

Passive Fire Protection

Fire protection of tunnels structural elements

FIREPROOFING - BIOFIRE 640T

BIOFIRE 640T

Fireproofing system for tunnels

selection & specification data

Generic Type

High density cementitious fireproofing designed for the fire protection of tunnels.

Description

A 640 kg/m³ density, Portland cement based, cementitious fireproofing. It provides both hydrocarbon and cellulosic fire protection for tunnel's concrete and can also be used to upgrade fire resistance of prior existing concrete. Recommended areas of application include refineries, petrochemical, pharmaceutical facilities, pulp and paper mills, offshore platforms, nuclear and conventional power plants, factories, warehouses, institutional and biomedical facilities.

Features

- Cost effective fireproofing solution.
- Outstanding coverage, high build.
- Exceptional durability and toughness.
- RWS Curve/Effectis Fire Test Tunnel Linings rated up to 3 hours.
- UL 1709 hydrocarbon fire rated up to 4 hours.
- BS 476 hydrocarbon fire rated up to 4 hours.
- ISO 22899-1 jet fire rated up to 2 hours.
- ASTM E119 cellulosic fire rated up to 4 hours.
- Cryogenic protection against LNG spills and immersion exposures.
- Resistant to 3 bar blast overpressure.
- Hose stream resistant.
- Tolerant to wide range of climates.
- Lightweight. One-fifth the weight of concrete for equal fire protection.
- Ideal for onsite application.
- Easy application by spray or trowel.
- Non-flammable – During or after application.
- Chloride and sulphide free
- No special priming required.
- Non-friable – High impact strength.

Color

Non-Uniform Speckled Gray.

Product color may vary due to variations in color of Portland cement.

Finish

Textured.

If a smooth finish is required, this may be done by trowel, roller or brush typically within 1 to 2 hours after final application of BIOFIRE 640T.

Primer

BIOFIRE 640T neither promotes nor prevents corrosion. The fireproofing should not be considered as part of the corrosion protection system. For applications where primers are required, use a TRIA approved, alkaline resistant primer. BIOFIRE 640T must meet minimum UL bond strength criteria for contour applications where primers are used. Contact the TRIA Fireproofing Technical Service for further information and approved primers.

Fireproofing Topcoats

Generally not required. In severely corrosive atmospheres, topcoats may be used for added durability and chemical resistance. consult TRIA Fireproofing Technical Service for selection of the coating most suitable for the operating environment. Seal Coat – In corrosive environments, use an appropriate topcoat. If topcoating is required, apply Carboguard 1340 as a seal coat. Carboguard 1340 may be applied after 24 hours of final application of BIOFIRE 640T. Consult the Carboguard 1340 Product Data Sheet for minimum and maximum cure times. Top Coat – Surface hardness should be a minimum Shore DO 64 as measured with a durometer prior to application of the topcoat. Normally, this minimum dry time is 10 days at 21°C and 40 days at 4°C, for thickness of 25.4 mm or less.

Caulking – For exterior installations, Acrilast caulk should be applied at all termination joints between BIOFIRE 640T and the substrate. Contact TRIA Fireproofing Technical Service for full information.

Application Thickness

13 - 16 mm on initial pass.

Theoretical Coverage Rates

1.66 m² at 25.4 mm thick @ 640 kg/m³.

Field results will vary depending upon application parameters.

Coverage based on theoretical gross yield without loss. Material losses during mixing and application must be taken into account when estimating project requirements. Coverage based on 22.7 kg bags 0.09 m² of material at 25.4 mm thick.

Limitations

Not recommended for use as a refractory cement or where continuous operating temperatures exceed (93°C).

substrates & surface preparation

General

Before applying BIOFIRE 640T, the substrate coating must be free of all oil, grease, condensation, or other contamination.

Steel

If primer is required, steel preparation before priming should be done in accordance with the recommended primer's product data sheet. Contact TRIA Fireproofing Technical Service for approved primers.

Galvanized Steel

BIOFIRE 640T is usually applied directly over galvanized surface. If priming is required, contact TRIA Fireproofing Technical Service for recommendations.

Concrete

The recommended primer to seal concrete prior to applying BIOFIRE 640T is Carboguard 1340.

Non-Ferrous Metals

Aluminum, copper and other non-ferrous metals shall be primed with one coat of Carboline's Carbomastic 15.

substrates & surface preparation

Lathing and Attachments

1.85 kg/m² galvanized metal lath, may be pre-bent and tie-wired into place for appropriate design. Optionally, beam furring clips or electrically welded, pneumatic or self-tapping screws or studs, may be used.

Contour Design 1.85 kg/m² galvanized metal lath wrapped around the flange edges toward the web approximately 38 mm. Contour column designs allow the use of 50.8 mm x 50.8 mm galvanized or PVC coated hexagonal metal mesh with beam furring clips as an alternate to the 1.85 kg/m² galvanized metal lath. Plastic-nosed corner beads may also be used for better thickness control and aesthetics on flange edges of steel. Please refer to design details. For contour applications on structural members with web span greater than 406 mm or flange widths greater than 304 mm refer to the UL Fire Resistance Directory under "Coating Materials" section.

