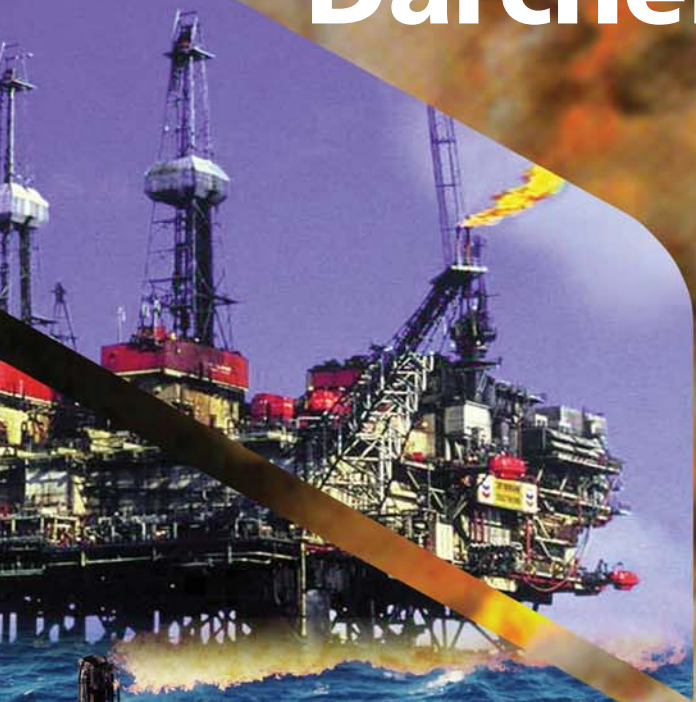


Darchem Thermal Protection



**Thermal
and Fire
Protection
for life**



PASSIVE FIRE PROTECTION SYSTEMS

DARMATT
Flexible passive fire protection systems



DARMATT J120
Jet fire rated flexible passive fire protection systems



DARSHIELD
Rigid and compact passive fire protection enclosures



HEAT SHIELDING

RADIANT HEATSHIELDS
DARMET Chevron System



RADIANT HEATSHIELDS
DARMET Radiant Heatshield System



FIRE BARRIERS FOR NUCLEAR APPLICATIONS

DARMATT KM 1
Fire barriers for nuclear installations



METALLIC INSULATION FOR NUCLEAR APPLICATIONS

DARMET
All metallic insulation systems



DARMET
SMRI and encapsulated



ENGINEERING & SERVICES

NUCLEAR, OIL AND GAS
industries



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Darchem Thermal Protection



"Darchem Thermal Protection is committed to providing its customers with uniquely engineered fire protection and specialist insulation systems to protect critical plant assets.

This is achieved worldwide by a responsive Global network of representatives and licensees.

The business continually strives to improve the level of technical expertise, product quality and after sales support to assist customers in meeting their performance and budget aspirations."

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DARMATT

Flexible passive fire protection systems

Fire Condition: Hydrocarbon Pool Fire tested (UL-1709, BS476 Pt 20 Amendment 6487)

Danger and damage from fire at refineries, petrochemical and offshore installations can be minimised by efficient protection of the systems controlling the plant.

Darchem Engineering has developed DARMATT to provide a flexible fire protection system, which can dramatically reduce fire loss or damage by allowing a controlled shutdown of critical facilities.



DARMATT is designed for the protection of actuators and valves, cable routes, conduits and signal lines, junction boxes, solenoid stations, air receivers, process vessels and other equipment applications requiring fire protection.

DARMATT flexible mattress systems provide excellent fire protection due to their unique construction of compressed layers of insulating fibre combined with layers of metallic foil.

DARMATT is renowned for its durability at very high temperatures. The **DARMATT** system is entirely asbestos free.

Darchem Engineering has carried out extensive development work which, confirmed by test data, enables combinations of infill material to be specified to suit individual customer requirements.

Designs are computer generated using Darchem Engineering's own Lloyd's certified programme.

DARMATT is fully tested and certified for use in high-rise hydrocarbon fires such as denoted in the UL1709 and BS476 (Pt 20 Amendment 6487) fire test curves. Such fires reach approximately 1100°C within minutes.

DARMATT has also been successfully explosion tested to 1.6 bar overpressure.

