



Ultralite™

Advanced Solutions

Thermal Insulation Products

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Mantec Technical Ceramics is pleased to present its complete range of innovative and energy efficient **Ultralite™ Thermal Insulation Products** for a wide range of high temperature applications.

Uniquely available from Mantec, Ultralite is a lightweight, microporous refractory material developed and manufactured in the UK. Mantec's smart processing of largely traditional materials has resulted in a range of Ultralite products which have exceptional thermal insulation properties.

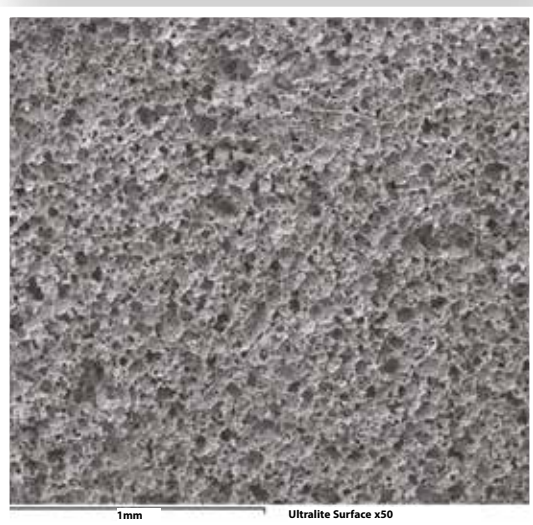
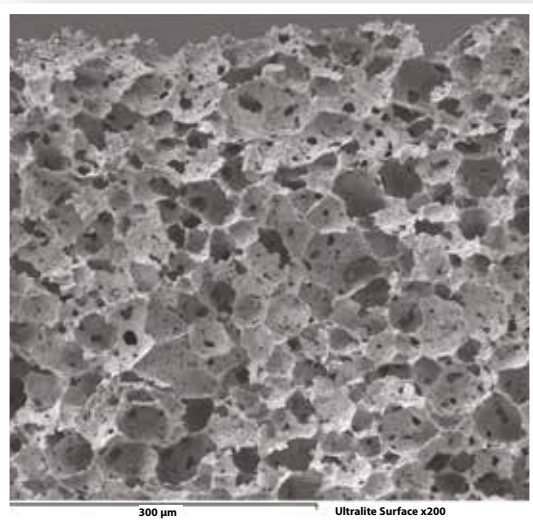
The superior thermal performance of Ultralite means it is becoming invaluable across a wide range of industries including global heavy clay, sanitaryware, tableware, refractories, iron and steel and glass production industries – reducing energy consumption and saving manufacturers significant costs associated with the overall kiln and furnace operations.

**SAVE
UP TO
40%
on
KILN CAR
ENERGY
COSTS**





Ultralite Technology



Micrographs of Ultralite microporous structure

The unique, patent pending Ultralite technology has been developed by Mantec's in-house ceramic experts and is manufactured in its factory in Stoke-on-Trent in the heart of the UK ceramics region. It is designed to be a modern substitute for more traditional materials across a number of quite distinct applications.

The special refractory formulation that is used to produce Ultralite has given it a technological and performance advantage over other refractory materials and as such offers a suite of benefits such as:

- High open porosity
- Low thermal mass
- Low permeability
- Low thermal conductivity
- Low bulk density
- Lightweight

The exact combination of materials for Ultralite has been selected by Mantec to optimise the generation of a highly porous open structure with a uniform wall thickness and honeycomb microstructure (*see micrographs on the left*). As these micrographs show, there is a high proportion of space for air within the Ultralite structure. Air is a good thermal insulator, so materials that trap air like Ultralite have inherent characteristics for insulation, which means that heat transfer through Ultralite products at elevated temperatures is **significantly less** than that of traditional materials.

Typical Applications for Ultralite

The Ultralite technology can be designed for use in all types of kilns and furnaces. Mantec offers a number of important Ultralite products for this industry, including:

- Insulation firebricks
- Refractory castables
- Cover tiles for kiln cars
- Pre-cast shapes
- Loose fill insulation for kiln car bases
- Graded aggregate
- Kiln wall cavity insulation

Ultralite Insulating Firebricks

In response to increasing market demands for ultra-lightweight and highly insulating refractory products – and following extensive research and development – Mantec Technical Ceramics has unveiled its **Ultralite Insulating Firebricks (UIFB)** as the latest addition to the Ultralite family of insulation products.

Manufactured using a combination of Mantec's advanced microporous refractory technology and its unique **patent pending** engineering expertise, Ultralite insulating firebricks are now probably the **LIGHTEST FIREBRICKS**, for their classification, in the world today and have been specifically engineered to deliver even greater energy savings for customers compared to other leading comparable products.

