

Advanced thermal
management solutions for
**Petrochemical
and Refinery
Processes**

Enabling sustainability and
safety of people and processes

Petrochemical and Refinery

We manufacture high-performance engineered thermal management solutions. We are a reliable and trusted partner. Our solutions reduce energy by 20%, extend lining service life, and deliver the transition to a low-carbon environment.

Demanding environments and processing equipment in the Petrochemical and Refinery industry require thermal management and passive fire protection products and systems designed and developed specifically for these harsh conditions - that's where we come in.

With our applications engineering experts and through our collaborative relationship with industry leaders, from licensors to OEM to plant managers to end users across the globe, we develop and design solutions to help improve the efficiency of processes by reducing energy consumption, CO₂ emissions, operating costs and extending the service life of your operations.

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Thermal Ceramics

We innovate to meet the challenges of a changing world



Safe and Reliable Products

Our products and systems protect lives and processes 24 hours a day and 365 days of each year.



A Truly Global Footprint

We have operations on 5 Continents and in 30 Countries to efficiently serve our Customers.



Commitment to Innovation

Our R&D and Engineering teams collaborate to create innovative market solutions that meet evolving low-carbon and technical demands.



Trusted Engineering Services

Our global resources and dynamic engineering services efficiently support our Customers application demands.

www.morganthermalceramics.com

#wearemorgan

The Thermal Ceramics business of Morgan Advanced Materials makes advanced ceramic products and systems for thermal insulation in high temperature environments. We engineer products and systems for equipment in demanding applications and for the safety of people.

Our solutions help customers, especially those operating energy intensive processes, to reduce energy consumption, emissions and operating costs. Our core strength is our ability to address individual customer challenges, using our materials and our applications expertise to design, manufacture and install optimum thermal solutions.

What we do in Petrochemical and Refinery industries

Thermal Ceramics makes reliable refractory and insulation lining solutions for the global petrochemical industry. Our materials are specified and chosen to fulfill critical applications onshore and offshore in exploration, drilling and downstream processing. From protecting the employee during pre-installation and post-installation to maintaining safety with improved thermal performance, we offer reliable solutions and applications engineering for a turn-key project.

It is the resistance of our materials to chemical and physical wear, corrosion and extreme heat that makes them ideally suited for use in these severe-duty applications. Our solutions offer:

- Extensive experience for lining development and optimisation of: Ethylene Crackers. Primary and Secondary Reformers. Boilers and Pressure Vessels. Reactors, including SRUs and FCCUs.
- Manufacturing products for a wide range of temperatures up to 1650°C (3000°F) and thermo-physical properties: fibre materials (blanket, modules, boards, etc), castables, insulating firebricks, structural insulation, microporous etc.
- Dedicated teams of experienced engineers and Project Managers for a smooth execution of projects.
- 50 years of successful references.

Sustainability and Reliability

are at the centre of everything we do



We realise that our clients need reliability, they need solutions that will perform and will last. In addition to the operating and technical requirements, we also recognise that our solutions have to be sustainable.



We take sustainability seriously in all aspects, from ethics and fair behaviour to health and safety compliant materials to minimisation of environmental impact.

Health & Safety is our first priority, as it is for our clients. We are continuously investing in new products that are not hazardous and that can perform in the applications that we serve.

We have in our portfolio, **Superwool® XTRA**, a low biopersistent potassium alkali silica fibre classified at 1450°C (2642°F) that can reliably operate at high temperatures, up to 1300°C (2372°F). It has been successfully used in several ethylene crackers and primary reformers since 2015.



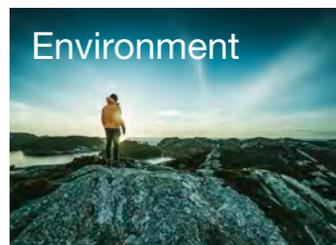
Ethics

1. Full control of the supply chain and qualification of our vendors
2. Respect of local legislation and setting global EHS standards
3. Lining materials have a negative carbon footprint across their life cycle
4. Committed to create a great workplace for our People and be fair to them



Health & Safety

1. Creating safer workplaces for personnel and our contractors
2. Reduce health risk exposure of the personnel
3. Extensive and consistent R&D activities on new, H&S compliant lining materials and systems



Environment

1. Maximise your energy efficiency
2. Contribute to reduce your CO₂ emissions
3. Committed to continuous reduction of waste, water, energy and emissions intensity in our facilities
4. Providing heat containment solutions for the electrification process

Our thermal efficiency and CO₂ calculator

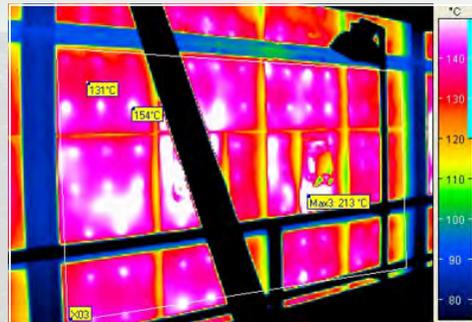
Morgan has developed a Thermal Efficiency and CO₂ Emissions Calculator (TECE) for this purpose. It provides a simplified total client's cost comparison of various lining solutions, considering Materials and Installation Price, Insulation Efficiency, Heat Storage and Cost of Energy and CO₂ Emissions over the expected lifecycle of the lining system, estimating the 'Total True Cost' over the entire Service Life and enables a 'Payback Period' to be calculated for each lining solution.

Case Study

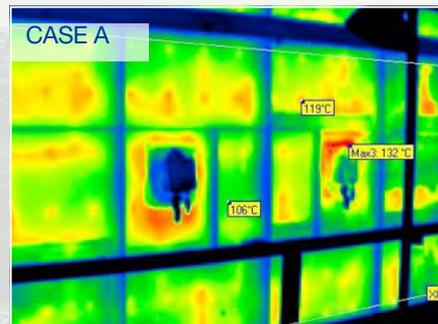
Ethylene cracker challenge for performance improvement

Challenge

- Client had issues with the lining performance of the old ethylene crackers experiencing high casing temperatures reducing the safety conditions for operators and generating undesired excessive heat losses through the casing.
- Existing lining of the old units was 200mm only (175mm conventional fibre modules 160kg/m³ + 25mm blanket 128 kg/m³).
- Preference was not to increase the thickness of the lining to avoid relocating the burners.



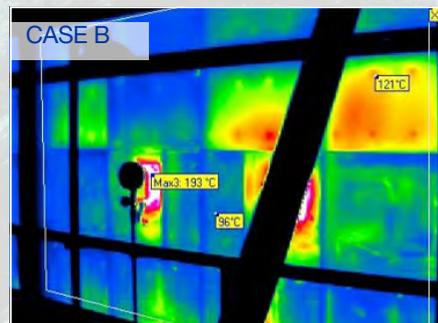
Existing Lining 123°C (253°F)



New Lining 104°C (219°F)

Operating conditions

- Operating temperature up to 1200°C (2192°F).
- Metallic elements of the fibre modules lining system to operate at a safe temperature.



New Lining with Microporous 82°C (179°F)

Solution

To maximise the lining performance without increasing the lining thickness, we suggested using high-density Pyro-Bloc modules with microporous as backup. The Client wanted to prove the benefit of microporous and decided to use it as backup in one unit first (case B) to compare it with blanket insulation (case A).

CASE A	
Hot Face	175mm, 240kg/m ³ density Pyro-Bloc Modules 1430°C (2606°F)
Backup	25mm, 128kg/m ³ density Cerablanket 1260°C (2300°F)
CASE B	
Hot Face	175mm, 240kg/m ³ density Pyro-Bloc Modules 1430°C (2606°F)
Backup	25mm, 300kg/m ³ density WDS Board 1000°C (1832°F)

Infrared pictures taken during the operation of the units are shown on the left, where the superior performance of CASE B using microporous is proven. The Client was very pleased with the performance of relined units and decided to use microporous as backup in the lining design of all the remaining furnaces to be revamped.

Lining features during Installation

Our WDS microporous technology allows us to provide excellent handling properties and products are easy to install, including eventual cutting and shaping.