Testing of the **DARMATT** system has been witnessed and approved by Lloyd's, and has letters of compliance from DNV and other licensing authorities.





DARMATT has been in use worldwide throughout the petrochemical industry for over 25 years.

Typical **DARMATT** installations range from 15 minutes of certified fire protection up to a full 2 hours which can be adapted to individual project/customer requirements.

Each DARMATT PFP system is specifically engineered to fit closely around the protected equipment providing a removable, compact and user friendly enclosure. The DARMATT PFP system is constructed from pre-shaped panels designed to fit together around the equipment to be protected.

The versatility of **DARMATT** is demonstrated by a wide variety of applications on petrochemical plants.



DARMATT has been tested and accepted by a number of major oil and petrochemical companies including Exxon-Mobil, Chevron, Dupont, Texaco, Aramco, British Petroleum and Shell.

DARMATT is durably constructed under strict quality control procedures (Darchem Engineering is BSEN 9001:2000 accredited).

The **DARMATT** composite often recommended for petrochemical plants provides a protection window from between 15 minutes to 120 minutes in a 1100 °C Hydrocarbon fire.

These approvals have given process plant operators the confidence to specify **DARMATT** as an integral part of their policy to protect installations against the effects of fire and blast.

The DARMATT PFP (Passive Fire Protection) System has been supplied extensively to the Oil and Gas Industry for both onshore and offshore applications. It is designed and manufactured as a removable, compact, flexible system, which has been tested and certified to provide protection against hydrocarbon fires.

The specific composite for each application is dependant upon the time / temperature requirements, geometry and mass of the protected equipment, and site conditions such as ambient temperature, fuel sources, air flow etc.

Our Lloyd's approved Thermal Transient Programme addresses each of these variables to determine the optimum solution. The sacrificial exterior layer is weather protective, usually either vinyl-coated polyester or a coated fibreglass cloth, depending on environmental and process conditions.

DARMATT is ideal for all process applications including non-petrochemical. Installation is readily undertaken. **DARMATT** can be easily removed and re-installed during equipment maintenance or inspection periods.

Inspection hatches and access areas can be incorporated if required.

The **DARMATT** system is held together by highly flexible nylon coated stainless steel multi strand wire lacing that helps to keep the jacket compact and maintains integrity.

This fastening system has been used on all **DARMATT** systems supplied by Darchem to date. There have not been any problems experienced with either installation or removal / re-installation of these systems.

The installation is described in the erection procedure supplied with each system. These tailor made documents describe the steps to follow for installation and are always adapted to the supply and the equipment protected.

DARMATT J120



Flexible passive fire protection systems

Fire condition: jet fire /hydrocarbon engulfment up to 120 minutes. Blast protection: up to 1.62 bar.

DARMATT J120 has been specifically developed to satisfy requirements for a flexible passive fire protection system to withstand jet fire and blast overpressure conditions. The increasingly onerous conditions that fire protection is now required to meet has led to the development of versions of DARMATT J120 that can withstand jet fires and greater blast overpressure.



DARMATT J120 is based on the company's standard Darmatt flexible mattress system widely developed over 20 years in the petrochemical, offshore and power generation markets for the protection of power and signal cables, valves, actuators, vessels, pipework and other safety critical equipment.

DARMATT J120 is a flexible composite mattress system constructed with both a varying number of layers and density of insulating fibres. An outer layer of stainless steel mesh is fitted that serves to protect against the effects of hydrocarbon jet fire.

The specific composite for each project is dependant upon the time / temperature requirements, site conditions for each localised configuration, the thermal mass of the materials being protected, local fuel sources, air flow and a number of other variables. The sacrificial exterior layer is weather protective, usually either a vinyl coated polyester or a coated fibreglass cloth, depending on environmental and process conditions.



Each Darmatt PFP system is specifically engineered to fit closely around the protected equipment providing a removable, compact, flexible and user friendly enclosure. It is constructed from pre-shaped panels designed to fit together around the equipment to be protected.

DARMATT J120 can be easily removed and re-installed during equipment maintenance or inspection periods.



The **DARMATT J120** PFP (Passive Fire Protection) System has been supplied extensively to the oil and gas industry for both onshore and offshore applications. It has been tested and certified to provide protection against hydrocarbon jet fire and blast conditions.