Not only are Ultralite Insulating Firebricks **HALF THE WEIGHT** and **HALF THE DENSITY** of comparable products on the market – confirmed by recent independent testing – but they also offer superior thermal insulation and mechanical properties.

Mantec's standard **UIFB-26** brick meets the requirements of ASTM C155 for group 26 applications requiring a temperature rating of 1400°C/2550°F.

Ultralite Insulating Firebricks are available in 2 standard sizes:

- 🔥 230mm x 114mm x 76mm / 9" x 4 ½" x 3"
- 🔥 230mm x 114mm x 64mm / 9" x 4 ½" x 2 ½"

According to customers' requirements, Mantec can manufacture other sizes and special shapes to order as part of our bespoke engineering service.

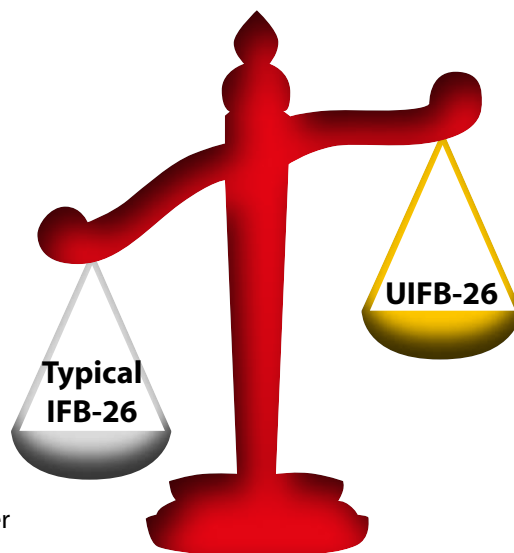
Applications for Ultralite Insulating Firebricks:

The main application for Ultralite Insulating Firebricks is as a primary hot face refractory lining in kilns and furnaces or in other areas requiring high temperature insulation. They can also be used as secondary back-up insulation behind other hot face linings.

The main industrial sectors where Ultralite Insulating Firebricks would make an impact are traditional ceramics, refractories, iron & steel and glass production.

