Adhesion and Intumescent Paint: Why it Matters





Adhesion and Intumescent Fireproofing

Fireproofing has long been a paramount part of building design, but never more than now with current events making the need for fireproofing glaringly important. Fire resistant materials are used to increase the survivability of building materials in the event of a fire and create a safe structure. Intumescent fire-resistant coatings, some of which are applied like paint, are a relatively new option for specifiers and architects.

During a fire, intumescent coatings and technology (like intumescent caulk) can protect steel and other substrates from direct exposure to flames and dangerously high temperatures.

However, a coating's fire protection is based on its adhesion – or how well it sticks to a substrate – and its cohesion – or how well the coating holds together.



Adhesion is tested in two ways: by tape test or pull-off adhesion test.

During a tape test, cross cuts or ribbon cuts are made in a coated surface. A special tape is used to try to pull off the paint.

The pull-off adhesion test, which is the industry's more definitive test,

evaluates adhesion by placing a steel plug on the coated surface. A large amount of pressure is applied to pull up the plug and the coating. Technicians then determine if the failure was adhesive or cohesive.



In both adhesion tests, Contego received a perfect score – Zero loss or 100% adhesion. "You can't get better than that." –Tony Scott, VP of Contego

Using the ASTM D4541 standard, Contego offers 631 psi of pull test adhesion. The closest competitor shows half the adhesion Contego has, while most had one-third to one-fifteenth of Contego's strength. Ideally what you *want* to see is an adhesive failure because that means you're getting the maximum strength out of the coating, and the failure is not within the coating, but rather at the substrate, explains Tony Scott

Name one other type of coating where adhesion isn't critical. Would anyone accept the paint on his or her house falling off or the finish on their automobile disappearing? In this case, it's not just about an architectural finish; it's about minimizing property loss and gaining necessary time to save lives.

9/11 AND WHY ADHESION MATTERS

Fireproofing can mean life or death. Adequate fire protection has garnered much more attention following the collapse of the World Trade Center.

On 9/11, the towers' steel was exposed to temperatures of more than 2,000°F/ 1,905°C, but a compounding problem was that all of the fireproofing fell off on impact, robbing the steel of its protective coating. "The building collapsed because it could no longer support the tens of thousands of tons of structure," says Scott. "If the steel in the World Trade Center could have been adequately protected, it might not have fallen, since after an hour, the fuel load was dwindling. Protective coatings need to adhere to steel and other substrates, even at extremely high temperatures. When a building catches fire, intumescent coatings heat up and expand 10 to 75 times their original thickness, so 1 millimeter of coating could expand to as much as 40 to 50 millimeters.

Without strong adhesion, the coating flakes off, exposing steel to intense heat. When steel heats up to 1,000°F/535°C (the temperature a building fire quickly and easily exceeds), it loses half its strength.

At 1,000°F/535°C, a steel beam supporting 200 tons can only support half that weight, putting the structure at risk of collapsing. In a fire, steel softens and deforms, so much so that if heated to 1,200°F/650°C you could easily bend a giant steel beam.

Strong adhesion in acrylic copolymer latex paint allows the coating to stick to the steel, even when heat causes the steel to lose shape. Additionally, the intumescent coating keeps the steel from reaching those dangerous temperatures by insulating the substrate, even at elevated ambient temperatures, such as in a fire. While a fire might be burning at 2,000°F/ 1095°C, the coating keeps the steel at a safe temperature long enough to allow firefighters to intervene and residents to escape.

Fire-resistant coatings can't withstand heat indefinitely, but the goal is to protect the steel long enough so the fire burns out, the structure is safely abandoned or help arrives. Furnace fire tests and control burns show that Contego protects steel "extremely well," says Scott.

Fortunately, most buildings won't experience a fire. Still, the same adhesive properties that allow intumescent coatings to protect in a fire also help coated surfaces tolerate other elements that could be destructive to the substrate below. After substrates are coated, they're often left for 20 years or more, so coatings need to help protect these surfaces and maintain their integrity for many, many years.

During a 20-year period, surfaces can be subjected to a wide range of environmental conditions like dirt, dust, wind and rain, as well as industrial equipment or vehicle traffic. Contego's strong adhesive coating allows surfaces to withstand these conditions for decades.

Many fire barrier products with poor adhesion fall off under normal conditions like the interior of the Big Dig in Boston, the new convention center in San Juan, Puerto Rico (and the attached Sheraton Puerto Rico), along with thousands of other buildings.



The images above and below illustrate what happens when Contego, or any other intumescent, is applied in a cold, humid environment on steel that has not been primed. The results is moisture being trapped beneath the coating which eventually expands causing delamination.



HOW TO PICK THE BEST COAT

When it comes to fireproofing a building or other structure, architects and specifiers have to choose between cementitious materials, cellulose materials, or intumescent latex paint. These three options have different qualities, and the coat you choose depends on the job.

Cementitious products, which consist of lightweight cement and ground-up newspapers, are cheap and quick to apply. These materials are often used on tunnels or girders that are enclosed within walls of a building, since their thick, "paper mache" appearance is very unattractive.

Like cementitious products, cellulose coatings, made of ground up newspaper, go on dirty and thick.

"You don't want to put cementitious or cellulose materials in a building or an open atrium, where you want to show off steel. Those products give off dust that can interfere with electronics. You wouldn't want to use them at a company like Intel. Frankly, the only reason I can envision why someone would consider using them is cost – they're inexpensive, but as with most things, there's a reason for that" -Tony Scott



An inherent problem with these types of fireproofing materials is that the application instructions tell you *not* to prime the steel. Unprimed steel is completely vulnerable to rust and would typically arrive at the construction site with rust already forming. In many of these products, boric salts and other component ingredients are corrosive and promote rust. Once rust has started, it doesn't stop and nothing bonds to rust. It's just a matter of time before the fireproofing delaminates and falls off. Architects and specifiers who want to highlight the building's structure can opt for intumescent acrylic latex paint. Contego offers an attractive finish that highlights – not hides – the architecture.

In terms of fireproofing, intumescent acrylic latex paints vary in terms of how many coats need to be applied for the same protection. Contego's paint is designed to offer maximum fire protection without having to apply an excessive number of coats, to save you time and money.



About Contego

Contego intumescent acrylic copolymer latex paint offers the very best in fire protection on virtually any surface. In addition to providing a fire barrier, Contego protects surfaces from other harsh elements and moisture while giving buildings an attractive – and cost effective – finish.

It's Contego's advances in adhesion that make it a superior product.

More than any other company in this market, Contego continues to evaluate and select additives to give its paint improved adhesion properties, while maintaining its smooth-looking finish, keeping it ecologically friendly and VOC free. Contego intumescent fire barrier products are all non-toxic and safe for pets, children and applicators.

In tune with big changes in intumescent technology and global initiative to build and maintain a better, safer environment. Contego intumescent fire barrier products are all non-toxic and safe for pets, children and applicators.