The **DARMATT J120** composite often recommended for petrochemical plants provides a protection window from between 15 minutes to 120 minutes in a jet fire up to 1300°C.

Rigid and compact passive fire protection enclosures

Fire condition: jet fire /hydrocarbon engulfment up to 120 minutes. Blast protection: up to 1.62 bar.

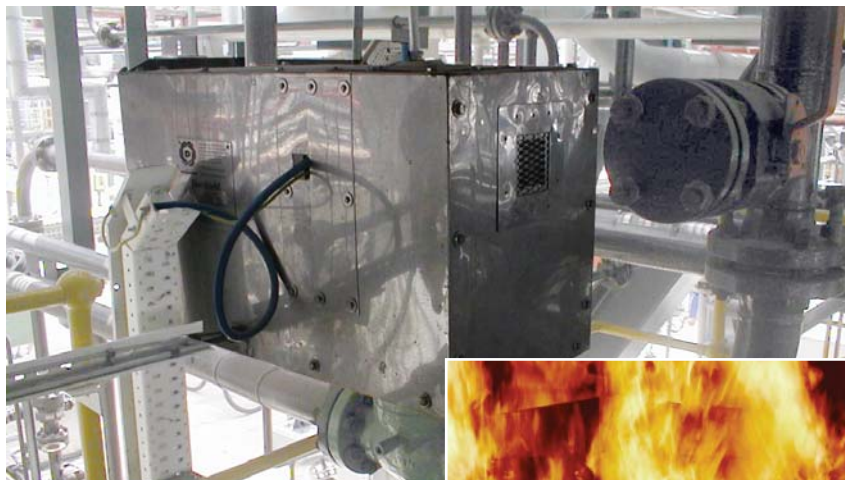
Fire and explosion is a major cause of concern to refinery, gas processing, petrochemical and offshore installations. Danger and damage from fire can be minimised by the efficient and effective protection of the systems, which control the plant.

DARSHIELD engineered enclosures can provide this protection as they are designed and manufactured specifically to fit the protected equipment. The design principles used have been validated by extensive test programmes. They give up to 2 hours protection against flame temperatures in excess of 1100°C. Features can be incorporated into the design to provide resistance to both blast and jet fire.



DARSHIELD enclosures are designed to withstand the most rigorous fire conditions. They are ideal for the protection of equipment requiring ease of access. The enclosures are constructed using high thermal performance materials encapsulated within stainless steel skins.

The versatility of the **DARSHIELD** system enables a variety of materials to be selected in order to best meet the customer specification. This ensures that the design can accommodate difficulties in location and space restrictions.



There are many advantages of the **DARSHIELD** system. Independent tests have been carried out on **DARSHIELD** enclosures, which confirm their ability to:

- Withstand a standard hydrocarbon pool fire with temperatures in excess of 1100°C
- Control the temperature rise of the protected equipment
- Provide protection for up to 120 minutes
- Withstand jet fire up to 1300°C
- Withstand blast overpressure.

The main features of the **DARSHIELD** system are :

- Lightweight for ease of handling and totally removable
- No deterioration of performance throughout intended life span even in hostile environments
- High resistance to corrosion and vibration.

Special features e.g. hinged doors, can be incorporated to give direct access to the protected equipment. The material of the outer skin is stainless steel which will not be affected by temporary exposure to petroleum products, sub zero ambient conditions or ultra-violet irradiation by sunlight. None of the materials of construction are flammable. No maintenance of the **DARSHIELD** is required.

DARSHIELD can be easily removed and re-installed during equipment maintenance or inspection periods.



Thermal performance is predicted by **fully approved** computer modelling techniques.

The **DARSHIELD** system has been approved by Lloyd's, and has letters of compliance from DNV and other specialist authorities. These approvals have given process plant operators the confidence to specify Darshield as an integral part of their policy to protect installations against the effects of fire and blast.

Durable construction under strict quality control procedures (Darchem Engineering is BSEN ISO 9001:2000 accredited).

RADIANT HEATSHIELDS

Heat flux reduction solutions

Darchem Engineering specialises in the design, development and manufacture of RADIANT HEATSHIELDS for the protection of personnel, equipment and structures from radiated heat and flames.