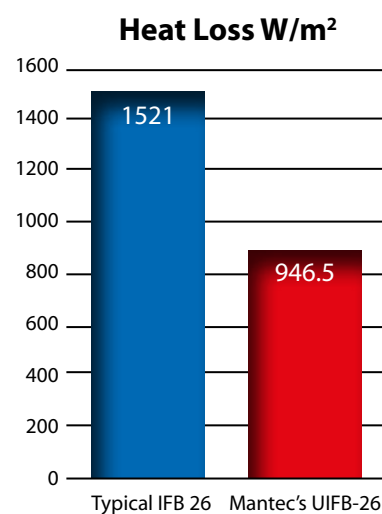
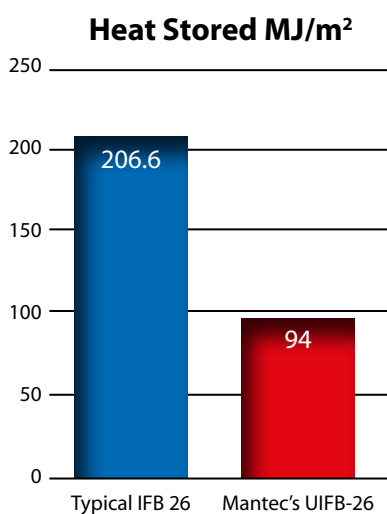
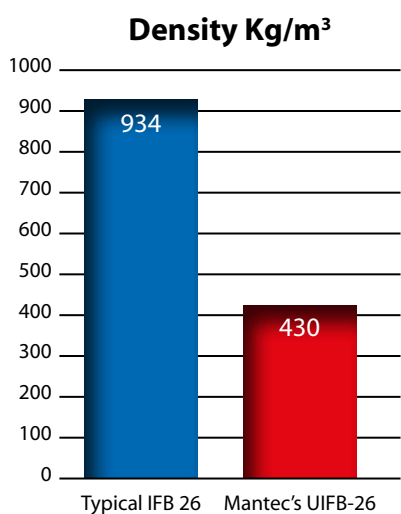
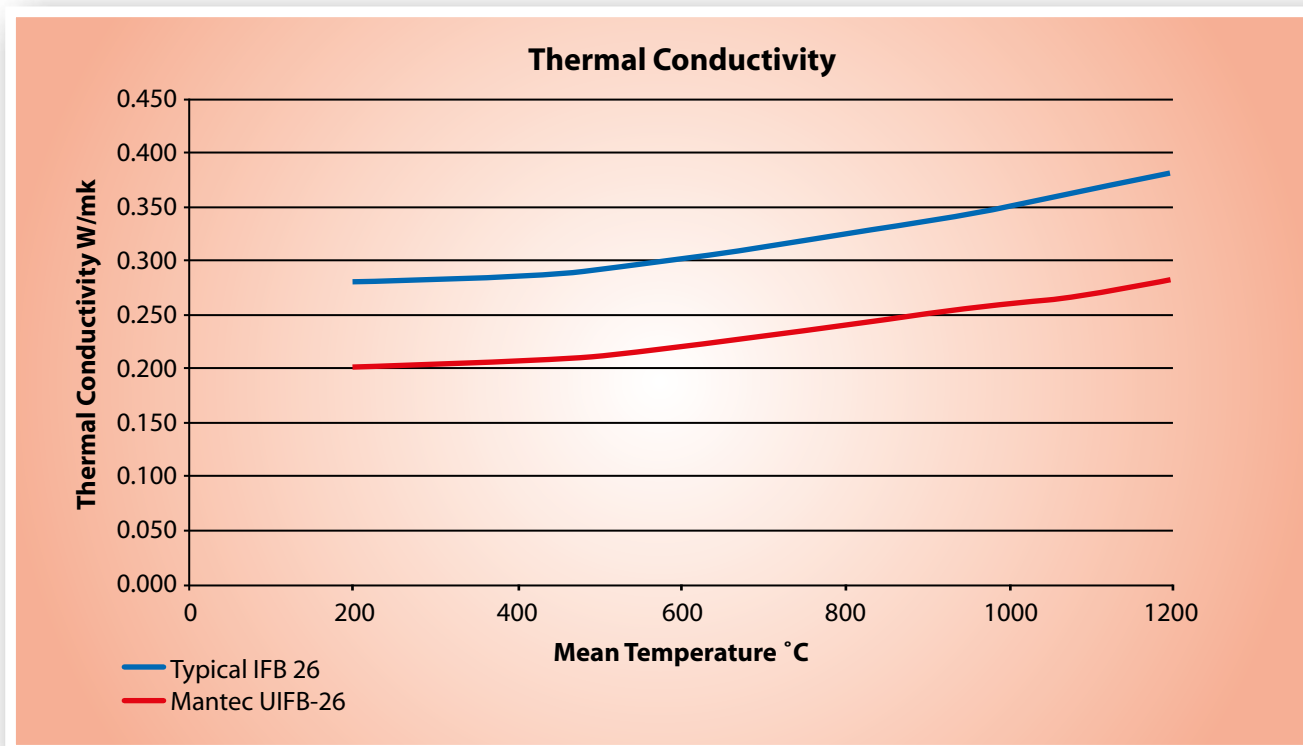
What are the advantages of Ultralite Insulating Firebricks?

- | | |
|--|--|
| 🔥 Probably the lightest insulating firebrick on the market today within its classification | 🔥 Higher strength |
| 🔥 Patent pending technology | 🔥 Superior all-round thermal performance |
| 🔥 Half the weight and half the density of other industry standard Group 26 insulating firebricks | 🔥 Thinner wall constructions are possible for the same energy efficiency of other products |
| 🔥 Lower thermal conductivity | 🔥 Special shapes available to customer order |
| 🔥 Lower heat storage | 🔥 Ease of handling due to their lightness |



How do Mantec's Ultralite Insulating Firebricks Compare?

The following graphs indicate how well the enhanced properties of Mantec's Ultralite Insulating Firebricks compare against a typical industry standard IFB-26 product.



The above density, heat stored and heat loss data has been calculated based on a 300mm thickness at a hot face temperature of 1250°C (2282°F) using SIMU-THERM Heat Flow Simulation Software.

The lower thermal conductivity, lower density, lower heat storage and lower heat loss properties of Ultralite Insulating Firebricks will therefore allow customers to benefit from additional reduction in energy usage and thus improved manufacturing efficiencies.

Ultralite Loose Fill Insulation

Ultralite is the ultimate kiln car loose fill insulator. It is a unique lightweight refractory aggregate with exceptional insulating properties and has been designed to replace less thermally stable kiln car insulation media such as ceramic fibre, vermiculite and perlite.

The unique properties of Ultralite make it an ideal loose fill insulator especially within kiln car bases. Unlike other typical insulation materials, the thermal efficiency of **Ultralite Loose Fill (ULF)** insulation does not degrade so it will perform consistently over its whole lifetime.

