

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
Ironmasters Way, Stillingon, Stocken-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	190mm at 128kg/cu m
Insulation Thickness	75mm
Inner Skin Thickness	0.91mm
Inside Area of Darshield	5.008 sq m
Minimum Periphery of Shield Section	3.2m
Valve Stem Included?	Yes
Metallic Cross-Sectional Area of Stem	0.0036 sq m
Length of Stem to Outer Surface of Shield	0.076m
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	401	127	51	45	45	45	45	45	45	45	45	45
3.0	1093	737	360	108	51	45	45	45	45	45	45	45
4.5	1093	889	644	373	146	61	47	45	45	45	45	45
6.0	1093	934	747	535	313	138	64	48	45	45	45	45
7.5	1093	959	803	627	435	248	115	61	48	45	45	46
9.0	1093	975	839	687	518	344	190	83	56	47	45	46
10.5	1093	986	865	729	579	420	265	142	76	53	46	46
12.0	1093	995	895	762	626	480	332	199	107	63	47	47
13.5	1093	1002	900	787	663	528	388	255	147	81	50	47
15.0	1093	1008	913	808	693	568	436	305	190	106	54	48
16.5	1093	1012	923	825	717	601	477	350	232	133	61	48
18.0	1093	1017	932	840	738	629	511	390	270	162	71	49
19.5	1093	1020	940	852	756	652	541	424	305	191	82	51
21.0	1093	1023	947	863	772	673	567	454	338	217	95	52
22.5	1093	1026	953	872	786	691	589	479	363	240	108	55
24.0	1093	1028	958	881	797	706	605	501	386	262	122	57
25.5	1093	1030	962	888	807	719	624	520	406	281	135	60
27.0	1093	1032	965	894	816	731	638	536	424	297	148	64
28.5	1093	1034	970	900	824	741	650	551	439	312	160	68
30.0	1093	1035	973	905	831	750	661	563	453	325	171	72

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.

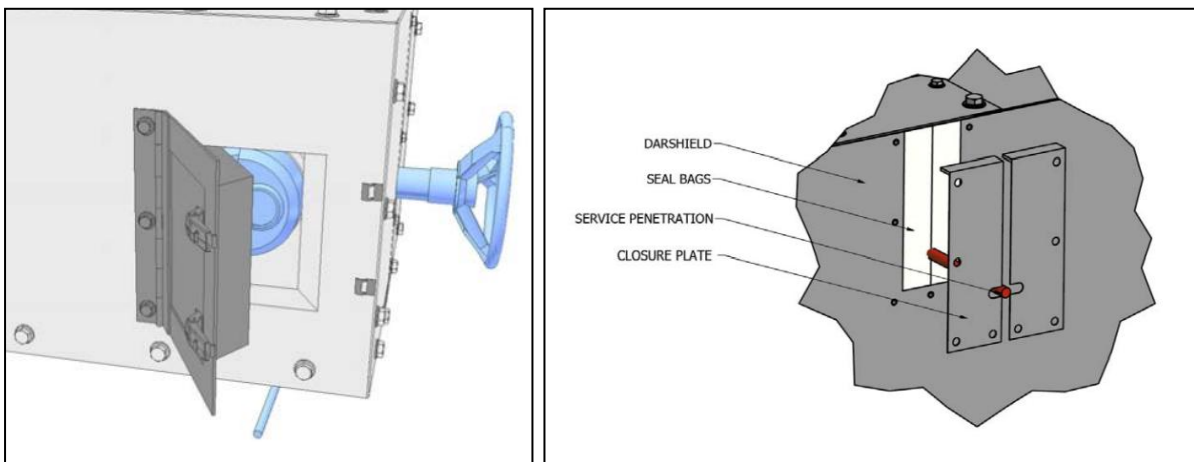
Optimisation of Darshield™ enclosures utilising Offtranp takes into account the following criteria, specific to each item being protected:

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

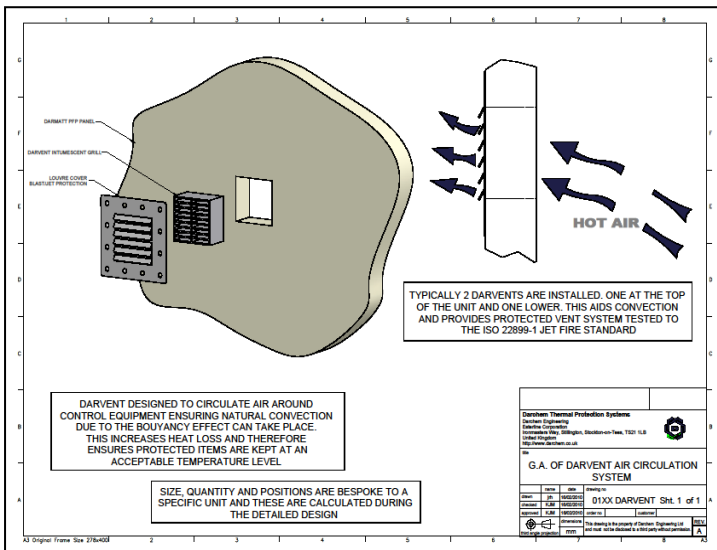
Hatches and Penetrations

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™.



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

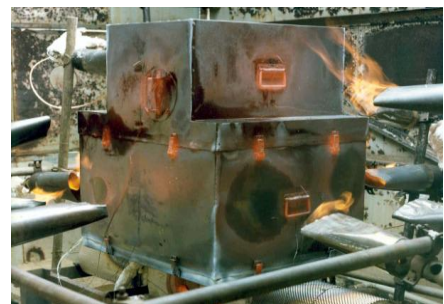
Darshield™ and Darmatt™ flexible jacket PFP systems can be combined to produce a Hybrid enclosure offering the benefits of both designs:



- **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 Large Scale Jet Fire Testing.



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 installations classed with Lloyd's Register, and for use on offshore 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 Enclosure System – Type: "DARSHIELD FIRE PROTECTION ENCLOSURES" for Hydrocarbon and Jet Fire Exposures
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	6 August 2009	Expiry date	5 August 2014
Certificate No.	SAS F090255	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.

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