	28 (4060)	-	-
Permanent Linear Shrinkage, ASTM C 210, 24 hours, %							
after drying	-3	-	-	-2.4	-2	-	-
Chemical Analysis, % weight basis after firing							
Al_2O_3	33.4	43	48	43.1	54.8	43	44
SiO_2	60.7	45	42	51.7	40.6	51	49
Fe_2O3	1.3	1	0.7	1.2	0.9	1.1	1.1
TiO_2	1.2	-	-	1	0.6	-	-
CaO + MgO	0.3	-	-	0.2	0.2	-	-
$Na_2O + K_2O$	2.8	-	-	2.7	2.3	-	-

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Section 13

Monolithics: Cast, Gun, Pump, Free Flow products

Monolithic Tri-Mor products

Insulating : Firelite®, Kaolite®, Tri-Mor® (Blockmix, Coolcast®, Extralite, Insulcast, Insulite)

- Used for the containment of heat within high temperature operating structure and can be used for either hot face working linings or as backing linings behind higher density working linings.

Dense : Firecrete®, Kaocrete®, Tri-Mor (Midcast, HT, BF Cast, 1800T Guncrete, etc)

- Dense and Conventional grades are bonded by high alumina cements. These grades are easily placed by casting or gunning and offer good performance in most general applications.

Low cement : Tri-Mor Hicast™, Morflo™, Higun™

- As the name suggests these grades are formulated with low cement, typical 5-7%. They also incorporate fine fillers and dispersants which significantly reduce water demand and enhance physical properties.

Medium cement : Tri-Mor Vibrotek™

- These grades contain cement additions of 10% to 15% and offer easy mixing and installation. They offer excellent resistance to abrasion and thermal shock for general purpose application.

Clay bonded : Tri-Mor Plastics, Plascast™, Plasgun™

- The original monolithic materials were clay bonded plastics/ moldables. Grades today can be supplied, with similar properties, which can be cast or gunned.

Aluminum resistance : Tri-Mor Alcast™, Albond™, Alumor™, Alcoat™

- Specifically developed with enhanced resistance to corundum growth which can occur when molten aluminium is in contact with refractory materials.

Special duty : Tri-Mor Kao-Tuff®

- Grades have been specifically developed for particular applications where abrasion resistance is essential.

Phosphate bonded : Tri-Mor Morbond™

- Compositions bonded with phosphate binders offer excellent resistant to most molten metals and slags. Grades are available which can be installed by ramming, casting or gunning.

Dry vibratory : Tri-Mor TV90

- This material is installed dry and consolidated by vibration to form a dense lining. On heating the material it forms a sintered, strong lining.

Cements and mortars : Airset™, Blakite™, Triset™, JM™

- These are fine grained compositions, which can be supplied dry and ready mixed. They are used for bonding bricks or fibre modules in furnace linings.

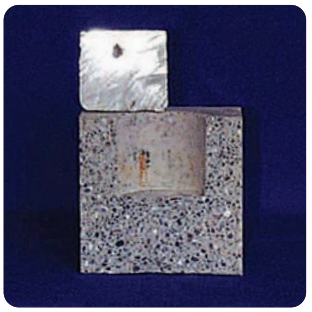
Thermal Ceramics produce a range of Monolithic materials which can be placed in-situ by casting, gunning, parging, trowelling or ramming and provide a wide range of innovative solutions for heat-intensive challenges.

Available in different formulations, densities, and installation methods, monolithics can be used as primary or secondary insulation, for repair, or for speciality applications. Particular grades will be selected depending on the structure to be lined. A lining may be installed using a single material or can be a complex selection depending on the environment and operation of the lined structure.

Specific grades have been developed for high temperature insulation, metal contact, slag resistance, abrasion resistance or thermal shock resistance.

Thermal Ceramics offer an extensive range of alumino-silicate and silicon carbide based Monolithic grades.

Tri-Mor®



Typical applications - for Monolithic Tri-Mor® products:

- Heat treatment applications
- Convection section
- Wood fired boilers
- Reheating furnace
- Vibration casting of transfer lines
- Water tube boiler
- Steel ladle safety linings

Typical benefits - for Monolithic Tri-Mor® products:

- Good thermal shock resistance
- Thermal stability
- Low operational costs
- Easy to repair
- Flexible and resilient
- Lower operational costs

Monolithic Tri-Mor® products

Benefits of Superwool® textiles:

Linings generally provide lower thermal conductivity results compared to traditional dense brick constructions, achieving greater heat savings.

They are faster to install, resulting in:

- Faster turnaround of repairs and maintenance
- Lower operational costs
- Greater production availability
- Give reduced stock levels of expensive special brick shapes
- Monolithic lining reduced joints
- Easy to repair
- Form complex shapes easily
- Good thermal shock resistance
- Improve thermal efficiency

Applications:

Aluminium

- **Joint free lining**
  Reduced joint penetration by molten Aluminium
  Reduced mechanical damage and no 'brick pull out'
- **Reduced lining thickness**
  Increased furnace capacity
- **Easy to repair**
  Easier to patch repair than brick linings
  Wide range of compatible repair materials available
- **Fast installation rates**
  Materials can be mixed in bulk, at fast installation rates without the need for time served brick layers
- **Higher technology products**
  New generation monolithic refractories are out-performing brick linings
- **Elimination of special shapes**
  Monolithic linings can be cast to intricate designs without the need for special shapes
- **Material availability**
  Monolithics can be supplied at much shorter lead times compared to brick linings

Iron and steel

- Blast furnace repairs
- Remote controlled stack gunning
- Steel ladle safety linings
- Reheating furnace
- Pipe protection and insulation
- Heat treatment applications
- Pre cast shapes

Petrochemical

- Fluid Catalytic Cracking Unit (FCCU)
- Vibration casting of transfer lines
- Process heaters
- Reformers and pyrolysis units
- Convection section
- Side wall convection
- Underfired floor section

Power generations

- Wood fired boilers
- Recovery boiler
- Radiant boiler
- Fluidised bed boiler
- Water tube boiler
- Fire tube boiler

Incineration

Refractory installers

Cement

Monolithic products: Insulating Very Lightweight - Firelite®

	105	105 L	105 L-G	1700	BM		LW RK
Manufacturing location	EU	EU	EU	EU	EU	EU	EU
Method of application	cast	cast	gun	cast	cast	gun	cast
Temperature limit, °C	1100	1100	1100	1000	870	870	980
Basic raw material							
insulating aggregate	-	-	-	-	-	X	-
vermiculite	X	-	X	-	X	-	-
vermiculite silicate	-	-	-	X	-	-	-
vermiculite/insulating aggregate	-	X	-	-	-	-	-
Maximum grain size, mm	3	8	8	3	8	8	-
Density, kg/m³							
as placed	1216	1190	1300	990	1020	1050	-
oven dried @ 105°C	720	660	720	550	450	540	600
after 5 hours firing @ 815°C	620	570	660	490	400	490	595
Cold crushing strength, Mpa							
oven dried @ 105°C	2.2	1.3	1.6	1.6	0.6	1.0	0.9
after 5 hours firing @ 650°C	1.8	1.1	1.4	1.2	0.5	0.8	-
815°C	1.6	1.0	1.3	1.1	0.4	0.7	0.6
1600°C	34.3	-	-	-	-	-	-
Permanent linear change, %							
after 5 hours @ 650°C	-0.2	-0.2	-0.2	-0.2	-0.7	-0.6	-
815°C	-0.5	-0.5	-0.5	-0.4	-1.2	-1.0	-1.1
1000°C	-1.0	-1.1	-1.1	-	-	-	-
Thermal conductivity, W/m•k							
@ 200°C	0.13	0.13	0.14	0.12	0.09	0.11	0.13
@ 400°C	0.15	0.15	0.16	0.14	0.12	0.14	0.15
@ 600°C	0.17	0.17	0.18	0.16	-	-	0.17
Estimated weight of dry material/ m³ of construction, kg	640	580	700	500	400	500	590
Estimated weight of water/100kg of dry material, kg	85	90	80	98	165	110	79
Chemical composition, %							
Al_2O_3	35.0	33.7	33.7	31.8	24.7	24.7	17.66
SiO_2	22.6	23.3	23.3	26.2	32.6	32.6	48.51
Fe_2O_3	8.8	9.7	9.7	10.0	7.3	7.3	5.17
TiO_2	1.5	1.4	1.4	0.1	0.8	0.8	0.58
CaO	25.2	24.9	24.9	22.8	22.7	22.7	20.24
$MgO+K_2O+Na_2O$	5.7	6.1	6.1	8.3	9.9	9.9	5.97
Ignition Loss	1.1	0.1	0.1	0.7	2.0	2.0	-
Packaging in bags, kg	20	20	20	18	16	16	-

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Monolithic products: Insulating Lightweight - Firelite®

	LOD SW HT		20 X	20 X-G	20 XL	20 XL-G	20		124	124-G	124-L
Manufacturing location	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU
Method of application	cast	trowel	cast	gun	cast	gun	cast	gun	cast	gun	cast
Temperature limit, °C	1200	1200	1230	1230	1230	1230	1230	1230	1100	1100	1100
ASTM C-401-854 Classification	-	-	N,O,P	N,O,P	N,O,P	O,P	O,P,Q	O,P,Q	O,P	O,P	O,P
Basic raw material											
insulating aggregate	-	-	X	X	X	X	X	X	X	X	X
soluble glass fibre	X	X	-	-	-	-	-	-	-	-	-
Maximum grain size, mm	10	10	8	8	8	8	8	8	8	8	8
Density, kg/m³											
as placed	1530	1580	1460	1510	1310	1390	1570	1670	1400	1450	1350
oven dried @ 105°C	980	1040	880	950	850	930	1040	1130	1020	1060	960
after 5 hours firing @ 815°C	900	960	820	870	770	850	960	1050	900	920	860
Cold crushing strength, Mpa											
oven dried @ 105°C	1.5	1.7	2.0	2.8	2.9	3.9	4.0	5.4	5.9	5.9	4.5
after 5 hours firing @ 650°C	-	-	-	-	-	-	-	-	-	-	-
815°C	1.2	1.4	1.5	2.3	2.1	3.0	3.3	3.9	4.2	4.2	3.1
1000°C	-	-	1.2	1.8	-	-	2.9	3.4	2.5	2.5	1.7
1100°C	-	-	1.0	1.5	2.0	2.7	-	3.3	-	-	-
1200°C	-	-	-	-	-	-	2.8	3.4	-	-	-
1370°C	-	-	10	12	15	10	5	12	-	-	-
Permanent linear change, %											
after 5 hours @ 815°C	-0.2	-0.2	-0.3	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
1000°C	-1.0	-1.0	-0.3	-0.3	-0.3	-0.3	-0.2	-0.2	-0.3	-0.3	-0.4
1100°C	-1.5	-1.5	-0.4	-0.4	-0.5	-0.5	-0.5	-0.3	-0.6	-0.6	-0.6
1200°C	-	-	-0.6	-0.7	-0.6	-0.6	-0.4	-0.4	-	-	-
Thermal conductivity, W/m•k											
@ 200°C	0.17	0.18	0.15	0.15	0.15	0.17	0.20	0.22	0.17	0.20	0.16
@ 400°C	0.20	0.21	0.17	0.17	0.17	0.20	0.21	0.24	0.20	0.21	0.19
@ 600°C	0.22	0.23	0.20	0.22	0.20	0.22	0.23	0.27	0.22	0.24	0.21
@ 800°C	0.24	0.25	-	-	0.22	0.24	-	-	-	-	-
Estimated weight of dry material/ m³ of construction, kg	900	960	820	890	780	870	970	1060	900	920	860
Estimated weight of water/100kg of dry material, kg	70	65	78	75	72	60	62	58	55	50	50
Chemical composition, %											
Al_2O_3	-	-	37.0	35.9	37.1	34.6	39.0	39.0	32.0	31.5	30.6
SiO_2	-	-	33.6	32.0	31.0	34.4	28.9	28.9	29.0	30.0	34.7
Fe_2O_3	-	-	4.5	5.3	6.7	6.4	5.4	5.4	8.9	9.6	9.5
TiO_2	-	-	1.2	1.3	1.2	1.1	1.4	1.4	1.4	1.4	1.2
CaO	-	-	22.0	22.5	21.3	19.6	23.2	23.2	21.8	22.0	18.8
$MgO+K_2O+Na_2O$	-	-	1.2	1.5	1.7	0.1	1.0	1.0	4.9	3.3	5.0
Ignition Loss	-	-	0.3	0.7	1.0	1.7	1.1	1.1	0.2	0.7	0.2
Packaging in bags, kg	25	25	25	25	25	25	25	25	25	20	20

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Monolithic products: Insulating Low Lime - Firelite®

	2500		LW		LW HS	LW HS-G	2200 LL		2000 LL	2000 LL-G
Manufacturing location	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU
Method of application	Cast	Gun	Cast	Gun	Cast	Gun	Cast	Gun	Cast	Gun
Temperature limit, °C	1370	1370	1320	1320	1320	1320	1200	1200	1100	1100
Basic raw material										
insulating aggregate	X	X	X	X	X	X	X	X	X	X
Maximum grain size, mm	6	6	6	6	4	4	4	4	4	4
Density, kg/m3										
as placed	1860	1930	1740	1760	1610	1680	1510	1560	1300	1300
oven dried @ 105°C	1420	1500	1200	1290	1340	1430	1230	1390	1040	1060
after 5 hours firing @ 815°C	1340	1420	1150	1200	1250	1330	1190	1330	1010	1050
Cold crushing strength, Mpa										
oven dried @ 105°C	8.8	10.8	4.3	6.4	9.8	14.7	9.1	19.6	5.9	9.8
815°C	6.9	8.4	3.2	5.9	7.8	11.8	6.2	14.7	3.9	6.9
1000°C	5.1	6.0	2.8	5.4	-	-	-	9.8	-	-
1100°C	-	-	-	4.9	4.9	5.9	-	-	-	-
1200°C	5.9	6.5	3.9	4.4	-	-	-	-	-	-
1300°C	6.9	7.0	-	-	6.4	6.9	-	-	-	-
Permanent linear change, %										
after 5 hours @ 650°C	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.3	-0.2	-0.3	-
815°C	-0.3	-0.3	-0.3	-0.3	-	-0.6	-0.5	-0.6	-0.5	-
1000°C	-0.4	-0.5	-	-	-0.4	-	-	-	-	-
1100°C	-	-	-0.6	-0.5	0.6	-	-	-	-	-
1200°C	-0.7	-0.7	-1.0	-0.8	-1.5	-	-	-	-	-
Thermal conductivity, W/m•k										
200°C	0.34	0.36	0.28	0.29	0.29	0.31	0.24	0.29	0.21	0.21
400°C	0.37	0.39	0.30	0.31	0.31	0.33	0.27	0.31	0.23	0.24
600°C	0.40	0.42	0.33	0.34	0.34	0.36	0.29	0.34	0.26	0.27
800°C	0.42	0.45	0.35	0.36	0.36	0.38	0.33	0.36	-	-
1000°C	0.44	0.48	0.38	0.39	0.39	0.41	-	-	-	-
Estimated weight of dry material/ m^3 of construction, kg	1350	1450	1160	1220	1250	1330	1190	1300	1020	1040
Estimated weight of water/100kg of dry material, kg	25	23	30	27	24	20	27	20	27	25
Chemical composition, %										
Al_2O_3	44.4	44.4	46.2	46.2	38.8	40.0	30.7	30.7	28.0	29.1
SiO_2	34.4	34.4	34.3	34.3	37.6	36.2	42.9	42.9	45.8	45.2
Fe_2O_3	5.4	5.4	4.7	4.7	6.9	6.8	8.0	8.0	8.4	8.1
TiO_2	1.5	1.5	1.4	1.4	1.1	1.1	1.4	1.4	1.0	1.0
CaO	11.7	11.7	10.1	10.1	11.8	11.8	11.8	11.8	10.5	10.3
$MgO+K_2O+Na_2O$	1.1	1.1	1.5	1.5	1.9	1.3	3.9	3.9	5.3	4.8
Ignition Loss	1.1	1.1	1.7	1.7	1.9	2.3	1.3	1.3	1.0	1.5
Packaging in bags, kg	22	22	25	25	30	-	-	-	-	-

Monolithic products: Insulating and Finishing Cements

	JM 500	JM 460	JM 375
Manufacturing location	EU	EU	EU
Max. continuous use temperature, °C	980	980	760
Basic raw material			
soluble glass fibre	-	X	X
vermiculite	X	-	-
Density, kg/m3			
oven dried @ 105°C	280	470	750
Permanent linear change, %			
oven dried @ 105°C	-3	-4	-0.5
after 5 hours @ 650°C	-3.5	-2.5	-2.1
815°C	-4	-2.8	-
Modules of rupture, Mpa			
oven dried @ 105°C	0.4	0.5	0.8
after 5 hours firing @ 650°C	-	0.9	1.2
after 5 hours firing @ 815°C	0.4	0.8	-
Thermal conductivity, W/m•k			
at mean temperature of 200°C	0.12	0.14	0.13
@ 400°C	0.14	0.16	0.14
@ 600°C	0.16	0.19	-
Estimated weight of dry material/ m3 of construction, kg	250	750	850
Estimated weight of water/100kg of dry material, kg	250	120	100
Chemical composition, %			
Al2O3	15.3	13.2	13.6
SiO2	54	59.4	50
Fe2O3	5.3	0.76	1.3
TiO2	-	0.2	0.1
CaO	1.7	20.5	26.9
MgO+K2O+Na2O	19.1	6.6	4.4
Packaging in bags, kg	7	18	18

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Monolithic products: Insulating Medium Lightweight - Firelite®