Impact and value to the Customer

Health & Safety benefits of the chosen materials:

- Lower casing temperature providing safer workplace for operators

Technical benefits:

- Improved lining performance with reduced heat losses and fuel consumption
- Same thickness has been maintained, avoiding an expensive relocation of the burners
- Easy installation and maintenance

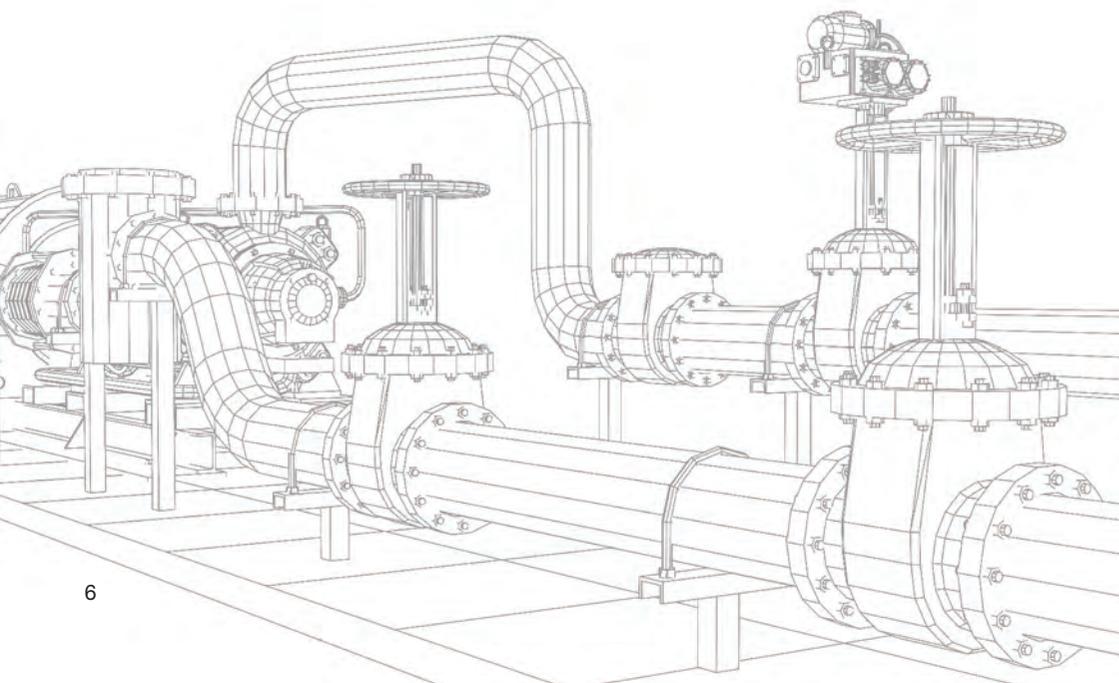
Products, Systems and Engineering Services

for Petrochemical and Refinery processes

Thermal Ceramics is a complete solution provider for your Petrochemical and Refinery equipment processes.

- Emissions reduction - our specialised products portfolio brings reduced energy consumption, environmental emissions and operating costs.
- Trusted and reliable engineering competencies - to provide state-of-the-art solutions for your bespoke application.
- Product portfolio - where processes require thermal management solutions up to 1650°C (3000°F).

Using our matrixed thermal insulation portfolio, our technical experts can develop a bespoke solution for your needs, budget and logistics. By selecting the appropriate products for your project and combining them in the most efficient manner, enables the required performances whilst achieving optimum cost-effective solutions.



Benefits of partnering with Thermal Ceramics

Our engineering capabilities and product portfolio allow Morgan to be your complete solution provider.

Engineering

Matrix of subject matter experts with more than 120 years of combined experience to support our customers ambition to reduce emissions and improve overall performance of their processes.

Material supply and installation

Process demands for efficient design and material selection are required to achieve optimal thermal performance. Partnering with the reliable and trusted installation teams while providing on-site support to deliver these performance requirements.

InfraRed analysis and thermal efficiency studies

Partnering with plant managers and maintenance teams to analyse the opportunity for improved design or materials to deliver improved thermal management and reduce energy loss.

Engineering services and capabilities

1. 2D and 3D CAD modelling
2. Operational analysis and heat flow calculations
3. Maintenance optimisation analysis, combining operation improvement with easier, faster maintenance activities and shorter turnaround
4. Project management
5. Supervision and installation advisory
6. Failure analysis
7. InfraRed surveys, thermal efficiency analysis and CO₂ emissions comparison

Primary heat containment solutions, benefits, features and typical application areas

We manufacture high-performance solutions, providing trusted and reliable materials for Petrochemical and Refinery applications in Fired Heaters (e.g. ethylene crackers), Sulphur Recovery Units (SRU), Fluid Catalytic Cracking Units (FCCU). Newly developed and long-track record and specified for many years.

IFBs



Critical elements to consider

- Shelf supports
- Proper lining design needed (expansion joints)

Main benefits and features

- No water content
- High insulating value
- Medium weight constructions
- Good flame erosion resistance
- Good thermal shock resistance at high temperatures
- Long lifecycle

Typical application areas

- Floors: Very good (hot-face with HDFB)
- Walls: Very good
- Roof: Possible
- Convection section: Good (care during transportation)

Monolithics



Critical elements to consider

- High water content (dry out required)
- Water quality and temperature sensitive during installation
- Anchors (metal or ceramic) close to the hot-face
- Heavy construction

Main benefits and features

- Good insulating value
- Gun and cast applications
- Rapid Fire Technology
- Excellent abrasion resistance

Typical application areas

- Floors: Good (easy construction)
- Walls: Possible
- Roof: Possible
- Convection section: Very good
- Vessels: Very good

Fibre Modules



Critical elements to consider

- Flame impingement can cause high shrinkage and erosion
- Likely to need replacement if water soaked

Main benefits and features

- No water content
- Very high insulating value
- Light weight construction
- Good laminar flow erosion resistance
- Excellent thermal cycles resistance

Typical application areas

- Floors: Possible (only in areas without mechanical stress)
- Walls: Very good
- Roof: Very good
- Convection section: Possible (only in areas without soot blowers / coils water cleaning)

Ethylene Cracking Furnace

our high performance products operate efficiently in the most demanding of environments

Ethylene Cracking Furnaces operate in critical conditions and need to withstand high operating temperatures, typically from 1150°C (2100°F) up to 1250°C (2280F), with direct flame impingement on lining surface.

In such conditions, you need products with high insulating properties, spalling resistance, and good hot load properties that can last reliably for several years. In addition, the prefabrication of the units in yards and their shipment to the final destination require considerations to minimise weight while not compromising the performance. Where prefabrication occurs many months ahead of full dry-out, our Kaolite AHR, Alkali Hydrolysis preventing castables and coatings are available to mitigate potential risks.

The Thermal Ceramics portfolio includes products that are ideal in the design of the lining to suit your specific requirements and the confidence they meet API material standards.



Advantages and Benefits of Morgan Fibre, Refractory, and Microporous Products

Our Pyro-Bloc® Modules and Blanket Modules, Pyro-Fold™ and Pyro-Stack™, are ideally suited and specified for ethylene crackers. Our newest innovation, Superwool® XTRA has proven performance in walls and the convection section.

Our Module systems provide excellent thermal shock resistance, good strength, and resistances to abrasion.

Our Refractory solutions, Insulating Firebricks, JM®, K™, and TJM® and Insulating Monolithics, Kaolite® and Firelite®, are lightweight, feature low thermal conductivity bringing improved thermal management performance to the radiant and convection sections.

