

Advanced thermal
management solutions for

Heat Recovery Steam Generator Applications

Enabling **sustainability** and
safety of **people** and **processes**

> **Energy**

HRSG applications

Insulation can play a significant role in the reduction of heat loss from power plants. Even a small gain in thermal efficiency can save millions of dollars in fuel costs over the life of an installation.

Thermal Ceramics advanced thermal insulation materials help heat recovery steam generation (HRSG) plants to make significant reductions in energy losses.

Our high performance products offer lower thermal conductivity and longer operational life than any other competing insulation materials. The Superwool® insulating fibre range of materials for HRSG applications includes Superwool Plus fibre, a high thermal efficiency blanket, and Pyro-Bloc® monolithic fibre modules for wide ranging applications in boilers, ductwork, auxiliary burners and acoustic applications in silencers.

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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.

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 the Heat Recovery Steam Generator industry

The Heat Recovery Steam Generator (HRSG) is a demanding environment. Insulation materials must be able to retain their strength and resistance to erosion, even in very high temperature conditions, and high velocity gas turbulence.

A hot spot caused by insulation deterioration in a stack or boiler can result in a forced stop, days of downtime and loss in the power supply. Thermal Ceramics has more than 25 years' experience in the design and delivery of thermal insulation systems. Our products help power plants all over the world to make vital improvements in efficiency through reduced energy loss.

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:

- Engineered solutions of rigid, flexible or panel systems.
- Low thermal conductivity, exceptional thermal efficiency, high compressive strength, low weight and low shrinkage at high temperatures.
- Dedicated teams of experienced engineers and Project Managers for a smooth execution of projects.

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High Efficiency Thermal Insulation

for Heat Recovery Steam Generator applications

Thermal Ceramics advanced thermal insulation materials help heat recovery steam generation (HRSG) plants to make significant reductions in energy losses.

Our high performance products offer lower thermal conductivity and longer operational life than any other competing insulation materials. The Superwool® insulating fibre range of materials for HRSG applications includes Superwool Plus fibre, a high thermal efficiency blanket, and Pyro-Bloc® monolithic fibre modules for wide ranging applications in boilers, ductwork, auxiliary burners and acoustic applications in silencers.

Superwool Plus insulating fibre

a high temperature low-biopersistent insulating material that provides excellent insulation in applications up to 1200°C (2192°F).

- Up to 20% more thermally efficient than competing products
- High fibre index (65%) for exceptional strength and durability
- Light-weight and flexible for easy installation

Pyro-Bloc modules

Made from Pyro-Log™ Superwool in edge-grain orientation offer high temperature insulation.

- Modular format for rapid, cut-to-fit field installation
- Resilient and compressible during installation but hardens upon exposure to working temperatures
- Durable for long service life in harsh conditions
- Excellent resistance to high velocity gas turbulence up to 45m/s (148ft/s)

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

The insulation challenges within Heat Recovery Steam Generator applications and the solutions we offer

We manufacture high-performance solutions, providing trusted and reliable materials for Heat Recovery Steam Generator applications. Newly developed and long-track record and specified for many years.

Insulation CHALLENGE:

The need to minimise heat loss in an HRSG boiler operating at temperatures up to 1000°C (1832°F), in order to reduce energy costs. The thermal efficiency of a traditional low-biopersistence insulation blanket is limited by its fibre index, which is typically about 40-45%.

Insulation CHALLENGE:

Noise and vibration damage causes breakdown of the acoustic insulating material used in the hot silencer and stacks. Bigger, better turbines produce hotter exhaust gases. Under long-term exposure to these higher temperatures, the traditional wool fibre insulation blankets used on hot silencers and stacks tends to break down. As a result, they become vulnerable to vibration damage; the acoustic properties degrade and the material weakens and may collapse.

Insulation CHALLENGE:

The possibility of hot spots in the HRSG boiler lining caused by erosion of the insulation blanket under harsh conditions of high gas velocity 20-30m/s (66-98ft/s) and high temperatures 600 - 700°C (1112 - 1292°F). Traditionally, a stainless steel shroud is installed as a lining to protect the boiler insulation from direct contact with the high velocity gas. This is expensive and requires the use of steel studs, which transfer heat and vibration to the boiler casing.

Morgan Thermal Ceramics SOLUTION:

Tests in HRSG steel liner construction have shown that the normal insulation performance can be achieved easily using only 80% of the normal insulation thickness.

This allows the duct walls to be reduced in thickness saving costs in the steel mounting studs and, more importantly, allowing the HRSG panels to be shipped more efficiently. Superwool® Plus is set to become the new standard for insulating HRSG ductwork.

Morgan Thermal Ceramics SOLUTION:

Thermal Ceramics high performance insulation Superwool Plus insulating fibre performs well in high temperature, high vibration conditions.

It is able to provide much better long term acoustic insulation than traditional wool fibre materials with the virtual elimination of large shot particles resulting in an improved fibre network of 30% more fibre providing higher tensile strength.