	2500		LW		LW HS	LW HS-G	1230		14	14-G	14 HS
Manufacturing location	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU
Method of application	Cast	Gun	Cast	Gun	Cast	Gun	Cast	Gun	Cast	Cast	Cast
Temperature limit, °C	1370	1370	1320	1320	1320	1320	1230	1230	1100	1100	1100
Basic raw material											
insulating aggregate	X	X	X	X	X	X	X	X	-	-	-
porous aggregate	-	-	-	-	-	-	-	-	X	X	X
Maximum grain size, mm	6	6	6	6	4	4	8	8	8	4	4
Density, kg/m3											
as placed	1860	1930	1740	1760	1610	1680	1700	1750	1490	1580	1520
oven dried @ 105°C	1420	1500	1200	1290	1340	1430	1150	1220	1200	1200	1300
after 5 hours firing @ 815°C	1340	1420	1150	1200	1250	1330	1100	1140	1060	1100	1190
Cold crushing strength, Mpa											
oven dried @ 105°C	8.8	10.8	4.3	6.4	9.8	14.7	4.2	6.4	8.8	8.8	15.7
815°C	6.9	8.4	3.2	5.9	7.8	11.8	3.7	6.2	5.9	5.9	9.3
1000°C	5.1	6	2.8	5.4	-	-	2.9	5.9	-	-	7.4
1100°C	-	-	-	4.9	4.9	5.9	2.7	4.5	3.9	3.9	-
1200°C	5.9	6.5	3.9	4.4	-	-	2.8	4.4	-	-	-
1300°C	6.9	7	-	-	6.4	6.9	-	-	-	-	-
Permanent linear change, %											
815°C	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.3	-0.3	-0.2	-0.3	-0.2
1000°C	-0.3	-0.3	-0.3	-0.3	-	-	-	-	-	-	-
1100°C	-0.4	-0.4	-	-	-0.4	-0.4	-0.4	-0.4	-0.2	-0.3	-0.2
1200°C	-	-	-0.6	-0.7	-0.6	-0.6	-0.4	-0.4	-	-	-
1300°C	-0.7	-0.7	-1	-0.8	-0.5	-1.5	-	-	-	-	-
Thermal conductivity, W/m•k											
at mean temperature of 200°C	0.34	0.36	0.28	0.29	0.29	0.29	0.31	0.22	0.21	0.23	0.27
@ 400°C	0.37	0.39	0.3	0.31	0.31	0.33	0.24	0.26	0.24	0.27	0.29
@ 600°C	0.4	0.42	0.33	0.34	0.34	0.36	0.26	0.28	0.27	0.29	0.31
@ 800°C	0.42	0.45	0.35	0.36	0.36	0.38	0.28	0.3	-	-	-
@ 1000°C	0.44	0.48	0.38	0.39	0.39	0.41	-	-	-	-	-
Estimated weight of dry material/ m^3 of	1350	1450	1160	1220	1250	1330	1110	1180	1060	1160	1200
Estimated weight of water/100kg of dry material,	28	35	30	45	24	24	53	48	36	36	27
Chemical composition, %											
Al2O3	44.4	44.4	46.2	46.2	38.8	40	36.8	36.8	31.4	30.9	28.1
SiO2	34.6	34.6	34.3	34.3	37.6	36.2	33.1	33.1	36	36.6	39.9
Fe2O3	5.4	5.4	4.7	4.7	6.9	6.8	5.8	5.8	7.2	7.3	7.9
TiO2	1.5	1.5	1.4	1.4	1.1	1.1	1.3	1.3	1.4	1.3	1.3
CaO	11.7	11.7	10.1	10.1	11.8	11.8	20.3	20.3	19.8	19.4	17
MgO+K2O+Na2O	1.1	1.1	1.5	1.5	1.9	1.3	1.5	1.5	3.7	3.9	5.3
Ignition Loss	1.1	1.1	1.7	1.7	1.9	1.3	1.1	1.1	0.3	0.5	0.3
Packaging in bags, kg	22	22	25	25	30	30	30	30	25	25	25

Safety Data Sheet (SDS): are available for all products.
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Monolithic products: Insulating Low Iron - Firelite®

	95	2800 LI	2700 LI	2600 LI	2600 LI-G	2300 VLI	2300 LI-G
Manufacturing location	EU	EU	EU	EU	EU	EU	EU
Method of application	Cast	Cast	Cast	Cast	Gun	Cast	Cast
Temperature limit, °C	1760	1540	1480	1430	1430	1260	1260
Basic raw material							
insulating aggregate	-	-	X	X	X	X	X
bubble and tabular alumina	X	-	-	-	-	-	-
bubble alumina	-	X	-	-	-	-	-
Maximum grain size, mm	5	6	6	6	6	8	6
Density, kg/m3							
as placed	1690	1820	1760	1720	1760	1480	1660
oven dried @ 105°C	1730	1430	1330	1230	1320	930	1080
after 5 hours firing @ 815°C	1690	1340	1210	1140	1200	860	1020
Cold crushing strength, Mpa							
oven dried @ 105°C	17.6	10.0	9.3	6.3	9.8	3.7	6.9
815°C	9.8	6.0	6.3	4.5	6.5	2.1	4.9
1000°C	10.8	4.2	-	4.3	6.0	1.9	4.4
1200°C	11.8	3.6	4.9	3.9	5.5	1.7	-
1400°C	17.6	3.6	5.9	5.3	7.0	-	-
1500°C	25.5	7.2	-	-	-	-	-
Permanent linear change, %							
815°C	-0.1	-0.1	-0.2	-0.2	-0.2	-0.1	-0.2
1000°C	-0.1	-0.2	-	-	-	-	-
1200°C	-0.2	-0.2	-0.6	-0.8	-0.7	-0.3	-0.4
1400°C	-0.2	-0.6	-1.2	-	-	-	-
1500°C	+0.6	-0.10	-	-	-	-	-
1600°C	-0.3	-	-	-	-	-	-
Thermal conductivity, W/m•k							
at mean temperature of 200°C	0.42	0.35	0.29	0.28	0.29	0.16	0.17
@ 400°C	0.49	0.40	0.32	0.31	0.32	0.19	0.20
@ 600°C	0.52	0.44	0.35	0.34	0.35	0.21	0.23
@ 800°C	0.57	0.48	0.37	0.36	0.37	-	-
@ 1000°C	0.63	0.53	0.42	0.40	0.42	-	-
@ 1200°C	0.67	-	-	-	-	-	-
Estimated weight of dry material/ m3 of construction, kg	1690	1350	1220	1140	1230	860	1050
Estimated weight of water/100kg of dry material, kg	16	38	44	49	43	70	65
Chemical composition, %							
Al2O3	94.5	79.7	60.8	58.0	58.7	47.4	47.4
SiO2	0.2	11.7	28.2	31.4	30.0	31.7	31.8
Fe2O3	0.1	0.3	0.7	0.7	0.7	0.5	0.5
TiO2	-	-	0.3	0.5	0.1	0.7	0.7
CaO	4.3	6.5	7.7	6.8	7.0	17.6	16.9
MgO+K2O+Na2O	0.2	0.9	1.1	1.4	1.6	1.0	0.8
Ignition Loss	trace	0.2	1.1	1.8	1.0	1.0	1.6
Packaging in bags, kg	25	30	30	30	30	25	25

Monolithic products: Insulating - Firelite®

	Firelite 14 R	Firelite 55	Firelite 80	Firelite 105 L R	Firelite 110	Firelite 124 L R	Firelite 2500 HS	Firelite 2600 LI HD	Firelite 2700 LI HD	Firelite 2600 LI HD	Firelite 2700 LI HD
Manufacturing location	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU
Bond type	Hydraulic	Hydraulic	Hydraulic	Hydraulic	Hydraulic	Hydraulic	-	-	-	-	-
Method of application	Cast	Cast	Cast	Cast	Cast	Cast	Cast	Cast	Cast	Gun	Gun
Maximum allowable temperature, °C	-	-	-	-	-	-	1370	1430	1480	1430	1480
Maximum service temperature, °C	1000	1000	1100	900	1100	1000	-	-	-	-	-
ASTM C-401-854 Classification	-	-	-	-	-	-	Q, R	Q, R	S	Q, R	S
Basic raw material											
Aggregate	X	-	-	-	-	X	-	-	-	-	-
Dust, Perlite	-	X	X	-	X	-	-	-	-	-	-
Maximum grain size, mm	8	4	1	8	1	8	6	6	6	6	6
Density, kg/m3											
after drying kg/m3	-	-	-	-	-	-	-	1380	1430	1420	1550
110°C	1100	550	890	700	1200	930	-	-	-	-	-
after 5 hours firing @ 815°C	-	-	-	-	-	-	1370	1280	1300	1320	1380
Cold crushing strength, Mpa											
110°C	8.0	0.45	1.4	1.3	5.5	4.1	12.0	10.5	10.0	11.0	20.0
815°C	4.0	0.40	1.1	0.5	3.5	2.7	8.0	7.0	8.0	7.5	12.0
MST	1.0	-	-	-	-	1.0	-	-	-	-	-
Permanent linear change, %											
600°C	-	-	-	-1.2	-	-	-	-	-	-	-
815°C	-0.5	-1.6	-1.4	-1.5	-0.75	-0.8	-0.2	-0.2	-0.2	-0.2	-0.2
1000°C	-	-2.0	-1.5	-	-0.90	-	-	-	-	-	-
1200°C	-	-	-	-	-	-	-	-0.8	-0.6	-0.8	-0.6
MST	-1.4	-	-	-	-	-1.3	-	-	-	-	-
Thermal conductivity, W/m•k											
at mean temperature of 200°C	0.23	-	-	0.15	-	0.17	-	0.37	0.37	0.38	0.38
@ 400°C	0.26	-	-	0.17	-	0.21	-	0.38	0.39	0.39	0.40
@ 600°C	0.29	-	-	0.19	-	0.23	-	0.39	0.41	0.40	0.42
@ 800°C	-	-	-	-	-	-	-	0.40	0.43	0.41	0.44
@ 1000°C	-	-	-	-	-	-	-	0.41	0.45	0.42	0.46
Estimated weight of dry material/ m3 of construction, kg	1020	525	820	680	1100	850	-	-	-	-	-
Water addition, % by weight	46	100	60 - 70	85	45 - 55	46	-	-	-	-	-
Chemical composition, %											
Al2O3	28.0	29.0	34.0	24.5	38.0	24.0	41.4	58.0	60.8	58.0	60.8
SiO2	36.0	40.5	35.0	29.0	32.0	39.0	37.6	31.4	28.2	31.4	28.2
Fe2O3	8.0	4.0	3.0	8.0	5.7	8.5	5.4	0.7	0.7	0.7	0.7
TiO2	1.0	0.9	n.a.	1.0	1.3	1.5	1.5	0.5	0.3	0.5	0.3
CaO	23.0	23.0	23.0	31.0	20.7	22.0	11.7	6.8	7.7	6.8	7.7
MgO+K2O+Na2O	-	-	-	6.5	1.9	-	1.1	1.4	1.1	1.4	1.1
Na2O +K2O	4.0	1.9	-	-	-	5.0	-	-	-	-	-
Ignition Loss	-	-	-	-	-	-	1.1	1.8	1.1	1.8	1.1
Packaging in bags, kg	25	15	15	20	15	25	-	-	-	-	-

Monolithic products: Medium Cement

	Vibrotek					
	42	**54 C**	**55 A**	**60**	**60 R**	**70 R**
Manufacturing location	EU	EU	EU	EU	EU	EU
Bond type	Hydraulic	Hydraulic	Hydraulic	Hydraulic	Hydraulic	Hydraulic
Installation method	Cast	Cast	Cast	Cast	Vibro casting	Vibro casting
Max. service temperature, °C	1400	1500	1600	1600	1600	1650
Raw material base						
Chamotte	x	x	x	x	-	-
Andalusite	-	-	x	-	-	-
Bauxite	-	x	-	x	-	-
Maximum grain size, mm	6	6	6	6	6	6
Bulk density, kg/m3, 110°C	2200	2250	2400	2540	2200	2450
Net material required, kg/m3	2150	2200	2400	2480	2440	2530
Cold crushing strength, MPa						
110°C	80	50	60	75	35	35
815°C	60	50	50	55	-	-
1000°C	60	-	-	65	45	75
1300°C	70	40	-	90	60	80
1400°C	70	-	-	-	-	-
1600°C	-	-	80	95	-	-
MST	-	-	-	-	70	120
Permanent linear change, %						
815°C	-0.3	-0.3	-0.3	-0.2	-	-
1000°C	-0.3	-	-	-0.2	-0.20	-0.30
1300°C	-0.6	0.8	-	-0.5	-0.50	-0.40
1400°C	+/-0.5	-	-	-	-	-
1600°C	-	-	1.5	1.8	-	-
MST	-	-	-	-	+/- 1.5	+/- 2.0
Thermal conductivity, W/mK						
600°C	1.4	1.5	1.6	1.7	1.65	1.7
Chemical analysis, %						
Al2O3	42	50	55	65	57.0	65.0
SiO2	50	43	40	29	33.0	25.0
CaO	3.8	4.3	1.5	1.9	2.0	1.5
Fe2O3	2.2	2	0.8	1	1.5	1.5
TiO2	-	-	-	-	0.9	-
MgO	-	-	-	-	2.0	-
Na2O +K2O	-	-	-	-	0.7	-
Water addition, %	6 - 7.5	7.5 - 9	4.5 - 6.5	5.5 - 6.5	11 - 12	8.0 - 10.5
Packaging in bags, kg	25	25	25	25	25	25

Safety Data Sheet (SDS): are available for all products.
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Monolithic products: Dense - Firecrete®

	95	95 Fluid	3X	3X-G	HT	HT-G
Manufacturing location	EU	EU	EU	EU	EU	EU
Method of application	Cast	-	Cast	Gun	Cast	Gun
Classification, (ASTM C-401-84)	-	High Strength	-	-	-	-
Temperature limit, °C	>1800	-	1650	1650	1540	1540
Maximum allowance temperature, °C	-	>1800	-	-	-	-
Pyrometric cone equivalent	40	-	33	33	29	29
Basic raw material						
bubble and tabular alumina	X	-	-	-	-	-
chamotte corundum	-	-	X	-	-	-
chamotte	-	-	-	X	X	X
Maximum grain size, mm	3	-	5	5	5	5
Density, kg/m3						
as placed	2830	-	2410	2350	2220	2250
oven dried @ 105°C	2620	-	2190	2150	1980	2000
after 5 hours firing @ 815°C	2550	-	2150	2050	1900	1910
after drying, kg/m3	-	2820	-	-	-	-
after firing @815°C, kg/m3	-	2750	-	-	-	-
Cold crushing strength, Mpa						
oven dried @ 105°C	66.7	-	31.4	34.3	19.6	21.6
110°C	-	85.0	-	-	-	-
after 5 hours firing @ 815°C	60.8	80.0	21.6	30.4	11.8	13.7
1000°C	60.8	-	16.7	22.5	9.8	11.8
1200°C	59.8	-	16.7	20.6	10.8	13.7
1400°C	58.3	-	36.5	-	22.5	25.5
1600°C	51.0	-	52.9	-	-	-
Permanent linear change, %						
after 5 hours @ 815°C	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2
1000°C	-0.1	-	-0.1	-0.2	-0.2	-0.2
1200°C	-0.1	-	-0.2	-0.2	-0.3	-0.3
1400°C	-0.2	-	-0.4	-0.3	-0.5	-0.5
1600°C	-0.3	+/- 1	+0.2	-	-	-
Thermal conductivity, (ASTM C-417-84) W/m•K						
400°C	-	-	0.97	0.97	0.64	0.66
600°C	1.60	1.80	1.02	1.02	0.73	0.75
800°C	1.45	1.65	1.09	1.09	0.81	0.84
1000°C	1.35	1.55	1.22	1.22	0.92	0.95
1200°C	1.30	1.50	1.50	1.50	1.01	1.05
Estimated weight of dry material /m3 of construction, kg	2570	-	2170	2100	1950	1970
Estimated weight of water/100kg of dry material, kg	10	-	11	12	14	14
Chemical composition, %						
Al2O3	94.1	94.1	53.4	53.4	47.1	47.0
SiO2	<0.1	0.1	39.6	38.5	45.3	45.3
Fe2O3	0.1	0.1	1.1	1.3	1.5	1.5
TiO2	Trace	Trace	1.6	1.6	1.4	1.3
CaO	4.9	4.9	3.3	4.0	4.0	4.0
MgO+K2O+Na2O	<0.4	0.40	0.3	0.3	0.4	0.4
Ignition Loss	0.5	0.50	0.2	0.8	0.2	0.4
Packaging in bags, kg	25	-	25	25	25	25

Monolithic products: Dense - Firecrete®

	40	60	70
Manufacturing location	EU	EU	EU
Bond type	Hydraulic	Hydraulic	Hydraulic
Method of application	Casting, Trowelling	Casting, Trowelling	Casting, Trowelling
Temperature limit, °C	1350	1400	1450
Basic raw material			
Calcined Fireclay	X	-	-
Mullite, Chamotte	-	X	-
Mullite, Bauxite	-	-	X
Maximum grain size, mm	6	6	6
Density, kg/m3, 110°C	2070	2100	2210
110°C	25	60	30
after 5 hours firing @ 815°C	16	-	-
1000°C	13	30	18
1200°C	-	30	-
1300°C	-	-	19
MST	10	50	30
Permanent linear change, %			
after 5 hours @ 815°C	-0.1	-	-
1000°C	-0.2	-0.20	-0.20
1200°C	-	-0.30	-
1300°C	-	-	-0.60
MST	+/- 2.0	-0.80	-3.00
Thermal conductivity, (ASTM C-417-84) W/m•K			
600°C	0.76	0.85	1.4.
Net material requirement, kg/m3	2000	2050	2100
Water Addition, @% by weight	14.0 - 15.0	13.0 - 16.0	14.5 - 16.5
Chemical composition, %			
Al2O3	41.0	56.0	70.0
SiO2	39.0	32.0	13.0
Fe2O3	5.0	1.0	5.0
CaO	12.0	6.0	9.0
Packaging in bags, kg	25	25	25

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Monolithic products: Dense - Firecrete®

	STD		2400	2400-G	C2	C2G
Manufacturing location	EU	EU	EU	EU	EU	EU
Method of application	Cast	Gun	Cast	Gun	Cast	Gun
Temperature limit, °C	1400	1400	1315	1315	1260	1260
Pyrometric cone equivalent	16	16	15	15	15	15
Basic raw material						
chamotte	X	X	X	X	X	X
Maximum grain size, mm	5	5	3	3	3	3
Density, kg/m3						
as placed	2260	2280	2110	2130	2200	2300
oven dried @ 105°C	2090	2090	1850	1910	2000	2090
after 5 hours firing @ 815°C	1970	2010	1750	1810	1850	2000
Cold crushing strength, Mpa						
oven dried @ 105°C	36.3	39.2	22.5	30.4	58.8	63.7
after 5 hours firing @ 815°C	27.4	30.4	14.7	25.5	35.3	40.2
1000°C	22.5	25.5	14.7	24.5	29.4	34.3
1200°C	17.6	17.8	18.6	26.5	26.5	32.3
1400°C	35.3	37.3	-	-	-	-
Permanent linear change, %						
after 5 hours @ 815°C	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
1000°C	-0.2	-0.2	-0.2	-0.2	-0.4	-0.3
1200°C	-0.3	-0.3	-0.4	-0.4	-0.8	-0.7
1400°C	-0.5	-0.5	-	-	-	-
Thermal conductivity, (ASTM C-417-84) W/m•K						
400°C	0.59	0.59	0.56	0.58	0.47	0.49
600°C	0.64	0.64	0.60	0.62	0.49	0.50
800°C	0.71	0.71	0.68	0.69	0.54	0.56
1000°C	0.81	0.81	0.79	0.80	0.70	0.74
1200°C	0.93	0.93	-	-	-	-
Estimated weight of dry material /m3 of construction, kg	1980	1980	2020	1800	1900	2020
Estimated weight of water/100kg of dry material, kg	14	13	17	15	16	14
Chemical composition, %						
Al2O3	41.6	41.6	31.9	31.8	34.5	34.6
SiO2	40.0	40.0	48.9	48.9	41.9	42.3
Fe2O3	5.2	5.2	4.9	4.9	7.2	7.1
TiO2	1.8	1.8	1.4	1.4	1.4	1.4
CaO	10.7	10.7	9.0	9.0	13.8	13.4
MgO+K2O+Na2O	0.3	0.3	3.5	3.6	1.2	1.2
Ignition Loss	0.3	0.3	0.3	0.3	0.1	0.2
Packaging in bags, kg	25	25	25	25	25	25