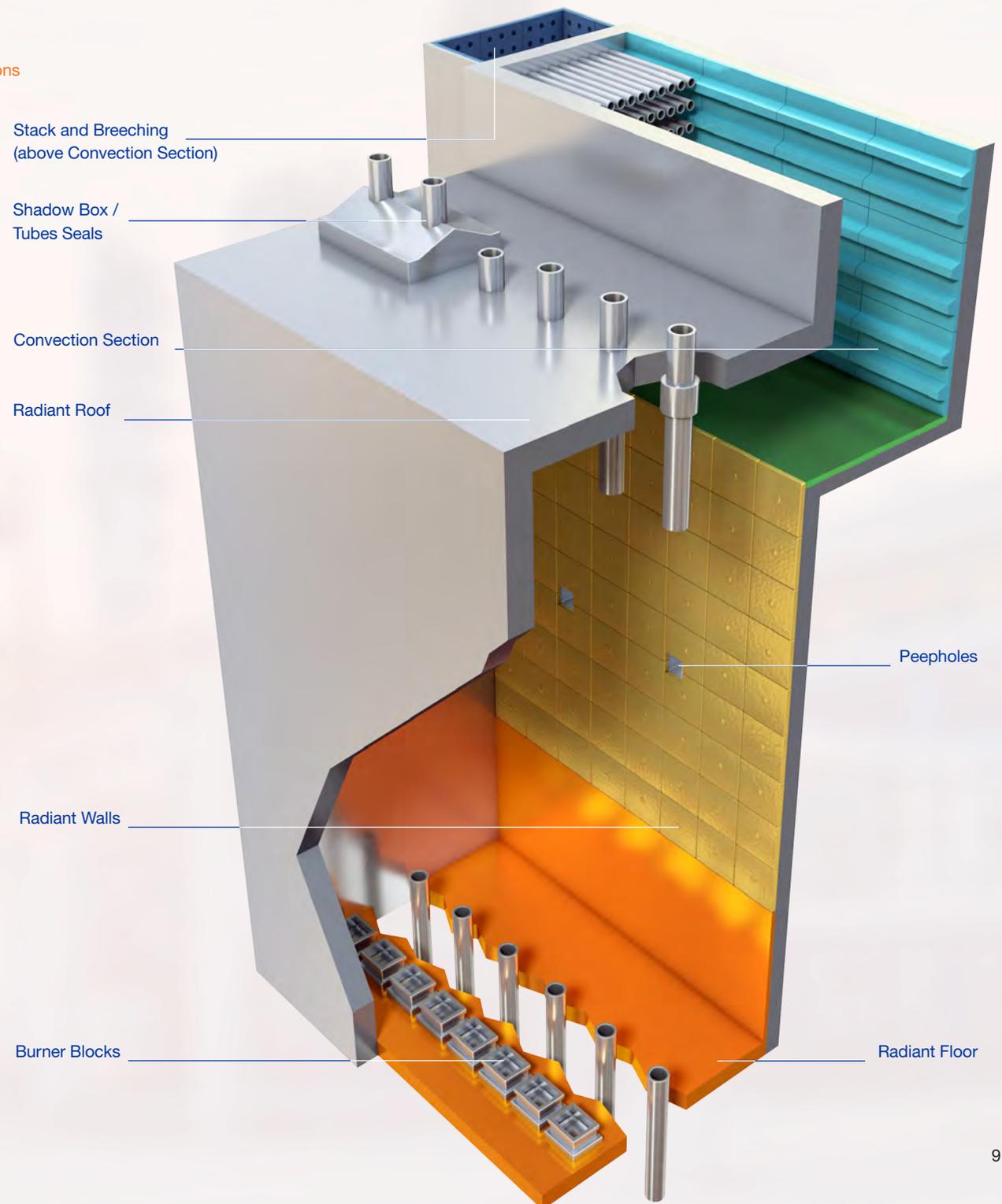
For even more thermal performance advantage, our WDS® Microporous Boards and Panels are incorporated into the backup linings in the radiant sections to improve energy performance further reducing emissions.

Ethylene Cracking Furnaces

Thermal Ceramics offers a total package of insulation linings for use in fired heaters, from the floor to the walls to the convection section to the stack and any ductwork in between.

All areas of the furnace utilise our full portfolio of high-temperature thermal management materials.

Application areas	Products used
Radiant Sections	<ul style="list-style-type: none"> • Pyro-Bloc® Modules • Firebricks and Insulating Firebricks • Insulating and Dense Monolithics • Microporous Boards and Panels
Convection Section	<ul style="list-style-type: none"> • Insulating Monolithics • Insulating Boards • Microporous Boards and Panels • Insulating Firebricks • Pyro-Bloc Modules
Stack and Breeching	<ul style="list-style-type: none"> • Insulating Monolithics
Tube Seals	<ul style="list-style-type: none"> • Fibre Shapes and Systems
Burner Blocks / Peepholes	<ul style="list-style-type: none"> • Pre-Cast Special Duty Shapes • Fibre Shapes • Insulating Firebricks • Microporous Boards and Panels



Refinery Fired Heaters and Process Heaters

fired heaters-process heaters, reformers, pyrolysis heaters

The fired heater is the 'central processing unit' in many refineries and petrochemical plants. Thermal Ceramics offers a total package of insulation linings for use in fired heaters, from the floor to the walls to the convection section to the stack and any ductwork in between.

Several other innovative products for fired heaters are also available from Thermal Ceramics like Pyro-Log™ insulation for easily applied floor insulation, high thermal efficiency microporous insulation in radiant walls and specially engineered Pyro-Bloc® and vacuum formed shapes for burner blocks and peepholes. Where prefabrication occurs many months ahead of full dry-out, our Kaolite® AHR, Alkali Hydrolysis preventing castables and coatings are available to mitigate potential risks.



Advantages and Benefits of Morgan Fibre, Refractory, and Microporous Products

Our conventional insulating materials - JM®, K™, and TJM® insulating firebrick and Kaowool®, Cerablanket fibre layered constructions, are true worldwide industry standards with more than 30 years of service.

High quality castable products such as Kaolite, Firelite®, Tri-Mor® insulating castables offer superior heat savings and long service life in heater floors, walls, convection sections, ductwork and stacks.

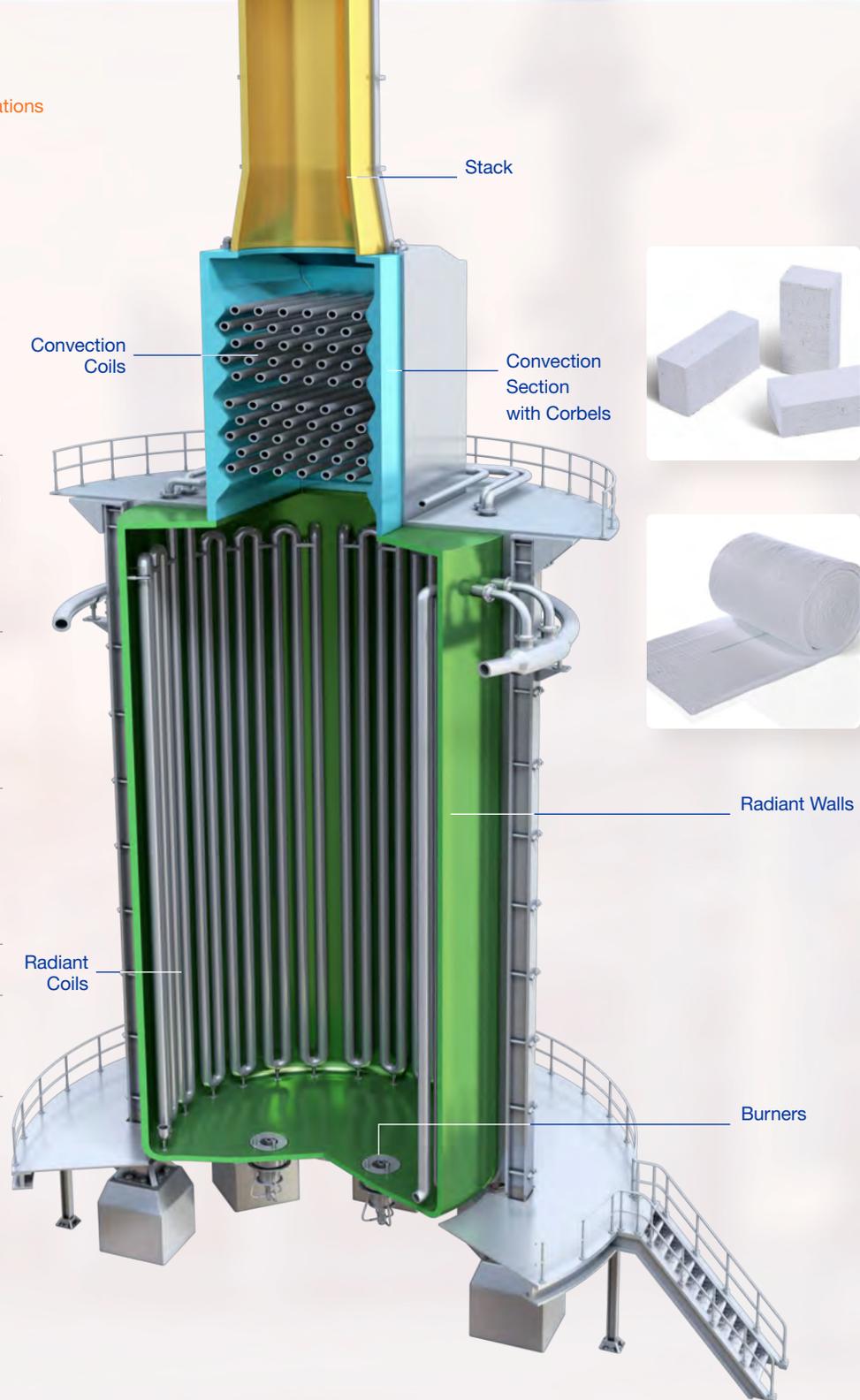
Easy-to-install insulation designs like Pyro-Bloc and our folded module systems offer an unparalleled combination of thermal efficiency and quick installation.

