



Module 8 v1.0

Introduction to Hydrocarbon Fire Protection



A brand of *SHERWIN-WILLIAMS*.












Hydrocarbon PFP

The FIRETEX[®] brand has been providing fire protection to hydrocarbon projects around the world for over 20 years.

In this module we will explore the origins of hydrocarbon fire protection and how the FIRETEX[®] product range has evolved for use on offshore platforms, FPSOs, refineries, petrochemical plants, LNG terminals and storage facilities globally, making FIRETEX[®] the first choice for the oil, gas and petrochemical industry.

Hydrocarbon PFP

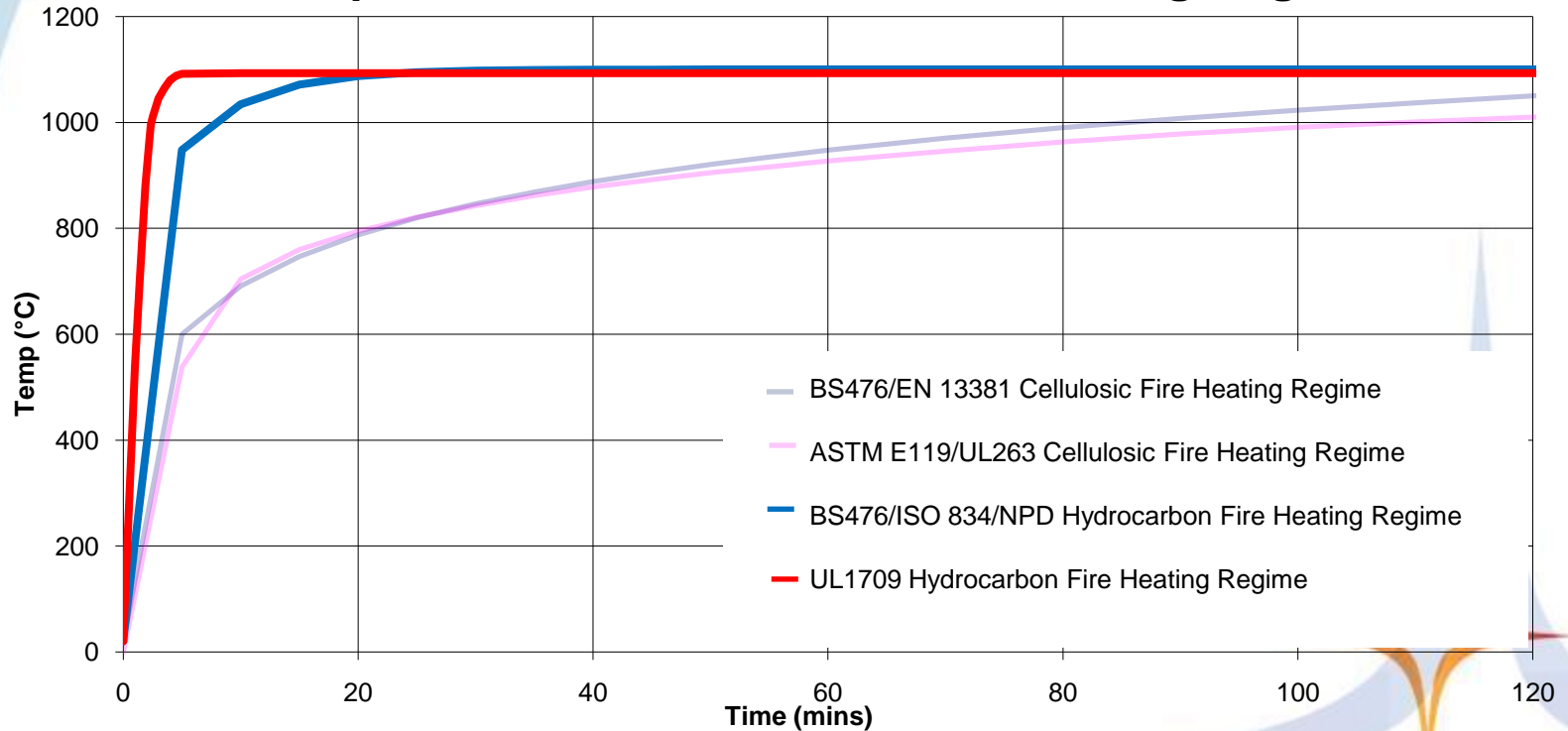
-  What is a hydrocarbon fire?
-  Testing of fire protection
-  Products
-  Specifying fire protection
-  Fire/certification type
-  Substrate type/section factor
-  Special considerations

