Industrial Fireproofing

Superior Fire Protection for Industrial Applications
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.

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

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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 SA Rev. 6

Pyroclad X1 is in full compliance with NORSOK M-501 System SA 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.

Cable Fireproofing

Carboline’s Thermo-Lag 270 offers 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. This durable and proven cable protection coating is 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.

<table>
<thead>
<tr>
<th>Product</th>
<th>Type</th>
<th>Environment</th>
<th>Hydrocarbon Protection</th>
<th>Jet Fire Protection</th>
<th>Cryogenic Protection</th>
<th>Environmental Protection</th>
<th>Topcoat Requirement</th>
<th>Explosion Resistance</th>
<th>Primary Certification</th>
<th>Suitable for Offsite Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pyrocrete® X1</td>
<td>Cementitious</td>
<td>Onshore Petrochemical</td>
<td>Up to 4 Hours</td>
<td>2 hour</td>
<td>Up to 60 Minutes</td>
<td>UL 1709 Environmental Program</td>
<td>No</td>
<td>3 Bar</td>
<td>UL 1709 Hydrocarbon Fire</td>
<td>Yes</td>
</tr>
<tr>
<td>Pyrocrete® 40</td>
<td>Epoxy Intumescent</td>
<td>Onshore Petrochemical Offshore Oil &amp; Gas</td>
<td>Up to 3 Hours</td>
<td>Up to 2 hours</td>
<td>NR</td>
<td>NORSOK M501 System SA Rev. 6</td>
<td>No</td>
<td>4 Bar</td>
<td>ISO 22999-1 Jet fire</td>
<td>Yes</td>
</tr>
<tr>
<td>Thermo-Lag* 3000</td>
<td>Epoxy Intumescent</td>
<td>Onshore Petrochemical Offshore Oil &amp; Gas</td>
<td>Up to 4 Hours</td>
<td>NR</td>
<td>Up to 60 Minutes*</td>
<td>UL 1709 Hydrocarbon Fire</td>
<td>Yes</td>
<td>1.43 Bar</td>
<td>UL 1709 Hydrocarbon Fire</td>
<td>Yes</td>
</tr>
</tbody>
</table>

2. Requires Carbotherm syntactic epoxy insulation beneath PFP system

Cable Fireproofing

Carboline’s Thermo-Lag 270 offers 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. This durable and proven cable protection coating is 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

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

<table>
<thead>
<tr>
<th>Product Comparison</th>
<th>Pyroclad X1</th>
<th>Thermo-Lag 3000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>ASTM E605</td>
<td>64.3 pcf (1.03 g/cm³)</td>
</tr>
<tr>
<td>Hydrocarbon Fire Protection</td>
<td>UL 1709</td>
<td>Up to 3 hours</td>
</tr>
<tr>
<td>Jet Fire Protection</td>
<td>ISO 22899</td>
<td>Up to 4 hours</td>
</tr>
<tr>
<td>Cryogenic Protection</td>
<td>Yes¹</td>
<td>Yes¹</td>
</tr>
<tr>
<td>Shore “D” Hardness</td>
<td>ASTM D2240</td>
<td>70</td>
</tr>
<tr>
<td>Bond Strength</td>
<td>ASTM E736</td>
<td>1,840 psi (12.7 MPa)</td>
</tr>
<tr>
<td>Compressive Strength</td>
<td>ASTM E761</td>
<td>3,672 psi (25.3 MPa)</td>
</tr>
<tr>
<td>Flexural Strength</td>
<td>ASTM D638</td>
<td>3,925 psi (27.1 MPa)</td>
</tr>
<tr>
<td>Explosion Resistance</td>
<td>4 Bar</td>
<td>1.43 Bar (Bulkhead)</td>
</tr>
<tr>
<td>Hose Stream Endurance</td>
<td>NFPA 58 Annex H</td>
<td>Pass</td>
</tr>
<tr>
<td>Flame Spread</td>
<td>ASTM E84</td>
<td>20</td>
</tr>
<tr>
<td>Smoke Development</td>
<td>ASTM E84</td>
<td>65</td>
</tr>
</tbody>
</table>

1. 1:63 Bar (Bulkhead)
1. ¹: Cryogenic protection requires Carbotherm syntactic epoxy underlayment

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.

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<td>Jet Fire Protection</td>
<td>BS 476</td>
<td>NR¹</td>
<td>Up to 4 Hours</td>
<td>Up to 4 Hours</td>
</tr>
<tr>
<td>Cryogenic Protection</td>
<td>ISO 22899</td>
<td>2 Hour</td>
<td>2 Hour</td>
<td>2 Hour</td>
</tr>
<tr>
<td>Cellulosic Fire Protection</td>
<td>ASTM E119</td>
<td>Up to 60 minutes</td>
<td>Up to 60 minutes</td>
<td>Up to 60 minutes</td>
</tr>
<tr>
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<td>ASTM D2240</td>
<td>84</td>
<td>79</td>
<td>79</td>
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<tr>
<td>Bond Strength</td>
<td>ASTM E736</td>
<td>23,567 psi (121 kPa)</td>
<td>22,026 psi (108 kPa)</td>
<td>16,085 psi (87 kPa)</td>
</tr>
<tr>
<td>Compressive Strength</td>
<td>ASTM E761</td>
<td>1,556 psi (10.6 MPa)</td>
<td>1,111 psi (7.5 MPa)</td>
<td>850 psi (5.8 MPa)</td>
</tr>
<tr>
<td>Expansion Resistance</td>
<td>ASTM E937</td>
<td>3 Bar</td>
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<tr>
<td>Corrosion</td>
<td>ASTM E937</td>
<td>0.00 g/m²</td>
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<tr>
<td>Coverage / Bag</td>
<td></td>
<td>11.3 Bd. Ft. (1.04 m² @ 25.4 mm)</td>
<td>13.3 Bd. Ft. (1.33 m² @ 25.4 mm)</td>
<td>14.4 Bd. Ft. (1.35 m² @ 25.4 mm)</td>
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1. NR = Not Rated

Pyroclad X1 Thermo-Lag 3000 Density ASTM E605 64.3 pcf (1.03 g/cm³) 78.0 pcf (1.25 g/cm³)

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2. Bond strength testing performed utilizing ASTM E736 with AWCI Technical Manual 12-A (Appendix B) modifications
3. 1:63 Bar (Bulkhead)
GLOBAL REPRESENTATION
Coatings - Linings - Fireproofing

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