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Monolithic products: Dense - Firecrete®

	FP	FP HT
Manufacturing location	EU	EU
Maximum allowance temperature, °C	1000	1400
Maximum grain size, mm	1.5	3
Density, kg/m3		
after drying, kg/m3	1900	2180
after firing @815°C, kg/m3	-	1990
after firing @900°C, kg/m3	1560	-
Specific heat, (EN 821-3:2005) J/gK		
@50°C	-	-0.2
@150°C	-0.5	-
@300°C	-0.6	-
Bending strength, MoR (MPa) (TM C-MP-PF-218/ASTM C-133		
Curing	2.2	-
after drying at 110°C	9.5	-
after 5hrs firing @ 1000°C	5.2	-
Cold crushing strength, Mpa		
Curing 48h	12.0	50.0
110°C	52.0	80.0
after 5 hours firing @ 815°C	-	70.0
after 5hrs firing @ 900°C, kg/m3	28.0	-
1000°C	28.0	60.0
1200°C	-	40.0
Permanent linear change, %		
after 5 hours @ 815°C	-	-0.2
after 5hrs firing @ 900°C	-0.5	-
1000°C	-0.6	-
1200°C	-	-0.2
1400°C	-	+/- 0.5
Thermal conductivity, (ASTM C-417-84) W/m•K		
200°C	0.456	0.55
400°C	0.477	0.57
600°C	0.498	0.59
800°C	0.519	0.61
Net material requirement, kg/m3	1710	2010
Mixing water, %	15 - 18	11 - 13
Chemical composition, %		
Al2O3	50.0	57.0
SiO2	36.0	32.0
Fe2O3	0.5	0.8
CaO	12.0	8.0
MgO+K2O+Na2O	1.0	-

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Monolithic products: Dense - Tri-Mor®

	1350 GP	Insulbond	Midcast	HT Cast	1800 T
Manufacturing location	EU	EU	EU	EU	EU
Bond type	Hydraulic	Hydraulic	Hydraulic	Hydraulic	Hydraulic
Method of application	Cast/Gun	Trowel	Cast	Cast	Cast
Max. service temperature, °C	1350	1500	1500	1700	1800
Basic raw material					
Aluminosilicate	x	-	-	-	-
Bauxite	-	-	x	x	-
Tabular Alumina	-	-	-	-	x
chamotte	-	x	-	x	-
Maximum grain size, mm	6	6	6	6	6
Bulk density, kg/m3					
110°C	2125	1920	2560	2210	2850
Cold crushing strength, Mpa					
110°C	30	28	45	17	50
after 5 hours firing @ 815°C	25	11	40	11	40
1000°C	18	11	23	11	40
1350°C	20	-	-	-	-
1500°C	-	28	45	-	-
1600°C	-	-	-	60	70
Permanent linear change, %					
after 5 hours @ 815°C	-0.2	-0.2	-0.1	-0.1	-0.1
1000°C	-0.3	-0.3	-0.2	-0.2	-0.1
1350°C	+/-0.5	-	-	-	-
1500°C	-	-0.4	-1.8	-	-
1600°C	-	-	-	+/-0.5	+/-0.5
Thermal conductivity, (ASTM C-417-84) W/m•k					
600°C	0.79	0.72	1.31	0.86	2.16
Net material requirement, kg/m3	2110	1830	2500	2130	2790
Water Addition, @% by weight	13 - 14	18 - 20	11 - 13	11 - 13	7 - 9
Chemical composition, %					
Al2O3	53	51.5	78	66	97
SiO2	33	40	6	28	0.1
Fe2O3	1.7	0.8	4.7	1.1	0.1
CaO	9	5.9	8.8	3	2.8
Packaging in bags, kg	25	25	25	25	25

Safety Data Sheet (SDS): are available for all products.
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Monolithic products: Dense Low Cement

	Hicast Super	Hicast Extra	LC 140	Lo-cast LC 160	Lo-cast Extra	Morflo 160	Morflo 165	Morflo 170	Morflo 180	Morflo 40 SiC	Morflo 80 SiC
Manufacturing location	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU
Bond type	Hydraulic	Hydraulic	Hydraulic	Hydraulic	Hydraulic	Hydraulic	Hydraulic	Hydraulic	Hydraulic	Hydraulic	Hydraulic
Installation method	Cast	Cast	Cast	Cast	Cast	Cast	Cast	Cast	Cast	Cast	Cast
Max. service temperature, °C	1600	1700	1400	1600	1700	1600	1650	1700	1800	1450	1450
Raw material base											
Aluminosilicate	-	-	-	x	-	-	-	-	-	-	-
Chamotte	x	-	x	x	-	x	-	-	-	x	-
Andalusite	-	-	-	-	-	-	x	-	-	-	-
Silicon Carbide	-	-	-	-	-	-	-	-	-	x	x
Tabular Alumina	-	-	-	-	-	-	-	-	x	-	-
Bauxite	-	x	-	-	x	-	-	x	-	-	-
Maximum grain size, mm	6	6	6	8	6	6	6	6	5	6	3
Bulk density, kg/m3, 110°C	2300	2850	2440	2350	2600	2400	2640	2800	3100	2400	2550
Net material required, kg/m3	2300	2800	2440	2350	2600	2400	2640	2800	3100	2350	2550
Cold crushing strength, MPa											
110°C	80	80	100	90	80	70 - 120	70 - 130	100 - 180	100	50 - 80	50 - 80
815°C	80	100	60	-	80	70 - 120	80 - 130	100 - 180	150	70 - 90	70 - 90
1000°C	90	110	75	70	-	100 - 150	80 - 130	150 - 200	200	100 - 120	140 - 180
1300°C	90	110	-	-	-	120 - 150	80 - 130	150 - 200	200	100 - 150	140 - 180
1400°C	-	-	80	-	-	-	-	-	-	-	-
1450°C	-	-	-	-	-	-	-	-	-	80 - 120	200 - 250
1600°C	90	120	-	110	85	150 - 200	100 - 180	150 - 200	200	-	-
Permanent linear change, %											
815°C	-0.2	-0.1	-0.2	-	-0.3	-0.2	+/-0.1	-0.2	-0.2	-0.3	-0.2
1000°C	-0.3	-0.2	-0.3	-0.3	-	-0.3	+/-0.1	-0.3	-0.3	-0.4	-0.2
1300°C	-0.3	-0.2	-	-	-	-0.5	+/-0.2	-0.4	-0.3	-0.5	-0.4
1400°C	-	-	-1.0	-	-	-	-	-	-	-	-
1450°C	-	-	-	-	-	-	-	-	-	+/-0.5	0.2
1600°C	-0.8	-1.5	-	+/-1.5	1.2	-1.0	+/-0.5	-1.5	-1.5	-	-
Thermal conductivity, W/m•K											
600°C	1.53	2.19	1.6	1.5	2.19	1.6	1.85	2.3	3.5	4.0	10.0
Chemical analysis, %											
Al2O3	49	80	52	56	75	55	60	79	93	38 SiC	76 SiC
SiO2	47	13	40	37	15	41	37	14	5	28	7
CaO	2	1.8	3.8	2.1	1.8	1.9	1.7	1.8	1.2	2	1.9
Fe2O3	0.8	1.5	2.5	1.4	1.7	1	0.8	1.5	0.1	0.5	0.2
Water addition, %	5.5 - 6.5	5.5 - 6.5	6 - 7	6.4 - 7.4	7.0 - 8.3	5.2 - 6.4	5.0 - 6.4	5.5 - 6.5	4.0 - 5.0	5.5 - 6.5	5.5 - 6.5
Packaging in bags, kg	25	25	25	25	25	25	25	25	25	25	25

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Monolithic products: Low Cement Gun

	Higun 160	Higun 170
Manufacturing location	EU	EU
Bond type	Hydraulic	Hydraulic
Installation method	Gun	Gun
Max. service temperature, °C	1600	1700
Raw material base		
Chamotte	x	x
Bauxite	-	x
Maximum grain size, mm	6	6
Bulk density, kg/m3, 110°C	2280	2530
Net material required, kg/m3	2200	2450
Cold crushing strength, MPa		
110°C	95	100
815°C	75	90
1000°C	80	70
1300°C	80	80
1600°C	150	110
Permanent linear change, %		
815°C	-0.3	-0.2
1000°C	-0.3	-0.3
1300°C	-0.5	-0.3
1600°C	-1.5	1.4
Thermal conductivity, W/m•K		
600°C	1.55	1.85
Chemical analysis, %		
Al2O3	50	67
SiO2	45	26
CaO	2.8	3
Fe2O3	0.8	1
Water addition, %	At nozzle	At nozzle
Packaging in bags, kg	25	25

Monolithic products: Clay Bonded

	Plascast Super	Plascast HT	Plasgun
Manufacturing location	EU	EU	EU
Bond type	Ceramo-Hydraulic	Ceramo-Hydraulic	Ceramo-Hydraulic
Installation method	Cast	Cast	Gun
Max. service temperature, °C	1600	1700	1700
Raw material base			
Chamotte	x	x	x
Bauxite	-	x	x
Maximum grain size, mm	6	6	6
Bulk density, kg/m3, 110°C	2200	2300	2170
Net material required, kg/m3	2200	2300	2110
Cold crushing strength, MPa			
110°C	5	6	10
815°C	12	12	10
1000°C	20	22	15
1300°C	30	30	20
1600°C	38	38	45
Permanent linear change, %			
815°C	-0.2	-0.2	-0.2
1000°C	-0.2	-0.2	-0.3
1300°C	-0.5	-0.3	-0.7
1600°C	+/-1.0	+/-1.0	+/-1.5
Thermal conductivity, W/m•K			
600°C	0.86	1.01	1.0
Chemical analysis, %			
Al2O3	52	66	66
SiO2	44	30	29
Fe2O3	1	1.1	1.2
Water addition, %	8.5 - 9.5	8.5 - 9.5	At nozzle
Packaging in bags, kg	25	25	25

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Monolithic products: Special Duty

	Morbond AL	Morgun AL	Morgun HT	Guncrete BFS	Guncrete 160
Manufacturing location	EU	EU	EU	EU	EU
Bond type	Chemical	Phosphate	Phosphate	Hydraulic	Hydraulic
Installation method	Cast	Gun	Gun	Cast/Gun	Cast/Gun
Maximum service temperature, °C	1450	1600	1600	1500	1600
Raw material base					
Aluminosilicates	-	x	x	-	-
Bauxite	x	-	-	-	-
Chamotte	-	-	-	x	x
Maximum grain size, mm	3	6	6	6	6
Bulk density, kg/m3, 110°C	2650	2450	2450	2160	2080
Net material required, kg/m3	2650	2450	2450	2120	2020
Cold crush strength, MPa					
110°C	30	16	16	70	34
815°C	30	16	16	30	27
1000°C	30	16	16	20	24
1300°C	-	-	-	-	31
1450°C	50	-	-	-	-
1500°C	-	-	-	70	-
1600°C	-	100	100	-	34
Permanent linear change, %					
815°C	-0.1	-0.1	-0.1	-0.2	-0.2
1000°C	-0.1	-0.1	-0.1	-0.3	-0.3
1300°C	-	-	-	-	-0.6
1450°C	-1.0	-	-	-	-
1500°C	-	-	-	+/-1.0	-
1600°C	-	-1.3	-1.3	-	-1.8
Thermal conductivity, W/m•K					
600°C	2.42	1.95	1.95	0.79	0.79
Chemical analysis, %					
Al2O3	87	75	75	52	50
SiO2	3	17	17	39	42
CaO	1.6	1.4	1.4	7	6
Fe2O3	0.6	0.8	0.8	0.8	1
Water addition, %	Accelerator	At nozzle	At nozzle	11 - 13	12 - 14
Packaging in bags, kg	25	25	25	25	25

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Monolithic products: Aluminium Cast

	Albond					Alcast			Alumor		
	HS	**65 HS**	**65 HSC**	**GB**	**HS-LS**	**70 FS**	**Extra HS GB**	**Extra HSF**	**50 AL**	**90 LS**	**SHI**
Manufacturing location	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU
Bond type	Hydraulic	Hydraulic	Hydraulic	Hydraulic	Hydraulic	Hydraulic	Hydraulic	Hydraulic	Hydraulic	Hydraulic	Hydraulic
Max. service temp., °C	1400	1300	1300	1400	1400	1300	1300	1400	1550	1500	1260
Raw material base											
Alumino and Alumino silicates	-	x	x	-	-	-	-	-	-	x	-
Bauxite	x	-	-	x	x	-	x	x	-	-	-
Chamotte	-	-	-	-	-	-	-	-	x	-	x
Fused Silica	-	-	-	-	-	x	-	-	-	-	-
Maximum grain size, mm	8	10	15	6	8	6	6	6	8	2	6
Bulk density, kg/m3, 110°C	2920	2630	2645	2820	3000	2170	2900	2880	2370	2910	2150
Net material required, kg/m3	2890	2625	2590	2800	2980	2020	2900	2810	2300	2780	2060
Cold crush. stregth, MPa											
110°C	140-160	100-140	100-140	110-160	140-160	80	90-140	100	130	135	58,8
815°C	150-160	90-120	-	110-160	150-160	80	100-160	90	130	100	35,3
1000°C	160-200	90-120	80-100	140-200	160-200	80	90-140	90	100	-	-
1300°C	-	90-150	90-150	-	-	90	90-140	-	130	84	26,5
1400°C	150-200	-	-	140-200	150-200	-	-	90	-	-	--
1550°C	-	-	-	-	-	-	-	-	130	-	-
Permanent linear change, %											
815°C	-0.2	-0.2	-	-0.2	-0.2	-0.2	-0.3	-0.3	-0.2	-0,15	-0,2
1000°C	-0.25	-0.2	-0,1 to -0,3	-0.3	-0.25	-0.3	-0.5	-0.3	-0.3	-	-
1300°C	-	1.2	0 to 1,2	-	-	1	-0.7	-	-0.4	-0,05	-0,8
1400°C	0,7	-	-	-1.2	0.7	-	-	+/-1,5	-	-	-
1550°C	-	-	-	-	-	-	-	-	-1	-	-
Thermal conductivity, W/mK											
600°C	2.3	1.95	-	2.3	2.3	0.73	2.3	2.3	1.34	1.6	0,5
Chemical analysis, %											
Al2O3	81	67	67	81	81	18	77	77	53	90	34.5
SiO2	11.5	28	28	11.5	11.5	74	12	8	42	0,1	41.6
CaO	2.6	1.6	1.6	2.8	2.8	2.2	1.4	2.2	3	4,9	13.8
Fe2O3	1.2	1	1	1.2	1.2	0.2	1.1	1.1	1	0,1	7.2
Water addition, %	4,7-5,2	5-5,5	5-5,5	5,5-6,5	4,7-5,2	6-7	5,0-5,8	5,6-6,0	6,0-6,5	7	13
Packaging in bags, kg	25	25	25	25	25	25	25	25	25	25	25

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Monolithic products: Aluminium Cast

	Higun Extra AL	Insulbond AL	Firecrete 308	Morflo 165 AL
Manufacturing location	EU	EU	EU	EU
Bond type	Hydraulic	Hydraulic	Hydraulic	Hydraulic
Max. service temp., °C	1400	1400	1350	1650
Raw material base				
Alumino and Alumino silicates	x	-	-	-
Chamotte	-	x	x	-
Andalusite	-	-	-	x
Maximum grain size, mm	6	6	5	6
Bulk density, kg/m3, 110°C	2800	1900	2150	2640
Net material required, kg/m3	2800	1800	2100	2640
Cold crush. stregth, MPa				
110°C	70	20	55	70 - 130
815°C	70	23	50	80 - 130
1000°C	70	21	-	80 - 130
1300°C	-	20	20	80 - 130
1400°C	70	-	-	-
1600°C	-	-	-	100 - 180
Permanent linear change, %				
815°C	-0.2	-0,2	-0,1	+/-0.1
1000°C	-0.3	-0,3	-	+/-0.1
1300°C	-	-0,4	-0,7	+/-0.2
1400°C	+/-1,5	-	-	-
1600°C	-	-	-	+/-0.5
Thermal conductivity, W/mK				
600°C	2.2	0,72	0,9	1.85
Chemical analysis, %				
Al2O3	77	47	48	61
SiO2	11.5	44	39	35
CaO	1.7	5,4	8	1.9
Fe2O3	1.1	0,7	1,8	0.8
Water addition, %	added at nozzle	18-20	12,0-15,0	5.0 - 6.4
Packaging in bags, kg	25	25	25	25

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Monolithic products: Aluminium Cast

	Alcoat	Alpatch
Manufacturing location	EU	EU
Bond type	Air Setting	Hydraulic
Max. service temp., °C	>1600	>1400
Raw material base		
Alumino and Alumino silicates	x	-
Bauxite	-	x
Chemical analysis, %		
Al2O3	86	72
SiO2	-	13
CaO	-	1.5
Fe2O3	-	1
Water addition, %	supplied ready mixed	8.5
Packaging in bags, kg	15	25

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Monolithics products: Insulating Very Lightweight - Kaolite®