Several other innovative products for fired heaters are also available from Thermal Ceramics like Pyro-Log insulation for easily applied floor insulation, high thermal efficiency microporous insulation in radiant walls and specially engineered Pyro-Bloc and vacuum formed shapes for burner blocks and peepholes.

Fired Heaters and Process Heaters

Thermal Ceramics offers a total package of insulation linings for use in fired heaters, from the floor to the walls to the convection section to the stack and any ductwork in between.

Application areas	Products used
Radiant Sections: Floor, Walls, Arch	<ul style="list-style-type: none"> • Insulating and Dense Monolithics • Pyro-Bloc® Modules and Pyro-Log™ Systems • Structural Insulating Block • Insulating Firebrick • WDS® Microporous Boards and Panels • Blankets and Fibre Boards for Layer Linings
Burner Blocks / Peepholes	<ul style="list-style-type: none"> • Insulating and Dense Pre-Cast Monolithic Shapes • Insulating Firebricks and Shapes • Fibre Shapes • Pyro-Bloc Module Systems
Convection Section	<ul style="list-style-type: none"> • Insulating Monolithics • Structural Insulating Block • Pyro-Bloc Module Systems • Blankets and Boards for Layer Linings • Insulating Firebricks
Tube Seals	<ul style="list-style-type: none"> • Textile Engineered Systems
Corbels	<ul style="list-style-type: none"> • Insulating Monolithics • Pyro-Bloc Module Systems • Insulating Firebricks
Stack and Breeching	<ul style="list-style-type: none"> • Insulating and Dense Monolithics



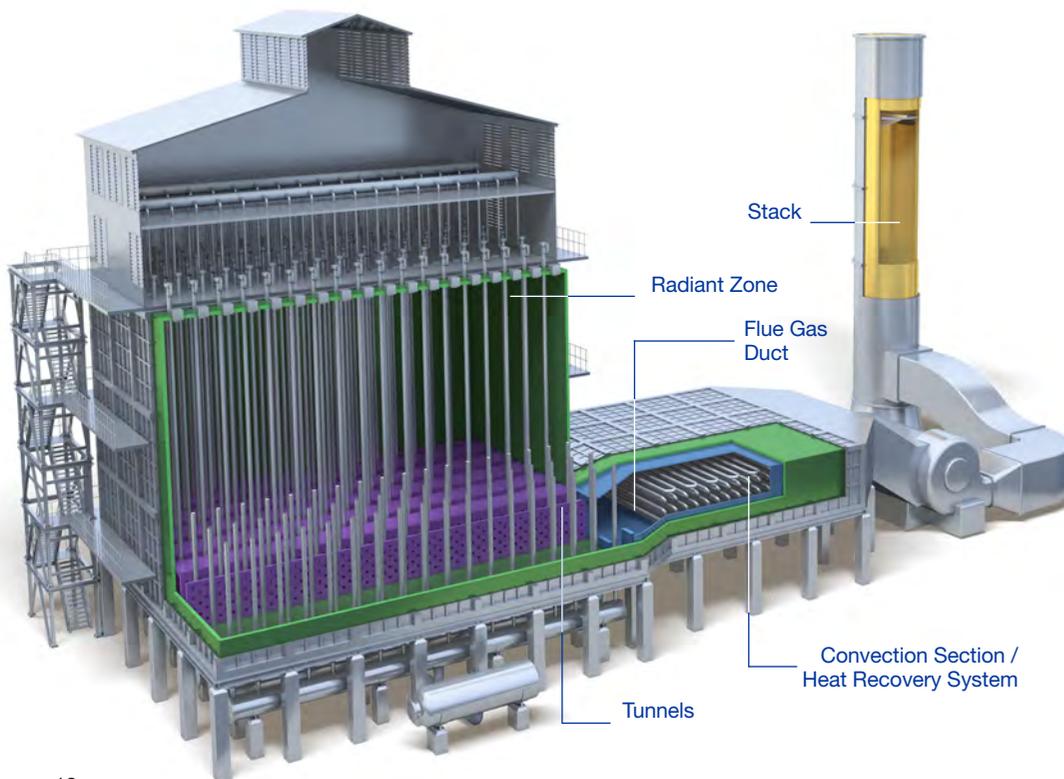
Primary and Secondary Reformers

operating at high temperatures typically up to 1150°C / 1250°C

Designs for Primary and Secondary Reformers require specific thermal and mechanical solutions and a choice of materials that can perform best considering their operating conditions.

Primary Reformers

Primary reformers are operating at high temperatures, typically up to 1150°C (2100°F) and are traditionally top-fired and wall-fired configurations.



Application areas	Products used
Radiant Sections	<ul style="list-style-type: none"> • Fibre Modules • Firebricks and Insulating Firebricks • Insulating and Dense Monolithics • Microporous Boards and Panels
Convection Section / Heat Recovery System	<ul style="list-style-type: none"> • Insulating Monolithics • Insulating Boards • Microporous Boards and Panels
Flue Gas Duct	<ul style="list-style-type: none"> • Fibre Modules • Insulating Monolithics • Insulating Boards
Tunnels	<ul style="list-style-type: none"> • Firebricks and Insulating Firebricks • Cover tiles in Monolithics
Stack and Breeching	<ul style="list-style-type: none"> • Pre-Cast Special Duty Shapes • Fibre Shapes • Insulating Firebricks • Microporous Boards and Panels

Advantages and Benefits of Morgan Fibre, Refractory and Microporous Products

The reliability of design and material selection is critical to optimal performance of the reformers, especially as most often there is only one hydrogen reformer on the plant footprint. Hydrogen transfer lines and Secondary Ammonia Reformers present very tough service conditions for refractory materials due to the high pressure and high hydrogen environments.

Our special duty monolithics, developed for harsh conditions features products like Kao-Tab™ 95 and Firecrete® 95 monolithics with a high alumina composition and our bubble alumina insulating monolithic, Kaolite® 3300 and Firelite 95.

For backup insulation where very low iron products are necessary our Kaolite and Firelite low iron (LI) monolithics are suited to do the job. In catalyst support domes and checkers, our high alumina composition SR-99™ Firebrick features ultra-high purity, excellent dimensional tolerances and fired strength.

Secondary Reformers and Transfer Lines

Hydrogen transfer lines and secondary ammonia reformers present very tough service conditions for refractory materials due to the high pressure, high-hydrogen environments. All areas of the furnace utilise our full portfolio of high-temperature thermal management materials.

Application areas	Products used
Transfer Line	<ul style="list-style-type: none"> High alumina special duty castable (Firecrete®, Kao-Tab™, Tri-Mor®) backed with high strength, low iron insulating castable (Kaolite®, Firelite®) Bubble alumina high strength insulating castable (Kaolite 3300)
Main Vessel	<ul style="list-style-type: none"> High alumina special duty castable (Firecrete, Kao-Tab, Tri-Mor) backed with high strength, low iron insulating castable (Kaolite, Firelite) Bubble alumina high strength insulating castable (Kaolite 3300)
Top of Catalyst Bed	<ul style="list-style-type: none"> High alumina tile (SR-99™, Kao-Tab 95, Firecrete 95)
Support Dome	<ul style="list-style-type: none"> High alumina dense Firebrick (SR-99)
Waste Heat Boiler	<ul style="list-style-type: none"> Bubble alumina high strength insulating castable (Kaolite 3300) High alumina special duty castable (Firecrete, Kao-Tab, Tri-Mor)



Fluid Catalytic Cracking Units (FCCU)

reliable, trusted and specified Kao-Tuff® and Kaolite® products for FCCU applications

FCCU have many different operating parameters, and thus refractory lining requirements vary throughout the entire unit.

