

Flammadur® E473

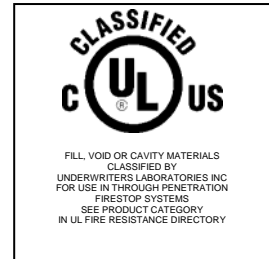
Expanding Firestop Mortar

Flammadur® E473 is a water based inorganic heat absorbing mortar that expands on curing to form a tight gas fit, water resistant and long lasting, possibly for the lifetime of the building (see attached UL systems summary or go to www.flammadur.com).

Industry Qualifications:

- ASTM E 814 fire tests for through penetration firestops, UL® 1479, CAN4-S115 fire tests for firestop systems.
- Flammadur® E473 has been tested and classified by Underwriter's Laboratories for use in UL® systems in USA and Canada. Factory Mutual witnessed and approved many UL tests

Made in Germany by AIK Flammadur Brandschutz, GmbH



Features:

- **LONG LIFETIME: LASTING AS LONG AS THE BUILDING**
- **Proven performance history**, used around the world for **over 40 years** in Nuclear Power Plants, High Rise Buildings, Factories, High Security Buildings
- **EXPANDS IN CURING, MAKING TIGHT FIT**
- **NON-TOXIC** (No asbestos, no halogens, no noxious vapors, no lead)
- **MAXIMUM FIRE SAFETY** (high F (fire) and T (temperature) ratings up to 4 hours)
- **APPLICATIONS: Sealing through penetrations for pipes, conduits, cables, cables in cable trays, ducts, with F=3 and 4, and T=0 to 4 hrs.**
- **RELIABLE** (Used for over 30 years)
- **CONVENIENT TO USE, EASY TO REPAIR AND FINISH**
- **HIGH STRENGTH, EXCELLENT SHEARING STRENGTH TO STEEL AND CONCRETE**
- **NO DERATING OF CABLES**
- **ECONOMICAL**
- **TESTED AND CERTIFIED BY UL® AND APPROVED BY FACTORY MUTAL**

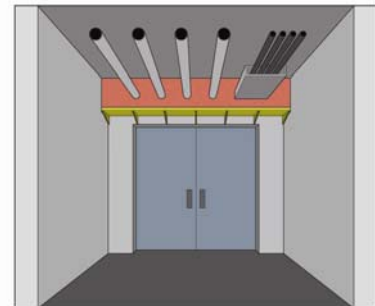
Unique Systems:

FPT is now the only company with numerous UL and FM approved systems with the following:

- **F=3 hours and T=3 hours** ratings for cables, cables in cable trays, cables in conduit- for power, control and instrumentation cables
- **F=T=4 hours** ratings for communication cables
- **High T ratings**, permitting time for firemen to combat fire spread on off fire side
- **F=T=3 hours** ratings for up to **4 cable trays** in an opening with up to **36" wide** cable trays
- **F=3 hours rating** unique for **sealing large opening** with rigid E473 and placing pipes, conduits sealed with elastomeric Flammadur A107
- **F=3 and T=2 and 3 hour** rating using a patent pending method for **externally fireproofing** non-performing old penetration seals, applicable to sealing through penetrations with insufficient annular space
- **F=4 hour** system for pipes, conduits and EMT, D< 4.5 inch

New Method of Fire Stopping using E473 as an External Seal:

The new method (patents pending), utilizing cementitious Flammadur® E473, is applied to **the outside** of walls and floors, around the existing penetrants (pipes, conduits, cable trays, busways, cables) when the openings are too small in floors and walls around penetrates, so that the annular spaces are not large enough for a firestop with the wall or floor. The figure at the right illustrates an externally applied firestop (red) using E473 mortar. See the special instruction for installing this type of firestop and for more information go to www.flammadur.com



Fire Protection Technologies, Inc.

A. General

Installation of Flammadur® fire-stop sealant E473 shall be performed by trained or approved personnel. The Contractor shall perform the installation in accordance with job specifications and installation instructions. Installations shall conform to the UL® system as tested per UL® 1479 (ASTM E 814). If installation instructions differ from job specification, the contractor shall resolve the discrepancies with the Project Manager.

