

Darmatt™ Flexible Passive Fire Protection



Darchem Thermal Protection's Darmatt™ flexible jacket Passive Fire Protection system is a high performance solution designed to meet the most demanding requirements for protection of critical flow and process equipments from Hydrocarbon Pool Fire conditions.

Offering up to an unprecedented 180 minutes protection, Darmatt™ can be fitted to valves, actuators, instrument panels, process vessels, cable trays, pipework and has been supplied extensively worldwide for both Onshore and Offshore Oil & Gas and Petrochemical installations.

Darmatt™ Design Specification

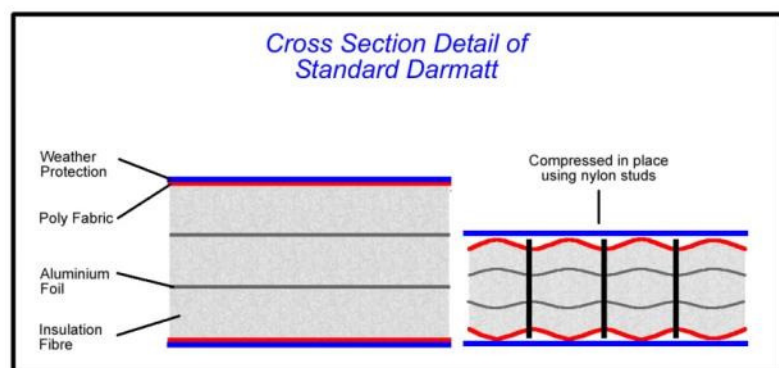
- **Fire Condition - Hydrocarbon Pool Fire Engulfment up to 180 mins**
- **Blast Protection - Up to 0.43 bar as standard or up to 1.62 bar with Jetfire Darmatt™**
- **Limiting Temperatures – as per project requirements, with Lloyds approved Offtranp software calculations to be issued to clients for each item of equipment protected.**

Construction Details

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.

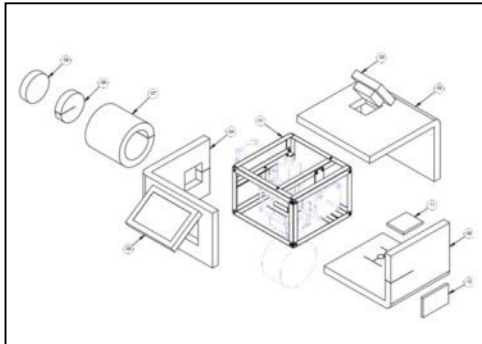
Each panel is made up of layers of insulation fibre and reflective foil, compressed and studded with nylon pins throughout the panel's area. The complete exterior is covered by a non-fire rated weather resistant skin.

The nylon pins hold the components in the Darmatt™ PFP system together to ensure that the insulation materials remain securely in place and do not migrate to a different part of the panel (as experienced with lower quality PFP and insulation jacket systems). The nylon pins also compress the insulation to approximately 60% of its original thickness to provide a very flexible but compact system. All this helps to ensure that the PFP system is easy to remove and re-install.



Accessibility - Inspection Hatches and Penetrations

Inspection hatches can be provided for each Darmatt™ installation to provide quick access to areas of the protected equipment that requires regular inspection or maintenance. Also, access can be further improved by utilisation of a space-frame around actuator controls. Lloyds have approved these hatches for use along with the Darmatt™ PFP system.



Penetrations for operating mechanisms, hydraulic tubing and position indicators etc. can be provided to facilitate problem-free operation and maintenance of equipment without the need to remove the jackets.

It is important that the client identifies any requirements for hatches and penetrations as early as possible such that they can be incorporated into the Darmatt™ PFP system's design.

Darmatt™ PFP Lacing Method

Darmatt™ panels are fastened together using high quality PVC coated stainless steel wire lacing. This lacing method is simple to apply and provides an extremely durable fastening, ensuring that the panels are secured permanently. By using this lacing method, the panels can be pulled tight around the equipment in such a way that they take shape around the valve / actuator. Once installed, each panel will retain its moulded shape making future removal / installation quicker and easier. This lacing method has been used on all Darmatt™ PFP systems supplied by Darchem since 1986.



Testing & Certification



Since its introduction Darmatt™ has been tested continuously to prove its capability as a passive fire protection system. The Darmatt™ PFP system is ideally suited to protect ESD valves, actuators, vessels, instrumentation panels, cable trays, pipe work, and other process equipment against hydrocarbon engulfment fire.

The Darmatt™ PFP System is Lloyds Type Approved and also holds accreditation from DNV and ABS.