	Kaolite 1600	Kaolite 1800	Kaolite 1800 Gun
Manufacturing location	NA	NA	NA
Material method of installation	cast/gun	cast/gun	gun
Temperature use limit, °C (°F)	871 (1600)	982 (1800)	982 (1800)
Placement, average lb to place 1 ft3	25/34	26/33	33
Shelf life, months	12	12	12
Water, %, recommended, casting by vibrating	140-160	145-165	-
Density, ASTM C 134, kg/m3 (pcf)			
dried 24 hrs @ 104°C (220°F)	464-625/529-721 (29-39/33-45)	464-625/497-673 (29-39/31-42)	449-609 (28-38)
fired @ 816°C (1500°F)	368-513/432-609 (23-32/27-38)	368-496/400-577 (23-31/25-36)	400-561 (25-35)
Modulus of Rupture, MOR, ASTM C 133, MPa (psi)			
dried 24 hrs @ 104°C (220°F)	0.41-0.86/0.48-1.03 (60-125/70-150)	0.27-0.48/0.34-0.55 (40-70/50-80)	0.34-0.62 (50-90)
fired 5 hrs @ 816°C (1500°F)	0.14-0.31/0.21-0.34 (20-45/30-55)	0.21-0.34/0.27-0.41 (30-50/40-60)	0.38-0.69 (55-100)
fired 5 hrs @ temperature use limit, °C (°F)	0.17-0.27/0.24-0.34 (25-40/35-50)	0.17-0.27/0.27-0.41 (25-40/40-60)	0.41-0.69 (55-100)
Cold crushing strength, CCS, ASTM C 133, MPa (psi)			
dried 24 hrs @ 104°C (220°F)	1.03-2.07/1.21-2.41 (150-300/175-350)	0.52-1.03/0.55-1.03 (75-150/80-150)	0.62-1.21 (90-175)
fired 5 hrs @ 816°C (1500°F)	0.69-1.38/0.83-1.72 (100-200/120-250)	0.55-1.03/0.62-1.21 (80-150/90-175)	0.66-1.24 (95-180)
fired 5 hrs @ temperature use limit, °C (°F)	0.48-0.83/0.62-1.10 (70-120/90-160)	0.34-0.62/0.48-1.03 (50-90/70-150)	0.55-1.21 (80-175)
Permanent Linear Shrinkage, ASTM C 113, %			
dried 24 hrs @ 220°F (104°C)	0 to -0.3	0 to -0.3	0 to -0.3
fired 5 hrs @ 1500°F (816°C)	-1.0 to -2.0	-1.0 to -1.8	-0.8 to -1.8
fired 5 hrs @ temperature use limit, °F (°C)	-1.5 to -2.5	-1.5 to -2.5	-1.5 to -2.5
Thermal Conductivity, W/m•K (BTU•in/hr•ft2) ASTM C201			
260°C (500°F)	0.13/0.15 (0.87/1.03)	0.11 (0.75)	0.11 (0.74)
538°C (1000°F)	0.15/0.16 (1.02/1.11)	0.14 (0.95)	0.13 (0.90)
815°C (1500°F)	0.17/0.17 (1.16/1.2)	0.16 (1.15)	0.15 (1.06)
Chemical Analysis, % weight basis after firing			
Alumina, Al2O3	9.9	30	27
Silica, SiO2	31	29	39
Ferric Oxide, Fe2O3	7.4	9.2	7.0
Titanium Oxide, TiO2	1.1	2	1.6
Calcium Oxide, CaO	39	18	15.5
Magnesium Oxide, MgO	8.2	8.1	6.3
Alkalies as Na2O and K2O	3.4	3.1	3.5

*** For overhead gunning applications, pounds required to place one ft^3 should be increased to 40 - 50 %. Does not include rebound loss.**

1. Properties indicated are for vibratory cast materials only unless specified otherwise.
2. Gunite installation may require 10-30% more material due to compaction and rebound loss.
3. Water requirements indicated are offered as a guide. Actual water required may be subject to field conditions. Consult Thermal Ceramics installation advisor for assistance.
4. Fired linear change values reflect samples taken from a dried to fired state.
5. Chemical analysis % for CaO in parenthesis indicates the % of reactive CaO present if less than the total. The balance is Calcia from the anorthite aggregate.
6. Kaolite 2000-HS and Kaolite 2200 may be gunited, with care. The rebound will be significantly higher and the difficulty greater than with the respective grades.

Safety Data Sheet (SDS): are available for all products.
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Monolithics products: Insulating Lightweight - Kaolite®

	Kaolite 2000	Kaolite 2000-HS	Kaolite 2000-HS Gun	Kaolite 2200	Kaolite 2200 Gun	Kaolite 1:2:4
Manufacturing location	NA	NA	NA	NA	NA	NA
Material method of installation	cast/gun	cast	gun	cast	gun	cast/gun
Temperature use limit, °C (°F)	1093 (2000)	1093 (2000)	1093 (2000)	1204 (2200)	1204 (2200)	1093 (2000)
Placement, average lb to place 1 ft3	32	61	62	61	62	57
Shelf life, months	12	12	12	12	12	12
Water, %, recommended, casting by vibrating	110-125	45-53	-	45-53	-	55-65
Density, ASTM C 134, kg/m3						
dried 24 hrs @ 104°C (220°F)	496-657 (31-41)	977-1105 (61-72)	1009-1186 (63-74)	977-1105 (61-72)	1009-1186 (63-74)	881-1057 (55-66)
fired @ 816°C (1500°F)	432-577 (27-36)	881-1057 (55-66)	897-1073 (56-67)	881-1057 (55-66)	897-1073 (56-67)	801-961 (51-61)
Modulus of Rupture, MOR, ASTM C 133, MPa (psi)						
dried 24 hrs @ 104°C (220°F)	0.31-0.62 (50-90)	0.62-1.21 (90-175)	0.59-1.03 (85-150)	0.62-1.21 (90-175)	0.62-1.03 (90-150)	0.86-1.38 (125-200)
fired 5 hrs @ 816°C (1500°F)	0.38-0.76 (55-100)	0.69-1.55 (100-225)	0.76-1.55 (110-225)	0.69-1.55 (100-225)	0.76-1.55 (110-225)	0.55-1.21 (80-175)
fired 5 hrs @ temperature use limit, °C (°F)	0.41-0.76 (60-100)	0.55-1.10 (90-160)	0.90-1.72 (130-250)	0.55-1.10 (80-160)	0.90-1.72 (130-250)	0.52-1.03 (75-150)
Cold crushing strength, CCS, ASTM C 133, MPa (psi)						
dried 24 hrs @ 104°C (220°F)	0.65-1.24 (95-180)	2.1-5.2 (350-750)	2.1-4.8 (300-700)	2.4-4.5 (350-650)	2.06-3.5 (300-500)	2.06-3.5 (300-500)
fired 5 hrs @ 816°C (1500°F)	0.69-1.28 (100-185)	2.1-5.2 (350-800)	2.1-5.2 (350-800)	2.4-5.2 (350-800)	2.76-6.2 (400-900)	1.7-3.1 (250-450)
fired 5 hrs @ temperature use limit, °C (°F)	0.69-1.38 (100-200)	3.1-6.2 (450-900)	3.1-6.2 (450-900)	3.1-6.2 (450-900)	3.1-6.2 (450-900)	1.7-3.1 (250-450)
Permanent Linear Shrinkage, ASTM C 113, %						
dried 24 hrs @ 220°F (104°C)	0 to -0.3	0 to -0.2	0 to -0.2	0 to -0.2	0 to -0.2	0 to -0.2
fired 5 hrs @ 1500°F (816°C)	-0.6 to -1.5	-0.2 to -0.55	-0.2 to -0.65	-0.2 to -0.55	-0.2 to -0.65	-0.4 to -1.0
fired 5 hrs @ temperature use limit, °F (°C)	-1.5 to -2.5	-0.3 to -1.0	-0.3 to -0.8	-0.3 to -1.0	-0.3 to -0.8	-
Thermal Conductivity, W/m•K (BTU•in/hr•ft2) ASTM C201						
260°C (500°F)	0.11 (0.73)	0.21 (1.48)	0.21 (1.48)	0.21 (1.48)	0.21 (1.48)	0.14 (1.3)
538°C (1000°F)	0.13 (0.88)	0.23 (1.63)	0.23 (1.63)	0.23 (1.63)	0.23 (1.63)	0.22 (1.55)
815°C (1500°F)	0.14 (0.98)	0.26 (1.79)	0.26 (1.79)	0.26 (1.79)	0.26 (1.79)	0.27 (1.9)
1093°C (2000°F)	-	0.28 (1.96)	0.28 (1.96)	0.28 (1.96)	0.28 (1.96)	-
Chemical Analysis, % weight basis after firing						
Alumina, Al2O3	33	37	36	37	36	26
Silica, SiO2	35	38	42	38	42	38
Ferric Oxide, Fe2O3	4.0	2.2	1.6	2.2	1.6	11
Titanium Oxide, TiO2	1.7	1.5	1.4	1.5	1.4	1.4
Calcium Oxide, CaO	18	19 (12)	17 (10)	19 (12)	17 (10)	17
Magnesium Oxide, MgO	4.6	0.2	0.2	0.2	0.2	3.4
Alkalies as Na2O and K2O	3.1	1.2	1.4	1.2	1.4	2.6

1. Properties indicated are for vibratory cast materials only unless specified otherwise.
2. Gunite installation may require 10-30% more material due to compaction and rebound loss.
3. Water requirements indicated are offered as a guide. Actual water required may be subject to field conditions. Consult Thermal Ceramics installation advisor for assistance.
4. Fired linear change values reflect samples taken from a dried to fired state.
5. Chemical analysis % for CaO in parenthesis indicates the % of reactive CaO present if less than the total. The balance is Calcia from the anorthite aggregate.
6. Kaolite 2000-HS and Kaolite 2200 may be gunited, with care. The rebound will be significantly higher and the difficulty greater than with the respective grades.

Monolithics products : Insulating Mediumweight - Kaolite®

	Kaolite 2200-HS	Kaolite 2200-HS Gun	Kaolite 2500-HS	Kaolite 2500-HS Gun	Kaolite 2500-EXHS	Kaolite Super HS Gun
Manufacturing location	NA	NA	NA	NA	NA	NA
Material method of installation	cast	gun	cast	gun	gun	gun
Temperature use limit, °C (°F)	1204 (2200)	1204 (2200)	1371 (2500)	1371 (2500)	1371 (2500)	1315 (200)
Placement, average lb to place 1 ft3	76	76	83	83	86	78
Shelf life, months	12	12	12	12	12	12
Water, %, recommended, casting by vibrating	38-44	-	29-35	-	-	-
Density, ASTM C 134, kg/m3 (pcf)						
dried 24 hrs @ 104°C (220°F)	1282-1474 (80-92)	1282-1474 (80-92)	1394-1570 (87-98)	1394-1570 (87-98)	1426-1603 (89-100)	1281-1458 (80-91)
fired @ 816°C (1500°F)	1121-1298 (70-81)	1121-1298 (70-81)	1265-1425 (79-89)	1265-1425 (79-89)	1298-1458 (81-91)	1154-1330 (73-83)
Modulus of Rupture, MOR, ASTM C 133, MPa (psi)						
dried 24 hrs @ 104°C (220°F)	1.6-2.4 (225-350)	1.72-2.76 (250-400)	1.72-2.76 (250-400)	1.72-2.76 (250-400)	2.07-3.79 (300-550)	3.10-6.21 (450-900)
fired 5 hrs @ 816°C (1500°F)	1.03-2.07 (150-300)	1.38-2.41 (200-350)	1.38-2.41 (225-375)	1.72-2.76 (250-500)	1.90-3.44 (275-500)	1.38-4.14 (350-600)
fired 5 hrs @ temperature use limit, °C (°F)	1.38-2.07 (200-300)	1.72-3.44 (250-500)	2.07-3.79 (300-550)	2.41-4.14 (350-600)	2.59-4.48 (375-650)	3.44-6.9 (500-1000)
Cold crushing strength, CCS, ASTM C 133, MPa (psi)						
dried 24 hrs @ 104°C (220°F)	5.86-11.03 (850-1600)	6.20-11.03 (900-1600)	6.20-10.34 (900-1500)	6.20-10.34 (900-1500)	6.89-11.03 (1000-1600)	15.1-34.5 (2200-5000)
fired 5 hrs @ 816°C (1500°F)	5.52-11.03 (800-1600)	6.20-11.72 (900-1700)	5.86-11.03 (850-1600)	6.20-11.03 (900-1600)	6.55-11.72 (950-1700)	12.4-24.1 (1800-3500)
fired 5 hrs @ temperature use limit, °C (°F)	5.17-9.65 (750-1400)	5.52-10.34 (800-1500)	6.21-10.34 (900-1500)	6.20-11.03 (900-1600)	7.58-12.41 (1100-1800)	17.2-34.5 (2500-5000)
Permanent Linear Shrinkage, ASTM C 113, %						
dried 24 hrs @ 220°F (104°C)	0 to -0.2	0 to -0.2	0 to -0.2	0 to -0.2	0 to -0.2	0 to -0.2
fired 5 hrs @ 1500°F (816°C)	-0.1 to -0.5	-0.2 to -0.55	-0.1 to -0.4	-0.2 to -0.5	-0.2 to -0.5	-0.1 to -0.4
fired 5 hrs @ temperature use limit, °F (°C)	-0.3 to -1.0	-0.5 to -1.5	-1.5 to +1.5	-1.0 to +0.5	-1.0 to +0.5	-0.5 to -1.5
Thermal Conductivity, W/m•K (BTU•in/hr•ft2) ASTM C201						
260°C (500°F)	0.25 (1.71)	0.25 (1.71)	0.4 (2.8)	0.4 (2.8)	0.4 (2.8)	0.39 (2.7)
538°C (1000°F)	0.26 (1.83)	0.26 (1.83)	0.43 (3.0)	0.43 (3.0)	0.43 (3.0)	0.42 (2.9)
815°C (1500°F)	0.29 (2.01)	0.29 (2.01)	0.46 (3.2)	0.46 (3.2)	0.46 (3.2)	0.43 (3.0)
1093°C (2000°F)	0.32 (2.23)	0.32 (2.23)	0.51 (3.4)	0.51 (3.4)	0.51 (3.4)	0.46 (3.2)
1371°C (2500°F)	-	-	0.53 (3.5)	0.53 (3.5)	0.53 (3.5)	-
Chemical Analysis, % weight basis after firing						
Alumina, Al2O3	44	41	43	40	42	28
Silica, SiO2	27	31	35	40	38	53.5
Ferric Oxide, Fe2O3	3.2	3	2.2	2.2	2.2	2.6
Titanium Oxide, TiO2	1.8	1.5	1.6	1.4	1.3	1.2
Calcium Oxide, CaO	22 (17)	22 (17)	17 (12)	15 (11)	16 (11)	11.5
Magnesium Oxide, MgO	0.4	0.2	0.2	0.2	0.2	0.7
Alkalies as Na2O and K2O	0.9	0.9	0.7	0.7	0.8	2.3

1. Properties indicated are for vibratory cast materials only unless specified otherwise.
2. Gunite installation may require 10-30% more material due to compaction and rebound loss.
3. Water requirements indicated are offered as a guide. Actual water required may be subject to field conditions. Consult Thermal Ceramics installation advisor for assistance.
4. Fired linear change values reflect samples taken from a dried to fired state.
5. Chemical analysis % for CaO in parenthesis indicates the % of reactive CaO present if less than the total. The balance is Calcia from the anorthite aggregate.

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Monolithics products : Insulating Low Iron - Kaolite®

	Kaolite 2000-LI	Kaolite 2300-LI	Kaolite 2300-LI Gun	Kaolite 2300-LI AHR	Kaolite 2500-LI	Kaolite 2500-LI Gun	Kaolite 2600-LI	Kaolite 2600-LI Gun
Manufacturing location	NA	NA	NA	NA	NA	NA	NA	NA
Material method of installation	cast/gun	cast	gun	gun	cast	gun	cast	gun
Temperature use limit, °C (°F)	1093 (2000)	1260 (2300)	1260 (2300)	1260 (2300)	1371 (2500)	1371 (2500)	1427 (2600)	1427 (2600)
Placement, average lb to place 1 ft3	38	61	62	61	70	71	83	84
Shelf life, months	12	12	12	12	12	12	12	12
Water, %, recommended, casting by vibrating	78-90	46-54	-	-	38-47	-	29-35	-
Density, ASTM C 134, kg/m3								
dried 24 hrs @ 104°C (220°F)	577-753 (36-47)	993-1169 (62-73)	1010-1186 (63-74)	993-1169 (62-73)	1154-1330 (72-83)	1154-1330 (72-83)	1362-1538 (85-96)	1362-1538 (85-96)
fired @ 816°C (1500°F)	513-657 (31-42)	881-1057 (55-66)	897-1073 (56-67)	881-1057 (55-66)	1041-1218 (65-76)	1041-1218 (65-76)	1250-1410 (79-89)	1250-1410 (79-89)
Modulus of Rupture, MOR, ASTM C 133, MPa (psi)								
dried 24 hrs @ 104°C (220°F)	0.41-0.83 (60-120)	0.83-1.38 (120-200)	0.83-1.38 (120-200)	1.38 - 276 (200-400)	1.21-1.90 (175-275)	1.21-1.90 (175-275)	2.07-3.45 (250-400)	2.07-3.44 (300-500)
fired 5 hrs @ 816°C (1500°F)	0.38-0.76 (55-110)	0.80-1.38 (110-200)	0.80-1.55 (110-225)	1.03-1.52 (150-220)	0.86-1.72 (125-250)	0.86-1.72 (125-250)	1.38-2.41 (250-350)	1.72-2.76 (225-400)
fired 5 hrs @ temperature use limit, °C (°F)	0.52-1.03 (75-150)	1.03-1.72 (150-250)	1.03-2.07 (150-300)	1.38-2.41 (200-350)	1.38-2.41 (200-350)	1.72-2.75 (250-400)	2.75-5.52 (400-800)	3.45-6.21 (500-900)
Cold crushing strength, CCS, ASTM C 133, MPa (psi)								
dried 24 hrs @ 104°C (220°F)	1.55-2.76 (225-400)	2.41-4.13 (350-600)	2.41-4.13 (350-600)	6.89-10.34 (1000-1500)	4.14-8.28 (600-1200)	4.14-8.28 (600-1200)	5.86-11.03 (850-1600)	6.55-11.7 (950-1700)
fired 5 hrs @ 816°C (1500°F)	1.21-2.41 (175-350)	2.41-6.21 (350-900)	2.41-6.21 (350-900)	3.45-6.89 (500-1000)	3.79-7.59 (550-1100)	3.79-7.59 (550-1100)	6.20-11.0 (900-1600)	6.55-11.7 (950-1700)
fired 5 hrs @ temperature use limit, °C (°F)	1.38-2.59 (200-375)	2.76-6.89 (400-1000)	2.76-6.89 (400-1000)	4.83-10.34 (700-1500)	5.52-9.65 (800-1400)	4.83-8.97 (700-1300)	8.28-13.79 (1200-2000)	7.58-13.79 (1100-2000)
Permanent Linear Shrinkage, ASTM C 113, %								
dried 24 hrs @ 220°F (104°C)	0 to -0.2	0 to -0.2	0 to -0.2	0 to -0.2	0 to -0.2	0 to -0.2	0 to -0.2	0 to -0.2
fired 5 hrs @ 1500°F (816°C)	-0.6 to -1.3	-0.1 to -0.55	-0.2 to -0.6	-0.1 to -0.7	-0.1 to -0.4	-0.2 to -0.5	-0.1 to -0.4	-0.2 to -0.5
fired 5 hrs @ temperature use limit, °F (°C)	-1.5 to -3.0	-1.0 to -2.0	-1.0 to -2.0	-1.0 to -2.0	-0.5 to -1.5	-0.5 to -1.5	-0.5 to -1.5	-0.5 to -1.5
Thermal Conductivity, W/m•K (BTU•in/hr•ft2) ASTM C201								
260°C (500°F)	0.14 (1.1)	0.21 (1.48)	0.21 (1.48)	0.28 (1.96)	0.25 (1.76)	0.25 (1.76)	0.39 (2.7)	0.42 (2.9)
538°C (1000°F)	0.19 (1.3)	0.23 (1.62)	0.23 (1.62)	0.29 (2.05)	0.28 (1.95)	0.28 (1.95)	0.42 (2.9)	0.42 (2.9)
815°C (1500°F)	0.22 (1.5)	0.26 (1.77)	0.26 (1.77)	0.30 (2.14)	0.31 (2.15)	0.31 (2.15)	0.43 (3.0)	0.43 (3.0)
1093°C (2000°F)	-	0.28 (1.90)	0.28 (1.90)	0.32 (2.25)	0.34 (2.36)	0.34 (2.36)	0.46 (3.2)	0.46 (3.2)
Chemical Analysis, % weight basis after firing								
Alumina, Al2O3	30	40	37	40	44	41	47	45
Silica, SiO2	46	38	42	44	36	39	36	38
Ferric Oxide, Fe2O3	1.4	0.9	0.9	0.4	0.9	0.9	1	1
Titanium Oxide, TiO2	1	1.4	1.4	0.8	1.4	1.4	1.5	1.8
Calcium Oxide, CaO	16	18 (10)	17 (9)	12	17 (11)	16 (11)	13 (10)	13 (10)
Magnesium Oxide, MgO	0.5	0.2	0.2	0.1	0.2	0.2	0.2	0.2
Alkalies as Na2O and K2O	4.5	1.2	1.2	1.5	1	1	0.8	0.8

