

# Industrial fireproofing

Superior performance in intense hydrocarbon fire events



# Proven products from the industry leader

Solving our customers' problems is how we got started and after over 75 years, it's still our focus at Carboline.

# 1947

Since 1947, we have been dedicated to delivering innovative coatings, linings and fireproofing products. We are driven to provide the best solutions, service and quality to our customers.



Our customers can be confident that behind every sale is a team of some of the most well-respected members of the industry, dedicated and determined to make your project a success.



Our global network of industrial service centers and distribution points are strategically located around the world to provide the highest level of service and support for your project.



[www.carboline.com](http://www.carboline.com)





Carboline manufactures rigorously tested, field-proven passive fire protection (PFP) solutions for demanding onshore petrochemical and offshore oil & gas environments. High-performance cementitious and intumescent materials are developed to protect people and infrastructure while accelerating schedule for value-added construction.

## Certifications & listings

Carboline's PFP materials have been fully tested and are qualified according to the vigorous standards published by world-class organizations such as:



intertek

## Affiliations





# TESTING

## Extensive performance testing

Our Pyroclad®, Pyrocrete®, and Thermo-Lag® series materials are rigorously tested under destructive exposures to simulate real-world catastrophic fire events. Extensive third party certification ensures that our products meet the harsh performance and environmental requirements of onshore petrochemical facilities and offshore oil and gas assets. Meet hydrocarbon pool fire, jet fire, overpressure, and even cryogenic spill resistance criteria with this comprehensive portfolio.

## Performance testing & certification

Carboline's industrial fireproofing products have been certified to the following industry-accepted and third-party fire test standards:

- > UL 1709 Rapid Rise hydrocarbon fire
- > BS476-20 Appendix D hydrocarbon pool fire
- > ISO 834-3 hydrocarbon pool fire
- > ISO 22899-1 jet fire
- > ISO 20088-1 cryogenic spill
- > ISO 20088-1 cryogenic spill followed by ISO 22899-1 jet fire
- > NFPA 290 and NFPA 58 Annex H torch & hose stream resistance
- > Up to 4-bar overpressure explosion resistance
- > ISO 20340 cyclic aging
- > NORSOK M-501 System 5A

## UL 1709 Environmental Program

All Carboline industrial PFP products have been tested and certified to the UL 2431 Durability of Fire Resistive Coatings and Materials, Category I-A. This standard subjects materials to various condition environments that include air erosion, wet, freeze, and dry cycling, high humidity, physical impact, industrial fallout, salt spray, temperature stability, UV light, and vibration. Materials are fire tested post cyclic exposure and conditioning to ensure they retain fire performance.



## Comprehensive cementitious and intumescent fireproofing solutions

Use the chart below to build your site's best-fit passive fire protection program according to a variety of rating requirements and exposure scenarios.

Product	Pyrocrete Series*	Pyroclad X1	Thermo-Lag 3000
Type	Cementitious	Epoxy intumescent	Epoxy intumescent
Environment	Onshore petrochemical	Onshore petrochemical offshore oil & gas	Onshore petrochemical
Hydrocarbon protection	Up to 4 hours	Up to 3 hours	Up to 4 hours
Jet fire protection	2 hour	Up to 2 hours	NR
Cryogenic protection	Up to 90 minutes	Up to 60 minutes**	Up to 60 minutes**
Environmental protection	UL 2431 Category I-A	NORSOK M501 System 5A Rev. 6 UL 2431 Category I-A	UL 2431 Category I-A ISO 20340 Annex A aging procedure
Topcoat requirement	No	No	Yes
Explosion resistance (no cracking or disbondment)	4 bar	4 bar	1.43 bar + 7" deflection
Primary certification	UL 1709 hydrocarbon fire ISO 22899-1 jet fire	UL 1709 hydrocarbon fire ISO 22899-1 jet fire	UL 1709 hydrocarbon fire
Suitable for shop application	Yes	Yes	Yes

\* Pyrocrete Series includes: Pyrocrete 341, Pyrocrete 241 HD, Pyrocrete 241, Pyrocrete 241 HY, and Pyrocrete 40

\*\* Requires Carbotherm syntactic epoxy insulation beneath PFP system

■ Industrial cementitious

■ Industrial intumescent

# CEMENTITIOUS

## High-density cementitious fireproofing

To mitigate fire risk in on- and offshore facilities, higher-density, higher-performance cementitious materials are required compared to what's common in commercial structures. Carboline's Pyrocrete series products have been industry game-changers since the 1970s on the strength of their superior fire-resistive performance at a fraction of the installed weight of conventional concrete. They also featuring excellent weathering and resistance to the thermal and physical shock that are expected in extremely harsh industrial environments.

**Pyrocrete 341** is a next-generation reinforced hydrophobic cementitious hybrid fireproofing material. This minimum average 52 lb/ft<sup>3</sup> (833 kg/m<sup>3</sup>) density, Portland-cement based solution simplifies fire hazard planning because it is rated for hydrocarbon pool fire, hydrocarbon jet fire, and cryogenic spill exposure in a single package.

**Pyrocrete 241** is a 55 lb/ft<sup>3</sup> (881 kg/m<sup>3</sup>) high-density material that fundamentally changed industrial passive fire protection system design in the late 1970s and remains a high performer today.

**Pyrocrete 241 HY** is a 50 lb/ft<sup>3</sup> (800 kg/m<sup>3</sup>) high density fireproofing with high physical performance, excellent durability, and increased yield.