The Ultralite Loose Fill range of products covers classification temperatures up to 1450°C/2642°F, dependent upon the application (see below).

Ultralite Loose Fill is supplied in pellet form – a neat, simple and small aggregate that is easy and safe to handle. It pours very conveniently into awkward spaces and reduces kiln car construction time as no physical packing is required.

Aside from offering superb thermal insulation, Ultralite Loose Fill is stable at elevated temperatures and has already successfully demonstrated superior thermal efficiencies in a number of ceramic manufacturing sectors.

Ultralite Loose Fill Product Range

There are 3 standard grades of **Ultralite Loose Fill** available:

- 🔥 **ULF-10** - The standard loose fill product, with a classification temperature of 1050°C/1922°F. Typical industry sectors are brick, roof tile and sanitaryware.
- 🔥 **ULF-12** - Similar to ULF-10 but with a classification temperature of 1250°C/2282°F. Typical industry sectors are sanitaryware, tableware and refractories.
- 🔥 **ULF-14** - This grade has an enhanced Alumina content to allow it to have a classification temperature of 1450°C/2642°F. Typical industry sectors are refractories, technical ceramics and industrial ceramics.

Why Use Ultralite Loose Fill?

Whichever Ultralite Loose Fill grade customers choose, there are demonstrable energy savings on every firing. Mantec can readily prove **energy savings up to 40%** in kiln car bases and there are case studies to support this (please contact Mantec Technical Ceramics for further information or download the case studies from our website).

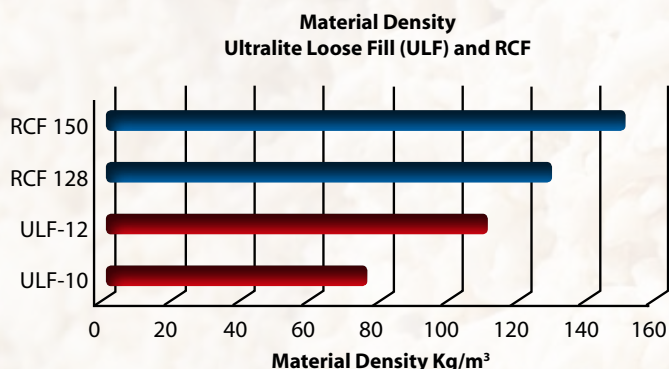
The main advantages and benefits of using Ultralite Loose Fill are as follows:

- 🔥 Highly efficient and lightweight, resulting in real energy savings on every firing and ease of handling
- 🔥 Low density, low thermal mass and high porosity, resulting in lower kiln energy costs which reduces carbon footprint
- 🔥 Free flowing loose fill – very easy to install. It pours very conveniently into awkward spaces and reduces construction time (no physical packing required)
- 🔥 No ceramic fibre, therefore not classified as hazardous waste
- 🔥 Stable at high temperatures - does not degrade in use, therefore can be re-used time and again
- 🔥 Superior alternative to conventional kiln car insulation materials
- 🔥 Can be re-used after kiln car repairs and maintenance



Ultralite Loose Fill versus Refractory Ceramic Fibre

Ultralite Loose Fill is designed to replace the more traditional insulation material within kiln car bases without any of the growing concerns about the health and safety implications of Refractory Ceramic Fibres (RCFs). Ultralite Loose Fill is therefore a real alternative choice for the discerning manufacturer.



The low thermal mass of Ultralite Loose Fill, coupled with its superior lower thermal conductivity compared to RCFs, gives energy savings on every kiln car fired. This significantly helps to reduce energy usage. The graph to the left is a comparison of material densities in which the standard Ultralite Loose Fill ULF-10 can be seen with the lowest value at 75 Kg/m³.

The installed density of RCF is often misunderstood. Whilst the nominal density stated by the supplier