Our insulating, dense, and special duty monolithic refractories are manufactured and tested to API refractory material standards.

High strength, high thermal efficiency Kaolite insulating monolithics are well proven for reactors and regenerators.

Kao-Tuff 110, a special-duty semi-insulating monolithic, is ideal for single component linings in spent catalyst lines, regenerated catalyst lines, riser lines, reactor vapour lines and flue gas lines. It is a best-in-class monolithic with unparalleled strength, abrasion resistance and insulating value.



Advantages and Benefits of Morgan Refractory Monolithic Products

Kaolite Insulating Monolithics are lightweight and feature low thermal conductivity, improving thermal management performance to FCCU applications.

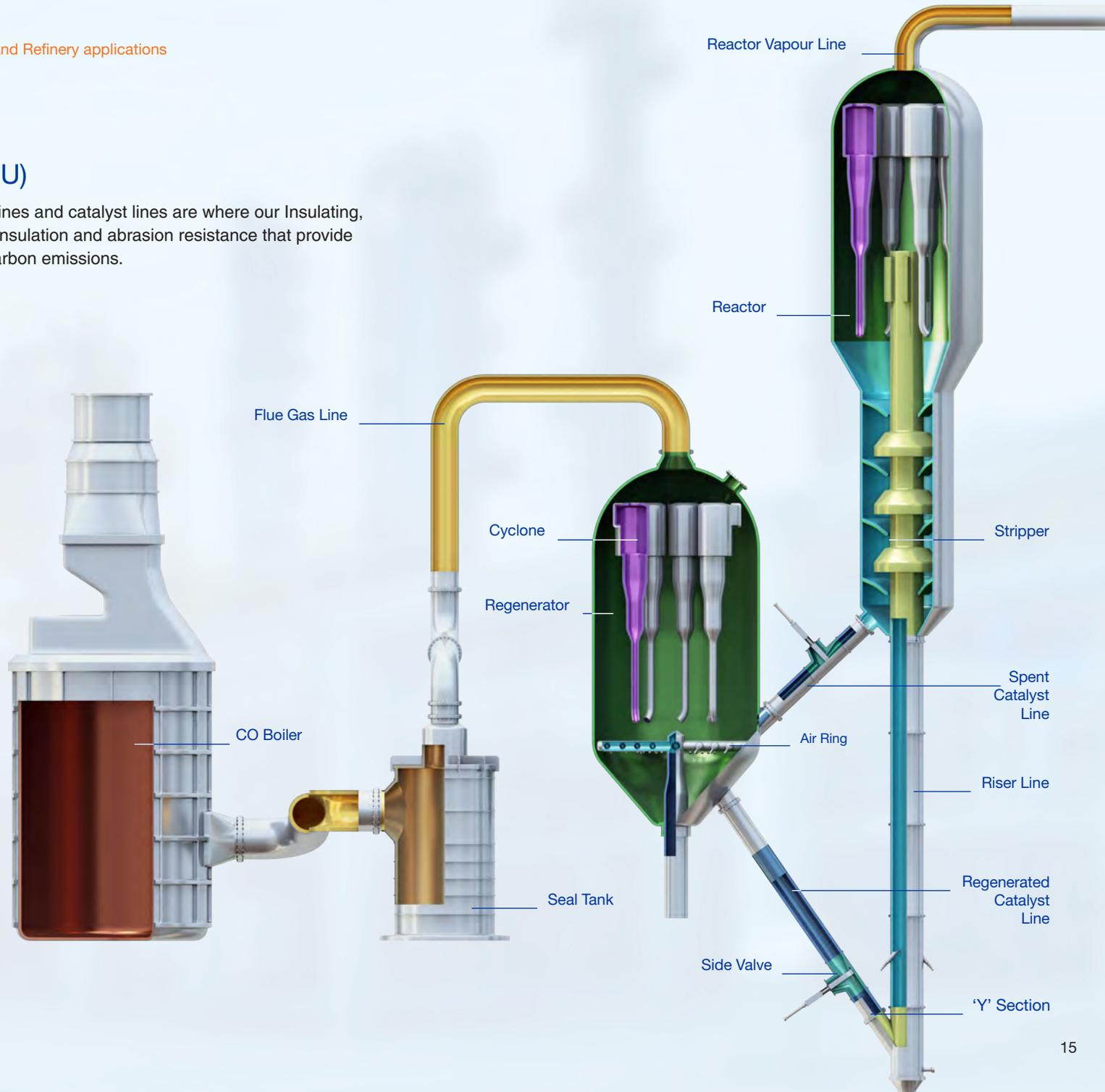
Dense and Special Duty Monolithics, Kaocrete® and Kao-Tuff, provide abrasion resistance and thermal shock resistance delivering improved operational performance in application areas of the FCCU.

Our Rapid Fire Technology (RFT) capable products offer the benefit of faster heat-ups with no holds, giving the advantage of less process downtime and increased flexibility during start-up.

Fluid Catalytic Cracking Unit (FCCU)

Vessel walls, cyclones, transfer lines, risers, flue gas lines and catalyst lines are where our Insulating, Dense and Special Duty Monolithics provide thermal insulation and abrasion resistance that provide the advantages of reducing downtime and lowering carbon emissions.

Application areas	Products used
Flue Gas Line Riser Line Reactor Vapour Line Spent Catalyst Line Regenerated Catalyst Line	<ul style="list-style-type: none"> Abrasion resistant Kao-Tuff®
Reactor Regenerator	<ul style="list-style-type: none"> High strength Kaolite® and Firelite® Insulating Monolithics
Cyclones	<ul style="list-style-type: none"> Extreme abrasion resistant Monolithics
CO Boiler Seal Tank	<ul style="list-style-type: none"> Thermal shock and abrasion resistant Kaocrete® and Kao-Tuff Monolithics
Stripper Air Ring and Slide Valve 'Y' Section	<ul style="list-style-type: none"> Abrasion resistant Kao-Tuff



Sulphur Recovery Units (SRU)

operating under severe conditions of high temperature and corrosive atmospheres

Sulphur Recovery Units (SRU) operate under severe conditions of high temperatures and corrosive atmospheric conditions.

Thermal Ceramics offers products that have exhibited long service life in standard and the more severe oxygen-rich SRU applications.

Advantages and Benefits of Morgan Fibre, Refractory, and Microporous Products

When energy savings and structural integrity are critical for optimal performance and extending service life, our SR-90™ Firebrick are ideal for the hot face use when high alumina and high hot strength are required.

Further extending these performance requirements, choosing our JM®, K™, and TJM® Insulating Firebrick or high temperature insulating castable (Kaolite®, Firelite®) as backup insulation brings an ideal combination of structural strength and low thermal conductivity.