Optimisation of Insulation Thickness

Darchem Engineering's Lloyds approved software, Offtranp, is used to determine the optimal insulation thickness for each PFP application. This ensures that adequate insulation is provided to protect the equipment in the fire condition and that the thickness of the insulation is kept to the absolute minimum.

The factors below are input into the "Offtranp" software, which calculates and displays the temperature drop across the insulation after a set period of time during the fire.

- **Type of Fire**
- **Duration of Fire**
- **Limiting Temperature Rise**
- **Relevant ambient and operating temperatures**
- **Mass and volume of Equipment**
- **Exposed Surface Area**

Temperature Limitation

A selection of outer weather resistant clothes is available to take into account differing ambient and operating temperatures for the equipment being protected. The standard Darmatt™ PFP system has a PVC coated outer cloth suitable for a maximum operating temperature of up to 60°C. However for high process temperatures a Silicone coated outer cloth withstanding up to 700°C can be utilised.

Product Customisation

Darmatt™ can be customised to meet the customers' specific environmental requirements, these include the following:-

- **Coloured Cloth to be in line with plant identification policies**
- **DARVENT™ grilles to aid with ventilation to reduce the internal ambient temperature of protected item and prevent the build-up of gas.**
- **Access Doors for maintenance or operating purposes.**
- **Custom designed Rain Jackets for added weather protection.**



Darmatt™ applications include:



Valves and actuators



Process vessels



Cable trays



Pipe work

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JETFIRE DARMATT™ FLEXIBLE PASSIVE FIRE PROTECTION



Darchem Thermal Protection's Jetfire Darmatt™ flexible jacket Passive Fire Protection system is a high performance solution designed to meet the most demanding requirements for protection of critical flow and process equipments from Jet Fire conditions. Offering up to an unprecedented 180 minutes fire protection, JetFire Darmatt™ is the latest development of the Darmatt™ PFP system, which has been supplied extensively worldwide for both Onshore and Offshore Oil & Gas and Petrochemical installations.

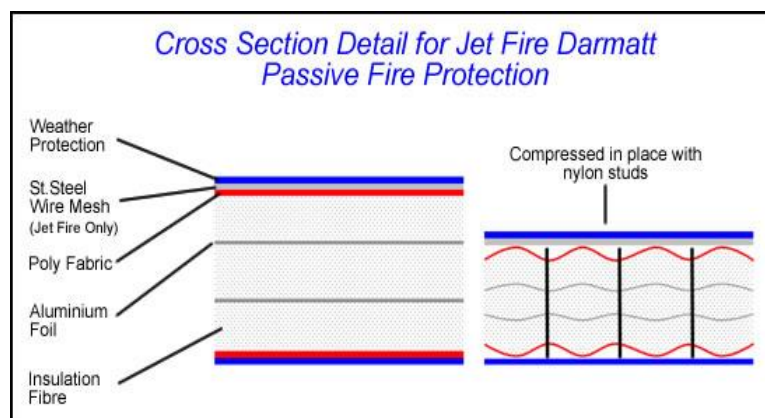
Design Specification

- **Fire Condition - Hydrocarbon Engulfment / Jet Fires up to 180 mins**
- **Blast Protection - Up to 1.62 bar**
- **Limiting Temperatures – as per project requirements, with Lloyds approved Offtranp software calculations to be issued to clients for each item of equipment protected.**

Construction Details

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

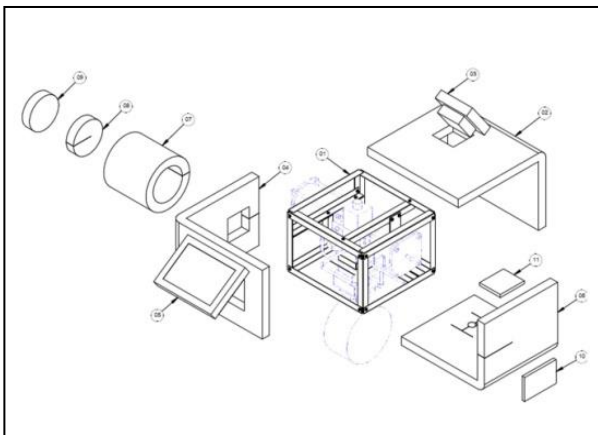
Each panel is constructed from layers of insulation fibre and reflective foil, compressed and studded with nylon pins throughout the panel's area. The blanket is shrouded on the hot face by a steel mesh and the complete exterior covered by a non-fire rated weather resistant skin.



The nylon pins hold the components in the Darmatt™ PFP system together to ensure that the insulation materials remain securely in place and do not migrate to a different part of the panel (as experienced with lower quality insulation jacket systems). The nylon pins also compress the insulation to approximately 60% of its original thickness to provide a very flexible but compact system. All this helps to ensure that the PFP system is easy to remove and install again.