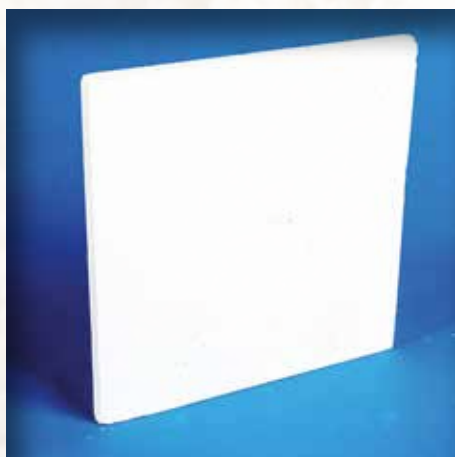
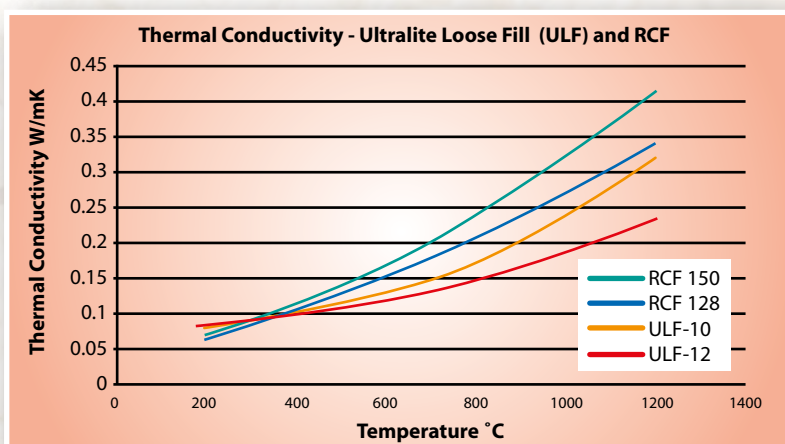
may be 90 Kg/m³, the actual installed density can typically be 125 to 200 Kg/m³ depending on how tightly packed the RCF material is inside the kiln car.

Ultralite Loose Fill on the other hand is free flowing (can be conveniently poured into spaces), easy to install (no tight packing required) and achieves an even density throughout the kiln car base.

The graph below shows a thermal conductivity comparison between Ultralite Loose Fill and various grades of RCF. It can be seen that Ultralite Loose Fill has a lower thermal conductivity, particularly at elevated temperatures (above 1000°C / 1832°F).

Practical benefits over ceramic fibre

Ultralite does not have the same associated health and safety issues as RCF. It does not break down or become brittle in use, therefore its thermal performance remains stable for much longer periods, thereby improving the whole life cost of the installation.



Ultralite Cover Tiles

Ultralite Cover Tiles (UCT) are an integral feature of kiln car base construction and are used to top off and protect the Ultralite Loose Fill insulation below.

Mantec's Ultralite Cover Tiles are manufactured from the same lightweight and thermally efficient material as the Ultralite Insulating Firebricks and therefore they offer the same design, thermal, mechanical and in-use performance benefits.

The standard size for Ultralite Cover Tiles is 305mm x 305mm x 15mm/ 12" x 12" x 0.59".

Other sizes are also available upon request.

Ultralite Cavity Fill Castable

Mantec Technical Ceramics offers **Ultralite Cavity Fill Castable (UCF-950)** as an alternative material to kiln manufacturers and maintenance teams. Ultralite Cavity Fill Castable exhibits all the same characteristics as Ultralite Loose Fill as it is manufactured from the same material and blended together with high grade refractory aggregates and cements. Ultralite Cavity Fill Castable is used to reduce the cool face temperature of a kiln's outer wall, particularly around the hot zone of the kiln or furnace. UCF-950 has a maximum service temperature of 950°C/1742°F.



Ultralite Refractory Castable

Ultralite Refractory Castable (URC) is also a blend of Ultralite Loose Fill and high grade refractory aggregates and cements, which results in an exceptional castable product.

Ultralite Refractory Castable is available in three main grades with maximum service temperatures ranging from 1100°C (2012°F) up to 1300°C (2372°F). This flexible material allows a variety of applications to be handled, from the creation of cast shapes that are lightweight with exceptional heat insulating properties to cement for refractory linings.



- 🔥 **URC-11** – Maximum service temperature of 1100°C/2012°F
- 🔥 **URC-12** – Maximum service temperature of 1200°C/2192°F
- 🔥 **URC-13** – Maximum service temperature of 1300°C/2372°F

Ultralite Pre-Cast Shapes

Mantec Technical Ceramics has both the technical expertise and manufacturing experience to produce from first design principles bespoke Ultralite Refractory Shapes such as setter blocks, cover tiles and many others.

There is a growing demand for general non-load bearing refractory products that offer exceptional heat insulation properties. It is essential in these energy conscious days not simply to specify the traditional old and heavy refractory products without any consideration being given to their heat absorption characteristics.



Mantec's technical team is available to handle your bespoke requests and enquiries.

Ultralite Graded Aggregate

Ultralite Graded Aggregate (UGA) can be supplied to customers who prefer to utilise Ultralite as a lightweight, microporous graded refractory aggregate to manufacture their own refractory shapes.