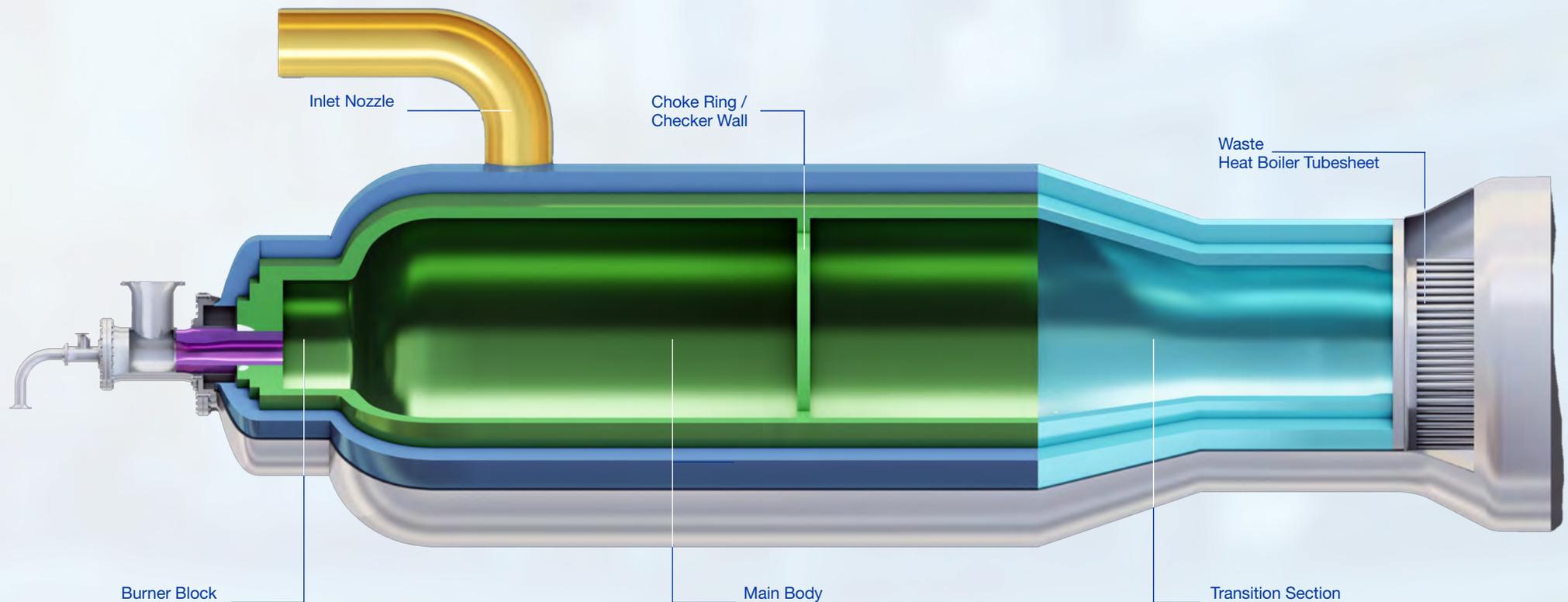
Sulphur Recovery Units (SRU)

Thermal Ceramics offers products that have exhibited long service life in both standard fired and the more severe oxygen enriched SRU applications.

Application areas	Products used
Inlet Nozzle	<ul style="list-style-type: none"> Insulating Monolithics
Burner Block	<ul style="list-style-type: none"> Dense Monolithics
Choke Ring/Checker Wall	<ul style="list-style-type: none"> High alumina, high density Firebricks

Application areas	Products used
Main Body and Transition sections present to lining options	<ul style="list-style-type: none"> High Alumina Firebricks backed up with high-temperature IFBs or Insulating Monolithics Dense high alumina Monolithics backed up with a high strength, low iron Insulating Monolithics

Application areas	Products used
Waste Heat Boiler Tubesheet	<ul style="list-style-type: none"> Dense high alumina Monolithics Bubble Alumina Insulating Monolithics Ferrules wrapped with Kaowool® Paper



Fire Protection for Petrochemical and Refinery

developed to meet industry needs for high quality, reliable, true fire protection materials

Thermal Ceramics FireMaster® line of products are dedicated to the fire protection market.

These products were developed to meet industry needs for high quality, reliable, true fire protection materials. FireMaster systems provide fire protection for:

- Cable Trays
- Pipework, tanks and Vessels
- Valves, actuators and flanges
- Fire Divisions and Structural Steel

The products used in these fire protection applications meet strict manufacturing tolerances and rigorous quality control inspections in order to ensure conformance and certification capability to national testing laboratory standards.

Instrument Cable Tray Fire Protection

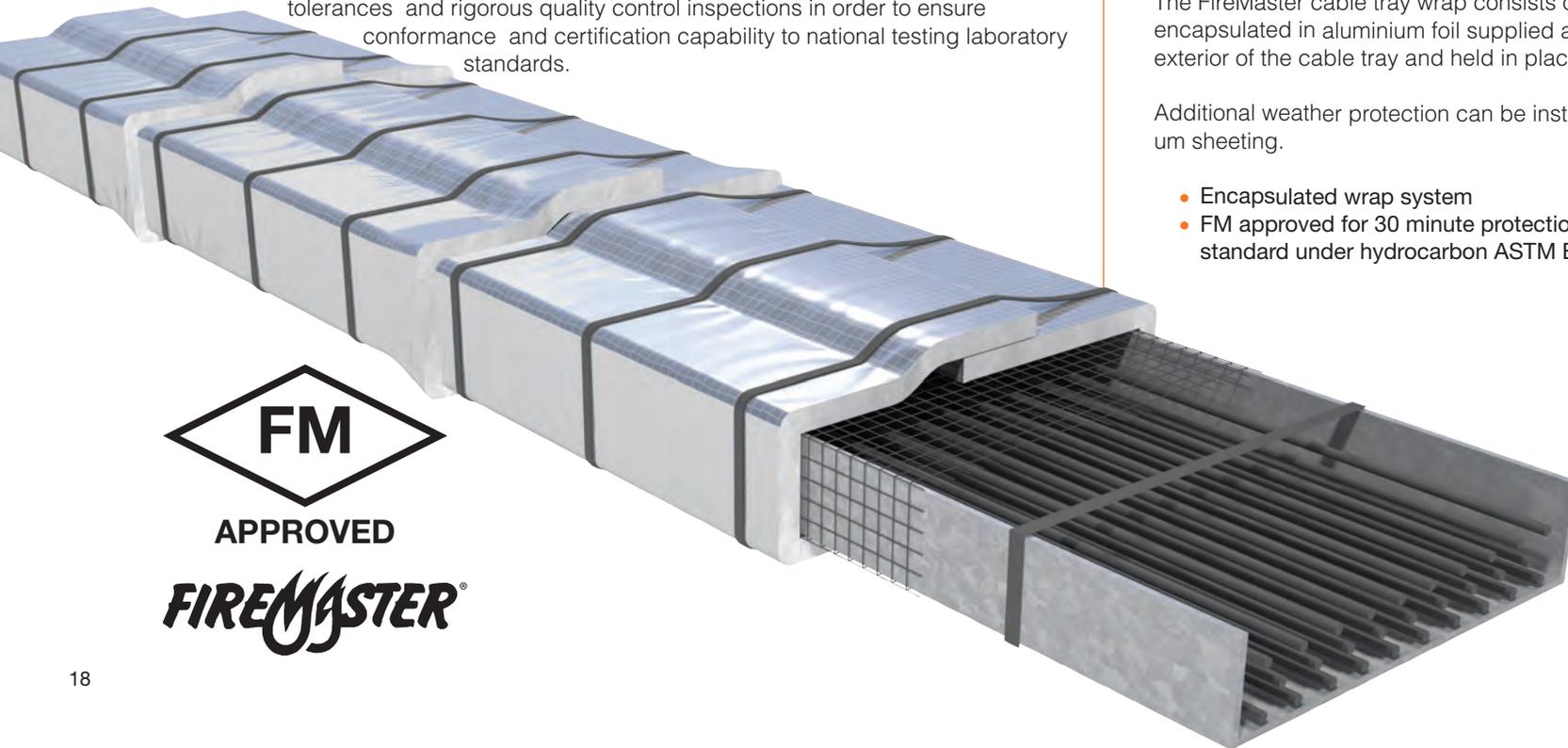
FireMaster Cable Tray system is a fully encapsulated flexible wrap system specifically designed to protect instrument and control cable trays against hydrocarbon fires to ensure that the cables can operate long enough to allow process shut down during fires. The system has been installed in chemical process plants worldwide tested to the stringent ASTM E-1725 method.

The FireMaster cable tray wrap system provides 30 minutes hydrocarbon fire protection to cable trays carrying control cable wiring.

The FireMaster cable tray wrap consists of FireMaster Marine Plus blanket fully encapsulated in aluminium foil supplied and in a roll form. It is wrapped around the exterior of the cable tray and held in place with steel banding straps.

Additional weather protection can be installed if required using corrugated aluminium sheeting.

- Encapsulated wrap system
- FM approved for 30 minute protection of cable trays to ASTM E-1725 test standard under hydrocarbon ASTM E-1529 fire conditions



Pipes and Vessels

Thermal Ceramics FireMaster® Marine Plus blanket is applied to process vessels (flare drums, separator vessels etc) to ensure they retain structural integrity in hydrocarbon pool or impinging jet.

