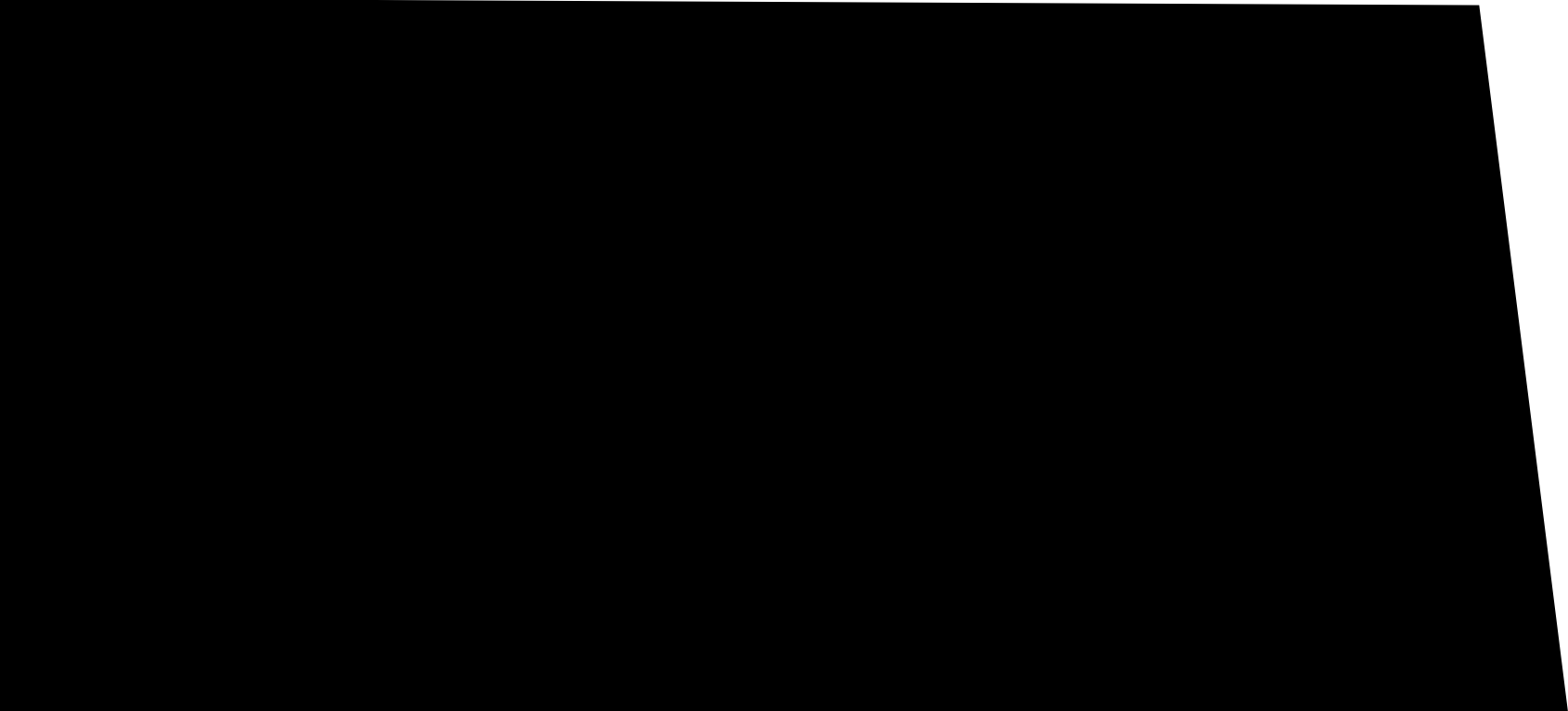


Industrial Fireproofing

Superior Fire Protection for Industrial Applications





Proven Products from an Industry Leader

Carboline is a global leader in providing high performance protective coatings and fireproofing products. Our comprehensive passive fire protection line offers dependable and proven solutions for the demanding onshore petrochemical and offshore oil & gas environments. Our global reach allows us to consistently provide the highest quality products and services to our customers anywhere in the world.