Types of fire

- ✦ No 2 real fires are the same!
- ✦ Conditions depend on:
 - ✦ The type and quantity of fuel
 - ✦ The availability of oxygen
 - ✦ Ambient conditions
- ✦ For reproducible product testing “standard” fires have been defined

Heating regimes

Comparison of Standard Fire Test Heating Regimes





What is a hydrocarbon fire?

Fire type is defined by the fuel

For hydrocarbon fire:

- Oil, petrol, solvents, liquefied gasses, gas, etc.

BS 476-20&21 Appendix D

ISO 834/NPD

UL1709



What is a hydrocarbon fire?

Flammable liquids & gasses

Atmospheric pressure release

- Pool fire

High pressure release

- Jet fire



What is a hydrocarbon fire?

Pool Fire



Jet Fire



Fire testing

BS 476 (parts 20 & 21) and UI1709 describe how intumescent coatings are tested.

Coating thicknesses

Steel section types

- I sections, hollow sections

Section orientation

- Beam, column



Fire testing

ISO 22899-1 – Jet fire test

TRB 801 – Pressure vessel test

NFPA 58 (App H) – Hose stream test

IMO A754 (18) – Division tests

Fire Testing


Testing carried out by an independent organisation

Thermocouples used to measure

- Furnace temperature
- Core/back face steel temperature

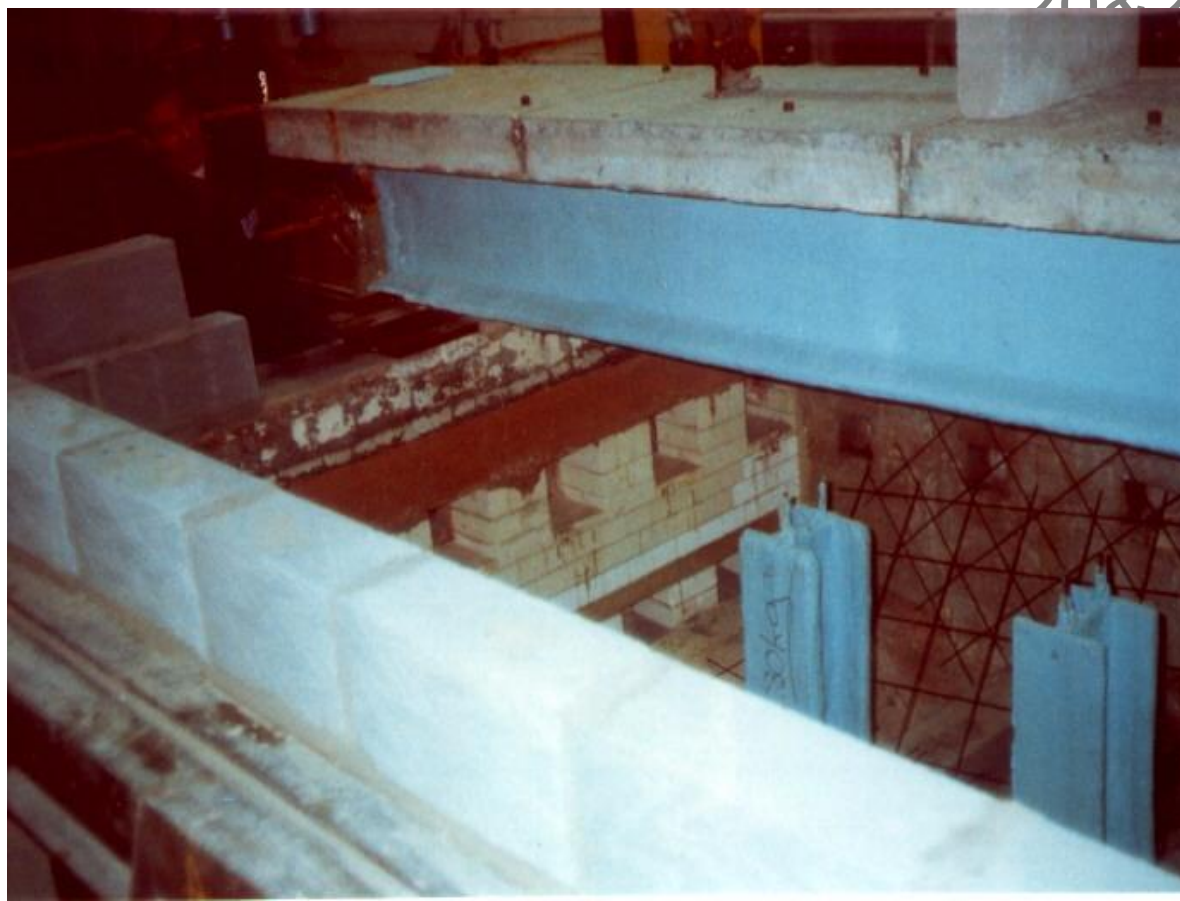
Can't test every possible variation

Results analysed to produce an
“Assessment” of performance



Fire Testing - BS476 Parts

20&21



Fire Testing – TRB 801



Fire Testing – TRB 801



Fire Testing

NFPA 58 Appendix H



Assessment/Type Approval



OFFICE
COPY

Lloyd's
Register

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	Leigh's Paints/ Sherwin Williams
Address	Tower Works Kestor Street Bolton, BL2 2AL United Kingdom (UK)
Type	STRUCTURAL STEEL HYDROCARBON FIRE PROTECTION SYSTEM
