



## Passive fire protection & Intumescent coatings

Passive fire protection, as opposed to active fire protection, such as sprinklers, is a common method for protecting structural steel against fire. Passive fire protection includes methods like fire resistant boards, concrete, cementitious materials, and intumescent coatings.

Structural steel need to be fire protected as it loses its structural strength when the steel temperature reaches around 500°C. The purpose of passive fire protection is to avoid or prolong the steel reaching the critical temperature of failure. There are three primary objectives of protecting structural steel:

- Allowing more time for people to evacuate a building in case of fire
- Protect firefighters during operations
- Minimise structural damage and loss of assets

The level of fire protection depends upon the type of construction, the type of fire, and local regulations. Often the fire protection regulations or building regulations state how long buildings must be able to maintain the load bearing capacity. Normally these periods are from 30 minutes to 120 minutes. If the structural steel was not protected the critical temperature and structural collapse will be reached within 10 minutes depending on the steel characteristics and use.

All fire protection products are tested and approved in independent test institutes according to international or national standards. The purpose of the tests is not necessarily intended to identify the structural performance that can be expected in a real case fire but instead a way of measuring the relative performance of structures and products in a defined test environment.



# THE CORE ISSUE

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Intumescent coatings are products that expand and create a char when exposed to fire. The char formed acts as an insulation layer, which reduces the rate of which heat is transferred to the steel surface. Intumescent coatings are different from many other passive fire protection types because the coating reacts when exposed to a fire, whereas many other types do not react but have a certain thermal insulation value before fire exposure.

Intumescent coatings are normally based on organic binders and active ingredients, which chemically react to form a carbonaceous char when exposed to fire. When the coating reaches around 200°C the binder system starts to melt while a carbon source and acid source reacts to form the carbonaceous char. At the same time a blowing agent begins to release gasses which cause the growing of the char. During a fire, the carbon containing compounds will burn and a char of titanium phosphates will remain. During this stage the char will change colour from black to white. Special additives are also added to the coating to provide strength to the char.

Intumescent coatings are often applied in thin film thicknesses compared to other passive fire protection types because the coatings react when exposed to fire and gradually build the thermal insulation during the fire. Intumescent coatings are normally applied in 0.2-5 mm, depending on requirements and expand up to 50 times the original coating thickness when exposed to fire.

The thickness of intumescent that should be applied on a structural steel section depends on the required protection time but also the characteristics of the steel section. A very thin steel section requires more intumescent coating compared to a very thick steel section. It generally requires more energy to heat up the core of a thick steel section and, therefore, less intumescent thickness is required to reach a certain protection time. For this reason intumescent coatings are often specified according to individual steel sections or  $H_p/A$  value, which is a measurement for the mass of the steel section.

Intumescent coatings have several advantages over other types of passive fire protection:

- The installation costs are low and application can even be done away from the construction site.
- The decorative appearance provides architects with more freedom and enables more open building designs.
- Intumescent coating systems can easily be repaired if damaged.

## More info

### The Core Issue

The Core Issue is Hempel's series of technical articles that highlight some of the important issues of fire protection. For more information and technical articles about fire protection and intumescent coatings.

Visit: <http://www.hempel.com/fireprotection>



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