

## 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**

Darchem Thermal Protection Systems  
Darchem Engineering  
Esterline Corporation  
Innovators Way, Dillingham, 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: 150mm 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: 0.254 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	265	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	388	258	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	308	181	82	25
21.0	1093	1023	876	863	772	673	567	454	336	217	95	25
22.5	1093	1026	876	872	789	691	589	479	363	249	109	25
24.0	1093	1028	876	881	799	706	605	501	386	262	122	25
25.5	1093	1030	876	888	807	719	624	520	406	281	135	25
27.0	1093	1032	876	894	816	731	635	536	424	297	148	25
28.5	1093	1034	876	900	824	741	650	551	439	312	160	25
30.0	1093	1035	873	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.

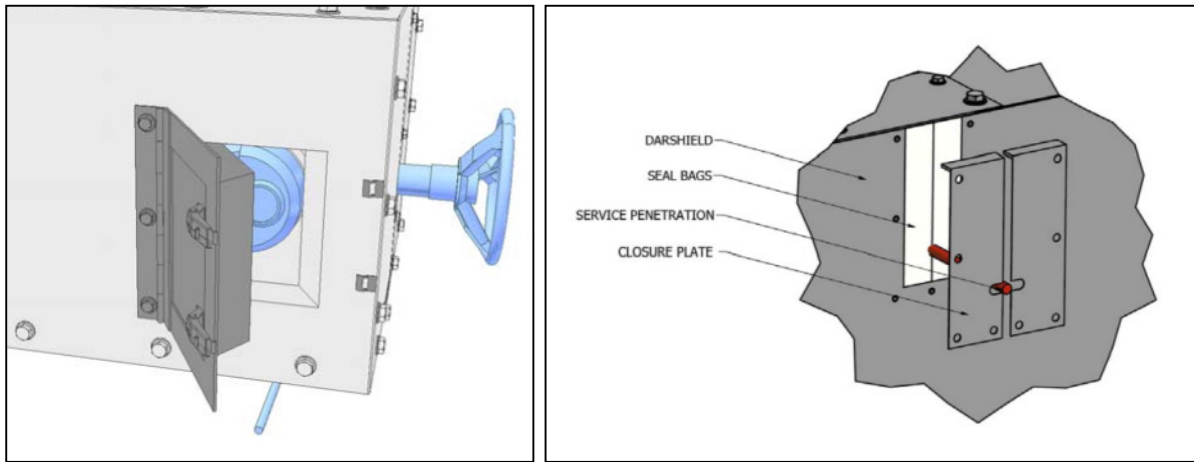
Optimisation of Darshield™ enclosures utilising Offtranp takes into account the following criteria, specific to each item being protected:

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

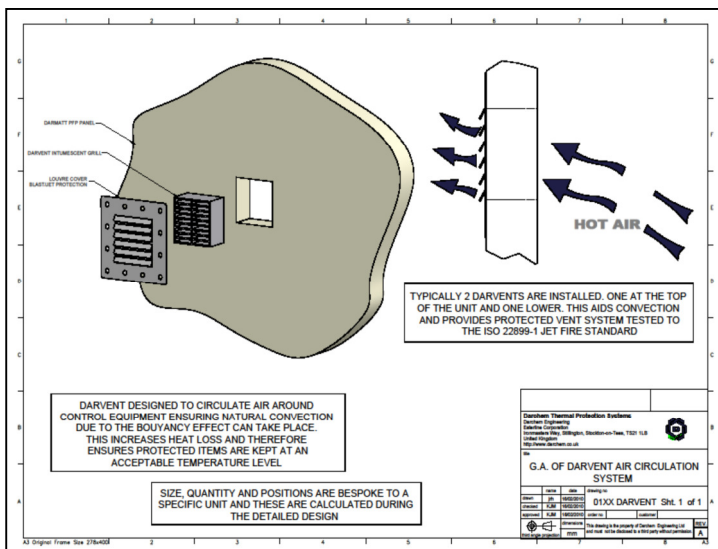
Hatches and Penetrations

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

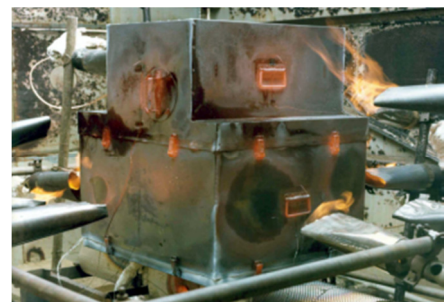
Darshield™ and Darmatt™ flexible jacket PFP systems can be combined to produce a Hybrid enclosure offering the benefits of both designs:



- **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.

<b>Manufacturer</b>	Darchem Engineering Limited		
<b>Address</b>	Ironmasters Way Stillington Stockton-on-Tees Cleveland, TS21 1LB United Kingdom (UK)		
<b>Type</b>	FIRE PROTECTION ENCLOSURE SYSTEM		
<b>Equipment Description</b>	Fire Resisting Rigid Enclosure System – Type: "DARSHIELD" for Hydrocarbon and Jet Fire Exposures up to 120 minutes		
<b>Specified Standard</b>	British Standard BS 476: Part 20, EN 1363-2, AMD 6487 and UL1709 (Hydrocarbon Fire Exposures) and Large Scale Jet Fire Testing		
<p>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.</p>			
<b>Date of issue</b>	7 October 2011	<b>Expiry date</b>	6 October 2016
<b>Certificate No.</b>	SAS F110391	<b>Signed</b>	
<b>Sheet No</b>	1 of 5	<b>Name</b>	M. Farrier Surveyor to Lloyd's Register EMEA A Member of the Lloyd's Register Group
<b>Note:</b>	<p>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.</p> <p><small>*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.*</small></p>		

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

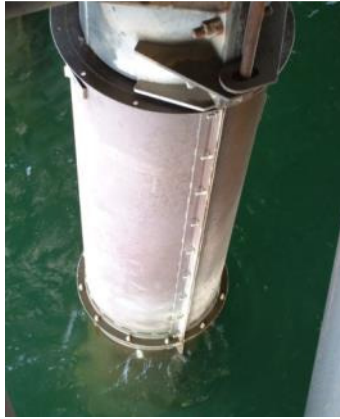


## Protection of rigid risers - Darsplash™

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



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