Boxed Design 1.85 kg/m² galvanized metal lath wrapped around member spanning the web, overlapped 25.4 mm and tie-wired on the flange face 304 mm on center. For large webbed members, additional support for lath may be needed for ease of installation. Plastic-nosed corner beads may also be used for better thickness control and aesthetics.

Tower Skirts and Flat Surfaces - Require that 1.85 kg/m² galvanized metal lath be anchored on 304 mm to 610 mm centers depending upon requirements. The lath should overlap and be tie-wired. On tower skirts only, PVC coated mesh can be used in lieu of 1.85 kg/m² galvanized lath. Mesh shall be 50.8 mm x 50.8 mm 20 gauge wire coated with PVC as furnished by TRIA. When ram set or welding is prohibited; a pneumatic fastener may be used. On very large areas, control joints are made by scoring halfway through the thickness of BIOFIRE 640T. This is achieved by using the trowel blade edge or an appropriate scoring tool. A preferred option would be the use of plastic-nosed corner beads. Spacing should be on 3 m centers, both horizontally and vertically. Please refer to design details or contact TRIA Fireproofing Technical Service.

Performance Data (Typical Values)

Test Realizado	Resultado
ASTM D2240 Durometer Hardness (Shore DO)	64
ASTM D2794 Impact Resistance	Pass (No cracking at 20 foot pounds)
ASTM E136 Combustability	Pass (Non-combustible)
ASTM E605 Density ¹	(640 Kg/m ³) (Minimum average)
ASTM E736 Bond Strength (Unprimed Steel) ²	491kPa
ASTM E759 Deflection	Pass
ASTM E760 Bond Impact	Pass
ASTM E761 Compressive Strength	456 psi (3,1 MPa)
ASTM E84 Flame Spread	0
ASTM E84 Smoke Development	10
ASTM E937 Corrosion	0,00 g/mm ²
Coverage 22.7 Kg bag	1,66 m ² @ 25,4 mm
Explosion Resistance	3 bar
NFPA 58 Annex H Torch / Hose Stream Resistance	Pass
Shrinkage	<0,5%

1- Air dry at ambient conditions until constant weight is achieved. Do not force dry. Use ASTM E605. Positive Bead Displacement modified to use 1 mm ceramic beads.

2- Bond strength testing performed utilizing ASTM E736 with AWC Technical Manual 12-A modifications. All test data above was generated under laboratory conditions. Field testing results may vary. Physical property data was derived using 17 liters per 22.7 kg bag. Material shall reach a hardness of Shore DO 64 prior to handling and topcoating. Test reports and additional data available upon written request.



mixing & thinning

Mixer

Use a heavy-duty mortar mixer with rubber tipped blades that will scrape the sides and bottom of the mixer. A 22.7 kg bag of BIOFIRE 640T typically requires a mixer volume of 227 L minimum. Do not use pan type mixers.

Mixing

Target water level: 18 liters

Water level range: 16 - 20 liters

Add clean, potable water to a mortar mixer with rubber tipped blades. With mixer running slowly, add powder and mix for 5 minutes until a homogeneous mortarlike consistency is achieved. Longer mixing times may result in lower densities. Total water must not exceed 20 liters per 22.7 kg bag. In cool weather, warm water may be used to enhance application. In hot weather, cold water may be used.

Pot Life

2 hours at 21°C and less at higher temperatures. Pot life ends when the material thickens and becomes unusable.

Density

Target wet density: 897 - 961 kg/m³.

Wet density measurements are critical to obtaining correct dry densities. To check wet densities, fill a Dixie cup (or other suitable container of known volume in ounces) with mixed material. Screed the excess until even with the rim of the container and weigh it on a gram scale. Multiply the weight (Kg) by a conversion factor based on the size of the container. This will yield density in Kg/m³

application equipment guidelines

Listed below are general equipment guidelines for the application of this product. Job site conditions may require modifications to these guidelines to achieve the desired results.

Pump

This material can be pumped with a wide range of piston, rotor stator and squeeze pumps designed to pump cement & plaster materials including:

- Essick – model# FM9/FM5E (Rotor Stator/2L4)
- Putzmeister – model# S6EV (Rotor Stator/2L6)
- Hy-Flex – model# HZ-30E (Rotor Stator/2L6)
- Hy-Flex – model# H320E (Piston)
- Strong Mfg – model# Spraymate 60 (Rotor Stator/2L6)
- Airtech – model# Swinger (Piston)
- Mayco – model# PF30 (Dual Piston)
- Thomsen – model# PTV 700 (Dual Piston).

Trowel

Standard plasterer's hawk and trowel may be used. A rubber float may also aid in finishing.

Material Hose

Minimum 25.4 mm I.D. hose with 300 psi minimum bursting pressure. For lengths over 15 m use 38 mm to 76 mm I.D. hose. Do not reduce hose diameter by more than 6.4 mm per 7.6 m unless a tapered conical reducer equipped with swivel fitting is used. A 3m length of 19 mm I.D. hose may be added at the gun for use as a whip.