For this application, the following typical Ultralite Grades are available:

- 🔥 0 – 1mm
- 🔥 0.5mm – 2mm
- 🔥 0 – 2mm
- 🔥 1 – 4mm
- 🔥 0 – 3mm

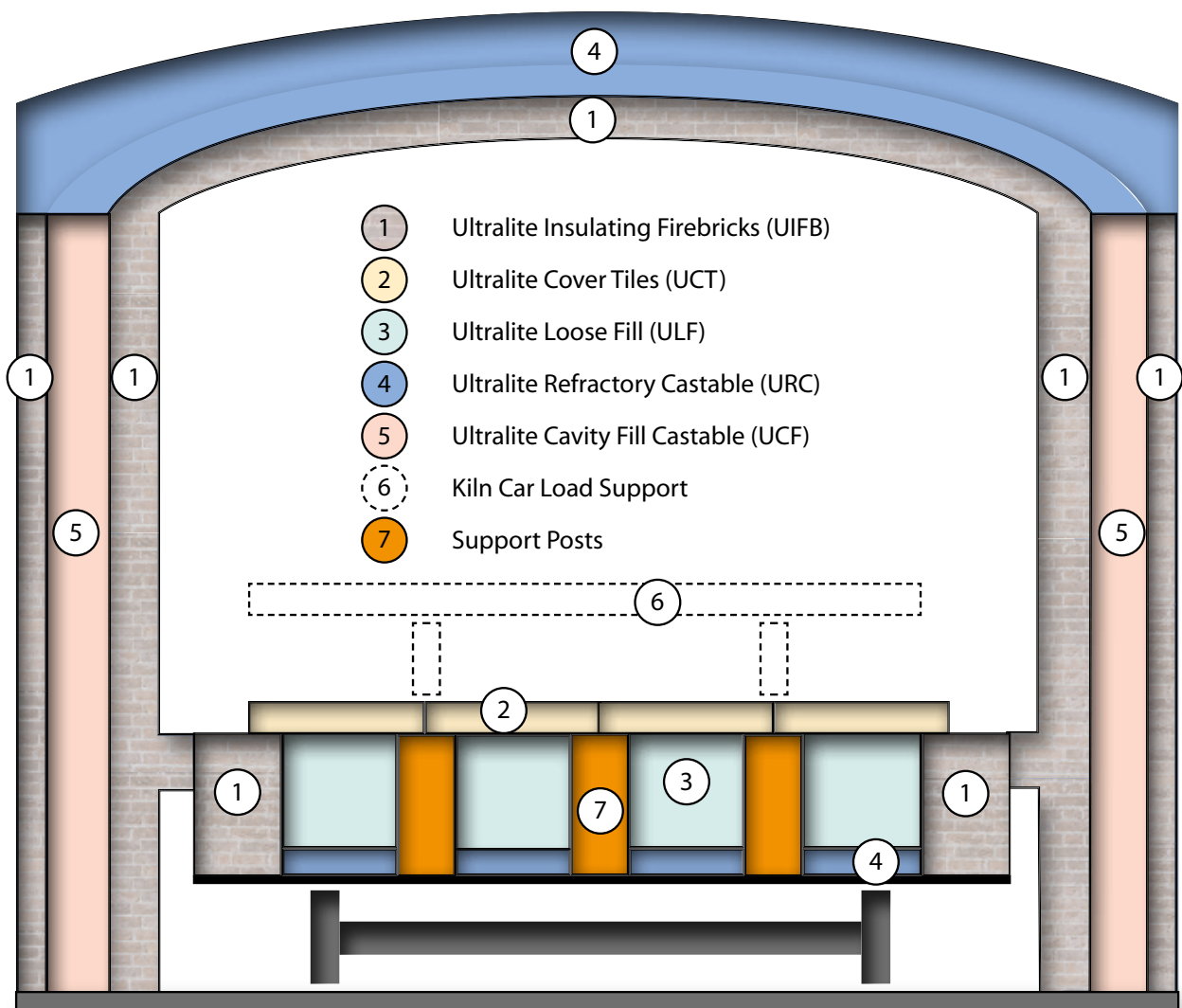


In addition to these typical Ultralite Graded Aggregate products, Mantec also has the ability to develop specific grades to suit customers' own bespoke requirements.

Kiln Applications for Ultralite Thermal Insulation Products

Mantec's family of Ultralite Thermal Insulation Products can be installed throughout the whole kiln – kiln cars, kiln walls, cavity walls, roof space and arched roofs.

The illustration below demonstrates how a kiln installation and construction will look by utilising the innovative Ultralite advanced kiln insulation technology.