1. The installation procedure applies to floor, wall or other openings as specified on the typical detail drawings. The tolerances and design limitations specified on the typical drawings shall be observed.
2. Storage and Handling-E473 shall be delivered to the job site in the original, unopened packages, stored above freezing temperature off the ground and protected from the weather.
3. Water to be mixed with E473 shall be clean, potable, free from chemical contamination or visible organic material.

B. Damming

For large openings temporary damming is recommended. Multiple pours are recommended for openings larger than 36 in (910 mm). Any damming material is acceptable provided it will hold the weight of the E473 mixture (e.g., bats made from mineral wool, fiberglass, ceramic fiber, fabric rags, polyurethane foam, cardboards or plywood).

For small openings damming materials may not be necessary if a relatively dry, trowelable mixture of E473 is used. In this case all surfaces of the penetration have to be wetted thoroughly to avoid water abstraction from the mixture. Remove the dams once the mortar has cured for few days, in order to speed up the drying. Non-combustible dams may be left in place if they cannot be reached after application of the E473 mixture.

C. Safety

Do Not Breath Dust While Mixing. Use an OSHA-approved dust mask and safety glasses while mixing. Contains cement and may be injurious to the eyes and skin. Protective gloves or creams will prevent skin from drying. If E473 mixture gets into eyes, rinse immediately and repeatedly with water. Obtain prompt medical attention.

D. Mixing

1. E473 powder may be mixed with water by hand, with a mechanical mixer and paddle or ribbon blades. The mixer must be clean. For small quantities, mix in suitable, clean mixing container.
2. Add water to the mixture using 7 parts of water per 11-12 parts of E473 by weight, depending on material consistency desired, or approximately 1 part of water per volume to 2 parts of E473 powder by volume. The water must be clean and free of contaminants. Average mixing time is 3 minutes. E473 may be re-tempered with more water prior to the initial set
3. Partially set, frozen or lumpy material shall not be used.
4. E473 mixture can be pumped with typical mortar pumps. An air diaphragm pump can be used to pump wet slurry. Specialized can be used to mix and pump E473.

E. Caution

Flammadur® E473, a water-based material, can conduct electricity until it is thoroughly cured. Extreme caution should be exercised when it is applied to energized cables or equipment

F. Installation

1. E473 shall not be applied if ambient or substrate temperature is less than 35°F (2°C) during installation or for the first 24 hours after installation.
2. The Contractor shall inspect and accept all surfaces prior to installing E473 mixture. All surfaces shall be free of frost, oil, grease, dirt and other contaminants prior to the installing of E473 mixture.
3. Wet all surfaces thoroughly with water prior to installation. Then the E473 mixture may be pumped or hand-filled into the opening. Use a probe to tamp around filled penetrations: this will remove possible voids in E473 mixture. Exposed surfaces can be finished using conventional plastering tools prior to set.
4. When installing around layered cables it is recommended that the E473 mixture be more fluid to provide a better fill between cables. Physical separation of layered cables is not required. It is permissible, however, to separate the cables with small pieces of non-combustible materials as a construction aid. Vibrate or move the cables slightly to prevent voids from forming between cables.
5. For successive application or patching of previously installed E473 mixture, clean or rough up the mortar's surface before thoroughly wetting and then follow installation instructions.

G. Cure Time

E473 mixtures require between 2 and 4 hours initial cure prior to form removal. The time may vary with the size of the openings, temperature, humidity and density of mortar when installed. When E473 mixtures are installed in successive stages, allow adequate time between installations to prevent slumping. Allow 25 days for full cure.

H. Repairs

1. All surfaces to be patched or re-paired should be cleaned with a stiff brush. If oils or other foreign materials cover the area to be patched, they must be removed by chipping until a clean surface is present.
2. If the surface is "green" or less than 3 days old, lightly wet the surface prior to installation. For material older than 3 days, clean as described above, then thoroughly wet the area.
3. E473 mixture can be hand-applied to damaged areas and troweled to the same finish as the surface. Apply pressure to the trowel to bond new material to the old. The area to be patched must be wet prior to repair.

I. Clean Up

Wet material may be cleaned up with water. Dried or cured E473 mixtures require scraping or chipping for removal.

J. Shelf Life:

3 years, if stored dry in un-opened bag. Extended shelf life by Fire Protection Technologies :unlimited, if also stored in a horizontal position, - based on UL® test CAJ1411 with 12 inch steel pipe, with15 years old bag.