Morgan Thermal Ceramics SOLUTION:

Thermal Ceramics high performance insulation Pyro-Bloc® modules can withstand higher gas velocities than other insulating materials, thanks to their unique interlocking fibre construction which hardens on exposure to working temperatures.

The Pyro-Bloc modules minimise the number of joints and allows for compression of the module in all directions during installation.

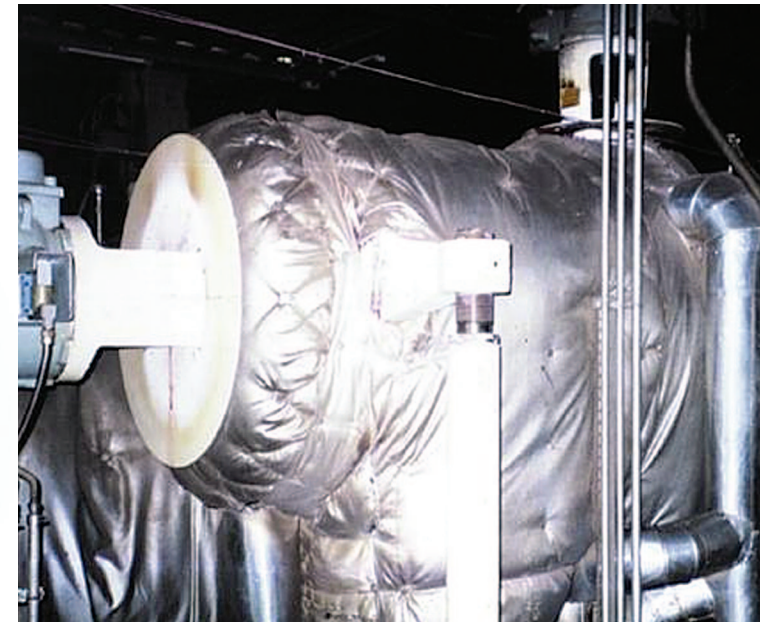
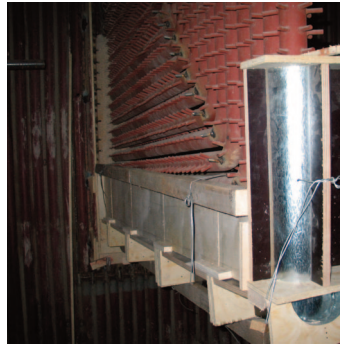
The design greatly reduces or eliminates gaps at elevated temperatures. Pyro-Bloc modules offer more robust, thermal efficient insulation linings at lower costs.

Performance Expectations of an HRSG

is typically 10 years or more

Thermal insulation in the HRSG must be able to withstand temperatures approaching 1093°C (2000°F) and gas velocities up to 37m/sec (120 ft/sec).

Our products help power plants all over the world to make vital improvements in efficiency through reduced energy loss.



Typical applications in a Heat Recovery Steam Generator and our product solutions

1. Stacks

Superwool® Plus Blanket
Cerablanket®
Pyro-Bloc® Modules

2. Silencers

Superwool Plus AC2 Blanket
Cerablanket AC2

3. Ductwork

Superwool Plus Blanket
Cerablanket
Pyro-Bloc Modules

4. Auxillary Burners

Superwool Plus Blanket
Pyro-Bloc Modules

5. Floor

Pyro-Bloc Modules
Pyro-Stack™, Z-Blok™

Insulating Castables
Kaolite®, Firelite®, TriMor®

Insulating Firebrick
K®, JM™, TJM® brands

Insulating Block
TR® -19, Ceraboard®

6. Casing Hotspots

Therm-O-Hot Patch™
Superwool Sealcoat™ HT

Superwool® Plus
Insulating fibre

Superwool® Plus fibre and Pyro-Bloc® Modules

Superwool Plus insulating fibre

Excellent thermal conductivity for reduced energy loss

Superwool Plus has a high fibre index which yields a 20% improvement in conductivity at 1000°C (1832°F). This translates to cooler cold surfaces and less energy loss (or less mass of fibre required to give the same performance).

Advanced control of the manufacturing process allows the fibre diameter to be kept predominantly in the optimal 1 to 6µm range, maximising the fibre surface area available for lower thermal and good thermal stability.

Long-term effective at high temperatures

The classification temperature for Superwool Plus fibre is 1200°C (2192°F) (EN1094-1). This means that shrinkage of the material is less than 4% with continuous use at this (maximum) temperature.

This high performance is achieved through consistent use of pure raw materials in manufacture.

Good tensile strength for ease of installation and durability

The patented manufacturing process results in an improved fibre network, reducing shot content resulting in a fibre matrix of up to 30% more fibres per unit of mass.

In tensile strength tests, Superwool Plus consistently out-performs competing products.