Certifications/Listing

Our highly regarded passive fire protection products have been fully tested and qualified to meet the most current fire protection and performance standards by world-class organizations such as:



Affiliations



Extensive Testing & Certification

Our Pyroclad, Pyrocrete, and Thermo-Lag brands have been rigorously tested and certified to trusted industry standards. These products have been subjected to a myriad of destructive exposures to simulate real world performance. 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. Our products stand the test of time and deliver hydrocarbon and jet fire protection when needed.

Fire Testing & Certification

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

- > UL 1709 Rapid Rise Hydrocarbon Fire
- > BS 476 Hydrocarbon Pool Fire
- > ISO 834 Hydrocarbon Pool Fire
- > ISO 22899-1 Jet Fire

Performance Testing

In addition to the fire and environmental test protocols, our products have also been successfully tested to the following independent third party test programs to simulate real world exposures:

- > Explosion Resistance (up to 4 Bar overpressure)
- > Hose Stream Resistance (NFPA 58 Annex H)
- > Cryogenic Immersion / Splash & Spill Resistance

Environmental Testing & Certification

UL 1709 Environmental Program

All Carboline industrial fireproofing products have been tested and certified to the UL 1709 Environmental Program. This program subjects products to harsh industrial atmospheric environments, high humidity, wet/freeze/thaw cycling, UV exposure and continuous salt spray conditions. Products are fire tested after cyclic exposures to ensure they retain fire performance.

NORSOK M-501 System 5A Rev. 6

Pyroclad X1 is in full compliance with NORSOK M-501 System 5A Rev. 6 with and without a topcoat. This program subjects products to 25 repeated cycles of accelerated aging according to ISO 20340. After exposure to cyclic testing, products are evaluated for corrosion creep beneath system, adhesion to substrate, and fire performance.



Carboline Passive Fire Protection Line

Carboline has the most comprehensive passive fire protection line in the industry. Our vast product depth allows for a tailor fit solution to meet any project's fire protection and performance requirement.

Product	Pyrocrete Series ¹	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 60 Minutes	Up to 60 Minutes ²	Up to 60 Minutes ²
Environmental Protection	UL 1709 Environmental Program	NORSOK M501 System 5A Rev. 6 UL 1709 Environmental Program	UL 1709 Environmental Program
Topcoat Requirement	No	No	Yes
Explosion Resistance (No cracking or disbondment)	3 Bar	4 Bar	1.43 Bar
Primary Certification	UL 1709 Hydrocarbon fire ISO 22899-1 Jet fire	ISO 22899-1 Jet fire UL 1709 Hydrocarbon Fire	UL 1709 Hydrocarbon fire
Suitable for Offsite Application	Yes	Yes	Yes

1. Pyrocrete Series includes: Pyrocrete 241 HD, Pyrocrete 241, Pyrocrete 241 HY, and Pyrocrete 40
 2. Requires Carbotherm syntactic epoxy insulation beneath PFP system

Industrial Cementitious
 Industrial Intumescent

Cable Fireproofing

Carboline's cable protection products offer an economical and maintenance-free solution to protect cables from fire exposure. Suitable for both exterior and interior use to protect cable trays and conduit. These durable and proven cable protection coatings are easily applied directly to cables and have extensive 3rd party testing and approvals to International Electrotechnical Commission (IEC) and Factory Mutual (FM Global) standards to provide up to 2 hour fire protection.



Thermo-Lag® 270 & Intumastic® 285

High performance, exterior rated, water based, fire resistant cable coatings that envelop the protected cables with a fire retardant jacket that protects against flame propagation and maintains circuit integrity during a fire.