1. Properties indicated are for vibratory cast materials only unless specified otherwise.
2. Gunite installation may require 10-30% more material due to compaction and rebound loss.
3. Water requirements indicated are offered as a guide. Actual water required may be subject to field conditions. Consult Thermal Ceramics installation advisor for assistance.
4. Fired linear change values reflect samples taken from a dried to fired state.
5. Chemical analysis % for CaO in parenthesis indicates the % of reactive CaO present if less than the total. The balance is Calcia from the anorthite aggregate.

Monolithics products : Insulating Low Iron - Kaolite®

	Kaolite 2800 Cast	Kaolite 2800 Gun	Kaolite 3000	Kaolite 3300
Manufacturing location	NA	NA	NA	NA
Material method of installation	cast	gun	cast	cast
Temperature use limit, °C (°F)	1538 (2800)	1538 (2800)	1649 (3000)	1816 (3300)
Placement, average lb to place 1 ft3	102	97	102	98
Shelf life, months	12	12	12	12
Water, %, recommended, casting by vibrating	16-22	-	14-20	11-13
Density, ASTM C 134, kg/m3 (pcf)				
dried 24 hrs @ 104°C (220°F)	1698-1858 (106-116)	1570-1730 (98-108)	-	-
fired @ 816°C (1500°F)	1538-1731 (96-108)	1442-1635 (90-102)	1570-1778 (98-111)	1505-1682 (94-105)
Modulus of Rupture, MOR, ASTM C 133, MPa (psi)				
dried 24 hrs @ 104°C (220°F)	2.76-5.52 (400-800)	2.07-3.45 (350-600)	1.55-3.79 (250-550)	2.76-5.52 (400-800)
fired 5 hrs @ 816°C (1500°F)	2.76-5.52 (400-800)	2.06-3.44 (300-500)	1.21-2.41 (175-350)	2.07-3.45 (350-600)
fired 5 hrs @ temperature use limit, °C (°F)	5.52-1034 (800-1500)	4.14-8.27 (600-1200)	2.76-5.52 (400-800)	6.2-11.72 (900-1700)
Cold crushing strength, CCS, ASTM C 133, MPa (psi)				
dried 24 hrs @ 104°C (220°F)	11.0-24.1 (1600-3500)	7.58-15.2 (1100-2200)	6.21-11.7 (900-1700)	13.8-24.1 (2000-3500)
fired 5 hrs @ 816°C (1500°F)	11.72-24.1 (1700-3500)	7.58-15.2 (1100-2200)	5.51-10.34 (800-1500)	10.3-20.7 (1500-3000)
fired 5 hrs @ temperature use limit, °C (°F)	10.3-34.5 (1500-5000)	10.3-34.5 (1500-5000)	8.27-15.2 (1200-2200)	17.2-27.6 (2500-4000)
Permanent Linear Shrinkage, ASTM C 113, %				
dried 24 hrs @ 220°F (104°C)	0 to -0.2	0 to -0.2	0 to -0.2	0 to -0.2
fired 5 hrs @ 1500°F (816°C)	-0.4 to -0.9	-0.4 to -0.9	-0.1 to -0.3	-0.1 to -0.3
fired 5 hrs @ temperature use limit, °F (°C)	-0.1 to +1.0	-0.1 to +1.5	-1.0 to -2.5	0 to -0.6
Thermal Conductivity, W/m•K (BTU•in/hr•ft2) ASTM C201				
260°C (500°F)	0.5 (3.5)	0.49 (3.4)	0.52 (3.6)	1.43 (9.9)
538°C (1000°F)	0.55 (3.8)	0.53 (3.7)	0.55 (3.8)	1.18 (8.2)
815°C (1500°F)	0.58 (4.0)	0.56 (3.9)	0.58 (4.0)	1.07 (7.4)
1093°C (2000°F)	0.62 (4.3)	0.61 (4.2)	0.62 (4.3)	1.08 (7.5)
1371°C (2500°F)	0.69 (4.8)	0.64 (4.5)	0.69 (4.8)	1.15 (8.0)
Chemical Analysis, % weight basis after firing				
Alumina, Al2O3	57	54	57	94
Silica, SiO2	36	36	35	0.5
Ferric Oxide, Fe2O3	0.7	0.9	1	0.1
Titanium Oxide, TiO2	1.5	1.8	2	-
Calcium Oxide, CaO	3.9	5.9	4.5	4.6
Magnesium Oxide, MgO	0.1	0.2	0.2	0.1
Alkalies as Na2O and K2O	1	1.1	0.8	0.4

1. Properties indicated are for vibratory cast materials only unless specified otherwise.
2. Gunite installation may require 10-30% more material due to compaction and rebound loss.
3. Water requirements indicated are offered as a guide. Actual water required may be subject to field conditions. Consult Thermal Ceramics installation advisor for assistance.
4. Fired linear change values reflect samples taken from a dried to fired state.
5. Chemical analysis % for CaO in parenthesis indicates the % of reactive CaO present if less than the total. The balance is Calcia from the anorthite aggregate.

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Monolithics products : Dense - Kaocrete®

	Kaocrete B	Kaocrete 2600 B	Kaocrete D	Kaocrete HS	Kaocrete HS Gun	Kaocrete 26	Kaocrete 28-LI	Kaocast	Kaocrete 30	Kaocrete 32-CM
Manufacturing location	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Material method of installation	gun / ram	gun / ram	cast	cast	gun	cast / gun	cast / gun	cast / gun	cast	cast
Temperature use limit, °C (°F)	1093 (2000)	1427 (2600)	1371 (2500)	1427 (2600)	1427 (2600)	1427 (2600)	1538 (2800)	1649 (3000)	1649 (3000)	1760 (3200)
Placement, average lb to place 1 ft³	104	107	130	130	125	126	127	128	138	149
Shelf life, months	12	12	12	12	12	12	12	12	12	12
Water, %, recommended, casting by vibrating	-	-	10-12	9-11	-	10-12	10-12	12-14	8-9.5	8-9.5
Density, ASTM C 134, kg/m3 (pcf)										
fired @ 816°C (1500°F)	1602-1794 (100-112)	1634-1826 (102-114)	1986-2179 (124-136)	1970-2163 (123-135)	1859-2051 (116-128)	1938-2114 (121-132)	1954-2130 (122-133)	1970-2146 (123-134)	2146-2340 (134-146)	2323-2483 (144-155)
Modulus of Rupture, MOR, ASTM C 133, MPa										
dried 24 hrs @ 104°C (220°F)	1.4 - 3.4 (200-500)	2.1 - 4.8 (300-700)	6.9 -10.3 (1000-1500)	7.6 - 11.0 (1100-1600)	4.1-6.9 (600-1000)	3.1 - 5.9 (450-850	3.1 - 5.9 (450-850)	3.4 - 6.9 (500-1000)	3.4 - 6.9 (500-1000)	3.1 - 6.2 (450-900)
fired 5 hrs @ 816°C (1500°F)	1.2 - 2.4 (175-350)	1.2 - 2.4 (175-350)	2.8 - 6.5 (400-800)	3.3 - 6.5 (475-950)	2.4-4.1 (350-600)	2.1 - 3.4 (250-450)	2.1 - 3.4 (300-500)	1.9 - 3.4 (275-500)	2.2 - 3.8 (325-550)	2.4 - 4.1 (350-600)
fired 5 hrs @ temperature use limit, °C (°F)	1.4 - 2.8 (200-400)	1.7 - 3.4 (250-500)	5.5 -9.7 (800-1400)	6.5 - 9.7 (950-1400)	-	5.5 - 10.3 (800-1500)	5.5 - 10.3 (800-1500)	3.4 - 6.2 (500-900)	6.9 - 12.4 (1000-1800)	8.3 - 13.8 (1200-2000)
Cold crushing strength, CCS, ASTM C 133, MPa (psi)										
dried 24 hrs @ 104°C (220°F)	6.9-12.4 (1000-1800)	10.3-18.6 (1500-2700)	31.0-51.7 (4500-7500)	37.9-62.0 (5500-9000)	22.1-34.5 (3200-5000)	17.2-27.6 (2500-4000)	19.3-31.0 (2800-4500)	14.5-24.1 (2100-3500)	20.7-48.3 (3000-7000)	20.7-41.4 (3000-6000)
fired 5 hrs @ 816°C (1500°F)	4.8-10.3 (700-1500)	7.6-13.8 (1100-2000)	24.1-44.8 (3500-6500)	29.0-55.2 (4200-8000)	18.6-31.0 (2700-4500)	13.8-24.1 (2000-3500)	15.9-27.6 (2300-4000)	12.4-20.7 (1800-3000)	17.9-34.5 (2600-5000)	17.2-31.0 (2500-5500)
fired 5 hrs @ temperature use limit, °C (°F)	2.8-5.5 (400-800)	8.3-17.2 (1200-2500)	20.7-41.4 (3000-6000)	24.1-48.3 (3500-7000)	-	19.3-27.6 (2800-4000)	24.1-48.3 (3500-7000)	13.8-27.6 (2000-4000)	27.6-55.2 (4000-8000)	34.5-62.0 (5000-9000)
Permanent Linear Shrinkage, ASTM C 113, %										
dried 24 hrs @ 220°F (104°C)	0 to -0.2	0 to -0.2	0 to -0.2	0 to -0.2	0 to -0.2	0 to -0.2	0 to -0.2	0 to -0.2	0 to -0.2	0 to -0.2
fired 5 hrs @ 1500°F (816°C)	-0.8 to -2.0	-0.3 to -0.7	-0.1 to -0.3	-0.1 to -0.3	-0.1 to -0.3	-0.1 to -0.3	-0.1 to -0.3	-0.1 to -0.3	-0.1 to -0.3	-0.1 to -0.3
fired 5 hrs @ temperature use limit, °F (°C)	-1.0 to -2.5	-0.7 to +0.7	-0.4 to -1.0	-0.4 to -1.0	-0.4 to -1.2	-0.4 to -1.0	-0.5 to -1.5	-0.2 to -1.0	-0.2 to -1.0	-0.2 to -0.7
Thermal Conductivity, W/m•K (BTU•in/hr•ft2) ASTM C201										
260°C (500°F)	0.47 (3.3)	-	0.89 (6.2)	0.85 (5.9)	0.81 (5.6)	0.81 (5.6)	0.86 (6.0)	1.17 (8.1)	1.4 (9.7)	1.67 (11.6)
538°C (1000°F)	0.5 (3.5)	-	0.95 (6.6)	0.89 (6.2)	0.86 (6.0)	0.86 (6.0)	0.91 (6.3)	1.12 (7.8)	1.38 (9.6)	1.6 (11.1)
815°C (1500°F)	0.54 (3.8)	-	0.98 (6.8)	0.94 (6.5)	0.91 (6.3)	0.91 (6.3)	0.95 (6.6)	1.11 (7.7)	1.38 (9.6)	1.57 (10.9)
1093°C (2000°F)	0.59 (4.1)	-	0.99 (6.9)	0.97 (6.7)	0.92 (6.4)	0.92 (6.4)	0.97 (6.7)	-	1.4 (9.7)	1.5 (10.4)
Chemical Analysis, % weight basis after firing										
Alumina, Al2O3	39	48	45	48	48	47	50	68	60	67
Silica, SiO2	46	41	40	-	40	43	41	24	34	28
Ferric Oxide, Fe2O3	1.3	1	2.3	1.1	1.1	1.1	1.0	1.0	0.8	0.9
Titanium Oxide, TiO2	1.6	1.7	2.1	1.9	1.9	2.4	1.9	2.3	1.7	1.8
Calcium Oxide, CaO	8.5	7.8	9.8	8.4	8.4	6.4	5.6	4.7	3.2	2.4
Magnesium Oxide, MgO	0.3	0.2	trace	0.1	0.3	-	-	-	-	-
Alkalies as Na2O and K2O	-	-	0.3	0.2	0.2	0.1	-	0.2	-	-

Monolithics products : Dense Gunning - Kaogun®

	Kaogun 26	Kaogun 28	Kaogun 30	Kaogun 32
Manufacturing location	NA	NA	NA	NA
Material method of installation	gun	gun	gun	gun
Temperature use limit, °F	2600	2800	3000	3200
Temperature use limit, °C	1427	1538	1649	1760
Placement, average lb to place 1 ft3	121	121	135	150
Shelf life, months	13	14	15	16
Density, ASTM C 134, kg/m3 (pcf)				
fired @ 816°C (1500°F)	1875 - 2019 (117 - 126)	1875 - 2034 (117 - 127)	2082 - 2275 (130 - 142)	2275 - 2499 (142 - 156)
Modulus of Rupture, MOR, ASTM C 133, MPa (psi)				
dried 24 hrs @ 104°C (220°F)	2.41 - 4.83 (350 - 700)	2.41 - 4.83 (350 - 700)	3.45 - 6.55 (500 - 950)	2.76 - 4.83 (400 - 700)
fired 5 hrs @ 816°C (1500°F)	1.38 - 2.76 (200 - 400)	1.72 - 3.10 (250 - 450)	2.76 - 5.52 (400 - 800)	2.41 - 4.10 (350 - 600)
fired 5 hrs @ temperature use limit, °C (°F)	4.14 - 6.89 (600 - 1000)	5.17 - 10.0 (750 - 1450)	4.14 - 6.55 (600 - 950)	4.14 - 6.89 (600 - 1000)
Cold crushing strength, CCS, ASTM C 133, MPa (psi)				
dried 24 hrs @ 104°C (220°F)	13.1 - 20.7 (1900 - 3000)	15.2 - 21.7 (2200 - 3150)	20.7 - 44.8 (3000 - 6500)	20.7 - 44.8 (3000 - 6500)
fired 5 hrs @ 816°C (1500°F)	9.0 - 15.9 (1300 - 2300)	9.0 - 17.2 (1300 - 2500)	17.2 - 41.4 (2500 - 6000)	20.7 - 41.1 (3000 - 6000)
fired 5 hrs @ temperature use limit, °C (°F)	15.2 - 24.1 (2200 - 3500)	17.2 - 27.6 (2500 - 4000)	17.9 - 48.3 (3500 - 7000)	31.0 - 55.2 (4500 - 8000)
Permanent Linear Shrinkage, ASTM C 113, %				
dried 24 hrs @ 220°F (104°C)	0 to -0.2	0 to -0.2	0 to -0.2	0 to -0.2
fired 5 hrs @ 1500°F (816°C)	-0.1 to -0.4	-0.1 to -0.4	-0.1 to -0.3	-0.1 to -0.3
fired 5 hrs @ temperature use limit, °F (°C)	0 to +1.0	-0.3 to +0.5	-0.5 to -1.2	0 to -2.0
Thermal Conductivity, W/m•K (BTU•in/hr•ft2) ASTM C201				
260°C (500°F)	0.75 (5.2)	0.76 (5.3)	1.1 (7.6)	-
538°C (1000°F)	0.78 (5.4)	0.79 (5.5)	1.1 (7.6)	-
815°C (1500°F)	0.82 (5.7)	0.83 (5.8)	1.1 (7.6)	-
1093°C (2000°F)	0.83 (5.8)	0.88 (6.1)	1.1 (7.6)	-
Chemical Analysis, % weight basis after firing				
Alumina, Al2O3	47	49	61	-
Silica, SiO2	43	42	32	-
Ferric Oxide, Fe2O3	1.8	0.9	0.9	-
Titanium Oxide, TiO2	2	2.1	2.2	-
Calcium Oxide, CaO	5.7	6	4.1	-
Magnesium Oxide, MgO	0.2	0.1	0.1	-
Alkalies as Na2O and K2O	0.4	0.4	0.4	-

1. Properties indicated are for vibratory cast materials only unless specified otherwise.
2. Gunite installation may require 10-30% more material due to compaction and rebound loss.
3. Water requirements indicated are offered as a guide. Actual water required may be subject to field conditions. Consult Thermal Ceramics installation advisor for assistance.
4. Fired linear change values reflect samples taken from a dried to fired state.

Reference for page 125:
1. Gunite installation may require 10-30% more material due to compaction and rebound loss.
2. Water requirements indicated are offered as a guide. Actual water required may be subject to field conditions. Consult Thermal Ceramics installation advisor for assistance.
3. Fired linear change values reflect samples taken from a dried to fired state.

