ContraFlame®

CSP/PFP

Is a lightweight composite coating system designed to provide resistance to liquid cryogenic spillage for 120 minutes.

With over 25 years of upstream offshore and near-shore track record in protecting structural, architectural and processing elements, ContraFlame® CSP/PFP's unique syntactic phenolic foam and phenolic glass reinforced laminate is truly passive. It does not undergo any chemical or physical change during exposure to heat, fire or cryogenic spill and is suited for operation in a wide range of temperatures between (-196°C and +185°C).

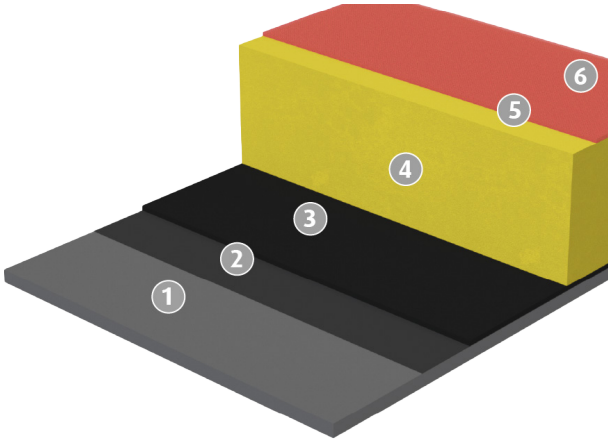
ContraFlame® CSP/PFP can be applied as a wet-applied system to protect risers, vessels and steel structures. It can also be pre-formed as enclosures and half shells to protect valves and flanges.

Ambient cure coupled with hand tooling application means that ContraFlame® CSP/PFP can be applied anywhere in the world, including offshore facilities. ContraFlame® CSP/PFP is designed for life of field and requires zero maintenance during operation.

Product construction

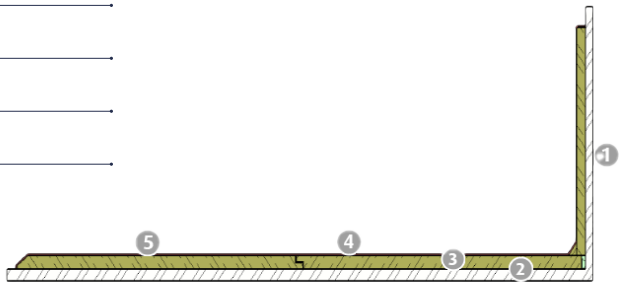
The wet-applied system comprises tiecoat, single layer of C50 phenolic syntactic foam, and D2004 phenolic laminate.

1. Blasted steel substrate (e.g. SA 2.5)
2. Approved primer (typically two-pack epoxy)
3. ContraFlame® tiecoat (150 - 300 micron)
4. ContraFlame® C50x8 (min.10mm - max. 90mm)
5. ContraFlame® D2004 laminate (min. 2.4mm)
6. Approved topcoat



The pre-formed system comprises 1m x 0.5m C50 tiles bonded to substrate and site applied D2004 phenolic laminate.

1. Steel substrate coated with anti-corrosion coating (can include PU topcoat)
2. Flexible adhesive
3. ContraFlame® pre-formed tile
4. ContraFlame® D2004 laminate (min 2.4mm - can include grit)
5. ContraFlame® D2004 laminate (min. 2.4mm)
6. Approved topcoat



Product characteristics

- Designed for an operational life over 25 years
- Superior resistance to cryogenic spillage
- Designed to resist jet fire following cryogenic spillage
- Operational temperature range (-196°C and +185°C)
- Jet fire JF120 and pool fire H240 rating
- DNV, Lloyds, BV and ABS approved
- 4.2 bar overpressure blast rated
- Closed cell structure
- Robust energy absorbing structure
- Excellent water resistance
- Designed to resist multiple cryogenic spillages.

Typical applications

- Underdecks, LNG decks, bulkheads, spill trays
- Gravity-based structures, concrete structures at risk of spalling
- Vessels, saddles
- Process pipework
- Separators, hot slug catchers
- Production risers, riser clamps, riser jet fire deflectors.

