THE SIGNIFICANCE OF THE UL CLASSIFICATION MARK ON INTUMESCENT COATINGS

Intumescent fire resistive coatings are paint like coatings that are applied to structural steel members. The final thickness of these coatings typically ranges from 0.03 inches to 0.50 inches.

The coatings are designed to provide insulation to the steel in the event of a fire. Their function is identical to other more traditional materials such as gypsum wallboard and coatings categorized as Spray Applied Fire Resistive Materials (SFRMs). The SFRMs typically include ingredients such as mineral wool, cement and gypsum. Because of the intumescent coating's paint like qualities and their other somewhat unique characteristics when compared to the more traditional materials, the use of intumescent coatings have expanded within the architectural and design communities.

The intumescent coatings, as well as the other traditional materials, are intended to provide an insulating barrier between a fire and the structural steel. This insulating barrier is necessary to ensure the structural performance of the steel members at the temperatures anticipated during a fully developed fire. For intumescent coatings to provide this insulating barrier to the structural steel, two unique characteristics of the coating must be considered, coating expansion and retention of a char layer.

Intumescent fire resistive coatings typically expand approximately 15 to 30 times during a UL 263; Fire Tests of Building Construction and Materials (ASTM E119, NFPA 251, and UBC 7-1) fire test. The more traditional insulating materials typically undergo a slight shrinkage during the fire exposure. In addition, most intumescent coatings generate an ash-like or char layer during their expansion process. As the fire exposure continues, the ash coating erodes exposing the remaining intumescent coating. This expansion process repeats itself several times during the test depending upon the coating thickness. The maintenance of the insulating or char layer during the expansion and the erosion process is much more dependent upon the shape of the structural steel as compared to maintaining the insulating barrier when more conventional materials are used. For example, while the char may adhere well to a wide flange column, the same material may not adequately adhere to and protect rectangular or round steel shapes. Some intumescent coatings require the addition of a reinforcing mesh when applied on specific structural shapes to retain their insulating or char layer.

Many studies have been published which document the relationships between steel temperature as a function of the size and the shape of the steel member and the thickness of the protective material. UL uses graphical methods and computer models to develop these relationships. A factor in evaluations conducted by UL is the reliance upon full-scale fire test data too not only generate input data for the analysis but also to confirm the performance of the rated assemblies. Small-scale data is not used since it does not provide sufficient information regarding adhesion.

When intumescent coatings are used, UL obtains full-scale test data from a variety of samples to verify the influence of the coating's expansion and the ability of the coating to retain its char layer. The full-scale test data is obtained from 8-ft long samples representing each steel shape being evaluated. The full-scale samples also represent the minimum and the maximum coating thickness, and minimum and maximum steel column size. Performance outside of the tested thickness range is not known. Therefore, UL publishes data only within the tested parameters of steel size and coating thickness, and imposes limits on maximum thicknesses. This limit is imposed since too much char can result in premature delamination. This characteristic of maximum thickness limitation is an important difference between intumescent coatings and

traditional SFRM materials. A similar approach is applied to the fire testing of steel beams.

To obtain a UL Classification, intumescent coatings must also demonstrate fire resistive performance after being subjected to several simulated environmental conditions. These conditions include accelerated aging and elevated humidity for coatings intended for use within a structure and accelerated aging, elevated humidity, carbon dioxide and sulfur dioxide air mixture, salt spray, ultraviolet light, freezing, and simulated rain for coatings intended for outside exposure. *Typically, these test samples are 2 ft long*. After being conditioned by the simulated environments, the samples are subjected to the same fire exposure as that specified in Standard UL 263. These additional tests are conducted again because of the unique characteristics of the intumescent coatings as compared to the traditional materials. For example, some intumescent coatings are extremely sensitive to moisture, exposure to which may result in char suppression in a fire and lack of fire resistive performance. Coatings which have not demonstrated compliance with the environmental testing protocol may not perform as intended after the product ages and is exposed to various conditions in the life of the protected steel structure. Some intumescent coatings, including those intended for interior use, require the use of a topcoat to provide a protective barrier.

UL's Fire Resistance Directory includes tables that specify thickness of intumescent coatings for various steel shapes for various hourly ratings. The Fire Resistance Directory also includes equations in the introductory section that relate SFRM thickness as a function the size and the mass of a steel section. It is important to note these general equations do not apply to intumescent coatings because of the unique characteristics of the coatings.

Primers are typically required on the steel prior to the application of the intumescent coating. Only those primers that are described in the individual designs may be used. Adhesion to other primers under fire conditions is not known. Likewise, when a topcoat is required, only those topcoats that are listed in the design may be used.

The presence of UL's Classification Mark on containers of fire resistive intumescent coatings is extremely important in that it is the only method that can be used to identify coatings manufactured in compliance with UL's requirements that include **BOTH** fire test performance and product performance. The Classification Mark indicates that the material was manufactured under UL's Follow-Up Services Program. Under this program, UL makes unannounced factory visits to monitor for compliance with various manufacturing criteria such as formulation, raw material qualification and quality control procedures. Data used during these visits is typically obtained from observations by UL's engineering staff who witness the production of the intumescent coating to be used to coat the fire test specimens. The intent of the Follow-up Services Program is to ensure consistency between the tested product and the product being supplied to project sites.

As a final note, UL's Fire Resistance Directory may be searched online at UL's home page at **www.ul.com/database**.