The design of RADIANT HEATSHIELDS will vary from application to application relative to the incidental heat fluxes to the shielding and the amount of heat reduction required.

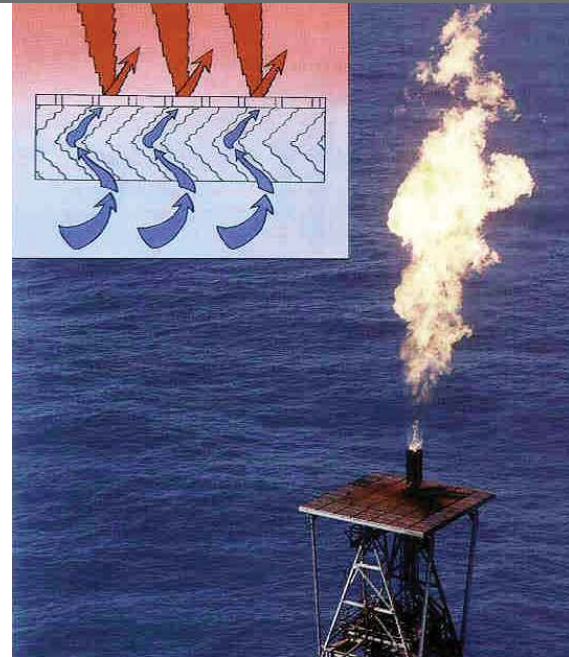
Darchem Engineering has a continuous programme of research and development of RADIANT HEATSHIELDS for use on both onshore and offshore installations. The use of both the CHEVRON and RADIANT HEATSHIELD have a number of distinct advantages over other radiation shield systems.

Darchem's range of heatshield systems are now well proven. The unique all metallic system utilises the effects of air flow to cool the shield and gives a heat flux reduction during flaring conditions.

The unique design features of the **DARMET RADIANT HEATSHIELD** ensures that heat is reflected while cooler air is drawn from the underside of the shield creating a 'steady state' situation, usually less than 100°C.

DARMET RADIANT HEATSHIELDING is adaptable in design and has the capability to incorporate cut outs for penetrations, lugs for temporary handrailing and weight bearing pads for plant maintenance requirements.

DARMET RADIANT HEATSHIELDING has been successfully installed on many platforms Worldwide. The shields withstand elevated temperatures from flare stacks and can tolerate this severe thermal cycling without detriment to thermal performance and durability.



Darchem Engineering has developed two main shield product designs:

- **DARMET CHEVRON SYSTEM**
- **DARMET RADIANT HEATSHIELD SYSTEM**

Darmet chevron system

DARMET CHEVRON SYSTEM has been developed for higher heat flux levels and is generally used for horizontal heatshields located directly below the flare tip.

This is a panel design that allows convective airflow inside the panels. The Darmet Chevron Radiation Shielding is normally designed so that the surface temperature of the underlying structural steelwork remains under 100°C during flaring. This is to ensure that the steelwork is not damaged as a result of exposure to severe thermal cycling effects.

Each panel generally consists of fabricated perimeter members with a load supporting grating fixed to the top "hot exposed" surface of the panel.

Formed thin sheet foils provide a contoured surface designed to promote cold air convection up through the panel to the hot face. The cold face of the panel is supported by a simple expanded metal mesh arrangement to maintain the foils in place.



All Darchem Engineering Radiation Shields are supplied as individual panels for modular installation. The panels are designed so that when installed, there will be sufficient gap to allow for expansion and shrinkage during thermal cycling and are designed to prevent internal panel stressing or buckling. The top grating (if required) is attached to the panel in such a manner as to allow individual expansion of the sections and avoid buckling or warping. The panels and fixings are designed to withstand the effects of the environmental loads.

In addition to this, certain panels will be designed to withstand a maximum imposed distributed load on any single panel in any location as specified by the customer. The panels fixings are designed so that they are welded to the structural steelwork with a flat retaining plate which screws into position.

The panels and fixings are designed to withstand the effects of wind, snow and ice loads in addition to a maximum imposed distributed load specified by the customer.