Accessibility - Inspection Hatches and Penetrations

Inspection hatches can be provided for each Darmatt™ installation to provide quick access to areas of the protected equipment that requires regular inspection or maintenance. Also, access can be further improved by utilisation of a space-frame around actuator controls. Lloyds have approved these hatches for use along with the Darmatt™ PFP system.



Penetrations for operating mechanisms, hydraulic tubing and position indicators etc. can be provided to facilitate problem-free operation and maintenance of equipment without the need to remove the jackets.

It is important that the client identifies any requirements for hatches and penetrations as early as possible such that they can be incorporated into the Darmatt™ PFP system's design.

Jetfire Darmatt™ PFP Lacing Method

Darmatt™ panels are fastened together using high quality PVC coated stainless steel wire lacing. This lacing method is simple to apply and provides an extremely durable fastening, ensuring that the panels are secured permanently. By using this lacing method, the panels can be pulled tight around the equipment in such a way that they take shape around the valve / actuator. Once installed, each panel will retain its moulded shape making future removal / installation quicker and easier. This lacing method has been used on all Darmatt™ PFP systems supplied by Darchem since 1986.



Testing & Certification



Since its introduction the Jetfire Darmatt™ PFP System has been tested continuously to prove its capability as a passive fire protection system. The system is ideally suited to protect ESD valves, actuators, pipe work, and other process equipment against hydrocarbon engulfment and Jet Fire.

Jetfire Darmatt™ has been tested and is certified to the standards ISO 22899-1 and OTI 95 634 for “Jet Fire Resistance Test of Passive Protection Materials”, the latest recognised standards for Jet Fire is testing.

Jetfire Darmatt™ has also undergone independent overpressure blast tests and is certified for blast pressures up to 1.62 bar. Additional information on Testing and Certification is available on request.

Optimisation of Insulation Thickness

Darchem Engineering use Lloyds approved software called “Offtranp” to determine the optimal insulation thickness for each PFP application. This ensures that adequate insulation is provided to protect the equipment in the fire condition and that the thickness of the insulation is kept to the absolute minimum. The factors below are input into the “Offtranp” software, which calculates and displays the temperature drop across the insulation after a set period of time during the fire.

- **Type of Fire**
- **Duration of Fire**
- **Relevant ambient and operating temperatures**
- **Limiting Temperature Rise**
- **Mass and volume of Equipment**
- **Exposed Surface Area**

Temperature Limitation

A selection of outer weather resistant clothes is available to take into account differing ambient and operating temperatures for the equipment being protected. The standard Darmatt™ PFP system has a PVC coated outer cloth suitable for a maximum operating temperature of up to 60°C. However for high process temperatures a Silicone coated outer cloth withstanding up to 700°C can be utilised.

Product Customisation

The Jetfire Darmatt™ PFP System can be customised to meet the customers’ specific environmental requirements, these include the following:-

- Coloured Cloth to be in line with plant identification
- DARVENT grilles to aid with ventilation to reduce the internal ambient temperature of protected item and prevent the build up of gas.
- Access Doors for maintenance or operating purposes.
- Custom designed Rain Jackets for added weather protection.

Jetfire Darmatt™ applications include:



Valves, actuators, and instrumentation



Process vessels



Cable trays



Pipe work

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Darshield™ Rigid Enclosure Passive Fire Protection Systems

Darchem's Darshield™ rigid Passive Fire Protection system is designed as a high performance solution to meet the most demanding requirements for protection of critical flow and process equipments from Hydrocarbon Pool Fire and Jet Fire conditions. Offering up to 120 minutes protection, Darshield™ can be fitted to valves, actuators, air tanks, instrument panels and other safety critical equipment to enable a controlled shutdown in the event of a fire.



Darshield™ PFP systems have been supplied extensively worldwide for both Onshore and Offshore Oil & Gas and Petrochemical installations.

Incorporating high performance thermal insulation materials encapsulated by stainless steel skins, Darshield™ is supplied in pre-fabricated panel form for assembly and installation onsite or in the factory. Forming a rigid PFP enclosure, the panels are held together using bolts and captive nuts, with the final construction providing the necessary structural integrity to withstand the specified fire and blast conditions.

Where access to equipment control mechanisms is required, doors are designed within the appropriate panels; or alternatively the panels themselves can be fixed together with quick release clamps. The transition of services (electrical cables, hydraulic or pneumatic pipes etc) into the enclosure is achieved via the use of closure plates and seal bags.