Performance and properties

Typical general characteristics	Value
Density (cured)	**C50x8** – 270-330 kg/m^3, **D2004** – 1,450 kg/m^3
Max and min operating temperatures	-196°C to +185°C
Thermal conductivity @ 25°C	**C50x8** – 0.05 W/mK, **D2004** – 0.2 W/mK
Specific heat capacity	1.5 J/g°C
Expansion coefficient	**C50x8** – 20.7 x 10-6, **D2004** – 23.96 x 10-6
Young's modulus	**C50x8** – 465 MPa, **D2004** – 5660 MPa
Tensile strain to failure	**C50x8** – 1%, **D2004** – 1.65%
Tensile strength	**C50x8** – 5.15 MPa, **D2004** – 61.6 MPa
Shear strength / modulus	**C50x8** – 0.76 MPa / 121 MPa
Compressive strength	**C50X8** – 5 MPa
Compressive resistance of the system	18.3 MPa
Water absorption	<1% by weight
Impact tested in accordance with ASTM G14	43.3J
Blast overpressure resistance	4.2 bar (unaffected)

Typical general characteristics	Value
Smoke generation - NES 711	8.71
Toxicity index - NES 713	1.41
Spread of flame - BS476: Part 7	Class 1
Limiting oxygen index - BS EN ISO 4589-2:1999	72%

Cryogenic spill performance

Cryogenic spill testing in accordance with ISO20088-1:2014, pre-formed ContraFlame® CSP/PFP system at overall thickness of 34mm (nominal) ambient temperature at 20°C

LIN Spill duration (min)	Wet-applied (°C)	Steel back face temp (°C)	Pre-formed (°C)	Temperature change (°C)
0	12.2	0	20	0
5	11.2	-1	20	0
10	10.7	-1.5	19.5	-0.5
15	9.6	-2.6	19	-1.0
20	7.8	-4.4	18	-2.0
25	5.6	-6.6	17	-3.0
30	3.1	-9.1	15.5	-4.5
45	-3.3	-15.5	10.5	-9.5
60	-6.5	-18.7	3.4	-166

Burning performance

Smoke, toxicity, combustibility, flame spread, oxygen Index, temperature Index, heat release

Test	Acceptance criteria	D2004	C50
Def stan 02-711 smoke densit	Index less than 50	N/A	8.71
Def stan 02-713 toxicity index	Index less than 5	N/A	1.41 - No HF, HCl or HBr was generated during the test
BS 476 Part 7 spread of flame	Class 1	N/A	Class 1
BS ISO 4589-2 oxygen index	Index in excess of 30%	72%	N/A

ContraFlame® planar jet fire rating to ISO 22899-1:2007

Total nominal thickness	C50x8 thickness	D2004 nominal thickness	Temperature rise (°C)			
(mm)	(mm)	(mm)	J30	J60	J90	J120
14	10	4	297.5	381.2	399.5	N/A
``	30	4	97	256	309	321
90	86	4	8	20	42	118

ContraFlame® JF120 tubular jet fire data (up to 0.5m dia) to ISO 22899-1

Total nominal thickness	C50x8 thickness	D2004 nominal thickness	Temperature rise (°C)			
(mm)	(mm)	(mm)	J30	J60	J90	J120
34	30	4	56	205	348.5	N/A
48.5*	42.5	6	44	82	N/A	N/A
96**	90	6	1.2	7.3	24.9	69.3

*Half shell system / ** JF20-200 system

ContraFlame® hydrocarbon fire resistant performance to UL1709 up to 240 minutes

Temperature rise	Total ContraFlame® system thickness	
(°C)	55mm	75mm
140	H60	H60/H120
180	H60	H60/H120
300	H60	H60/H120/H180
350	H60/H120	H60/H120/H180
400	H60/H120	H60/H120/H180
427	H60/H120	H60/H120/H180/H240
450	H60/H120	H60/H120/H180/H240
500	H60/H120	H60/H120/H180/H240
538	H60/H120	H60/H120/H180/H240
550	H60/H120	H60/H120/H180/H240

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