The fixings also provide for minimum necessary movement during thermal cycling (to avoid buckling and warping) while at the same time holding each panel in place to the supporting structure. Hatchways can be provided with hinged access doors secured with shoot bolts on the underside. Handgrips can be provided to raise the doors open and hinges can be welded to bearer bars on the doors and the shield panels.

DARMET RADIANT HEATSHIELDS are:

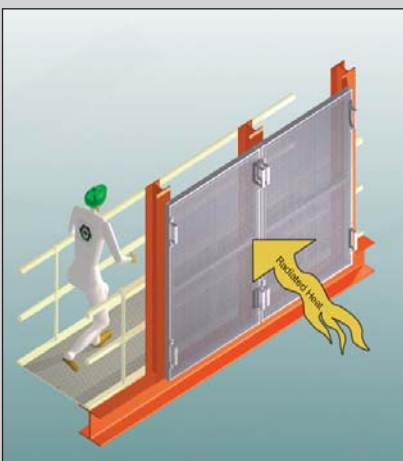
- Durable and have been installed for more than 20 years without deterioration
- Lightweight
- Maintenance free
- Corrosion resistant (high alloy)
- Self draining
- Impervious to effects of weather
- Suited for intermittent and severe thermal cycling conditions.



Darmet radiant heatshield system

The RADIANT HEATSHIELD system was developed for lower heat flux levels.

This system can be used also as a horizontal heatshield directly below the flare tip, but is more commonly used for vertical heatshield protecting critical plant equipment, steelwork and protecting personnel.



Each panel generally consists of a channel frame to which either 1 or 2 layers of woven wire mesh or expanded metal is attached across the frame. With this type of shield a 75% reduction in irradiance can be achieved. The system is designed to be entirely **maintenance free** during the projected life of the platform even when subjected to thermal cycling from the operation flares and extreme environmental conditions.

Heat Dissipation - RADIANT HEATSHIELDS have a greater heat dissipation than solid systems therefore a solid plate barrier would usually have a greater 'touch' surface temperature than a woven wire/expanded metal barrier.

See-through/Venting - Darchem Engineering's **RADIANT HEATSHIELDS** have excellent see-through properties and are naturally venting. Solid system barriers would prevent natural lighting and could trap gas, which may permeate from the adjacent process plant. The psychological effect of closing in the area under protection could be problematic under operating conditions.



DARMET

All metallic insulation systems for nuclear applications

Compliant with NRC Guide 1.82 and 1.36. Tested to International Standard ASTM C236-89

Darchem has developed **DARMET: an all-metallic insulation system designed to control the heat loss and temperature gradients on primary circuit vessels and associated equipment and pipework.**

DARMET is currently installed in over 120 nuclear power plants worldwide.

DARMET is a fully engineered all metallic construction in austenitic stainless steel with excellent performance characteristics.

Reduced heat losses, lower containment air temperatures and fewer equipment operational difficulties are the hallmarks of its capability.

DARMET offers multi-functional capability in its thermal performance, strength and structural aspects, removability features and through-life durability without environmental or Health and Safety problems.



There are a number of principle features of DARMET, which provide it with an overall superiority to conventional fibrous insulation materials.

Removability and Replacement

Being an engineered system, the ease of removability and replacement of **DARMET** can be varied in accordance with the requirements of a particular application. Therefore, for in service inspection or maintenance, the panels can be designed so that they can be removed in less than a minute. This rapid operation reduces radiation exposure times, reduces labour and material costs and down time of equipment.

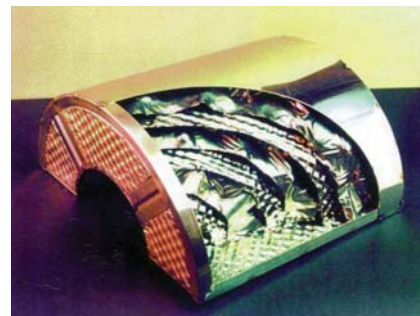
DARMET does not become radioactive when irradiated, making disposal easier at the end of the plants life.

Corrosion Resistance

The **DARMET** system is generally constructed from austenitic stainless steel. Darchem Engineering has not encountered any situation where it has corroded in nuclear environments.

DARMET has been installed for more than 30 years in some plants.