Each Darshield™ system is engineered from equipment manufacturer drawings and checked against potential site conditions to take into account of possible space restrictions. Lloyds Type Approval certification ensures that each Darshield™ installation, inclusive of access hatches and transition points, meets with customer fire specifications.

Darshield™ Design Specification

- **Fire Condition - Hydrocarbon Pool Fire and Jet Fire up to 120 mins**
- **Blast Protection - Up to 1.6 bar**
- **Limiting Temperatures – As per project requirements, with Lloyds approved Offtranp software calculations to be issued to clients for each item of equipment protected.**

Optimisation of Insulation Thickness

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Esterline Corporation
Innovators Way, Billingham, Stockton-on-Tees, TS21 1LB
United Kingdom <http://www.darchem.co.uk>

Offtranp V2.0 Page 1 of 1

Darchem GA: 38236-01
Emerson Process Management Manufacturing - 0 : BETTIS Actuator

Calculations Using UL1709 Firecurve.

Duration of Run: 30 minutes
 Mass of Protection Shield Contents: 254kg
 Insulation Type: PFRon at 120kg/cu m
 Insulation Thickness: 75mm
 Inner Skin Thickness: 0.91mm
 Inside Area of Darshield: 5.506 sq m
 Minimum Periphery of Shield Section: 3.2m
 Valve Stem Included?: Yes
 Metallic Cross-Sectional Area of Stem: 0.0026 sq m
 Length of Stem to Outer Surface of Shield: 0.075m
 Temperature of Exposed Stem at 30mins: 1093 deg C
 Initial Start Temperature: 45 deg C
 Time Constant Used in Calculations: 0.294 second

Time (mins)	Temperature Distribution Through System (deg C)											
1.5	481	127	51	45	45	45	45	45	45	45	45	25
3.0	1093	737	350	109	51	45	45	45	45	45	45	25
4.5	1093	889	644	373	148	61	47	45	45	45	45	25
6.0	1093	934	747	535	513	138	64	48	45	45	45	25
7.5	1093	959	803	627	435	248	115	61	48	45	45	25
9.0	1093	975	836	687	518	344	190	63	56	47	45	25
10.5	1093	986	855	729	579	420	285	142	76	53	46	25
12.0	1093	995	865	762	626	480	332	199	107	63	47	25
13.5	1093	1002	869	787	663	528	380	256	147	61	50	25
15.0	1093	1008	873	809	693	563	436	306	190	706	54	25
16.5	1093	1012	875	825	717	601	477	350	232	133	61	25
18.0	1093	1017	876	840	738	629	511	390	270	162	71	25
19.5	1093	1020	876	852	756	652	541	424	306	181	82	25
21.0	1093	1023	877	863	772	673	567	454	336	217	95	25
22.5	1093	1026	877	872	789	691	589	479	363	249	109	25
24.0	1093	1028	878	881	799	706	605	501	386	262	122	25
25.5	1093	1030	878	888	807	719	624	520	406	281	135	25
27.0	1093	1032	879	894	816	731	638	536	424	297	148	25
28.5	1093	1034	879	900	824	741	650	551	439	312	160	25
30.0	1093	1035	879	906	831	750	661	563	453	325	171	25

These calculations have been carried out in accordance with the Business Operating Procedure reference 7.04

Name: B.J. Baylidge Date: 29.03.11
 Checked: [Signature] Date: 29/03/11
 Approved: [Signature] Date: 29/03/11 Revision:

Darshield™ rigid enclosures are designed to limit the temperature rise of the protected equipment in the event of a fire and enable operation for a specified time period.

Lloyds approved thermal transient software called 'Offtranp' calculates the optimal insulation thickness for each PFP application; and ensures that the thickness of the insulation is kept to the absolute minimum while still protecting the equipment as per stipulated fire conditions.