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Monolithics products : Low Cement Vibratory Cast

	Kaocrete® 249C	Kaocrete 250C	Hicast® Super	Hicast Super R	Hicast 90	Hicast 90TR
Manufacturing location	NA	NA	NA	NA	NA	NA
Material method of installation	vibratory cast	vibratory cast	vibratory cast	hand ram	vibratory cast	hand ram
Temperature use limit, °C (°F)	1538 (2800)	1760 (3200)	1538 (2800)	1704 (3100)	1871 (3400)	1760 (3200)
Placement, average kg to place 1 ft3	138	150	140	145	182	179
Shelf life, months	12	12	6	6	6	6
Water, %, recommended, casting by vibrating	5.6-6.3	5.6-6.2	5.4-6.2	4.7-5.5	4.4-5.0	4.0-4.8
Density, ASTM C 134, kg/m3 (pcf)						
fired @ 816°C (1500°F)	2146-2292 (134-143)	2339-2515 (143-156)	2146-2307 (134-144)	2224-2368 (139-145)	2851-3027 (178-189)	2772-2963 (173-185)
Abrasion loss, ASTM C 704, cc						
fired @ 1500°F (816°C)	8 - 14	5 - 11	8 -12	7 -11	5 - 8	4 - 6
Modulus of Rupture, MOR, ASTM C 133, MPa (psi)						
dried 24 hrs @ 104°C (220°F)	5.5-8.3 (800-1200)	11.0-17.9 (1600-2600)	8.27-13.79 (1200-2000)	8.27-13.79 (1200-2000)	11-17 (1600-2400)	-
fired 5 hrs @ 816°C (1500°F)	5.5-9 (800-1300)	14.5-25.5 (2100-3700)	8.27-13.79 (1200-2000)	8.27-13.79 (1200-2000)	10-14 (1500-2100)	-
fired 5 hrs @ temperature use limit, °C (°F)	11.0-15.9 (1600-2300)	20.7-31.0 (3000-4500)	-	-	-	-
Hot Modulus of Rupture, MOR, ASTM C 583, MPa (psi)						
816°C (1500°F)	9.0-17.9 (1300-1700)	17.2-23 (2500-3300)	10.3-17.2 (1500-2500)	10.3-17.2 (1500 - 2500)	-	-
1093°C (2000°F)	7.6-11.0 (1100-1600)	13.1-17.9 (1900-2600)	13.8-21.4 (2000-3100)	13.8-21.4 (2000-3100)	-	-
1232°C (2250°F)	5.5-8.3 (800-1200)	6.9-11.0 (1000-1600)	4.8-9.0 (700-1300)	4.8-9.0 (700-1300)	-	-
1371°C (2500°F)	2.1-3.4 (300-500)	3.4-6.2 (500-900)	4.1-7.2 (600-1050)	4.1-7.2 (600-1050)	-	-
Cold crushing strength, CCS, ASTM C 133, Mpa (psi)						
dried 24 hrs @ 104°C (220°F)	41.4-62.1 (6000-9000)	55.2-82.7 (8000-12000)	55-76 (8000-11000)	55-76 (8000-11000)	69-97 (10000-14000)	76-131 (11000-19000)
fired 5 hrs @ 816°C (1500°F)	44.8-65.5 (6500-9500)	58.6-86.2 (8500-12500)	59-90 (8500-13000)	59-90 (8500-13000)	76-124 (11000-18000)	90-145 (13000-21000)
fired 5 hrs @ temperature use limit, °C (°F)	62.1-89.6 (9000-13000)	48.3-86.2 (7000-12500)	69-96 (10000-14000)	69-96 (10000-14000)	90-138 (13000-20000)	-
Deformation under hot load, ASTM C 16, % @ 25 psi (0.17 MPa)						
dried 24 hrs @ 220°F (104°C)	1.9	0.5	1.4	1.4	-0.6	-
fired 5 hrs @ 1500°F (816°C)	-	1.4	-	-	-	-
fired 5 hrs @ temperature use limit, °F (°C)	-	1.9	-	-	-	-
Permanent Linear Shrinkage, ASTM C 113, %						
dried 24 hrs @ 220°F (104°C)	0 to -0.2	0 to -0.2	0 to -0.2	0 to -0.2	0 to -0.2	0 to -0.1
fired 5 hrs @ 1500°F (816°C)	-0.1 to -0.3	-0.1 to -0.3	-0.1 to -0.3	-0.1 to -0.3	-0.1 to -0.3	-0.1 to -0.3
fired 5 hrs @ temperature use limit, °F (°C)	-0.2 to -0.6	-2.5 to -3.5	-0.5 to -1.5	-0.5 to -1.5	-0.5 to +0.5	-0.5 to +0.5
Thermal Conductivity, W/m•K (BTU•in/hr•ft2), ASTM C201						
260°C (500°F)	1.43	1.8	1.63	1.63	4.08	-
538°C (1000°F)	1.5	1.7	1.67	1.67	3.32	-
815°C (1500°F)	1.6	1.7	1.72	1.72	2.88	-
1093°C (2000°F)	1.7	1.8	1.74	1.74	2.67	-
Chemical Analysis, % weight basis after firing						
Alumina, Al2O3	50	65	50	50	92	91
Silica, SiO2	46	30	45	45	6.2	5.9
Ferric Oxide, Fe2O3	0.8	0.8	0.9	0.9	0.1	0.2
Titanium Oxide, TiO2	1.5	2.2	1.6	1.6	-	-
Calcium Oxide + Magnesium Oxide, CaO + MgO	2.0	1.8	2.0	2.0	1.2	1.9
Alkalies as Na2O	1.3	1.3	0.5	0.5	0.4	0.4

Monolithics products : Low Cement

	Morflo® 160	Morflo 165X	Morflo 170	Higun® 160	Higun 170	Higun 175X
Manufacturing location	NA	NA	NA	NA	NA	NA
Material method of installation	vibratory cast	vibratory cast	vibratory cast	gun	gun	gun
Temperature use limit, °C (°F)	1600 (2912)	1650 (3000)	1700 (3092)	1600 (2912)	1700 (3092)	1750 (3182)
Placement, average lb to place 1 ft3	151	165	178	137	153	161
Shelf life, months	9	9	9	6	6	6
Water, %, recommended, casting by vibrating	5.5-6.5	5.2-6.2	5.0-6.0	-	-	-
Density, kg/m3 (pcf), ASTM C 134						
fired @ 816°C (1500°F)	2339-2515 (146-157)	2579-2755 (161-172)	2787-2979 (174-186)	2280 (142)	2530 (158)	2691 (168)
Abrasion loss, cc, ASTM C 704						
fired @ 816°C (1500°F)	8-13	7-12	5-11	8-14	8-13	7-12
Hot Modulus of Rupture, MOR, ASTM C 583, Mpa (psi)						
1371°C (2500°F)	-	6.89 (1000)	-	-	-	-
Cold crushing strength, CCS, ASTM C 133, MPa						
dried 24 hrs @ 104°C (220°F)	55-90 (8000-13000)	66-97 (9500-14000)	76-103 (11000-15000)	62-97 (9000-14000)	76-97 (11000-14000)	-
fired 5 hrs @ 816°C (1500°F)	62-97 (9000-14000)	66-97 (9500-14000)	83-124 (12000-18000)	55-97 (8000-10000)	59-76 (8500-11000)	59-76 (8500-11000)
fired 5 hrs @ 1000°C (1832°F)	76 -110 (11000-16000)	69-110 (10000-16000)	90-138 (13000-20000)	72-97 (10500 - 14000)	69-93 (10000-13500)	69-97 (10000-14000)
fired 5 hrs @ 1600°C (2912°F)	93-117 (12000-17000)	97-145 (14000-21000)	103-152 (15000-22000)	76-124 (11000-18000)	76-110 (11000-16000)	76-103 (11000-15000)
Permanent Linear Shrinkage, ASTM C 113, %						
dried 24 hrs @ 220°F (104°C)	0.0 to -0.2	0.0 to -0.2	0.0 to -0.2	0 to -0.2	0 to -0.2	0 to -0.2
fired 5 hrs @ 1500°F (816°C)	-0.1 to -0.3	-0.1 to -0.3	-0.1 to -0.3	-0.3	-0.2	-0.2
fired 5 hrs @ 1832°F (1000°C)	-0.1 to -0.4	-	-0.1 to -0.4	-0.3	-0.3	-0.3
fired 5 hrs @ 2912°F (1600°C)	-0.5 to -1.5	-0.5 to +1.5	-0.5 to -1.5	-1.5	1.4	-0.4
Thermal Conductivity, W/m•K (BTU•in/hr•ft2), ASTM C201						
260°C (500°F)	1.34 (9.3)	-	-	-	-	-
538°C (1000°F)	1.37 (9.5)	-	-	-	-	-
600°C (1112°F)	-	-	2.3 (15.9)	1.55 (10.75)	1.9 (12.3)	1.9 (13.2)
815°C (1500°F)	1.4 (9.7)	-	-	-	-	-
1093°C (2000°F)	1.44 (10.0)	-	-	-	-	-
1371°C (2500°F)	1.48 (10.3)	-	-	-	-	-
Chemical Analysis, % weight basis after firing						
Alumina, Al2O3	52	68	82	47	66	81
Silica, SiO2	42	26	11	48	27	13
Ferric Oxide, Fe2O3	0.8	0.8	1.2	0.5	1	1
Titanium Oxide, TiO2	3.2	2.4	3.1	-	-	-
Calcium Oxide, CaO	1.5	1.8	1.7	2.9	2.9	2.8
Alkalies as Na2O	0.5	0.3	0.5	-	-	-

1. Properties indicated are for vibratory cast materials only unless specified otherwise.
2. Gunite installation may require 10-30% more material due to compaction and rebound loss.
3. Water requirements indicated are offered as a guide. Actual water required may be subject to field conditions. Consult Thermal Ceramics installation advisor for assistance.
4. Fired linear change values reflect samples taken from a dried to fired state.

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Monolithics products : Low Cement Aluminum Resistance

	Alcast Extra HS	Albond
Manufacturing location	NA	NA
Material method of installation	vibratory cast	vibratory cast
Temperature use limit, °C (°F)	1299 (2370)	1399 (2550)
Placement, average lb to place 1 ft3	180	174
Shelf life, months	6	6
Water, %, recommended, casting by vibrating	5.0-5.8	5.5-6.5
Density, ASTM C 134, kg/m3 (pcf)		
fired @ 816°C (1500°F)	2819-2947 (176-184)	2723-2851 (170-178)
Cold crushing strength, CCS, ASTM C 133, MPa (psi)		
dried 24 hrs @ 104°C (220°F)	66-97 (9500-14000)	62-90 (9000-13000)
fired 5 hrs @ 816°C (1500°F)	69-117 (10000-17000)	66-97 (9500-14000)
fired 5 hrs @ temperature use limit, °C (°F)	83-124 (12000-18000)	76-117 (11000-17000)
Permanent Linear Shrinkage, ASTM C 113, %		
dried 24 hrs @ 220°F (104°C)	0.0 to -0.2	0.0 to -0.2
fired 5 hrs @ 1500°F (816°C)	-0.1 to -0.3	-0.1 to -0.3
fired 5 hrs @ temperature use limit, °F (°C)	-0.2 to -0.6	-0.2 to -0.5
Thermal Conductivity, W/m•K (BTU•in/hr•ft2), ASTM C201		
538°C (1000°F)	2.4 (15.9)	2.4 (15.9)
Chemical Analysis, % weight basis after firing		
Alumina, Al2O3	77	82
Silica, SiO2	12	11
Ferric Oxide, Fe2O3	1.1	1.2
Calcium Oxide, CaO	1.4	1.8

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Monolithics products : Clay Bonded Plastics

	Plascast™ 60	Plasgun™ 60	Plascast HT	Plasgun HT	Plascast 90	Plasgun 90
Manufacturing location	NA	NA	NA	NA	NA	NA
Material method of installation	cast	gun	cast	gun	cast	gun
Temperature use limit, °C (°F)	1649 (3000)	1649 (3000)	1704 (3100)	1704 (3100)	1760 (3200)	1760 (3200)
Placement, average lb to place 1 ft3	145	139	145	140	147	141
Shelf life, months	9	9	9	9	6	9
Water, %, recommended, casting by vibrating	8.5-10.0	-	8.5-10.0	-	8.5-10.0	-
Density, ASTM C 134, kg/m3 (pcf)						
fired @ 816°C (1500°F)	2227-2403 (139-150)	2146-2307 (134-144)	2243-2387 (140-149)	2179-2323 (136-145)	2275-2451 (142-153)	2195-2355 (137-147)
Cold crushing strength, CCS, ASTM C 133, MPa (psi)						
dried 24 hrs @ 104°C (220°F)	3.45-6.21 (500-900)	3.45-6.21 (500-900)	3.45-5.52 (500-800)	3.10-5.52 (450-800)	3.45-5.52 (500-800)	3.10-5.52 (450-800)
fired 5 hrs @ 1093°C (2000°F)	10.3-20.7 (1500-3000)	10.34-19.3 (1400-2800)	10.3-20.7 (1500-3000)	10.3-17.2 (1500-2500)	13.8-24.1 (2000-3500)	8.3-13.8 (1200-2000)
fired 5 hrs @ 1538°C (2800°F)	27.6-46.3 (4000-7000)	20.7-34.5 (3000-5000)	-	-	-	-
fired 5 hrs @ temperature use limit, °C (°F)	-	-	27.6-41.1 (4000-6000)	20.7-34.5 (3000-5000)	24.1-41.1 (3500-6000)	20.7-34.5 (3000-5000)
Permanent Linear Shrinkage, ASTM C 113, %						
dried 24 hrs @ 220°F (104°C)	0.0 to -0.2	0.0 to -0.2	0.0 to -0.2	0 to -0.2	0.0 to -0.2	0 to -0.2
fired 5 hrs @ 2000°F (1093°C)	-0.1 to -0.4	-0.1 to -0.4	-0.1 to -0.4	-0.1 to -0.4	-0.1 to -0.4	-0.1 to -0.4
fired 5 hrs @ 2800°F (1538°C)	-1.5 to -3.0	-1.5 to -3.0	-	-	-	-
fired 5 hrs @ temperature use limit, °F (°C)	-	-	-1.0 to +1.0	-1.0 to +1.0	-1.0 to +1.5	-1.0 to +1.5
Thermal Conductivity, W/m•K (BTU•in/hr•ft2), ASTM C201						
260°C (500°F)	0.87 (5.8)	0.87 (5.8)	1.28 (8.9)	0.91 (6.3)	1.73 (11.5)	1.28 (8.9)
538°C (1000°F)	0.95 (6.3)	0.95 (6.3)	1.3 (9.0)	0.94 (6.5)	1.7 (11.0)	1.3 (9.0)
815°C (1500°F)	1.01 (6.7)	1.01 (6.7)	1.31 (9.1)	0.95 (6.6)	1.57 (10.4)	1.31 (9.1)
1093°C (2000°F)	1.06 (7.0)	1.06 (7.0)	1.27 (8.8)	0.95 (6.6)	1.48 (9.8)	1.27 (8.8)
Chemical Analysis, % weight basis after firing						
Alumina, Al2O3	60	59	65	66	89	89
Silica, SiO2	36	37	31	28	6.7	6.4
Ferric Oxide, Fe2O3	1	1.2	1.5	1.7	1.4	1.5
Titanium Oxide, TiO2	2.3	2.2	1.8	1.8	1.8	1.8
Calcium Oxide, CaO	0.8	0.8	0.7	1.1	0.7	0.9
Alkalies as Na2O	0.6	0.6	0.6	0.6	0.2	0.2

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Monolithics products : Special Duty

	Kao-Tab® SR	Kao-Tab 95	Kao-Tab 95EF	Kao-Tab 95 Gun	Kao-Tab HDHS-98
Manufacturing location	NA	NA	NA	NA	NA
Material method of installation	gun/hand ram	cast	cast	gun/hand ram	cast
Temperature use limit, °C (°F)	1649 (3000)	1871 (3400)	1871 (3400)	1871 (3400)	1871 (3400)
Placement, average lb to place 1 ft3	165	159	161	161	180
Shelf life, months	12	12	3-6	12	12
Water, %, recommended					
casting by vibrating	-	8-10	8-10	-	5-6.2
pouring	6-8	-	-	5-8	-
Density, ASTM C 134, kg/m3 (pcf)					
fired @ 816°C (1500°F)	2564-2724 (160-170)	2467-2643 (154-165)	2480-2659 (155-166)	2499-2675 (156-167)	2803-2979 (175-186)
Abrasion loss, ASTM C 704, cc					
fired @ 1500°F (816°C)	7-14	6-13	7-14	7-14	6-13
Modulus of Rupture, MOR, ASTM C 133, MPa (psi)					
dried 24 hrs @ 104°C (220°F)	7-10 (1000-1400)	8.3-13.8 (1200-200)	8.3-12.4 (1200-1800)	10-14 (1400-2000)	4.8-8.3 (700-1200)
fired @ 816°C (1500°F)	6.2-10 (900-1500)	6.5-11.7 (950-1700)	6.5-11.7 (950-1700)	6.9-12.4 (1000-1800)	4.1-6.2 (600-1000)
fired 5 hrs @ temperature use limit, °C (°F)	8.3-15 (1200-2200)	8.3-13 (1200-1900)	8.3-12.4 (1200-1800)	10-14 (1400-2000)	7-9.7 (1000-1400)
Cold crushing strength, CCS, ASTM C 133, MPa (psi)					
dried 24 hrs @ 104°C (220°F)	34-62 (5000-9000)	45-69 (6500-10000)	41-66 (6000-9500)	45-69 (6500-10000)	32.4-45 (4700-6500)
fired @ 816°C (1500°F)	38-59 (5500-8500)	48-90 (7000-13000)	45-86 (6500-12500)	48-90 (7000-13000)	27.6-55 (4000-8000)
fired 5 hrs @ temperature use limit, °C (°F)	41-62 (6000-9000)	41-62 (6000-11000)	41-62 (6000-11000)	41-62 (6000-11000)	41-62 (6000-9000)
Permanent Linear Shrinkage, ASTM C 113, %					
dried 24 hrs @ 220°F (104°C)	0 to -0.2	0 to -0.2	0 to -0.2	0 to -0.2	0 to -0.2
fired 5 hrs @ 1500°F (816°C)	-0.1 to -0.3	-0.1 to -0.3	-0.1 to -0.3	-0.1 to -0.3	0 to -0.3
fired 5 hrs @ temperature use limit, °F (°C)	-	0 to -1.5	0 to -1.5	0 to -1.5	-0.2 to -1.0
Thermal Conductivity, W/m•K (BTU•in/hr•ft2), ASTM C201					
260°C (500°F)	1.8 (12.7)	1.9 (13.4)	1.9 (13.4)	2.6 (18.1)	3.1 (21.4)
538°C (1000°F)	1.7 (11.6)	1.6 (10.9)	1.6 (10.9)	2.2 (15.3)	2.5 (17.4)
815°C (1500°F)	1.6 (11)	1.4 (9.8)	1.4 (9.8)	1.9 (13.3)	2.2 (15.2)
1093°C (2000°F)	1.4 (9.7)	1.4 (9.9)	1.4 (9.9)	1.7 (12.1)	1.9 (13.1)
1371°C (2500°F)	1.3 (9.2)	1.4 (9.4)	1.4 (9.4)	1.6 (11.2)	-
Chemical Analysis, % weight basis after firing					
Alumina, Al2O3	88	95	94	95	98
Silica, SiO2	0.2	0.1	0.1	0.2	0.1
Ferric Oxide, Fe2O3	7.1	0.1	0.1	0.2	-
Titanium Oxide, TiO2	-	trace	trace	trace	-
Calcium Oxide, CaO	4.2	4.5	4.6	4.2	1.8
Magnesium Oxide, MgO	-	0.1	0.2	trace	-
Alkalies as Na2O	0.4	0.4	0.4	0.3	0.1