DARMET does not contain any chloride ions and therefore does not initiate stress corrosion cracking. As **DARMET** is self-draining it does not maintain water in contact with pipes and therefore does not promote oxidation corrosion cells.



DARMET can be decontaminated if required. The self-draining all-metallic insulation can be washed down to remove any surface contamination and compared to fibrous solutions, offers ease in maintenance, removal and refitting.

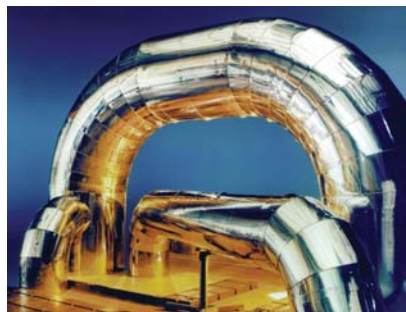
No Health Risk

Darmet all-metallic insulation contains no fibres and therefore does not contribute to the risks associated with the ingestion of contaminated airborne particles by maintenance personnel. Within some countries fibrous insulation materials are considered to be a class 2 carcinogen.

Drainability

The exterior of **DARMET** is water shedding. It is self-draining. Its thermal performance is therefore unaffected by water and does not hold chloride in contact with the pipework, unlike Fibrous insulation which quickly slumps when wetted.





DARMET will maintain design performance for the life of the plant, therefore eliminating the need for replacement materials and reducing the cost of ownership.



Representative insulation test to ascertain thermal performance at ranging temperatures.



Quality of the **DARMET** product is assured by thorough interstage inspections and the following requirements of BS EN ISO 9001:2000.

Testing, Certification and Development

Practical 'in-service' experience is complemented by a comprehensive laboratory test programme.

An ongoing programme of product development ensures the Darmet continues to be the most "user friendly" thermal insulation system available.

Extensive test programmes have been carried out including:

- Thermal performance on representative large scale vessel areas.
- Thermal performance of large and small bore pipework in various orientations.
- Mechanical shock up to 300g.
- Measurement of effect on thermal performance of ageing and contamination.
- Panel robustness.
- Drainage and water spray.
- Seismic accelerations up to 5G.

Performance

DARMET designed panels provide as close a fit as possible to the pipe or vessel being insulated. This means that on vertical risers the design severely restricts any "chimney effect" convection in the air gap between the pipe surface and the inner skin.

DARMET is an assembly of thin gauge stainless steel foils in factory made cassettes, which have been specifically designed to minimise heat loss that occurs through conduction, convection and radiation.

DARMET works by:

Creating pockets of air between the alternate layers of dimple foil. The design ensures that this air is kept stagnant, thus reducing heat loss by convection.

The design of the foils reduce conduction by creating the longest possible heat paths. The layers of highly polished stainless steel foil reflect back radiated heat.

DARMET all metallic insulation systems are neat, compact and clean in the most complex of arrangements.

Reactor Pressure Vessel insulation with **DARMET** is designed and fitted prior to vessel installation to provide long-life performance without deterioration.



DARMET

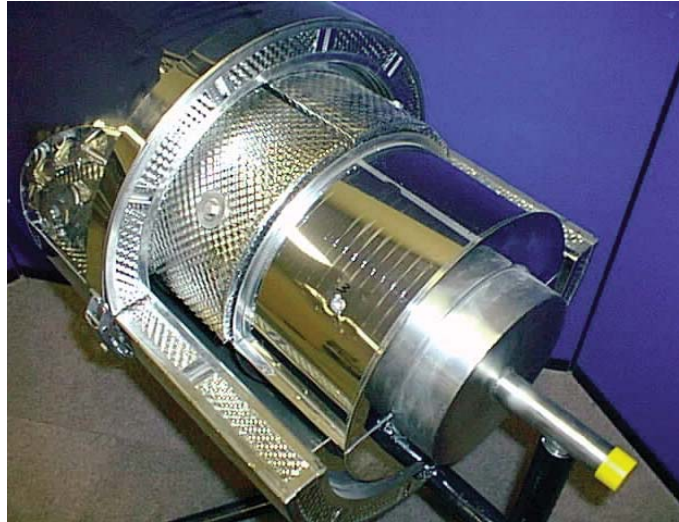
Shielded metallic reflective insulation

DARMET SMRI provides integral radiation protection with engineered insulation. The product is a development of the well proven DARMET all metallic stainless steel thermal insulation system also produced by Darchem. DARMET is currently installed in over 120 Nuclear power plants Worldwide.