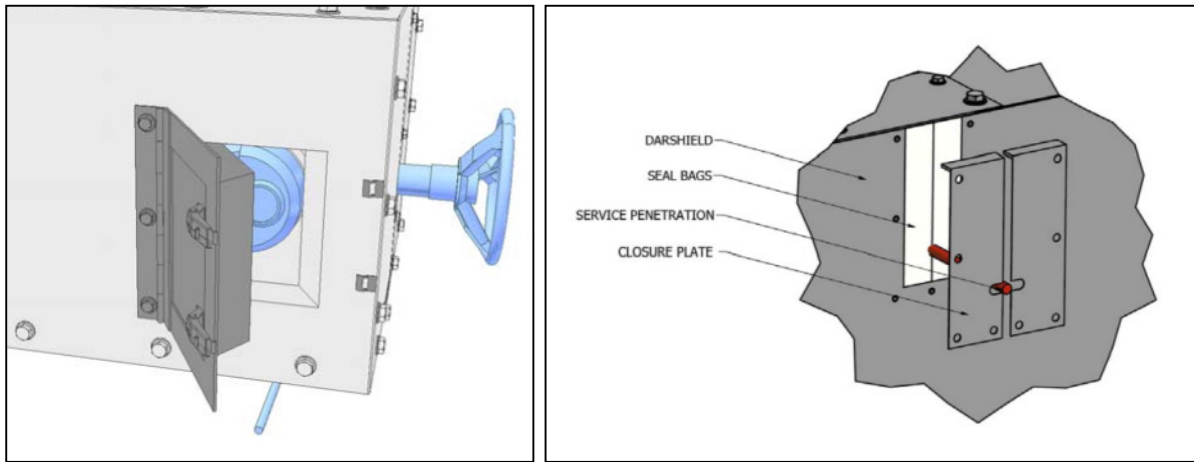
Optimisation of Darshield™ enclosures utilising Offtranp takes into account the following criteria, specific to each item being protected:

- **Type of fire**
- **Duration of Fire**
- **Limiting temperature rise**
- **Ambient and operating temperatures**
- **Mass of the equipment to be protected**
- **Exposed surface area**

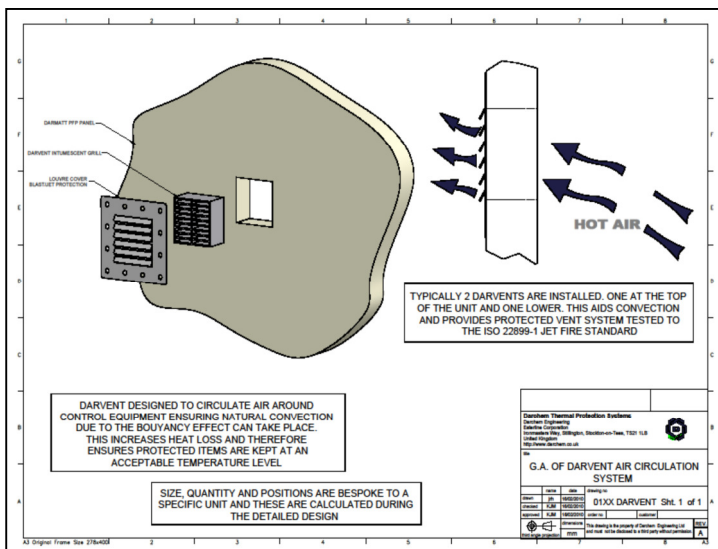
Hatches and Penetrations

Inspection hatches can be provided for each Darshield™ PFP system to provide quick access to areas that require regular inspection or maintenance. It is important that the client identifies any requirements for hatches and penetrations as early as possible such that they can be incorporated into the PFP system’s design.

Penetrations for operating mechanisms, hydraulic tubing and position indicators etc. can also be provided to facilitate problem-free operation and maintenance of equipment without the need to remove the enclosure. Incorporation of hatches and penetrations are approved within the Lloyds Type Approval certification for Darshield™. The system is designed such that installation at site can be achieved without disconnection of associated cables, piping etc.



Also, Darvent™ intumescent grills can be incorporated at customers request to allow for ventilation and air circulation around the protected equipment.



Darshield™ and Darmatt™ Hybrid Systems

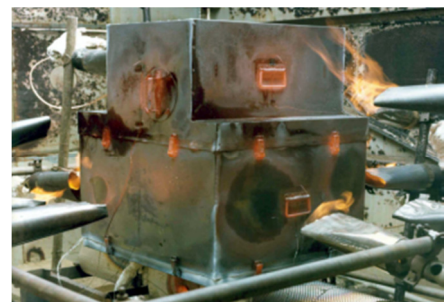
Darshield™ and Darmatt™ flexible jacket PFP systems can be combined to produce a Hybrid enclosure offering the benefits of both designs:



- **Darshield™ doors applied to regular access areas and enhance durability**
- **Darmatt™ jackets used where access is not required and space is at a constraint**
- **Hybrid combination helps reduce material costs**

Testing & Certification

Since its introduction the Darshield™ PFP System has been tested repeatedly to prove its capability as a PFP system. As a minimum Darshield™ enclosures are tested to the requirements of BS476 part 20 for UL 1709 for Hydrocarbon Pool Fires, and the OTI 95 634 standard for “Jet Fire Resistance Test of Passive Protection Materials”.



Lloyds Type Approval Certificate for Darshields™



CERTIFICATE OF FIRE APPROVAL

This is to certify that

The product(s) detailed below will be accepted for compliance with the applicable Lloyd's Register Rules and Regulations for use on offshore and onshore installations classed with Lloyd's Register, and for use on offshore and onshore installations when authorised by contracting governments to issue the relevant certificates, licences, permits etc.