**Pyrocrete 40** is a 40 lb/ft<sup>3</sup> (640 kg/m<sup>3</sup>) high-density material with excellent physical performance, high-build characteristics, and outstanding coverage.

### Product comparison

		Pyrocrete 341	Pyrocrete 241	Pyrocrete 241 HY	Pyrocrete 40
Density	ASTM E605	52-55 lb/ft <sup>3</sup> (833-881 kg/m <sup>3</sup> )	55 lb/ft <sup>3</sup> (881 kg/m <sup>3</sup> )	50 lb/ft <sup>3</sup> (800 kg/m <sup>3</sup> )	40 lb/ft <sup>3</sup> (640 kg/m <sup>3</sup> )
Hydrocarbon fire protection	UL 1709	Up to 4 hours	Up to 4 hours	Up to 4 hours	Up to 4 hours
Hydrocarbon fire protection	BS 476	NR*	Up to 4 hours	NR*	Up to 4 hours
Jet fire protection	ISO 22899	2 hours	2 hours	2 hours	2 hours
Cryogenic protection	ISO 20088-1	Up to 90 minutes	Up to 60 minutes***	Up to 60 minutes***	Up to 60 minutes***
Shore "D0" hardness	ASTM D2240	88	83	79	64
Bond strength**	ASTM E736	23,734 lb/ft <sup>2</sup> (1,136 kPa)	22,026 lb/ft <sup>2</sup> (1,054 kPa)	14,085 lb/ft <sup>2</sup> (674 kPa)	10,267 lb/ft <sup>2</sup> (491 kPa)
Compressive strength	ASTM E761	1,561 psi (10.76 MPa)	1,111 psi (7.6 MPa)	850 psi (5.8 MPa)	456 psi (3.1 MPa)
Explosion resistance		>4 bar	3 bar	3 bar	3 bar
Corrosion	ASTM E937	0.00 g/mm <sup>2</sup>	0.00 g/mm <sup>2</sup>	0.00 g/mm <sup>2</sup>	0.00 g/mm <sup>2</sup>
Hose stream endurance	NFPA 290	Pass	Pass	Pass	Pass

\* NR = Not Rated

\*\* Bond strength testing performed utilizing ASTM E736 with AWCI Technical Manual 12-A (Appendix B) modifications

\*\*\* Testing based on South Hook LNG immersion/splash and spill criteria



## Innovative epoxy intumescent fireproofing

Products in Carboline's Pyroclad and Thermo-Lag series comprise rugged, dependable fireproofing solutions for harsh industrial, petrochemical, and oil & gas environments. These innovative epoxy-based materials offer superior physical characteristics and long-term performance to ensure high durability during construction and in-plant exposure. The outstanding toughness of these materials makes them suitable for both shop and field applications.

**Pyroclad X1** is an ultra-durable epoxy based fireproofing with unsurpassed weathering characteristics, low thickness requirements, and excellent hydrocarbon jet and pool fire protection.

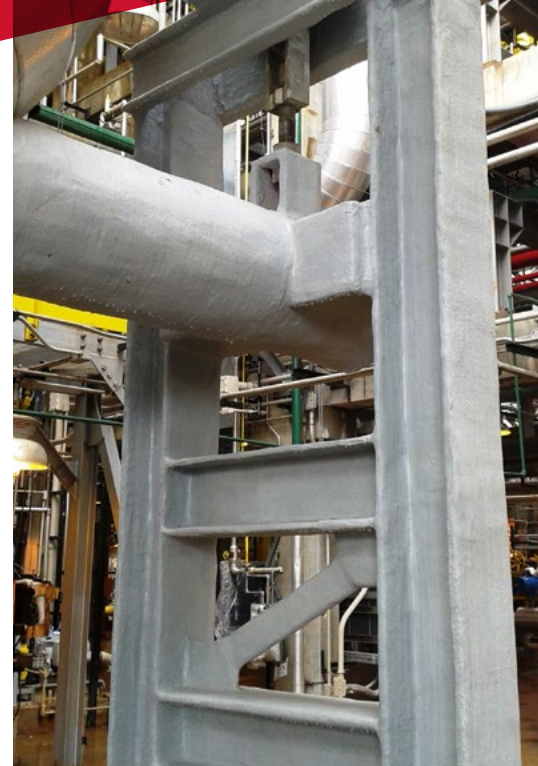
**Thermo-Lag 3000** is a flexible, two-component epoxy coating designed to provide asset integrity from the damaging effects of hydrocarbon fires. Thermo-Lag 3000 has established a record of exemplary fire protection in oil & gas, refining, power generation, marine, petrochemical, and liquefied natural gas facilities for over 25 years.

### Product comparison

		Pyroclad X1	Thermo-Lag 3000
Density	ASTM E605	64.3 pcf (1.03 g/cm <sup>3</sup> )	78.0 pcf (1.25 g/cm <sup>3</sup> )
Hydrocarbon fire protection	UL 1709	Up to 3 hours	Up to 4 hours
Jet fire protection	ISO 22899	Up to 2 hours	
Cryogenic protection		Yes*	Yes*
Shore "D0" hardness	ASTM D2240	70	55
IMO FTP code		H-0, H-60 & H-120 divisions	H-0, H-60 & H-120 divisions
Explosion resistance		4 Bar	1.43 Bar (Bulkhead)
Hose stream endurance	NFPA 290	Pass**	Pass
Flame spread	ASTM E84	20	0
Smoke development	ASTM E84	65	20

\* Cryogenic protection requires Carbotherm syntactic epoxy underlayment

\*\* Hose stream endurance for Pyroclad X1 is NFPA 58 Annex H



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