The system uses a substrate of wire mesh fixed to the vessel, with strands of the mesh cut to form anchor pins over which the FireMaster blanket is impaled. The mesh is fixed to the vessel by twisting adjacent sheets together, an important feature as welded fixings are not allowed.

- Process vessel protection against hydrocarbon or jet fires
- Non welded fixing system protection

The FireMaster pipe fire protection system offers up to up to 200 minutes in hydrocarbon fires according to the EN13381-4 standard, the same system is also fire tested against jet fires of 60 minutes duration to the ISO 22899-1 fire test standard.

To provide protection against the impinging jet, or combined with our microporous insulation solutions allow maximum flexibility in optimising cost and space and meeting varying pipe critical temperature limits up to 180 minutes jet fire protection.

Additional hydrocarbon fire testing to EN 1338-4 for up to 200 minutes accommodates combined jet and hydrocarbon pool fire scenarios.

The system has been tested at DNV-GL Spadeadam for explosion resistance up to 0.5 bar overpressure.



FIREMASTER

JetWrap System

The FireMaster FlexiJet system is a flexible jacket system comprising FireMaster Marine Plus blanket, temperature resistant textiles and a weather resistant outer textile material.

It is used for the fire protection of structural items such as steel pipes or structural steel against jet fires. Flexible systems are lighter in weight than rigid enclosures and typically used where regulations do not require metallic enclosures to be fitted but an easily removable system is still desired.

- Jet and Hydrocarbon fire protection of pipework
- Tested to ISO 22899-1 standard
- Simple system with a choice of 2 grades of steel cladding
- Flexible jacket version available

Valves, Actuators and Flanges

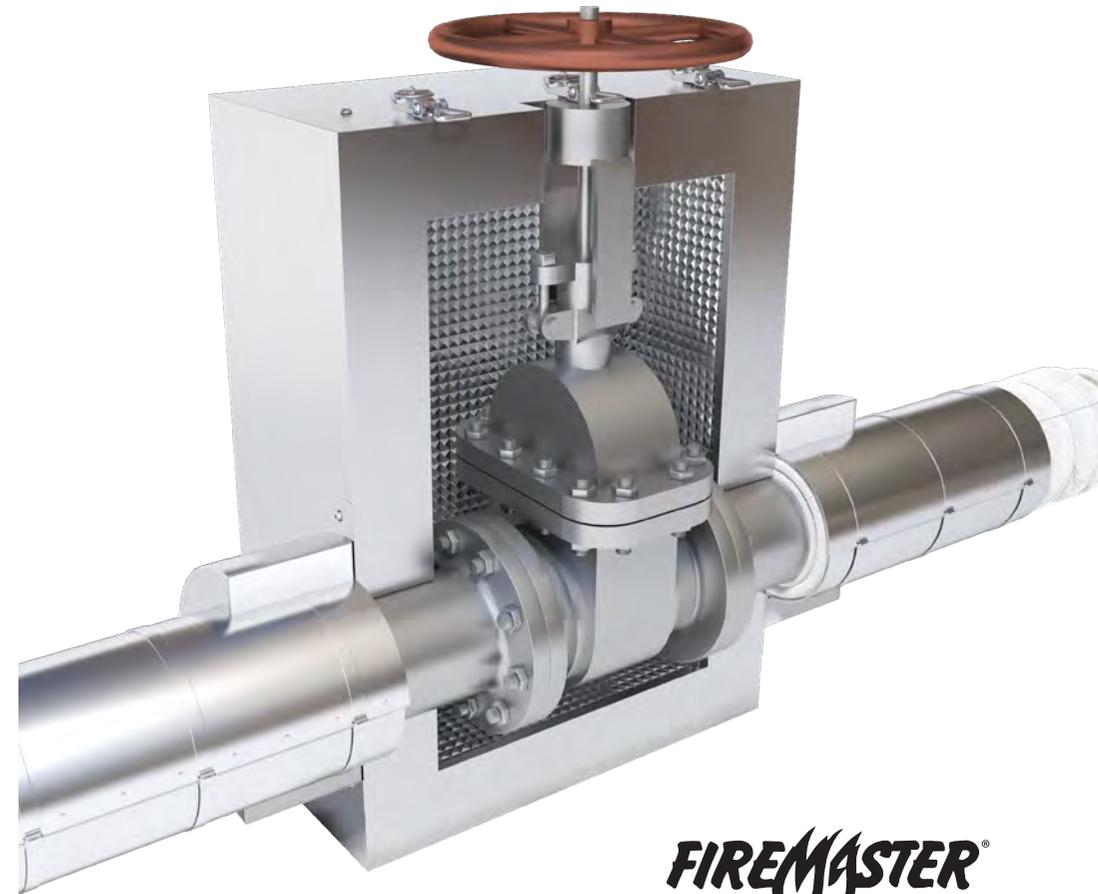
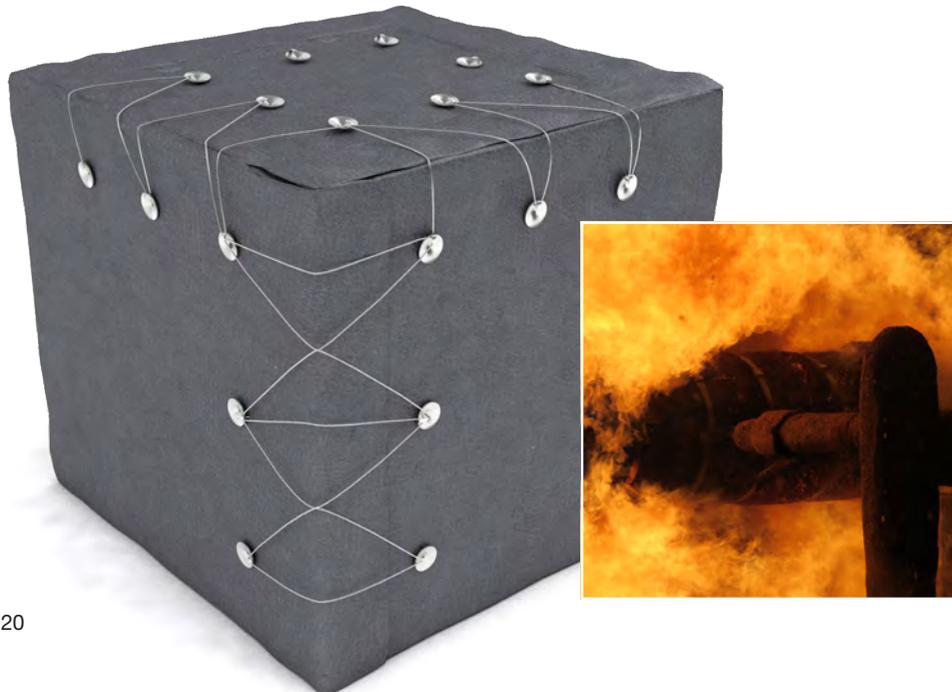
Flexible Enclosure System (FES)

The FireMaster® Flexible Enclosure system is specifically designed to provide high performance jet fire protection, especially for vulnerable equipment with low critical temperature limits.

Flexible systems are lighter in weight than rigid enclosures and typically used where regulations do not require metallic enclosures to be fitted but an easily removable system is still desired.

FireMaster FES contains low thermal conductivity FireMaster XLS blanket and flexible microporous insulation in an outer layer of weather and jet-fire resistant fabric. The use of a special fabric avoids the need for rigid metal meshes or foils in the jacket, improving ease of installation.

The system is Lloyds Register Certified for protection of pipes for jet fires of up to 150 minutes duration and for fire barriers, vessels and enclosures incorporating edge details for jet fires up to 175 minutes duration.



FIREMASTER®

Rigid Enclosure System (RES)

The FireMaster Rigid Enclosure System consists of a stainless steel enclosure incorporating our high performance FireMaster insulation products.

We offer jet fire protection of valves, actuators and pipe flanges to ISO 22899-1 standard for up to 60 minutes and hydrocarbon fire protection (UL-1709) for up to 120 minutes.

Very low critical temperature items can be insulated due to the high performance insulation used in the enclosure.

The FireMaster RES is custom-manufactured in sections designed to fit around the item needing protection and can incorporate water drain and inspection hatch features if required.

The system has been tested at DNV-GL Spadeadam for explosion resistance up to 0.5 bar overpressure.