The above cross sectional diagram of a typical kiln is for illustration purposes only and not drawn to scale

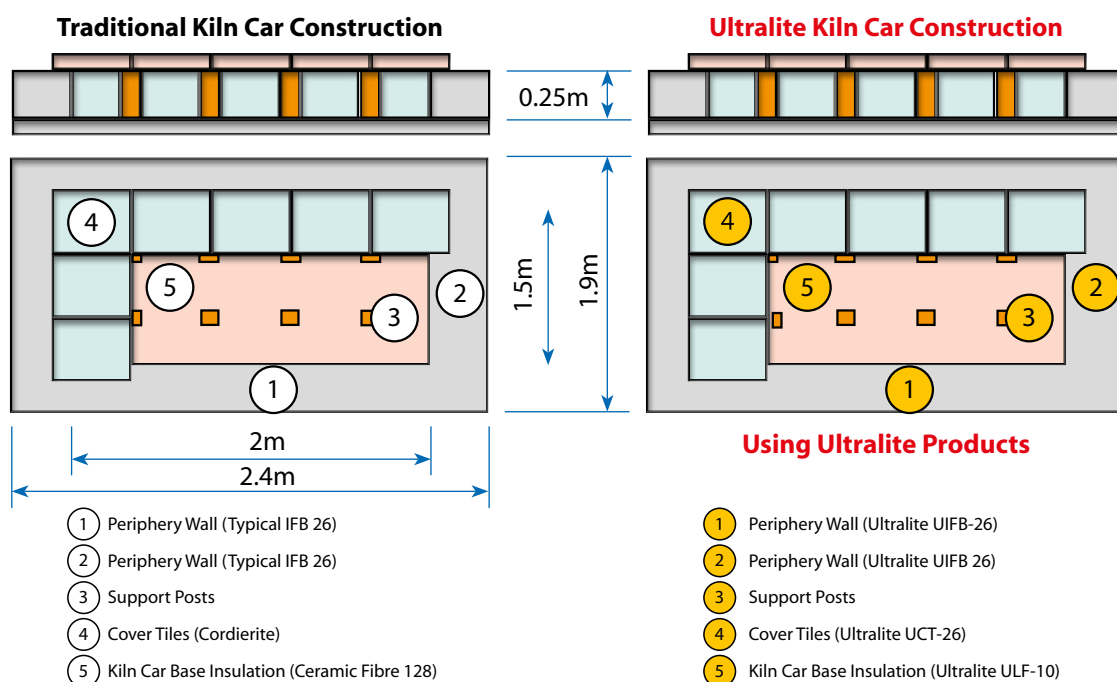
Ultralite Thermal Insulation Products therefore offer the complete solution to enable kiln builders and ceramic manufacturers to maximise thermal performance and efficiencies within their kilns.

How much can an Ultralite Kiln Car System save?

The adoption of Ultralite advanced kiln insulation technology in kiln car constructions can result in weight, energy and kiln undercar temperature savings.

Compared to more traditional construction materials, the following illustration demonstrates how Ultralite products could achieve weight savings in the region of **50%** and energy savings of **40%+** within kiln car bases.

In addition to weight and energy savings in the kiln car bases, Ultralite technology can also contribute towards reducing undercar temperature. A lower undercar temperature means less kiln car wheel wear and less maintenance on wheel bearings so that replacement cycles of wheel bearings can be extended thereby reducing maintenance costs.



Weight Comparison in Kiln Car Base

Section	Item	Length (m)	Width (m)	Height (m)	Qty	Vol (m³)	Traditional Construction			Ultralite Construction		
							Typical Kiln Car Construction	Density (Kg/m³)	Weight (Kg)	Construction using Ultralite Technology	Density (Kg/m³)	Weight (Kg)
1	Periphery Wall	2.4	0.2	0.25	2	0.24	Typical IFB 26	780	187.2	Ultralite UIFB-26	430	103.2
2	Periphery Wall	1.5	0.2	0.25	2	0.15	Typical IFB 26	780	117	Ultralite UIFB-26	430	64.5
3	Support Posts (See note 1 right)	0.1	0.1	0.25	8	0.02	-	-	-	-	-	-
4	Cover Tiles	2	1.5	0.012	1	0.036	Cordierite	2000	72	Ultralite UCT-26	430	15.48
5	Kiln Car Base Insulation	2	1.5	0.25	1	0.73	Ceramic Fibre	128	93.44	Ultralite ULF-10	75	54.75
	Totals								469.64			237.93
Weight Saving using Ultralite products ± 49%												

Heat Energy Comparison in Kiln Car Base

	Traditional Construction	Ultralite Construction
Total Heat Flow (MJ)	170.1	137.9
Heat Stored (MJ)	433.7	206.7
Combined Heat in Kiln Car Base	603.8	344.6
Energy Saving in Kiln Car Base Insulation ± 43%		