Radiation Reduction

The amount of radiation reduction is based on the thickness of lead used and on the time required to carry out specific maintenance operations.

DARMET SMRI can reduce high radiation emission areas to lower acceptable levels.



Reduction in Time

The introduction of **DARMET SMRI** significantly impacts the access time for maintenance and operational staff by permanently reducing radiation levels. Previously declared "restricted" levels can become readily accessible thus improving quality time within containment, saving at least 25-50% of dosage pick up time.

Dose Reduction

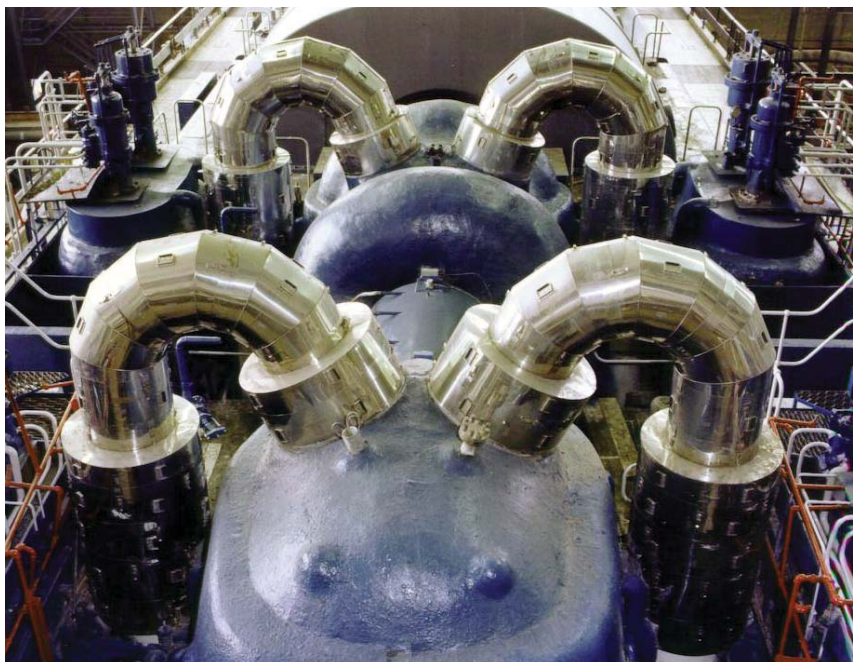
Site Feedback from operational plants with **DARMET SMRI** fitted has shown that the dosage pick up can be reduced by 50%.

Encapsulated fibre insulation

DARMET ENCAPSULATED Thermal Insulation System is specifically designed to minimise heat loss in various applications.

This product is installed where the requirement for LOCA (Loss of Coolant Accident) is not as stringent. The form of insulation varies from Mineral Wool to high performance insulations like microporous insulation. The insulation is encapsulated by thin gauge austenitic stainless steel, which provides simple installation and removability characteristics.

Each application is designed to suit the customer specification with respect to thermal and mechanical requirements. All infill materials are compliant with USNRG1.36.



DARMATT KM1

Fire barrier system for nuclear installations

DARMATT KM1 is a fire protection barrier system developed for the protection of safety and critical electrical equipment in the nuclear industry.

The system has successfully passed 1 and 3 hour fire tests in a wide range of boundary and site specific configurations. Boundary conditions include zero percent cable fill as well as free fall single and grouped cables. Fire tests are fully compliant with NRC Generic Letter 86-10, Supplement 1, and include configurations for both upgrades of existing systems as well as new applications.