Manufacturer Darchem Engineering Limited

Address Ironmasters Way
 Stillington
 Stockton-on-Tees
 Cleveland, TS21 1LB
 United Kingdom (UK)

Type FIRE PROTECTION ENCLOSURE SYSTEM

Equipment Description Fire Resisting Rigid Enclosure System – Type: "DARSHIELD" for Hydrocarbon and Jet Fire Exposures up to 120 minutes

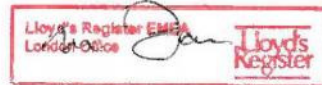
Specified Standard British Standard BS 476: Part 20, EN 1363-2, AMD 6487 and UL1709 (Hydrocarbon Fire Exposures) and Large Scale Jet Fire Testing

The attached Design Appraisal Document forms part of this certificate.
 This certificate remains valid unless cancelled or revoked, provided the conditions in the attached Design Appraisal Document are complied with and the equipment remains satisfactory in service.

Date of issue 7 October 2011 **Expiry date** 6 October 2016

Certificate No. SAS F110391

Signed



Sheet No 1 of 5

Name M. Farrier
 Surveyor to Lloyd's Register EMEA
 A Member of the Lloyd's Register Group

Note:

This certificate is not valid for equipment, the design or manufacture of which has been varied or modified from the specimen tested. The manufacturer should notify Lloyd's Register of any modification or changes to the equipment in order to obtain a valid Certificate.

Lloyd's Register, its affiliates and subsidiaries and their respective officers, employees or agents are, individually and collectively, referred to in this clause as the 'Lloyd's Register Group'. The Lloyd's Register Group assumes no responsibility and shall not be liable to any person for any loss, damage or expense caused by reliance on the information or advice in this document or howsoever provided, unless that person has signed a contract with the relevant Lloyd's Register Group entity for the provision of this information or advice and in that case any responsibility or liability is exclusively on the terms and conditions set out in that contract.

Darshield applications include – protection of valves, actuators, control boxes and instrumentation



Protection of rigid risers - Darsplash™

Darsplash rigid riser fire protection is a development of Darshield. The Darsplash system is fully seal welded to prevent water ingress, with the completed units being protected using “Anti-Fouling” coats of paint. Designed for a life span of twenty plus years, it is constructed from a rigid Stainless steel 316 construction encapsulating ceramic fibre, and uses standard angle fixings bolting panel to panel together. Neoprene gasket can be incorporated between the riser and the inner skin of the Darsplash and also between bolted joints if required.

Darsplash is designed to withstand a hydrocarbon flame and Jet Fire temperatures in excess of 1200°C for periods up to 120 minutes, controlling the temperature rise of the protected equipment to below its limiting temperature.

Darsplash examples



Darchem Thermal Protection, Darchem Engineering Ltd, Stillington, Stockton-On-Tees, TS21 1LB, UK
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Radiant Heat and Wind Shield Solutions

Darchem Thermal Protection, a strategic business unit within Darchem Engineering, specialises in the design, development and manufacture of Radiant Heat and Wind Shields for the protection of personnel, equipment and structures from radiant heat, fire and inclement weather conditions.

Darchem offers two types of Heat Shield solutions based upon the incidental heat flux levels and the required reduction:

- **Darscreen™ Woven Mesh System**
- **Darflare™ Chevron System**



Darflare™ Chevron System installed on BP Bruce, UK North Sea

The Darscreen™ Woven Mesh System is designed for use with lower level heat fluxes, or for wind shielding, and is commonly employed as a vertical heat shield protecting critical equipment, structures, and personnel.

The Darflare™ Chevron System is designed for use with higher heat flux levels such as those experienced during flaring operations.

The science of Thermal Radiation

Thermal radiation is the transmission of heat by the propagation of electromagnetic radiation. Unlike other forms of heat transfer it does not increase and decrease linearly with temperature but proportionately to the 4th power of the absolute temperature. The relationship between temperature and thermal radiation is defined by the relationship:

$$q = \epsilon \sigma AT^4$$

Radiant heat flux is equal to the product of emissivity, Stefan-Boltzmann constant, area and the fourth power of absolute temperature

Thermal radiation forms part of the electromagnetic spectrum of which visible light, radio waves and microwaves are also part. Thermal radiation is generally referred to as heat flux and is measured in kW/m².

In general, thermal radiation can be compared to the behaviour of visible light; in that it emanates from a point or series of points and disperses in intensity equally in all directions. Therefore, the intensity of the heat will diminish as the distance from the heat source increases. This heat dispersion pattern should be simple to calculate given a relatively small heat source.