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Monolithics products : special duty

	Kao-Tuff C	Kao-Tuff CV	Kao-Tuff G	Kao-Tuff 110C	Kao-Tuff 110FF	Kao-Tuff 110G	Kao-Tuff FS	Kao-Tuff FS Gun
Manufacturing location	NA	NA	NA	NA	NA	NA	NA	NA
Material method of installation	vibratory cast	cast	gun/ram	vibratory cast	free flow /vibratory cast	gun/ram	vibratory cast	gun/ram
Temperature use limit, °C (°F)	1538 (2800)	1538 (2800)	1538 (2800)	1316 (2400)	1316 (2400)	1316 (2400)	1316 (2400)	1316 (2400)
Placement, average lb to place 1 ft3	136	138	135	110	112	111	126	124
Shelf life, months	12	12	12	12	12	12	9	9
Water, %, recommended, casting by vibrating	8.0-9.5	7.5 - 9.0	9 - 10.5 (testing purposes)	13.5 - 15.5	14 - 15.5 /13 - 15	13.5 - 15.5 (testing purposes)	5.5 - 6.5	-
Density, ASTM C 134, kg/m3 (pcf)								
dried 24 hrs @ 104°C (220°F)	2211-2388 (138-149)	2228-2404 (139-150)	2211-2387 (138-149)	1810-1986 (113-124)	1810-1986 (113-127)	1794-1970 (112-123)	1986-2162 (124-134)	1906-2082 (121-130)
fired @ 816°C (1500°F)	2100-2259 (131-141)	2114-2291 (132-143)	2114-2275 132-142	1698-1858 (106-116)	1714-1874 (107-117)	1698-1858 (106-116)	1938-2098 (121-131)	1891-2067 (118-129)
Abrasion loss, ASTM C 704, cc								
fired @ 1500°F (816°C)	8-15	6-13	8-15	7-13	9-15	7-14	12-22	13-23
Modulus of Rupture, MOR, ASTM C 133, MPa								
dried 24 hrs @ 104°C (220°F)	7.6-13.8 (1100-2000)	8.3-15.2 (1200-2200)	7.58-13.80 (1100-2000)	6.90-12.41 (1000-1800)	5.17-8.27 (750-1200)	5.51-8.96 (800-1300)	4.83-8.27 (700-1200)	4.13-9.76 (600-1100)
fired @ 816°C (1500°F)	6.2-9.7 (900-1400)	6.6-10.3 (950-1500)	6.6-10.3 (950-1500)	5.15-9.65 (800-1400)	4.48-6.89 (650-1000)	5.17-7.58 (700-1100)	4.14-6.89 (600-1000)	3.45-6.21 (500-900)
fired 5 hrs @ temperature use limit, °C (°F)	8.3-13.8 (1200-2000)	10.3-20.7 (1500-3000)	8.3-13.8 (1200-2000)	5.52-9.65 (850-1400)	4.48-6.89 (650-1000)	5.17-8.27 (750-1200)	-	-
Cold crushing strength, CCS, ASTM C 133, MPa (psi)								
dried 24 hrs @ 104°C (220°F)	41.4-68.9 (6000-10000)	48.3-75.9 (7000-11000)	48.3-75.9 (7000-11000)	41.4-65.5 (6000-9500)	-	44.8-68.9 (6500-10000)	41.4-65.5 (6000-9500)	34.5-58.6 (5000-8500)
fired @ 816°C (1500°F)	41.4-75.8 (6000-11000)	48.3-75.9 (7000-11000)	44.8-82.7 (6500-12000)	48.3-86.2 (7000-12500)	41.4-75.9 (6000-11000)	44.8-75.9 (6500-11000)	34.5-62.0 (5000-9000)	31.0-55.2 (4500-8000)
fired 5 hrs @ temperature use limit, °C (°F)	55.2-82.7 (8000-12000)	58.6-96.6 (8500-14000)	48.3-82.7 (7000-12000)	41.4-68.9 (6000-10000)	41.4-68.9 (6000-10000)	48.3-75.9 (7000-11000)	44.8-68.9 (6000-10000)	-
Permanent Linear Shrinkage, ASTM C 113, %								
dried 24 hrs @ 220°F (104°C)	0 to -0.2	0 to -0.2	0 to -0.2	0 to -0.2	0 to -0.2	0 to -0.2	0 to -0.2	0 to -0.2
fired 5 hrs @ 1500°F (816°C)	-0.1 to -0.3	-0.1 to -0.3	-0.1 to -0.3	-0.1 to -0.3	-0.1 to -0.3	-0.1 to -0.3	-0.1 to -0.3	-0.1 to -0.3
fired 5 hrs @ temperature use limit, °F (°C)	-1.0 to -2.0	-1.0 to -2.0	-1.0 to -1.8	-0.6 to +0.4	-0.6 to +0.4	-0.6 to +0.4	0.2 to -0.5	0.2 to -0.5
Thermal Conductivity, W/m•K (BTU•in/hr•ft2), ASTM C201								
260°C (500°F)	1.28 (8.9)	1.3 (9.0)	1.05 (7.3)	0.74 (5.1)	0.74 (5.1)	0.75 (5.2)	1.27 (8.4)	1.27 (8.4)
538°C (1000°F)	1.3 (9.0)	1.33 (9.2)	1.07 (7.4)	0.75 (5.2)	0.75 (5.2)	0.76 (5.3)	1.40 (9.3)	1.40 (9.3)
815°C (1500°F)	1.28 (8.9)	1.3 (9.0)	1.08 (7.5)	0.76 (5.3)	0.76 (5.3)	0.78 (5.4)	1.48 (9.8)	1.48 (9.8)
1093°C (2000°F)	1.25 (8.7)	1.27 (8.8)	1.11 (7.7)	0.78 (5.4)	0.78 (5.4)	0.79 (5.5)	1.49 (9.9)	1.49 (9.9)
Chemical Analysis, % weight basis after firing								
Alumina, Al2O3	59	60	57	47	49	49	21	22
Silica, SiO2	33	32	34	35	33	33	75	74
Ferric Oxide, Fe2O3	0.8	0.8	0.6	1.6	1.7	1.5	0.2	0.4
Titanium Oxide, TiO2	1.3	1.3	1.4	0.8	0.7	0.8	0.4	0.4
Calcium Oxide, CaO	5.5	5.4	6.5	14	14	14	2.3	2.5
Magnesium Oxide, MgO	0.2	0.2	0.2	0.4	0.4	0.4	0.1	0.1
Alkalies as Na2O	1.2	1.2	1.2	1.3	1.2	1.3	0.1	0.1

Safety Data Sheet (SDS): are available for all products.
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Notes

Section 14

Fired refractory shapes products

Fired refractory shapes products

Cerox®
Valcor®

Thermal Ceramics fired refractory shapes are used in a wide range of critical, heat intensive applications.

High alumina, silicon carbide, fused silica and alumina-zirconia-silica (AZS) compositions are thixotropically cast to precise customer specifications. These products feature superior hot strengths, thermal shock Thermal Ceramics refractory fired shapes are used in a wide range of critical, heat intensive applications.

Fired refractory shape product range includes:

Cerox®

Cerox fired refractory shapes are thixotropically cast using a dispersion agent, which allows the Cerox mix to flow when vibrated without requiring a high water content.

These manufacturing techniques, combined with precisely controlled firing and 100% product inspection, produce high-quality components suited to the most arduous of high temperature environments.

- Variety of available compositions using high-alumina, fused zirconia mullite, and silicon carbide
- Excellent chemical attack resistance
- Excellent thermal shock resistance
- Low gas permeability
- Tight tolerance capability

The Cerox cast fired shapes are used in a variety of super alloy melt-pour systems. The cast manufacture process meets the tight tolerance specifications required by end users. Precise tooling and detailed product inspection provide the user with a high quality, dimensionally accurate refractory shape.

- Variety of available compositions in high alumina, mullite and fused silica
- Tight tolerance capabilities
- Good non-wetting characteristics and excellent mechanical strength
- Proven performance in super alloy, and investment casting Thermal Ceramics refractory fired shapes are used in a wide range of critical, heat intensive applications

Typical applications - for fired refractory shapes products:

- Vacuum induction melting industry
- Furnace spouts
- Distribution boxes (often referred to as hot tops)
- Samplers and 'Metamic' (metal-ceramic composite) thermocouple sheaths for the VIM market
- Muffles, ladle liners, saggars, sealed quench furnace muffle assemblies and other special shapes
- Glass contact refractories, particularly glass feeder ware consumables

Typical benefits - for Monolithic Tri-Mor® products:

- Good thermal shock resistance
- Thermal stability
- Low operational costs
- Easy to repair
- Flexible and resilient
- Lower operational costs

Valcor® products

Valcor fired refractory shapes, available in two compositions:

- G - high alumina mix
- G-AZ - AZS premium grade and has a proven track record inmolten glass contact applications.

The shapes are engineered to meet precise customer specifications and are individually inspected.

- Years of proven performance in molten glass contact applications
- Very smooth surface finish
- Individual part inspection

Fired refractory shapes products : Cerox®

	Cerox 100	Cerox 120	Cerox 200	Cerox FC 200	Cerox 700	Cerox 720	Cerox 730	Cerox 1000	Cerox 1200	Cerox 1300	Cerox 1400
Chemical analysis, % weight basis after firing											
Alumina, Al_2O_3	47	51	74		90	90	90	93	>99	64	35
Silica, SiO_2	50	46	22		10	9	10	5	0.4	12	5
Zirconia, ZrO_2	-	-	-		-	-	-	-	-	23	-
Silicon carbide, SiC	-	-	-		-	-	-	-	-	-	59
Ferric oxide, Fe_2O_3	1.0	0.6	1.0		0.2			0.5	0.1	0.2	0.2
Titanium oxide, TiO_2	1.9	1.5	2.3		0.1			0.7	trace	0.1	0.1
Magnesium oxide, MgO	0.1	trace									
Alkalies, as Na_2O	0.1	0.3	0.2				trace	0.2	0.1	0.2	0.2
Bulk density, pcf (kg/m³) ASTM C 134	154 (2468)	136 (2179)	161 (2580)	157 (515)	173 (2772)	176 (2820)	172 (2456)	179 (2869)	183 (2933)	190 (3045)	161 (2580)
Apparent porosity, % ASTM C 20	20			23	19	16	19	17	21	17	21
Permeability, ft/hr•ft²•in., psi (MPa)	4 (0.03)	3 (0.02)	4 (0.03)						6	4 (0.03)	
Modulus of rupture, psi (MPa), ASTM C 583											
75°F (24°C)	1200 (8.28)		1600 (11.03)	1500 (10.34)	1600 (11.03)	2400 (16.55)	1300 (8.97)-	1600 (11.03)	5000 (34.48)	3000 (20.69)	1800 (12.41)
2300°F (1260°C)	2400 (16.55)		2000 (13.79)	1800 (12.41)	2400 (16.55)	4800 (33.10)			2600 (17.93)		2200 (15.17)
2600°F (1426°C)	1000 (6.89)		1100 (7.59)	1000 (6.89)	1900 (13.10)	3700 (25.52)	-	900 (6.21)	1400 (9.65)	2300 (15.86)	1000 (6.89)
2800°F (1538°C)	600 (4.14)		800 (5.51)	700 (4.83)	1000 (6.89)	1600 (11.03)		700 (4.83)		1400 (9.66)	500 (3.44)
Cold crushing strength, psi (MPa), ASTM C 133											
2800°F (1538°C)	--		7000 - 10000 (48 - 69)	5000 - 8000 (34 - 55)	8000 - 10000 (55 - 69)	9000 - 10000 (62 - 76)	-			8000 - 11000 (55 - 76)	-
Permanent linear change, % ASTM C 113											
5 hrs. @ 3000°F (1648°C)	-	-3.3	-		-			-3.3	-		
5 hrs. @ 3200°F (1760°C)		-	-1.3		-0.4	-1.0	-		-1.3	-0.4	-1.0
Deformation under hot load, % @ 25 psi (0.17 MPa), ASTM C 16											
1½ hrs. @ 2640°F (1448°C)	-	0.4	-		-	0.0	-		-	0.0	-
1½ hrs. @ 2800°F (1538°C)		-				-				0.2	1.6
1½ hrs. @ 2850°F (1566°C)		-	6.0		0.2	0.3			3.6	-	
1½ hrs. @ 3000°F (1760°C)			0		-	1.3			0.5		
Abrasion loss, cm², ASTM C 704	-	10.0	7.0		6.5	4.5	-	5.0	4.5	4.0	5.0
Coefficient of reversible thermal expansion, in./in.•°F•10⁻⁶	-		3.3		4.3	4.0	3.7	4.7	5.8	3.4	3.3
Spall resistance, relative	good		very good			good	very good	fair	low	excellent	very good

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Fired refractory shapes : Cerox® pre-fired refractory shapes

	Cerox 90V	Cerox FS-99V	Cerox 90P	Cerox 95P	Cerox FS-85P
Method of forming	thixitropic cast	thixitropic cast	pressed	pressed	pressed
Chemical analysis, % weight basis after firing					
Alumina, Al_2O_3	91	0.7	90	95	14
Silica, SiO_2	8	99	8.6	4.0	85
Ferric oxide, Fe_2O_3	0.15	0.1	0.4	0.4	0.3
Titanium oxide, TiO_2	0.1	trace	0.2	-	0.7
Calcium + Magnesium oxide, CaO + MgO	0.04	0.1	0.1		0.15
Alkalies, $Na_2O + K_2O$	0.15		0.3	0.3	0.45
Bulk density, pcf (kg/m³) ASTM C 134	176 (2820)	113 (1811)	178 (2853)	188 (3013)	109 (1510)
Apparent porosity, % ASTM C 20	20	12	23	20	22
Classification temperature rating, °F (°C)	3090 (1699)	2800 (1538)	3090 (1699)	3100 (1704)	2750 (1510)
Modulus of rupture, psi (MPa), ASTM C 583	2500 (17.2)	1150 (7.9)	4000 (27.6)	4100 (28.3)	510 (3.5)
Coefficient of thermal expansion, in./in.•°F	4.1	0.2	4.2	4.5	3.2
Thermal conductivity, BTU•in./hr•ft²•°F (W/m•K), ASTM C 417					
2000°F (1093°C)	16.0 (2.3)	16.0 (2.3)	22.0 (3.2)	10.6 (1.5)	9.5 (1.37)

Fired refractory shapes : Valcor®

	Valcor G	ValcorG-AZ
Chemical analysis, % weight basis after firing		
Alumina, Al_2O_3	93	64
Silica, SiO_2	5	12
Zirconia, ZrO_2	-	23
Ferric oxide, Fe_2O_3	0.5	0.2
Titanium oxide, TiO_2	0.7	0.1
Magnesium oxide, MgO	trace	
Alkalies, as Na_2O	0.2	
Bulk density, pcf (kg/m³), ASTM C 134	179 (2868)	190 (3045)
Apparent porosity, % ASTM C 20	17	
Permeability, ft/hr•ft²•in., psi (MPa)	4	
Melting point, °F (°C)	3560 (1960)	3200 (1760)
Hot modulus of rupture, psi, ASTM C 583		
75°F (24°C)	1600 (11)	3000 (21)
2300°F (1260°C)		
2600°F (1426°C)	900 (6.2)	2300 (16)
2800°F (1538°C)	700 (4.8)	1400 (9.7)
Permanent linear change, %, ASTM C 113		
5 hrs. @ 3000°F (1648°C)	-	-0.4
5 hrs. @ 3200°F (1760°C)	-1.9	-
Deformation under hot load, % @ 25 psi, ASTM C 16		
1½ hrs. @ 2640°F (1448°C)	3.6	0.2
Coefficient of reversible thermal expansion, in./in.•°F•10^{-6}	4.7	3.4

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

Section 15

Structural block insulation products

Structural block insulation products

- **TR™-19 Block**
- **TR™-19HS Block**
- **TR™-20 Block**
- **TR™-2000-SL Block**

Our TR™-19 and TR™-20 block insulation products offer economical and efficient solutions to your insulation needs. These products feature significantly improved temperature and weight characteristics when compared with traditional products.

TR-19 and TR-19 HS are vermiculite based products and TR-20 is a diatomaceous silica product. These materials offer excellent energy saving efficiencies, good strength and minimal shrinkage.

TR-19 Block and TR-19HS Block

- Manufactured from vermiculite granules and high temperature bonding materials
- TR-19 features lower thermal conductivity than competitive vermiculite boards
- TR-19HS offers high compression strength
- Operates in temperatures up to 1038°C (1900°F)
- Exhibits good strength and minimal shrinkage up to use limit temperature
- Provides excellent resistance to aluminum cryolite attack

TR-20 Block

- Very good resistance to breakage
- Long, maintenance-free service and maximum operating efficiency
- Low conductivity and high stability
- Superior high-temperature block insulation
- Made from diatomaceous silica with a hydraulic binder
- Suitable for use up to 1093°C (2000°F)

TR-2000-SL Block

- Minimal shrinkage at top temperature limits
- Will not decompose at their maximum service temperature
- Calcium silicate composition
- Very low thermal conductivity
- Lightweight
- Good high temperature strength

TR block products are traditionally found in many Aluminium applications such as Carbon Bake Ovens, PotCells, Melting and Holding Furnaces.