Equipment Description	Structural Steel I-Sections Protected with "FIRETEX M90/02" reinforced with Firetex J220 Scrim Mesh, incorporating jet fires up to 120 minutes duration.
Specified Standard	International Standard BS 476: part 20, incorporating a Hydrocarbon Time/Temperature Relationship International Standard ISO 22899-1 "Determination of the resistance to jet fires of passive fire protection materials - Part 1 General Requirements

The attached Design Appraisal Document forms part of this certificate.



Assessment/Type Approval



Lloyd's Register EMEA

71 Fenchurch Street, London, EC3M 4BS

Telephone 020 7423 2416 Fax 020 7423 2053

Email tad@lr.org

OFFICE COPY
Lloyd's Register

Page	12 of 29
Document number	SAS F120232
Issue number	1

DESIGN APPRAISAL DOCUMENT

Date 29 June 2012	Quote this reference on all future communications LDSO/SFS/TA/PG
----------------------	---

ATTACHMENT TO CERTIFICATE OF TYPE APPROVAL No. SAS F120232

APPENDIX 5

Minimum dry film thickness (mm) of FIRETEX M90/02 reinforced with scrim mesh necessary to restrict the temperature rise in the steel core to 400 deg C, when applied to structural steel I sections within the specified time period in minutes, as a function of the cross sectional area and shape of the structural element, represented by the Hp/A value:

Where: Hp is the perimeter of the cross section of the element exposed to the hydrocarbon fire (m); and

A is the cross sectional area of the element (m²)

Hp/A	30	60	90	120	150	180	210
10	2.90	2.90	2.90	2.90	2.98	3.60	4.21
15	2.90	2.90	2.90	3.40	4.28	5.15	6.02
20	2.90	2.90	3.22	4.34	5.46	6.57	7.69



Durability

To protect steel in a fire the coating must:

- Be intact at the time of the fire
- Be resistant to the environment

Fire may occur during construction

May occur after 20 years service

Durability is ESSENTIAL!