However, these heat sources are complicated large moving, three-dimensional entities such as fire, flares, and hot exhaust gases, complicating the heat dispersion pattern.

Design of Thermal Radiant Shielding

Thermal Radiation Shielding can be divided in to two distinct categories:-

- a) Continuous Shielding (steady state); as in the case of a flare tip on an Offshore Installation
- b) Fire Hazard Shielding (limited duration); where a piece of equipment is adjacent to a potential fire hazard for the time it would take to extinguish the potential fire.

For most design cases the same design process is used for both types of shielding and that is to design to the worst case steady state scenario.

Thermal Radiation Shielding design is substantiated by test work. It must be remembered that an actual fire scenario is not a point source of heat and a view must be taken to the proximity of the fire and the viewable area of the fire relative to the size of the protected item.

Heat Shield Designs

Each heat shield manufactured is individually designed based on the incidental heat flux levels and frequency, heat reduction target and any additional customer specific requirements.

Darscreen™ Woven Mesh System



The Darscreen™ Woven Mesh system is designed for lower heat flux levels. Although the system can be employed as a horizontal heat shield fitted directly below the flare tip, it is more commonly used as a vertical heat shield solution protecting critical plant, steelwork and personnel in the event of a fire, offering up to a 75% reduction in irradiance.

Darscreen™ Woven Mesh system installed on the Escravos Platform, Nigeria

The system is manufactured as a modular system with individual panels made up of a 1 or 2 layers of 4 x 4 or 8 x 8 woven mesh welded to a channel frame. Where a load bearing requirement is present, i.e. in a horizontal system, grating can be welded to the top edge of the frame. The individual panels are kept at a manageable size to allow ease of installation.

Where solid system barriers would prevent natural lighting and could trap gas the woven mesh system has excellent see-through properties and is naturally venting. The woven mesh system also puts less loading from wind pressure on the supporting structure than a solid barrier



Model showing mounting of Darscreen™

Wind Shielding



Darscreen™ can also be installed to protect personnel using walkways, stairwells, and other areas exposed to high wind conditions.

The use of a mesh system has the advantage over a perforated plate system by having better visibility for personnel and less risk of stagnant regions.

Also the loading on the structure is less and the wind reduction is more evenly distributed than that achieved with perforated plate.

A choice of mesh size is available to achieve the required wind reduction for the lowest cost.

Darscreen™ wind / heat shield protection for escape stair tower

Darscreen™ Radiation Shield Performance

Darchem can predict the reduction in radiation heat flux for various different configurations of Darscreen™ Woven Mesh heat shields. For a known incident heat flux on the hot face of the heat shield the attenuated heat flux can be predicted at set distances from the cold face of the heat shield. A spreadsheet has been created using comprehensive test data on vertical heat shields.

The following summary shows the predicted heat flux in kW/m^2 at a distance X from the cold face of the heat shield for different shield designs. In conjunction with the recommended exposure data, it can be seen that in this example, a Double Layer 8 x 8 Woven Wire Mesh shield would be necessary to reduce the stated input heat flux to an acceptable level for general areas where personnel may be exposed.



Summary of Radiation Shield Performance

Input Heat Flux (kW/m²)
 Distance **X** (mm)

Description	Heat Flux kW/m ²	Reduction on Input Heat Flux
8 X 8 Woven Wire Mesh Single Layer (25%)	2.0	84%
8 X 8 Woven Wire Mesh Double Layer (25%)	0.6	95%
4 x 4 Woven Wire Mesh Single Layer (56%)	4.3	66%
4 x 4 Woven Wire Mesh Double Layer (56%)	2.0	84%

Based On Vertical Radiation Shield
 Test Report No. DF/06/0004

Exposure Time against Radiation Level

Conditions	Maximum Exposure Time	Radiation Level kW/m ²
Greatest Solar Radiation	Continuous in Light Winds	1
Working areas where personnel are continuously exposed	Continuous in Light Winds	1.6
General areas where personnel may be continuously exposed		1.9-2.5
Emergency action areas: upper limit for working when wearing normal clothes and intermittently sprayed by water or sheltered	2 Minutes	4.7
Emergency action areas	30 Seconds	6.3
Immediate evacuation required	Few Seconds Only	9.5

Note: Maximum permissible personnel exposure level to radiation from flare and Sun, according to API RP521

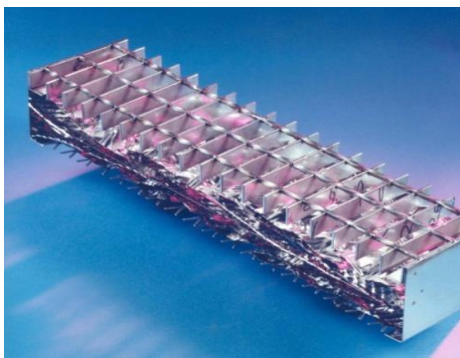
Darflare™ Chevron System

The Darflare™ Chevron system was developed in the early 1980's in collaboration with British Petroleum after experiencing problems on the Magnus Offshore Platform. The flare tip heat flux was higher than anticipated and the heat shield installed was buckling and distorting under normal operating conditions.