- TR block insulation products can be used as both general insulation or back-up insulation in roofs, walls and floors
- General back-up insulation use with Morgan Thermal Ceramics' monolithics, firebricks, refractory plastics, and ceramic fibre products

Structural block insulation products

	TR-19	TR-19 HS	TR-20	TR-2000 SL
Manufacturing location	NA	NA	NA	NA
Color	beige	beige	off-white	off-white
Continuous Use Temperature, °C (°F)	1038 (1900)	1038 (1900)	1093 (2000)	1050 (1922)
Classification Temperature, °C (°F)	-	-	-	1080 (2000)
Porosity, ASTM C493, %	93	85	91	90
Specific heat, BTU/lb•°F	0.2	0.2	0.24	-
Specific heat, J/kg•°C	0.8	0.8	1	-
Compressive strength, @ 10% deformation, MPa (psi)	-	-	-	1.48 (215)
Density, ASTM C303, kg/m³ (pcf)				
ambient	-	-	-	17.5
dried	25	35	29	-
1038°C (1900°F)	24.5	33	-	-
1093°C (2000°F)	-	-	30	-
Cold crushing strength, ASTM C 165, MPa (psi)				
dried	1.2 (175)	1.7 (250)	1.2 (180)	-
fired 24 hours @ continuous use limit	0.5 (65)	-	1.2 (180)	-
Modulus of Rupture, MOR, ASTM C 203, MPa (psi)				
ambient	-	-	-	1.07 (155)
dried	0.8 (110)	1.2 (175)	0.8 (110)	-
fired 24 hours @ 1038°C (1900°F)	0.7 (100)	-	0.7 (105)	-
fired 24 hours @ 1093°C (2000°F)	-	-	1.5 (216)	-
Permanent Reheat Shrinkage, ASTM C356, fired 24 hours, %				
1038°C (1900°F)	2	1.5	-	1
1093°C (2000°F)	-	-	4	-
Chemical Analysis, % weight basis after firing				
Alumina, Al_2O_3	12	12	4.3	-
Silica, SiO_2	38	38	80	49
Calcium oxide, CaO	22	22	11	46
Magnesium oxide, MgO	12	12	0.8	-
Ferric Oxide, Fe_2O_3	9.5	9.5	1.6	5
Titanium Oxide, TiO_2	1.6	1.6	0.2	-
Alkalies as Na_2O and K_2O	4.0	4.0	1.5	-
Loss of Ignition, LOI	-	-	-	10.5
Thermal Conductivity, W/m•K (BTU•in/hr•ft²), per ASTM C201				
Density, kg/m³ (pcf)	400 (25)	561 (35)	465 (29)	280 (17.5)
260°C (500°F)	0.11 (0.72)	0.16 (1.1)	0.09 (0.68)	0.08 (0.55)
538°C (1000°F)	0.13 (0.83)	0.17 (1.14)	0.11 (0.72)	0.1 (0.72)
816°C (1500°F)	0.15 (0.99)	0.17 (1.14)	0.14 (0.96)	0.14 (0.96)
980°C (1800°F)	-	-	-	0.16 (1.12)
1038°C (1900°F)	0.17 (1.14)	0.2 (1.35)	-	-
1093°C (2000°F)	-	-	0.17 (1.14)	-

Safety Data Sheet (SDS): are available for all products.
Datasheets, in other languages, can also be found by visiting our website **www.morganthermalceramics.com**

MEASUREMENTS, CONVERSIONS, AND FORMULAS

TEMPERATURE - Conversion formula
Celsius to Fahrenheit
[Celsius degrees] x 9/5 + 32 = °F

Fahrenheit to Celsius
[Fahrenheit degrees] - 32 x 5/9 = °C

THERMAL CONDUCTIVITY
Conversion formula - USA
Btu•in/h•ft2 •°F

Conversion formula - EUROPE
W/m•K or kcal/m•h•°C

To convert W/m•K to Btu :
multiply 6,93 or in Kcal by 0,86

To convert MPa in kg/cm^2, multiply by 10,2

AREA - Conversion formula

Metric		Imperial
1 square centimetre	=	0.1550 square inches
1 square metre	=	1.1960 square yards
1 hectare	=	2.4711 acres
1 square kilometre	=	0.3861 square miles

Imperial		Metric
1 square inch	=	6.4516 square centimetres
1 square foot	=	0.0929 square metres
1 square yard	=	0.8361 square metres
1 acre	=	4046.9 square metres
1 square mile	=	2.59 square kilometres

LENGTH - Conversion formula

Metric		Imperial
1 millimetre	=	0.0394 inches
1 centimetre	=	0.3937 inches
1 metre	=	1.0936 yards
1 kilometre	=	0.6214 miles

Imperial		Metric
1 inch	=	2.54 centimetres
1 foot	=	0.3048 metres
1 yard	=	0.9144 metres
1 mile	=	1.6093 kilometre

VOLUME - Conversion formula

Metric		Imperial
1 cubic centimetre	=	0.0610 cubic inches
1 cubic decimetre	=	0.0353 cubic feet
1 cubic metre	=	1.3080 cubic yards
1 litre	=	1.76 pints
1 hectolitre	=	21.997 gallons

Imperial		Metric
1 cubic inch (in^3)	=	16.387 cubic centimetres
1 cubic foot (ft^3)	=	0.0283 cubic metres
1 fluid ounce (fl oz)	=	28.413 millilitres
1 pint (pt)	=	0.5683 litres
1 gallon (gal)	=	4.5461 litres

WEIGHT - Conversion formula

Metric		Imperial
1 milligram	=	0.0154 grains
1 gram	=	0.0353 ounces
1 kilogram	=	2.2046 pounds
1 tonne	=	0.9842 tons

Imperial		Metric
1 ounce (oz)	=	28.35 grams
1 pound (lb)	=	0.4536 kilograms
1 stone	=	6.3503 kilograms
1 hundredweight (cwt)	=	50.802 kilograms
1 ton (t)	=	1.016 tonnes

DEFINITIONS EXPLAINED

A

Alkaline Earth Silicate (AES) Wool

AES wools consist of amorphous fibres produced by melting a combination of CaO, MgO and SiO_2. Key features of AES products are low thermal conductivity, low linear shrinkage and low biopersistence. Products made from AES wools are generally used at application temperatures >600°C (1112°F) in industrial equipment, fire protection, automotive exhaust systems and domestic appliances.

Alumino Silicate Wool (ASW)

Alumino Silicate Wools, also known as "refractory ceramic fibre" (RCF), are amorphous fibres produced by melting a combination of Al_2O_3 and SiO_2. Key features of ASW products are low thermal conductivity, high chemical stability, and low linear shrinkage. Products made from ASW are generally used at application temperatures >900°C in industrial equipment such as furnaces and kilns, in fire protection, and in automotive exhaust systems.

B

Binder (organic)

Organic binders such as starch or polymer latex are added to fibres when making boards, vacuum formed shapes, paper or felt. The organic binder adds strength in the green state, which is valuable for handling, cutting or application.

At high temperature the organic binder is burnt out and is no longer present in the fired product.

Biopersistence

The characteristic of a fibre to persist in the lung, involving or implying resistance to both dissolution and mechanical breakage. Biopersistence can only be directly measured in in vivo test systems, i.e. following inhalation, instillation or injection in experimental animals.

The rate of removal of fibres is typically expressed as “half life” - the time it takes for the number of fibres in the lungs to be reduced by 50%. Man Made Vitreous Fibres (MMVF; see below) have low biopersistence compared with most natural mineral fibres. Understanding the biological significance of biopersistence has resulted in the development of materials such as AES wools that have very low biopersistence.

C

C.A.S. number

Registry number given to a substance by the Chemical Abstract Service (CAS).

CARE Programme

Standing for "Controlled and Reduced Exposure", CARE is a cross-industry industrial hygiene programme initiated by ECFIA in 1996. It comprises exposure monitoring and risk assessment for all HTIW. Workplace control methods are evaluated and personal concentrations of fibrous dust monitored in both manufacturing and user company sites. The programme forms the basis for the production of ‘best practice’ guidance documents. See the Exposure Control / CARE section of the website for more information.

Classification temperature

The classification temperature is determined by following the test procedure in one of the accepted norms, such as ENV1094-3.
It corresponds to the temperature for which the product has a permanent linear shrinkage not exceeding a given value (depending on the product): 2% for boards and vacuum formed products 4% for blankets, felts, mats, and papers.

CLP Regulation

The Classification Labelling and Packaging Regulation (CLP-Regulation (EC) No 1272/2008) on the classification, labelling and packaging of substances and mixtures aligns existing EU legislation to the United Nations Globally Harmonised System (GHS). It replaces the former Dangerous Substances and Preparations EU Directives.

Cristobalite

Cristobalite is a type of crystalline silica that can form when MMVFs devitrify following heating to sufficiently high temperatures for a sufficient duration (depending on chemical composition).
See Devitrification.

Crystalline silica

Crystalline silica is found in industrial applications mostly as quartz. Crystalline silica is known to produce silicosis and has been classified as a human carcinogen by the WHO's International Agency for Research on Cancer (IARC).

Crystallization

See Devitrification.

D

Devitrification

The process by which prolonged high temperatures can alter the physicochemical properties and crystalline structure of amorphous HTIWs (AES and ASW), resulting in reduced resiliency and mechanical strength. Various crystalline phases can be formed by devitrification, including mullite, enstatite, wollastonite and cristobalite (a form of crystalline silica, see above). Crystalline phases produced when heating polycrystalline wools at high temperature 1400°C - 1600°C (2552°F - 2912°F) are mullite (main phase) and corundum (secondary phase). Crystalline silica (including cristobalite) is not formed on heating PCW.

Diameter

While this may seem a simple concept, the diameter of fibres in mineral wools is complex. Mineral wools contain fibres with a wide range of diameters; if these are to be measured in any type of microscope the mineral wool must usually be ground, milled or broken up in some other way. When this is done the thin fibres tend to break more easily than thick ones. This also happens when working with mineral wools, so that in workplace dusts length and diameter are correlated, with finer diameter fibres tending to be shorter than coarser fibres. If the diameter of a number of fibres is measured and a simple mean diameter calculated, then this figure will depend on how many thin fibres are created which, in turn, depends on the way the fibres have been handled. Therefore to obtain a meaningful and reproducible measure of mineral wool fibre diameter, independent of the preparation method, the so called length weighted geometric mean diameter (LWGMD) concept has been devised. As the diameters usually vary so that their logarithms are normally distributed then the geometric mean should be used; 50% of the total length of fibres present will be less than the LWGM. This value is also close to the median diameter.

The vast majority of man-made mineral fibres are fairly coarse, with most fibres having LWGMD well above 1μm.

Dimension
Fibre dimension is critical in terms of possible health effects as only fibres of a certain size can reach the lungs. Mineral fibres with a diameter >3μm are regarded as essentially "non respirable" in humans. While respirability is determined predominantly by fibre diameter, fibre length is also important.

Short fibres can be cleared by the normal mechanisms of phagocytosis by lung macrophages, but long fibres (e.g. >20μm) can frustrate this mechanism and are also more biologically active.

E
ECFIA
ECFIA represents the European High Temperature Insulation Wool (HTIW) industry in matters relating to health and safety.
www.ecfia.eu

EU Directive 97/69/EC
A technical amendment to the Dangerous Substances Directive 67/548 EU concerning the hazard classification and labelling of man-made vitreous (silicate) fibres as carcinogens. It exonerates thick fibres (see Note R) and then divides the rest into two groups according to their alkaline and alkaline earth oxide composition.

Those containing more than 18% alkaline and alkaline earth oxides by weight are called mineral wools and may be exonerated from classification and labelling if certain bioassays guarantee either their low biopersistence or lack of pathogenicity (see Note Q).

Exposure
Specifically in this context, exposure is the measure of airborne fibrous dust or other material that reaches the deep lung in exposed persons (or animals in the case of bioassays). Exposure is not the same as airborne fibre concentration, which is often evaluated according to the WHO definition of fibres.

F
Fibre
A fibre is any particle longer than it is wide. Material scientists normally call objects fibres when their length is more than 10 times their width (i.e. their 'aspect ratio' >10), although the WHO definition of a fibre refers to an aspect ratio of 3. To be useful in most applications, fibres must have aspect ratios very much greater than this. See also Diameter and Length and WHO Fibres.

G
GHS
The Globally Harmonized System of Classification and Labelling of Chemicals, or GHS, is an internationally agreed system set to replace the various different classification and labeling standards used in different countries.

H
High Temperature Insulation Wool (HTIW)
High Temperature Insulation Wools are synthetic mineral wools used in high-temperature industrial applications, typically in the range 600°C to 1800°C (1112°F - 3272°F).

They include three different types of wool: Polycrystalline Wools (PCW), Aluminium Silicate Wools (ASW/RCF) and Aluminium Earth Silicate (AES) wools. HTIW are specialist materials and account for only about 2% of the total synthetic mineral wool production in Europe.

High Temperature Insulation Wools Coalition (HTIWC)
HTIWC is the US and Canada association representing the high temperature insulation wool industry.

I
International Agency For Research on Cancer (IARC)
A major goal of the IARC is the identification of causes of cancer, so that preventive measures may be adopted against them. IARC does not deal in the formulation of policies or legislation aiming at controlling carcinogens.

L
Labelling
In the past, classification and labelling of hazardous substance and preparations had to be done following Directive 67/548/EEC and 1999/45/EEC. In order to harmonise classification and labelling regulation, the European Union decided to adopt and adapt the Global Harmonised System (GHS) proposed by the United Nations. As a consequence, a new Regulation (EC) No 1272/2008 has been published aiming at replacing the former above listed Directives.

Substances and mixtures will have to be labelled according to these new European regulation CLP-rules. In addition to the labelling of classified substances, ECFIA members are voluntarily labelling articles made of these substances.

Length
Another simple variable describing fibre dimension that conceals a degree of necessary complexity (c.f. Diameter). The length of fibres in mineral wools is highly variable, ranging from a few micrometers to some centimetres e.g. 25cm (1"). When fibres are handled, dust liberated into the air will include some non-fibrous particles as well as fibres with lengths up to some tens of mm.

Fibre length is a key determinant of hazard. See also Fibre and Dimension.

Length-Weighted Geometric Mean Diameter (LWGMD)
See Diameter.

M
Man made vitreous fibres (MMVF)
The class of materials including all the glassy fibres such as rockwool, glass wool, slagwool, AES and ASW/RCF-wools. The European Union added the term (silicate) in Directive EU/97/69 to identify a subset of these fibres. The term Synthetic Vitreous Fibres (SVF) is now often used instead of MMVF. Conglomerates made from MMVFs are called Man Made Vitreous Wools (MMVWs).

Non-vitreous synthetic mineral fibres, such as PCW, are described generically as Man Made Mineral Fibres (MMMF) or Synthetic Mineral Fibres (SMF). See also Wool

Maximum continuous use temperature
This term is used by Thermal Ceramics to advise on the temperature at which its products can be expected to work for extended periods of time without adverse effects. In some applications, where a short or one shot exposure is expected, this application temperature may be exceeded. It is always advisable to seek applications advice from Morgan Thermal Ceramics in such a case.

N

National Institute for Occupational Health and Safety (NIOSH)

NIOSH is the federal agency in the US responsible for conducting research and making recommendations for the prevention of work-related injury and illness. NIOSH is part of the Centers for Disease Control and Prevention (CDC) in the Department of Health and Human Services.

Note Q

A note in Directive EU/97/69 (q.v.) stating the conditions that may be used in Europe to exonerate some man-made vitreous (silicate) fibres from classification as carcinogens under this Directive.

P

Polycrystalline Wool (PCW)

Polycrystalline Wool is made predominantly of aluminum oxide (typically 72-99%), with the remainder consisting of silicon.It is manufactured using sol-gel technology and high temperature firing to produce fibres of well-defined dimensions. PCW is produced in relatively small quantities for very specific applications, typically from 600°C - 1700°C (1112°F - 3092°F).

PSP Product Stewardship Program

In 2002, the Occupational Safety and Health Administration (OSHA) endorsed a five year voluntary product stewardship program called PSP 2002. On May 23, 2007, HTIW Coalition's predecessor, RCFC, and its member companies renewed this voluntary product stewardship agreement with OSHA. On April 16, 2012, HTIW Coalition renewed this five year program, called PSP 2012. PSPS 2012 is a highly acclaimed, multi-faceted strategic risk management initiative designed specifically to reduce workplace exposures to refractory ceramic fibre (RCF).

R

REACH
(Reach, Evaluation, Authorization and Restriction of Chemicals)

REACH is a European Union Regulation introduced in December 2006. REACH addresses the production and use of chemical substances and their potential impacts on both human health and the environment inviting producers, importers and to a lesser extend users to provide extensive information on their substances, mixtures and products. REACH entered into force in June 2007, with a phased implementation over the next decade.

Refractory Ceramic Fibres (RCF)

Also (preferably) referred to as Aluminium Silicate Wool (ASW), which better describes the material's composition.

T

Thermal conductivity

This is the ability of a material to transmit heat. The lower the thermal conductivity the better the product is at resisting the flow of heat through it. The thickness of a furnace lining necessary to give a known cold face temperature can be calculated using the thermal conductivity. It is normally independent of size or shape of the tested material. Thermal conductivity is measured in Watts per meter per degree Kelvin W/m•K (BTU•in/hr•ft^2•°F).

V

Vitreous (Amorphous) Glassy Fibres

Vitreous fibres are amorphous rather than crystalline. They have no cleavage planes and when handled they break transversely rather than splitting into thinner fibres as asbestos does. This term has the same meaning as MMVF (see above).

W

WHO-Fibres

For the purpose of harmonising optical fibre counting, the World Health Organization has adopted a convention to define fibre dust size. To evaluate workplace fibre concentrations, only airborne fibres with diameter less than 3μm, length greater than 5μm, and an aspect (length to diameter) ratio greater than 3 are to be counted. Such so-called 'WHO Fibres' are not all equally respirable; fibres with diameter $< 1\mu$m are far more likely to reach the deep lung than those of 3μm diameter. See also Dimension.

Wool

Wool is the term used to describe an unordered mass of fibres of different lengths and diameters (EN 1094-1).

Morgan Advanced Materials

THERMAL CERAMICS

ABOUT MORGAN ADVANCED MATERIALS

Morgan Advanced Materials is a global engineering company offering world-leading competencies in materials science, specialist manufacturing and applications engineering.

We focus our resources on the delivery of products that help our customers to solve technically challenging problems, enabling them to address global trends such as energy demand, advances in healthcare and environmental sustainability.

What differentiates us?

Advanced material science and processing capabilities. Extensive applications engineering experience. A strong history of innovation and reinvention. Consistent and reliable performance. A truly global footprint. We find and invest in the best people.

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