Installation of External Seals

- It can have a cylindrical form around pipes, conduits and a rectangular form around cable trays and busways, or it can cover the entire wall or floor with multiple penetrates.
- This external mass extends about 6 inches (152mm) from the surface of a wall or floor, on both sides of a wall or floor, and about 4 inches (102mm) from an outside surface of penetrants.

- The semi-liquid E473 is poured between pipes, between conduits and the outside steel sleeve, or between the sides of the cable tray and steel or wooden or other removable damming frame. The E473 is also poured between the cables and between cables and the sides of the cable tray.

Physical Properties:	
Powder density	0.74 g/cm ³
Derating of Cables	Negligible (because of high thermal conduction)
Short-term loading capacity	30 psi (207kPa)
Expansion during curing	0.02% linear, @ 0.1% volume
Final material density at 68°F (20°C)	50-53 lbs/ft ³ (800-850 kg/m ³)
Shearing Strength, psi (kPa)	50% water by wt. 60 % water by wt
Concrete	80 (552) 35 (241)
Steel pipe	200 (1380) 650 (4482)
Tensile strength	655 psi (4500kPa)
Gamma Ray Resistance	Exposed to 200 million rads - no change in physical and chemical properties
Gamma Ray Extinction Coefficient (decadic)	Co60: 20.5 inch (52 cm) Cs 137: 16.5 inch (42 cm)
Heat conductivity	0.23 kcal/m-hours K = 0.267 Watts/meter C = 1.85 Btu-in/ft ² -hours ^o R
Specific heat	310kcal/m ³ °K = 19.4 Btu/ft ³ -°R
Thermal Diffusivity	7.4x10 ⁻⁴ m ² /hours = 8.0x10 ⁻³ ft ² /hours


Chemical Properties:	
Bonding to:	Concrete, masonry, itself
Does not contain:	Asbestos, halogens, lead
Resistant to:	Weak acids, alkalis, solvents, oils, etc.
P _H value in curing	12
Corrosive to steel?	No
Combustible?	No
Gases released in fire	None, except water vapor

Properties for Installation:	
Application temperature	Above 32F °(0°C)
Required additive	Water
Material needed per unit volume	740 kg/m ³ (47.6 lbs/ft ³)
Mixing ratio, about	2 parts powder to 1 part water
Application method	Trowel or pump
Pot life at 68°F (20°C)	30-45 minutes
Cure time at 68°F (20°C)	16-20 hours
Final curing to minimize moisture	at 68°F (20°C): 25 days and at 221°F (100°C): 8 days
Retrofit and repair ability	Excellent self-bonding to already installed E473 and easy to drill

Flammadur® E473 is available in

Bag	50 lbs (22.7 kg)	No. 40010
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Products and Technical Assistance available from

	Fire Protection Technologies, Inc. Suite 160 8000 Research Forest Drive The Woodlands, TX 77382 Website: www.flammadur.com		
	Adolf R. Hochstim, PhD Technical Director	e-mail: ahochstim@earthlink.net	Phone: (818) 730-7749 FAX: (936) 271-4114 (Fax only)
	Charles R. Eminhizer, PhD Thermal Physicist	e-mail: charles.eminhizer@yahoo.com ceminhizer@att.net	Phone: (858) 442-2192

Warranty: The information provided is based upon typical installation conditions and tests Fire Protection Technologies, Inc. believes to be reliable. However, due to a wide variety of possible use conditions, the manufacturer and distributor does not guarantee that typical values expressed will necessarily be obtained. THE FOLLOWING IS MADE IN LIEU OF ALL WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING MERCHANTABILITY. Seller's and manufacturer's only obligation shall be to replace such quantity of the product proved to be defective. NEITHER SELLER, DISTRIBUTOR, OR MANUFACTURER SHALL BE LIABLE FOR ANY INJURY, LOSS, OR DAMAGE, DIRECT, INCIDENTAL OR CONSEQUENTIAL, ARISING OUT OF THE USE OF OR THE INABILITY TO USE THE PRODUCT. Before using, user shall determine the suitability of the product of their intended use, and user assumes all risk and liability whatsoever in connection therewith. No statement or recommendation not contained herein shall have any force or effect unless in an agreement signed by officers of the manufacturer, or distributor.