Undercar Temperature Comparison

	Traditional Construction	Ultralite Construction
Hot Face/Peak Firing Temperature (°C)	1250	1250
Undercar Temperature/Cold Face (°C)	111	97
Undercar Temperature Saving ± 12%		

Ultralite Technical Data

		Ultralite Insulating Firebricks	Ultralite Cover Tiles	Ultralite Loose Fill			Ultralite Cavity Fill Castable	Ultralite Refractory Castable		
Property	Units	UIFB-26	UCT-26	ULF-10	ULF-12	ULF-14	UCF-950	URC-11	URC-12	URC-13
Classification Temperature	°C	1400	1400	1050	1250	1450	950	1100	1200	1300
Density (ASTM C134-84)	Kg/m ³	430	430	75	110	132	300 - 350	540-620	620-670	580-620
Modulus of Rupture (ASTM C93-84)	MPa	2.4	2.4	-	-	-	-	0.73	1.36	1.32
Cold Crushing Strength (ASTM C93-84)	MPa	2.6	2.6	-	-	-	-	1.5	2.91	3.7
Permanent Linear Change (ASTM C210) Δ	%	+0.4	+0.4	-	-	-	-	-1.5	-1.45	-1.1
Thermal Conductivity (ASTM C201/182)	200 °C	W / mK	0.20	0.20	0.08	0.08	TBC	0.14 §	0.26 §	0.22 §
	400 °C	W / mK	0.21	0.21	0.10	0.09	TBC	0.17 §	0.22 §	0.24 §
	800 °C	W / mK	0.24	0.24	0.17	0.15	TBC	0.16 §	0.25 §	0.20 §
	1000 °C	W / mK	0.26	0.26	0.23	0.19	TBC	-	-	-
	1200 °C	W / mK	0.28	0.28	0.32	0.23	TBC	-	-	-
	1400 °C	W / mK	-	-	-	-	-	-	-	-
Chemical Composition	Al ₂ O ₃	%	68.73	68.73	31.34	31.34	64.90	34.44	38.75	39.56
	SiO ₂	%	27.65	27.65	53.47	53.47	28.20	36.53	27.77	29.33
	Fe ₂ O ₃	%	0.44	0.44	0.84	0.84	0.50	5.74	9.23	8.71
	TiO ₂	%	0.58	0.58	1.21	1.21	0.50	1.48	-	-
	CaO	%	0.23	0.23	0.36	0.36	0.20	13.38	19.54	18.48
	MgO	%	0.30	0.30	0.56	0.56	0.40	0.37	-	-
	Na ₂ O	%	0.40	0.40	0.36	0.36	0.50	0.25	0.40	0.28
	K ₂ O	%	0.98	0.98	2.19	2.19	1.20	1.46	1.05	0.79
	Alkalis	%	<2.0	<2.0	<3.5	<3.5	<2.5	<2.5	<2.0	<1.5
Mixing Ratio (By Volume)		-	-	-	-	-	40:100	55:100	40:100	38:100
- Litres Water: Litres UCF or URC										
Mixing Ratio (By Weight)		-	-	-	-	-	175:100	130:100	90:100	88:100
- Kg Water: Kg UCF or URC										
Packaging		Cartons/ Pallets	Cartons/ Pallets	1 m ³ Bulk Bags			20 litre Plastic Sacks	20 litre Plastic Sacks		

Δ After 24 Hours at 1400 °C

§ Data based on ISO 8894-1

TBC To be confirmed.

Note: Information and technical data contained herein is correct at the date of issue. Mantec Technical Ceramics reserves the right however to change this information and technical data at any time without notice.
Contact Mantec Technical Ceramics for the most current information.

± NOTES

- Support posts are not considered.
- The energy calculations to the left are based on Static Heat Flow (SHF) at peak firing temperature for a duration of 10 hours (Time to end of firing cycle) using SIMU-THERM Heat Flow Simulation Software.
- The results are based on vertical flow of heat downwards through the kiln car base only. The calculations do not take account of horizontal flow of heat.
- Transient Heat Flow not considered.
- The above comparisons exclude the steel structure of the kiln car and its load.
- Due to limitations of the SIMU-THERM software, the above comparisons are for illustration purposes only. Verification using finite element analysis should be considered.

Thermal Calculation Disclaimer – The information provided by Mantec Technical Ceramics Ltd within this comparison is an estimation of the potential savings that can be obtained by the adoption of the Ultralite insulation technology. We have used information based on "best available data" as a basis on which to run the energy saving program. All cost saving information is provided in good faith, 'without prejudice' but is not guaranteed.

Ultralite™

Advanced Solutions



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