- > **Circuit Integrity (IEC 60331-11):**
90 minutes @ 118 mils (3.0 mm)
- > **Circuit Integrity (IEC 60331-1):**
50 minutes @ 62 mils (1.6 mm)
- > **Flame Propagation (IEC 60332-3-22):**
120 minutes @ 62 mils (1.6 mm)

High Density Cementitious Fireproofing

Carboline's industrial cementitious fireproofing line offers a level of performance second to none. Our versatile range of products allow us to provide trusted solutions to meet and exceed any specified density and performance criteria. These products have been formulated to provide high durability and excellent weathering resistance that can withstand the harsh conditions of onshore industrial and petrochemical environments. The Pyrocrete high density cementitious line has been the industry leader for over 35 years and continues to be the most widely specified cementitious fireproofing product line in the industry today.

Pyrocrete® 241 HD

70 pcf (1,121 kg/m³) ultra high density, heavy duty cementitious fireproofing with the highest durability and toughness in the marketplace.

Pyrocrete® 241

55 pcf (881 kg/m³) high density cementitious fireproofing with a 35 year history and exceptional durability.

Pyrocrete® 241 HY

50 pcf (800 kg/m³) high density cementitious fireproofing with high physical performance, excellent durability and increased yield.

Pyrocrete® 40

40 pcf (640 kg/m³) high density cementitious fireproofing with excellent physical performance, high build characteristics and outstanding coverage.

Product Comparison

		Pyrocrete 241 HD	Pyrocrete 241	Pyrocrete 241 HY	Pyrocrete 40
Density	ASTM E605	70 pcf (1,121 kg/m ³)	55 pcf (881 kg/m ³)	50 pcf (800 kg/m ³)	40 pcf (640 kg/m ³)
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 ¹	Up to 4 Hours	NR ¹	Up to 4 Hours
Jet Fire Protection	ISO 22899	2 Hour	2 Hour	2 Hour	2 Hour
Cellulosic Fire Protection	ASTM E119	Up to 4 Hours	Up to 4 Hours	Up to 4 Hours	Up to 4 Hours
Cryogenic Protection		Up to 60 minutes	Up to 60 minutes	Up to 60 minutes	Up to 60 minutes
Shore "D0" Hardness	ASTM D2240	84	83	79	64
Bond Strength ²	ASTM E736	23,567 psf (1,128 kPa)	22,026 psf (1,054 kPa)	14,085 psf (674 kPa)	10,267psf (491 kPa)
Compressive Strength	ASTM E761	1,546 psi (10.6 MPa)	1,111 psi (7.6 MPa)	850 psi (5.8 MPa)	456 psi (3.1 MPa)
Explosion Resistance		3 Bar	3 Bar	3 Bar	3 Bar
Corrosion	ASTM E937	0.00 g/mm	0.00 g/mm	0.00 g/mm	0.00 g/mm
Hose Stream Endurance	NFPA 58 Annex H	Pass	Pass	Pass	Pass
Coverage / Bag		11.3 Bd. Ft. (1.04 m ² @ 25.4 mm)	13.3 Bd. Ft. (1.33 m ² @ 25.4 mm)	14.6 Bd. Ft. (1.35 m ² @ 25.4 mm)	17.9 Bd. Ft. (1.66 m ² @ 25.4 mm)

1. NR = Not Rated

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



Epoxy Intumescent Fireproofing

Carboline's industrial intumescent products provide a superior level of fire protection for both land based and offshore projects. Our Pyroclad and Thermo-Lag brands provide rugged, dependable solutions for the industrial, petrochemical, and oil & gas industries. These innovative epoxy-based passive fire protection systems have been formulated to withstand the harsh environmental conditions of coastal and offshore environments. Their superior physical characteristics and the long-term performance ensures high durability during construction and in plant exposure. The outstanding toughness of these materials make them suitable for both shop and field applications.

Pyroclad® X1

Ultra durable epoxy based fireproofing with unsurpassed weathering characteristics, low thickness requirements, and excellent jet fire and hydrocarbon fire protection.

