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RE-FLAMEtm

Intumescent fire retardant coating with nanoparticles

QMS Standard ISO 9001:2008 (ISO 9001:2008) certified

www.inn-t.com

- ✓ **Lightweight**
- ✓ **Forms thin layer**
- ✓ **Easy to repair**
- ✓ **Excellent decorative properties**



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WHAT IS RE-FLAME

Lately industrial and commercial frame building featuring supporting steel structures has been in great demand. Such construction methods have several advantages over brick masonry, monolithic construction and other kinds primarily due to reduced construction time, cost and weight of buildings built with such technologies.

However, using this construction technology requires a lot of attention to the protection of load-bearing parts from corrosion, condensation and fire exposure in the event of a fire. Along with corrosion-resistant rust primer **NANO-FIX ANTICOR** and insulating coating **RE-THERM** our company developed a highly efficient fire-retardant paint **RE-FLAME**.



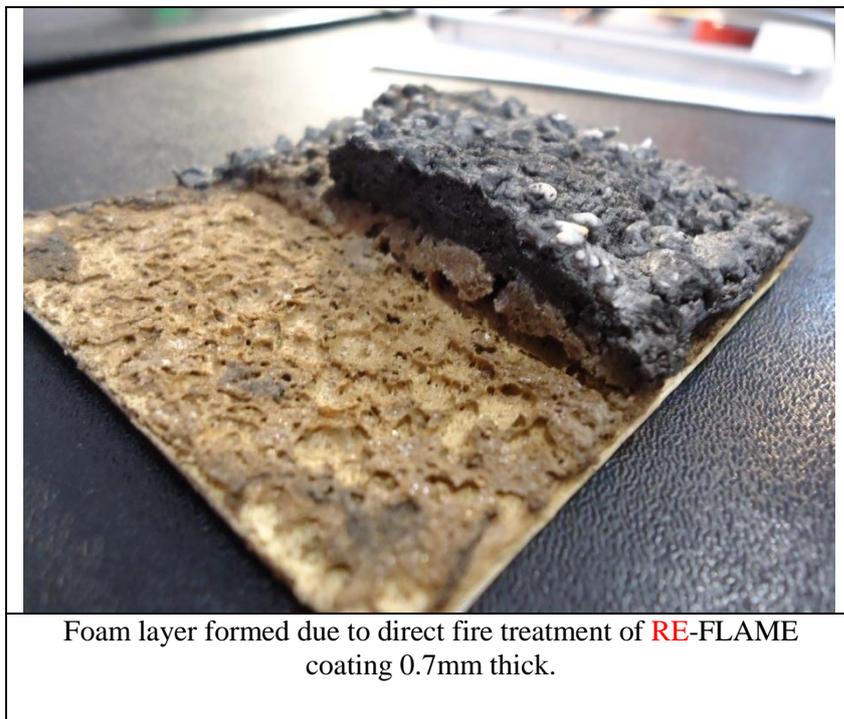
In the event of fire, bearing metal structures are subjected to high temperatures and begin to deform. This phenomenon leads to the destruction of an entire building over a very brief period of time.

In order to delay the moment of building collapse due to the heat produced by the fire, it is necessary to protect metal surfaces from heat exposure. **RE-FLAME** intumescent fire-retardant properties allow it to expand under heat exposure up to 50 times. While expanding **RE-FLAME** forms refractory foam that has low thermal conductivity, which prevents flames and heat from reaching metal surfaces. Thus, **RE-FLAME** restrains flame temperature up to 90 minutes. This amount of time is assumed to be sufficient for a complete evacuation of personnel from the premises and for arrival of emergency response team to the site, assuming that they would have time to put out the fire before the building starts to collapse.

Fire-protective coating **RE-FLAME** is produced with American and European-made components on high-tech equipment that allows components to be processed up to their optimum level of mixing and grinding. It should also be

noted that **RE-FLAME** fireproof composition includes nanostructured particles (nanoplatelets) of alumina which contributes to its durability, strength and resistance to humidity.

In addition to fire-retardant paint our company offers anti-corrosion primer **NANO-FIX ANTICOR** that protects metal from corrosion under a layer of fire-retardant paint. **NANO-FIX ANTICOR** would last for up to 30 years in outdoor conditions. Together, these coatings make up a system quality for which the manufacturer, Innovative Technologies takes full responsibility.