As a result the underlying steelwork was being compromised due to being exposed to temperatures beyond acceptable design conditions. Following the Darchem / BP Collaboration the Chevron system was developed and installed on the Magnus Platform. This not only resolved the problem but also offered a heat flux reduction of more than 90%.



Darflare™ Chevron System installed on the BP Magnus Platform, UK North Sea



Darflare™ Chevron System cross-section showing the load-bearing grating and underlying contoured foils.

The Chevron system is designed, through convective airflow through the panels, to reduce the radiant heat on the cold face of the shield to below 100°C during flaring ensuring that the structural steelwork is not compromised. The system is manufactured as a modular design with each panel made up of a fabricated perimeter consisting of a metallic edge skin with a load bearing supporting grating fixed to the top surface 'hot face' of the panel. Formed thin sheet foils provide a contoured surface to promote cold air convection up through the panel to the 'hot face'.

The bottom surface 'cold face' of the panel is supported by expanded metal to facilitate airflow and to hold the foil sheets in place.

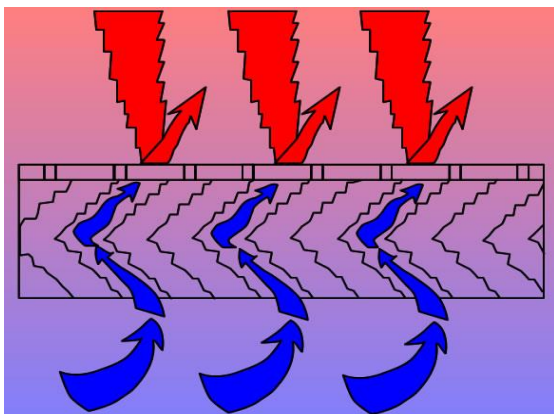


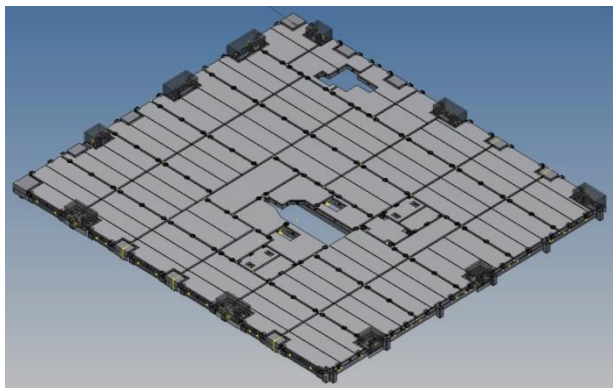
Diagram showing the cold air convection through to the hot face of the Darflare™ Chevron System



Completed panel sections incorporating grating and foils

The panels are assembled with a proprietary fixing system, designed to allow the system to expand during flaring intervals while holding each panel in place to the supporting structure.

To allow access for maintenance, hatchways can be incorporated in to the system, these are constructed using hinged access doors secured with shoot bolts, welded to the cold face of the shield.



Darflare™ heat shield model – overall design showing panel arrangement, access points and hand rail & pulling posts



Trial-build assembly of Darflare™ heat shield before shipment to customer

Principle Features of the Radiant Heat Shield Systems

- Lightweight:** Load bearing heat shields have a weight of circa 38 Kg/m² and the non-load bearing shields have a weight of circa 20 Kg/m².
- Cost Effective:** Darchem heat shields are competitively priced compared with solid systems. The systems can be designed and manufactured using both stainless steel and incoloy steel.
- Maintenance Free:** The Heat Shields are designed to be completely maintenance free during the projected life of the platform, even when subjected to thermal cycling from the operational flares and extreme environmental conditions.
- Heat Dissipation:** Darflare™ and Darscreen™ have a greater heat dissipation than their solid system counterparts. In the case of the Woven Wire System a solid plate barrier would have a greater touch surface temperature than the woven wire system.
- See-through venting:** The Darscreen™ Woven Wire system has excellent see-through properties and is naturally venting. Solid systems prevent natural light and could trap gas that may permeate from the adjacent process plant. The see-through properties reduces the claustrophobic effect that a solid system may present during normal operating conditions.

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