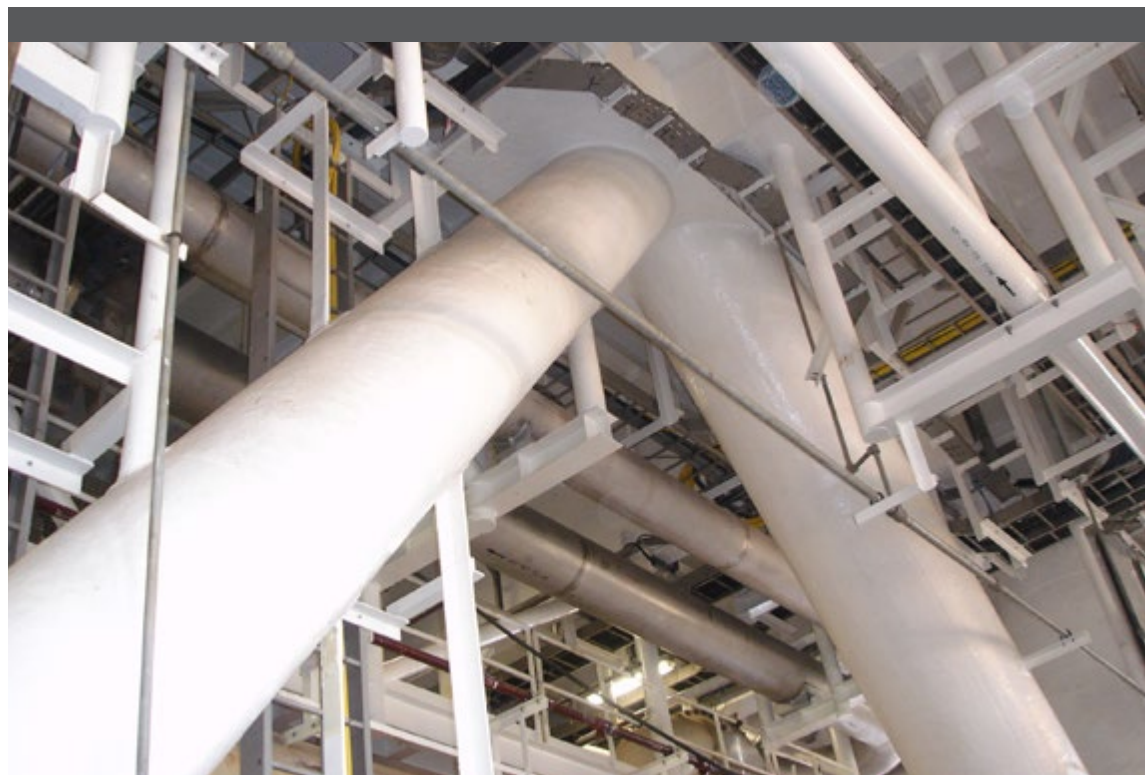
Thermo-Lag® 3000

The most efficient epoxy based fireproofing product on the market with high durability, excellent weathering properties and industry leading UL 1709 hydrocarbon ratings.

Product Comparison

		Pyroclad X1	Thermo-Lag 3000
Density	ASTM E605	64.3 pcf (1.03 g/cm ³)	78.0 pcf (1.25 g/cm ³)
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 ¹	Yes ¹
Shore "D" Hardness	ASTM D2240	70	55
Bond Strength	ASTM E736	1,840 psi (12.7 MPa)	300+ psi (2.1+ Mpa)
Compressive Strength	ASTM E761	3,672 psi (25.3 MPa)	2,190 psi (15.1 Mpa)
Flexural Strength	ASTM D638	3,925 psi (27.1 MPa)	2,253 psi (15.5 Mpa)
Explosion Resistance		4 Bar	1.43 Bar (Bulkhead)
Hose Stream Endurance	NFPA 58 Annex H	Pass	Pass
Flame Spread	ASTM E84	20	0
Smoke Development	ASTM E84	65	20

1. Cryogenic protection requires Carbotherm syntactic epoxy underlayment



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