RE-FLAME APPLICATION OBJECTIVES

1. To rescue and protect personnel:

- Safe evacuation of people from a building within a defined period of time;
- Establishment of a certain area or secure space in a building for a specified period of time.

2. To protect property and assets:

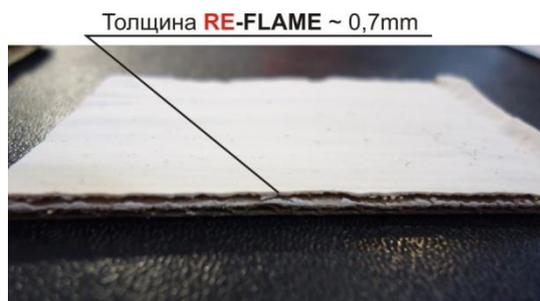
- Fire protection of various units, sections of buildings and equipment;
- Preventing spreading of flames around an object;

- Protection (insulation) of objects from fire exposure.

RE-FLAME PRINCIPLE OF OPERATION

When exposed to an open fire retardant intumescent coating **RE-FLAME** expands and forms a flame-imbued ashy foam that protects the surface it was applied to in order to protect it against overheating and destruction.

On the picture below is **RE-FLAME** (average coat thickness is 0.7 mm) applied on a sheet of corrugated board (the board is 2.5 mm thick)



This is what the foam created due to a thermal influence of fire of a surface painted with **RE-FLAME** looks like. The foam is usually about 35mm thick. The cardboard under a layer of **RE-FLAME** sustained fire exposure and remained intact.



SCOPE OF APPLICATION

Покрытие, как высокоэффективный огнезащитный состав, может быть применено в строительстве в следующих местах и узлах конструкции:

RE-FLAME, being a highly-effective flame-retardant substance can be used in construction in the following sites and construction nodes:

1. Protecting and supporting structures made of concrete and reinforced concrete

Concrete and reinforced concrete are not subject to combustion, but heat treatment in general and an open flame in particular can to destroy them within 5 to 20

minutes, depending on the intensity and the temperature. Therefore concrete and reinforced concrete need fire protection.

2. Structural section

Steel, like concrete, is not flammable, but when exposed to flame and high temperatures it begins to melt and lose its strength. Moreover this happens over a very short time interval. Therefore, steel sections, particularly structural ones, need fire protection at all times.

3. Air ducts (vents)

During a fire in a building, air ducts and plastic sewage risers are usually the main source of flame spreading on the floors.

4. Flat roofs

Bituminous materials which are often used as flat roofs coating are very combustible. Therefore a roof made with bituminous materials also needs fire protection

5. Window apertures

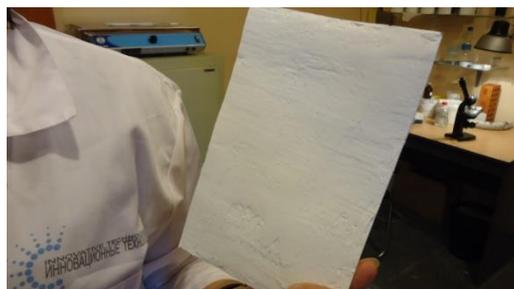
Window apertures are filled with materials like foam. Such materials are combustible and hence these structures also need to be protected against fire.

6. Wooden structures

Among non-synthetic and environmentally friendly building materials wood is the most combustible. Therefore fireproof coating **RE-FLAME**, applied to a wooden surface, will reliably protect it from fire for a long time and will not affect its environmental credentials.

ILLUSTRATIVE EXAMPLE

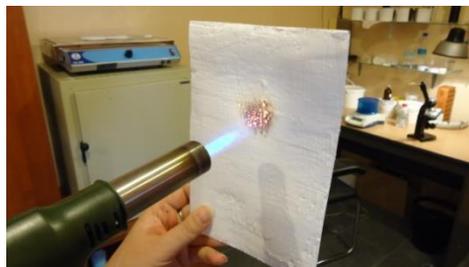
For experimentation purposes we took a cardboard sheet 0.5 mm thick coated with three layers of **RE-FLAME**. The thickness of each layer was 0.5 mm. Its overall thickness reached 1.5 mm.