Nozzle/Gun

Binks – part# 7E2 (47-49 fluid nozzle, 3/8"-1/2" air cap)
Graco – part# 204000 (3/8"-1/2" air cap)
Speeflow – part# 701 (3/8"-1/2" air cap)
Airtech – Internal mix with 3/8"-1/2" fluid tip
Standard plasterers gun 3/8"-1/2" fluid tip.

Compressor

Be certain that the air supply is a minimum 689 kPa and higher when distances longer than 22 m are required.

Air Line

Use 12.7 mm I.D. line, with a minimum bursting pressure of 689 kPa.

application procedures

General

BIOFIRE 640T may be applied by spray and/or trowel. Material build will depend on application method, weather conditions and equipment used. For application overhead, a scratch coat of up to 1/2" (12.7 mm) is recommended to key into the lath. Allow to set for approximately 1 to 2 hours at 21°C before applying the subsequent coats. It is recommended that the total required thickness be applied within a 24 hour period. If this is not possible, the preceding coats should be left as sprayed or scored after the initial 24 hour period, material should then be dampened with water before application of additional coats.

Maximum time to achieve the full thickness is 3 days at 21 °C.

All additional coats are applied monolithically to the entire perimeter.

At no time shall BIOFIRE 640T be applied at a thickness less than 6.4 mm or "skim" coated.

Finishing

Material can be left as sprayed or finished with a trowel for better aesthetics.

Application Conditions		
Condition	Minimum	Maximum
Material	4 °C	38 °C
Surface	4 °C	52 °C
ambient	4 °C	43 °C
Humidity	0%	95%

Curing Schedule	
Surface T ^a de & 50% de RH	drying when handling
21 °C	2 Hours

*Fresh BIOFIRE 640T must be protected from rain or running water for 24 hours at 70°F (21°C). In low humidity, high temperature, direct sun or wind, the BIOFIRE 640T surface should be kept damp for at least 12 hours by applying a water mist or wrapping in plastic sheets to reduce rapid water loss.

Caution: Do not start work if ambient temperatures are expected to drop below 35°F (2°C) for 24 hours after application. Material shall reach a hardness of Shore DO 64 prior to handling and topcoating.

cleanup & safety

Cleanup

Pump, mixer and hose should be cleaned with clean, potable water at least once every 4 hours at 21°C, and more often at higher temperatures. Sponges should be run through the hoses to remove residual material. Wet BIOFIRE 640T overspray must be cleaned up with soapy or clean, potable water. Cured overspray may require chipping and/or scraping to remove.

Safety

Follow all safety precautions on the Material Safety Data Sheet. It is recommended that personal protective equipment be worn, including spray suits, gloves, eye protection and respirators.

Overspray

Adjacent surfaces shall be protected from damage and overspray. Sprayed fireproofing materials may be difficult to remove from surfaces and may cause damage to architectural finishes. Cured overspray may require chipping and/or scraping to remove.

Ventilation

In enclosed areas, ventilation shall be 4 complete air exchanges per hour until the material is dry.

testing / certification / listing

Efectis Nederland Laboratories

BIOFIRE 640T has been tested by Efectis laboratory in Netherlands, and has been rated to be used in tunnels under RWS curve, up to 3 hours + 1 cooling hour at atmosphere temperature.
Ref. 2014-Efectis-R000910

Underwriters Laboratories, Inc.

BIOFIRE 640T has been tested by Underwriters Laboratories, Inc. and is classified for exterior or interior use by UL in the following designs:

UL 1709

Rapid temperature rise hydrocarbon fire exposure.

Columns – XR705, XR706, XR707 (without mesh)

Cryogenic Testing

Tested in accordance to “Specification for Cryogenic Protection and Passive Fire Protection of Structural Members”, dated March 2006 from South Hook LNG Terminal Company Ltd. Additional splash and spill testing perform at varying flow rates. All testing has been witnessed by UL.

ASTM E119 (UL 263, NFPA 251)

Cellulosic fire exposure

Columns – X760, X761, X762, X763, X784, X785, Y707, Y708

Roof Assembly – P927, P928, P934, P935, P936, P937, P938, P939, P926, P929

Beams – N737, N738, N739, N740, N771, N772, N773, N774, N775, S717, S719, S731, S732, S733

Floor Ceiling Assembly – D774, D767, D768, D769, D770, D771, D773, D774, D775, D776, D777, D927, D928

Walls – U704

Precast Concrete & Steel Joists – G706, G707, G708, J713, J714, J715, J716.

Intertek

NFPA 58 Annex H torch/hose stream testing.

BakerRisk

3 bar overblast protection.

Lloyd’s Register

ISO 22899-1 jet fire certification (2 hour).

Warrington Fire Research Ltd.

BS 476: PART 20: APPENDIX D HYDROCARBON FIRE EXPOSURE WFRC REPORT No. 128533

Packaging, Handling & Storage	
Surface T ^a de & 50% de RH	24 months (minimum) when kept at recommended storage conditions.
Shipping Weight (Approximate)	22,7 kg
Storage	Store indoors in a dry environment between - 29° C - 66° C.
Packaging	22,7 kg

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