Durability

Intumescent coatings contain key ingredients:

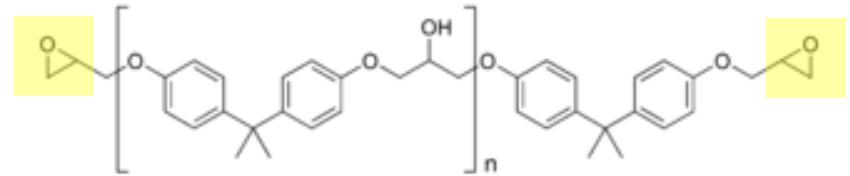
- Ammonium polyphosphate
- Melamine
- Pentaerythritol

Each are sensitive to moisture

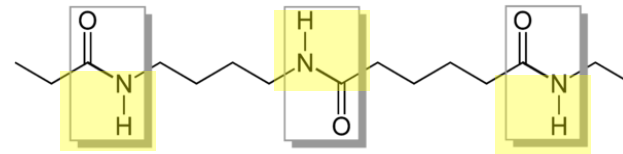
Careful formulation needed to produce durable products

Durability

Epoxy binder system
Epoxy resin



Amine curing agent



Produce a highly durable cross-linked
3D structure

Durability





Corrosion under Cementitious PFP



Corrosion under Cementitious PFP





Durability Testing Epoxy Intumescent

- UL1709
- Norsok M-501 revision 6
- GOST
- In-house data



UL1709 Durability Testing

Short sections exposed to environments and then fire tested:

Ageing – 70°C (158°F) for 270 days

Humidity - 100%RH @ 35°C (95°F) for 180 days

Industrial Atmosphere - SO₂/CO₂, 35°C (95°F) for 30 days

Salt Fog ASTM B117 for 90 days

Cycle test – Wet for 72 hrs; Freeze @ -40°C (-40°F) for 24 hrs; Dry 60°C (140°F) for 72 hrs

Time must be at least 75% of non-exposed control

May have top coat



Norsok M501 Durability Testing

Cycle testing

72 hours UV/Condensation (60°C/50°C)
(140°F/122°F)

72 hours Salt Fog

24 hours drying @ -20°C (-4°F)

Fire Testing exposed panel against
non-exposed control.

Must be within 10% of each other.

No top coat



In-house durability testing

Coated steel I - Section & CHS

Immersed in salt water

One removed each year & fire tested
against non-immersed control

No reduction in performance after 15 years
immersion in salt water

400 μ Glass Flake Epoxy top coat



Epoxy Intumescent – Durability

Will not spall or crack in use

Resistant to atmospheric and chemical attack

Excellent bonding between substrate, primers and Intumescent combats the problems of under-film corrosion

Re-coatable with itself – even after prolonged curing

Will provide Corrosion/Fire protection for the life of the asset





FIRETEX Intumescent Coatings

FIRETEX M90 launched in 1994

- 20 years track record
- Over 400 projects completed
- More than 12 million kilo's applied

FIRETEX M90/02 launched 2012

- Improved performance
- Reduced weight
- Extended fire protection





FIRETEX M90/02

Tested to:

BS476-20&21 Appendix D

Hydrocarbon

UL1709

TRB801

ISO 22899

IMO A754 (18)

NFPA 58, Appendix H



FIRETEX M90/02

Weight reductions

As low as ½ the weight of M90

Up to 30% less weight than market leader

Extended fire protection range:

UL1709

Up to 4 hours protection

Lloyd's Register, Det Norske Veritas &
American Bureau of Shipping:

Up to 3½ pool and jet fire protection





Specifying fire protection

Certification requirement

UL1709

Lloyd's Register Type Approval

Det Norske Veritas Type Approval

Etc

Fire case

Pool fire

Jet fire



Specifying fire protection

Items to be protected

Structural steel

Vessels

Divisions

Critical steel temperature

Divisions – 140°C temperature rise

Structural – 200 up to 750°C

Vessels – 200 up to 350°C

Section factor



Specifying fire protection

Fire protection period

½ up to 4 hours

Service environment

Special requirements

Blast resistance

High or low substrate temperature

Cryogenic spill protection



FIRETEX Application

Can't abrasive blast?

Water jet and prime with Epigrip M111

Hot substrate?

Insulate with FIRETEX M89/02

PFP in the splash zone?

Protect with Epigrip M922

Working deck area?

Protect with Epidek M153/M339





Any Questions?