- Excellent thermal insulation properties
- Free of binder or lubricant
- Thermal stability
- Low thermal conductivity
- Good resistance to tearing and vibration, flexible and resilient
- Immune to thermal shock and offers excellent shock resistance
- Low heat storage capacity
- Inorganic - smoke free
- 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 Harmonized System for the classification and labeling of chemicals)

Pyro-Bloc Modules

Abrasion resistant, high-density modules

Pyro-Bloc modules comprise two sections of Superwool fibre Pyro-Log in edge-grain orientation, held in position with two stainless steel tubes. This, and their high density makes them much more resistant to erosion than folded modules, particularly where a high velocity of gas moving through the unit tends to abuse linings.



Easy to install in tricky areas

Pyro-Log™ monolithic fibre are easy to cut and fit around openings and modify in the field. It provides a superior finished surface for such special shapes as peep site frames, tube penetrations and burner tiles. The modules are especially ideal for corners, bullnoses, or transition sections.



- High un-compressed densities give low thermal conductivity and a more uniform and faster installation
- Fast one step installation
- Resistant to mechanical damage and gas flow abrasion
- Anchorage remote from the hot face protects steel work

Project Reference List

Please contact your local Morgan Thermal Ceramics office for further advice.

1. **Exhaust duct.** Pyro-Bloc® Y modules, 12# ZR with Unikote® M, installed to replace original lining of blanket/stainless liner (Henry Vogt unit).
2. **Exhaust duct.** Pyro-Bloc Y modules, 12# ZR with Unikote, installed to replace original board lining.
3. **Duct roof and walls.** Aluminium foil vapour barrier, backing blanket and hydrotemp duct floor. Tri-Mor® Guncrete® BFS, Tri-Mor Insulite®, Kaowool® board, vapour barrier, Kaowool board and hydrotemp. Superheater floor and headed box cast Tri-Mor Insulite.
4. **Duct from burner to boiler roof, walls and floor.** Lined with Pyro-Bloc blanket modules, aluminium foil vapour, backing blanket, hydrotemp duct from generator. 2 layers 19/128 blanket with vapour barrier between, hydrotemp and hot face protected with 316 ss Knitmesh 310 ss threaded anchors.
5. **Lining waste heat boiler.** Pyro-Bloc modules, backing blanket, aluminium foil vapour barrier and hydrotemp, anti-corrosive coating on casting.
6. **Duct roof and walls.** Lined with Pyro-Bloc blanket modules, with backing blanket. Floor lined with Tri-Mor Insulcast®, Tri-Mor Coolcast® and hydrotemp. Y anchors welded to sloping area. Canopy and economiser by-pass duct lined with Kaowool blanket and covered with Knitmesh.
7. **Duct roof and walls.** Lined with Pyro-Bloc modules, aluminium foil vapour barrier, backing blanket and hydrotemp. Floor lined with Tri-Mor Guncrete, Tri-Mor BFS, Tri-Mor Insulite, Kaowool board vapour barrier, board and hydrotemp. Superheated floor and headed box cast with Tri-Mor Insulite.
8. **Exhaust duct.** Pyro-Bloc Y modules, 12# R, installed spring 1991 (new Zurn unit).
9. **Supply of lining materials for waste gas incinerator.** Pyro-Bloc modules hydrotemp coating and dense fire bricks for walkway (still in operation).
10. **Lining flame duct and boiler casing of waste heat unit.** Pyro-Bloc modules.
11. **Lining for waste heat unit burner duct roof and walls.** Pyro-Bloc modules, vapour barrier. Backing blanket and hydrotemp floor:- I.F.BN., Pyro-Log® fibre (blanket laid) vapour barrier. Cerablok™ hydrotemp.
12. **Exhaust duct.** Pyro-Bloc Y modules, 12# R, installed (new Zurn unit).
13. **Lining various sections of CHP scheme.** Pyro-Bloc modules, vapour barrier blanket and hydrotemp. SS plates, blanket, vapour barrier, blanket and hydrotemp. Moistfelt, vapour barrier, blanket and hydrotemp.
14. **Burner duct (walls).** Pyro-Bloc modules, aluminium foil vapour barrier, backing blanket and hydrotemp (floor) concrete with Cerablok backing and vapour barrier.
15. **Ducting - roof, walls and floor.** Pyro-Bloc modules, aluminium foil vapour barrier, blanket and hydrotemp.
16. **Exhaust duct.** Pyro-Bloc Y modules, 12# ZR with Unikote M. Installed September 1993 (two Deltak units).
17. **Burner duct (walls).** Pyro-Bloc modules, aluminium foil vapour barrier, backing blanket and hydrotemp (floor) concrete with Cerablok backing and vapour barrier.
18. **2 sets of ductwork lined with Pyro-Bloc modules.** Hot face coated with white cement at burner end as protection against flame impingement.
19. **Duct roof and walls.** Pyro-Bloc modules, aluminium foil vapour barrier, backing blanket and hydrotemp duct floor. Tri-Mor Guncrete.
20. **BFS.** Tri-Mor Insulite, Kaowool board, vapour barrier, Kaowool board and hydrotemp. Superheater floor and headed box cast with Tri-Mor Insulite.

Partnering with us

We are the partner of choice for the Heat Recovery Steam Generator 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.

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

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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

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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