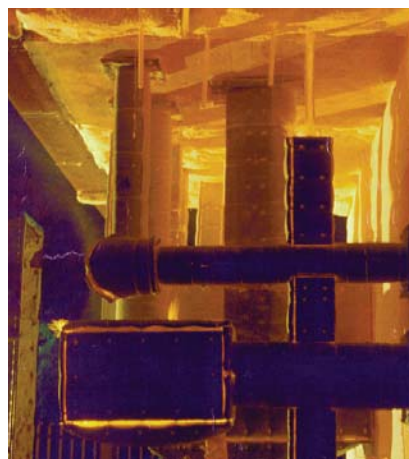
The system is based on a patented semi-rigid board, made of ceramic fibre sheets containing a strongly endothermic material which absorbs heat during a fire, creating an effective delay to the heat transfer mechanism.

The system has been designed for ease of installation and for future removal and replacement. Site installation is carried out using a kit of parts custom fabricated by Darchem from site survey information. The installed system is durable, weather proof and aesthetically appealing.

Darchem has been closely involved with the nuclear industry for over 30 years, during which time it has developed an extensive capability to solve customer problems through engineering, development, testing, manufacturing and installation under strong project management and compliance with international quality standards.

Darchem Engineering has specialised in the design, development and supply of fire barrier systems for primary circuit equipment with contracts on over 100 nuclear reactors.

Darchem Engineering is also engaged in the fire protection of cable trays and electrical equipment associated with emergency shut down systems. It has a strong reputation in the petrochemical and nuclear industries and has developed a capability for comprehensive engineering and test services.



Certification Testing
The system has successfully passed a number of boundary and site specific tests consistent with NRC procedure for both new and upgrade material to cover the configurations shown on right.

Fire tests have been UL witnessed and certified and successfully comply with the criteria of: NRC generic letter 86-10, supplement 1 UL 1724 and ASTM E119

other tests include:

- Ampacity derating - IEEE P848 Draft 16
- Ageing - ASTM E1027
- Combustibility - ASTM E136
- Corrosibility - US Reg. 1.36
- Surface spread of flame - ASTM E84
- UV Resistance testing.

Tests have been carried out at both the Faverdale Technology Centre, a NAMAS accredited, internationally recognised fire testing laboratory, our in-house UKAS approved test facility, and independent test facilities in the USA, such as Omega Point and Wyle Laboratories

ENGINEERING & SERVICES

Nuclear, oil and gas industries

TECHNICAL CAPABILITIES

The Darchem Thermal Protection Engineering Team has extensive experience in both Fire Protection and Thermal Insulation Solutions.

The introduction of 3D modelling into the business enables customers to export data that can be imported into our 3D system. However, more traditional methods are also used to feed our 3D system, such as Site Surveys or via customer 2D drawings.

The 3D system means that we can streamline the flow of data to our customers and manufacture facility.

This promotes a "right-first-time" environment, reducing the likelihood of site modifications

The Darchem Thermal Protection Engineering Team has vast experience in traditional calculation methods to analysing problems. However, the recent introduction of Finite Element Analysis (FEA) & Computational Fluid Dynamic (CFD), provides accurate analysis to customer problems. The business unit continually looks to use technology to provide solutions.

Darchem Thermal Protection is a World Leader in providing solutions to thermal and mechanical problems. Therefore practice of internationally recognised standards such as ASME, British, ISO and Country specific regulation is considered the norm. This emphasises the business philosophy of Engineer-To-Order (ETO) Products to meet the customers requirements.

The Engineering Team supports a global network of licensees and representatives, requiring adaptation to local business practices and cultures.



The Darchem Thermal Protection Engineering Team has experience of a broad range of bespoke design solutions. This occurs when customer problems are outside the tested parameters. In these instances, the Design provides Engineering Evaluations that can be verified by governing bodies or by further test work.

Site Services

Due to the increased activity in recent years, and the necessity for increased customer support, Darchem Engineering Site Services team has been set up to provide our customers with an all round service including front end survey, final installation and after sales support. Resources are made available both onshore and offshore in the UK and Worldwide to meet customer demands.

Darchem Engineering Ltd has the capability to:

- Respond to urgent fast track requirements
- Provide after sales services
- Co-ordinate manufacture and installation activities on critical programmes accommodating operational constraints
- Give worldwide support
- Provide key skilled engineers and technicians to perform design surveys, installation and training.



For the nuclear sector, Darchem Engineering Ltd can also offer:

- Detailed pre-planning of integrated outage activities
- Calculations of total radiation dosage for the agreed programme
- Co-operation with on-site health, physics and maintenance personnel.



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