Fire Resisting Divisions

There is a full range of FireMaster® fire protection solutions for modular buildings within petrochemical and refinery environments.

FireMaster Marine Plus fire division systems

Low weight, easy installation and density as low as 48kg/m³ ensures suitability in vessels where the weight of construction materials is critical, or for structures where topside weight must be minimal.

Certified for A, H and JF class by DNV and LR.

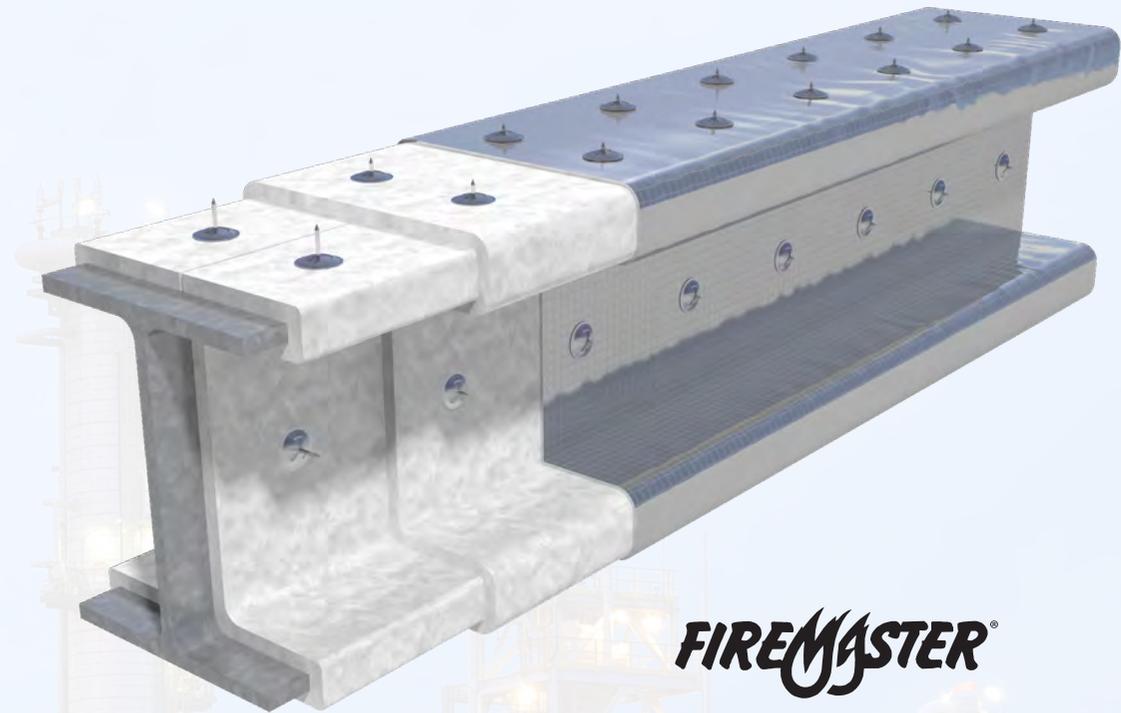


FireMaster Marine Plus blanket

A flexible material which wraps around the structure to allow the easy insulation of even complex shapes without the need for excessive cutting of the blanket or extra supporting anchoring. Saving both installation time and material wastage.

FireMaster XLS blanket fire divisions

The latest lighter weight evolution of FireMaster Blanket with time and space saving solutions for modular buildings fire protection.



Structural Steel Fire Protection

Two systems to satisfy all requests.

Traditional Spray Fire resistive material, FireMaster FB100 is UL listed to provide up to 4 hours of protection following UL1709.

Dry system using FireMaster blanket products provide fire insulation to steel beams and columns to ensure they maintain load-bearing capacity in a fire, thus preventing collapse of the structure they are supporting.

Traditionally, fire insulation is required to ensure the steel temperature does not exceed 550°C (1022°F), the point at which steel retains 60% of its room temperature structural strength.

However, different maximum temperatures are often specified, taking into account temperature profile and load on the sections. Critical temperatures ranging between 400°C (752°F) and 620°C (1148°F) are common, with 400°C (752°F) widely used in the offshore industry.

- Fast and simple to install using welded pins
- Ideal for complex shapes with low waste due to minimal cutting to fit complex structures

Partnering with us

We are the partner of choice for the petrochemical and refinery sectors. Working with us, customers are able to push the boundaries of performance without compromising safety, heat or weight management.

Our custom solutions are developed using our patented Superwool® Fibre, WDS® Microporous materials, JM®, K™, TJM® IFBs and FireMaster® products.

These technologies help designers achieve optimal thermal management and passive fire protection, throughout petrochemical and refinery installations.



Thermal Ceramics offers products and engineered systems for high-performance fire protection applications in a wide variety of industries world-wide

Benefits of partnering with Morgan

Harnessing our world-class design expertise and specialist manufacturing capabilities, we work in partnership with some of the world's largest petrochemical and refinery suppliers, developing competitive tailored solutions to meet the increasingly challenging demands of the sector. We are the forefront of technology helping manufacturers improve safety, performance, energy efficiency.

- **Research and development**
A dedicated team focused on innovating within the petrochemical industry, developing superior materials which excel in real-world applications.
- **Global manufacturing**
Operations on five continents, where we collaborate with customers and deliver solutions in region to support the 'just in time' manufacturing model.
- **Supporting the reduction of carbon dioxide**
Innovative solutions, designed and engineered to drive a reduction in emissions.

Our expanding clean energy solutions

Our new ceramic materials for customers producing solar panels support the latest generation of production technology. In addition we are developing brushes that provide longer lifetimes and higher current carrying capability to support the next generation of wind turbines.

We support the EV market with alumina seals and bearings for cooling pumps which are produced to fine dimensional tolerance, improving efficiency and minimising pump noise. Our thermal insulation Superwool® is used in heat recovery steam generators, fuel cells, and energy storage walls to improve energy efficiency.



Together, we are working to reduce our environmental impact...

...together, we are working to deliver robust environmental, social & governance (ESG) practices, and together, we have defined **five** environmental, social, and governance (ESG) improvement objectives and targets to improve our performance as a Group:

Reduce our environmental impact



- 1 Our aspiration is to be a CO₂ net zero business by 2050.
Our 2030 target is to reduce our scope 1 and scope 2 CO₂ emissions by 50% (from a 2015 baseline).
We will start to measure scope 3 emissions from 2023 onwards, with coverage increasing over time.
- 2 Our aspiration is to use water sustainably across our business.
Our 2030 target is to reduce our overall water usage by 30% and reduce our water usage in high stress areas by 30% (from a 2015 baseline).



Improve our safety performance

- 3 Our aspiration is to create an environment and culture with zero harm to our employees.
Our 2030 target is a lost time accident rate below 0.1 (lost time accidents per 100,000 hours worked).



Improve the diversity and inclusion of our business

- 4 Our aspiration is that our employee demographics reflect the communities that we operate in.
Our 2030 target is for 40% female representation across our leadership population of our organisation.
- 5 Our aspiration is a welcoming and inclusive environment where our employees can grow and thrive.
Our 2030 target is to attain a top quartile employee engagement score.

For more information please visit: www.morganthermalceramics.com/sustainability-responsibility
#wearemorgan

Morgan Advanced Materials

Significant trends shape our modern world, accelerating the demand for new and more sustainable advanced materials.

At Morgan Advanced Materials, we use advanced carbon and ceramics materials to support the move to a more sustainable world. Our people are driven to solve complex customer problems: from managing heat and enabling greener technologies, to supporting improved medical diagnostics and protecting life.

Our purpose is 'to use advanced materials to make the world more sustainable, and to improve the quality of life'. This purpose is underpinned by our safe, ethical and inclusive culture, embraced by our 7,800 employees spanning over 25 countries. Working across many industries and in a number of markets, we deliver the materials science and technologies the world needs now.

Our Strategy

We are a global advanced manufacturing organisation with leading capabilities in three areas: materials science, application engineering and customer focus.

Our Business Model

We operate as two global divisions and five global business units. We empower our global business unit teams, giving them considerable autonomy and enabling them to act quickly and support their customer needs. Our broad manufacturing footprint enables us to supply customers locally from a short supply chain.

www.morganthermalceramics.com
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