A gas burner with a positive pressure jet was used to simulate the fire. The burner was directed at a painted side of cardboard sheet. The temperature of combustion of natural gas with a positive pressure jet is +1600C.



Once the temperature of **RE-FLAME** reached +200C flammable foam started to form. The purpose of this foam is exactly to prevent or reduce heating of underlying painted surface.



one minute of exposure



five minutes of exposure

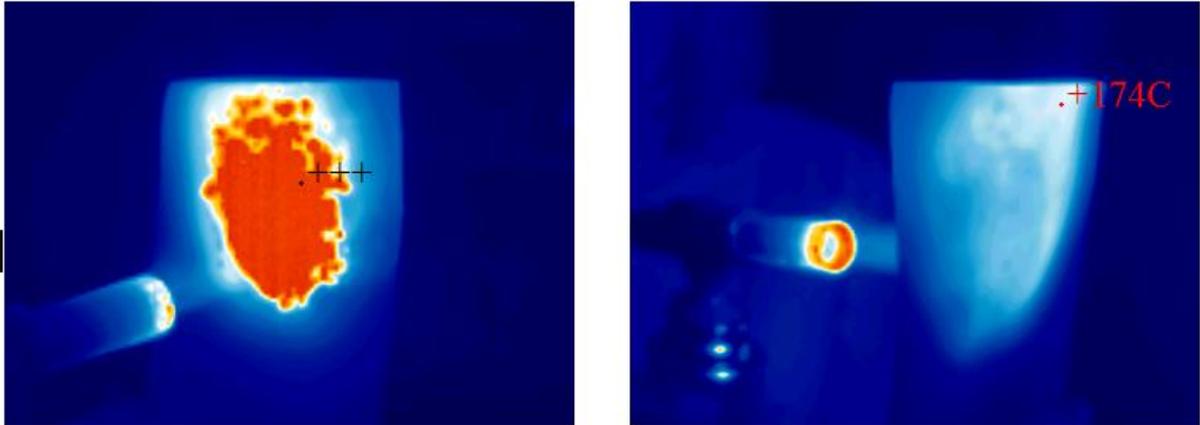


twenty minutes of exposure



The process of RE-FLAME coating heat treatment was accompanied by thermal mapping of both sides of cardboard sheet. Indicators of surface

temperatures have been identified below (the one under exposure and the flip side).



The temperature of the surface under heat exposure is outside of the thermal imager's range of measurements, i.e. higher than +500 C. The temperature of a reverse side of cardboard sheet at its highest point is +174C. This temperature is lower than the combustion temperature of wood and paper, and it is below the temperature of metal melting and concrete deterioration. However, the cardboard sheet that was coated with **RE-FLAME** did not catch on fire or char despite prolonged exposure to flame.



The experiment clearly shows how highly efficient fire-retardant coating **RE-FLAME** is against flames and high temperatures. When exposed to high temperatures or fire **RE-FLAME** bulges up to form refractory foam which prevents further heating of the structure it was applied to. Consequently a surface covered with **RE-FLAME** is protected against heat and open fire treatment.

TECHNICAL SPECIFICATIONS

Coating appearance	Brushed even surface
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Coating color	White (pastel colors tinting is possible)
Solids, minimum (% by weight)	72
Density (kg /cubic meter)	1200...1300
Particle size (microns)	Not exceeding 60
Durability indoors	Up to 30 years
Durability outdoors	Up to 20 years

FIRE RESISTANCE RATING

Fire rating	Mass factor (mm)	RE-FLAME dry layer thickness (mm)	RE-FLAME flow rate (kg /m ²)
45	3,4	0,7	1,25
60	3,4	1,35	2,25
90	5,8	1,65	2,7

If an object coated with **RE-FLAME** is to be used outdoors its surface after drying should be painted with weatherproof paint or enamel. Thermal protective coating **RE-THERM** is suitable for these purposes as it would protect both **RE-FLAME** and the structure itself from adverse atmospheric conditions (changes in temperature, light intensity, humidity, etc.), and would eliminate existing "thermal bridges". If the structure doesn't have any thermal bridges then **R-COMPOSIT**, a water proofer coating with excellent weather resistance, flexibility and hydrophobic properties, could be used as a protective paint coating.