Primed Structural Steel Guidelines For Spray-Applied Fireproofing

Primed/Painted structural steel is a very important project condition that cannot be over-looked when installing Spray-Applied Fireproofing, also know as Spray-Applied Fire Resistive Materials (SFRMs).

As the world's leading manufacturer of passive fire protection products, we recommend that structural steel members to receive SFRM remain unprimed/unpainted in order to ensure proper adhesion to the substrate.

Most fire testing by UL and/or SFRM manufacturers have been conducted on unprimed steel and therefore, unprimed/unpainted steel is the preferred substrate condition for commercial construction.

UL does allow the application of SFRM to primed/painted wide flange steel members (beams and columns) and pipe and tube steel columns provided the guidelines that are listed in the 2014 UL Fire Resistance Directory - Volume 1 (see attached excerpt) are followed in their entirety.

Prior to 1989, UL had little or no fire test data demonstrating the performance of SFRMs when applied to painted or primed members. Since then, a limited number of tests with paints and primers were conducted with different manufacturers' SFRMs. This resulted in a database of tested steel sizes. The largest beam tested had a flange width of 12 inches and a web depth of 16 inches[1]. Likewise, the largest column tested had a flange width of 16 inches and a web depth of 16 inches[1]. The largest pipe outer diameter and tube width had a dimension of 12 inches. Therefore, any members exceeding these dimensions require a mechanical break be installed such as metal lath or steel studs with discs prior to the installation of the fire protection material. If metal strip lath is utilized, no less than 25% of the width of the oversized flange, web element or face of tube or pipe shall be covered by the metal lath. The strips of metal lath shall be minimum 1.7 lbs. per sq. yard and minimum of 3½ inches wide. If steel studs with discs are used, the studs shall be welded to the oversized element in rows such that the maximum clear span is in accordance with either the 12 inch or 16 inch requirements previously mentioned. The spacing of the studs in each row shall not exceed 24 inches and a minimum of one stud per 256 sq. inch shall be provided.

Even if the steel member is "oversized" and requires one of the preceding mechanical breaks, acceptable bond strength values still must be achieved . These bond tests are conducted in accordance with ASTM E736, "Standard Test Method for Cohesion/Adhesion of Sprayed Fire Resistive Materials Applied to Structural Members". A minimum average bond strength of 80% and a minimum individual bond strength of 50% must be maintained when compared to the bond strength of the fire-resistive coating applied to clean uncoated steel. Bond tests can be conducted within a laboratory environment or within the field on existing structures. In some cases, achieving these acceptable bond strength values may require the use of a bonding adhesive. In these cases, the SFRM manufacturer should be contacted for specific details.

When bond strengths are not within the aforementioned specifications, or the primer is unknown and cannot be field tested, mechanical bond may be obtained by completely wrapping the structural member with expanded metal lath (minimum 1.7 lbs. per sq. yard) following the contour of the steel member.

The direct application of SFRMs to primed/painted bar joists is acceptable, provided the SFRM thickness is in accordance with the appropriate design. The use of metal lath or non-metallic fiber mesh is optional and is only used to help aid in the application.

For specific information pertaining to Primed/Painted Decking, refer to Isolutions - Primed / Painted Decking.

The above mentioned information has been provided as a summary of the requirements necessary for the proper installation of SFRMs to various primed/painted structural steel members.

[1] **Web depths are measured from inside of top flange to inside of bottom flange**

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3. Coating Materials

Coating materials include products identified as: 1) Spray-applied Fire-resistive Materials and 2) Mastic and Intumescent Coatings.

The type of material is specified in each design. Materials that have been investigated for exterior application are so indicated in the individual designs and in the product category.

Regulations governing the application and use of coating materials have been promulgated by many governmental agencies. Authorities having Jurisdiction should be consulted for current local requirements.

Unless specifically detailed in the individual designs or in the product certification information, the interaction of dissimilar fireproofing materials on the same structural element or at the intersection of structural members, and the adherence of one product to the other, has not been investigated under fire-test conditions.

Unless specifically detailed in the individual designs or in the product certification information, the impact of galvanization applied to structural steel members has not been investigated under fire-test conditions. Galvanization may impact the adhesion of spray-applied fire-resistive materials or mastic and intumescent coatings.

Spray-applied Fire-resistive Materials

The surfaces on which the material is to be applied must be free of dirt, oil and loose scale. Surfaces may be primed with the primers/ paints covered under Primers for Structural Steel (CGJM).

The following method of determining the bond strength of the spray-applied materials only applies to primers or paints that are not covered under Primers for Structural Steel (CGJM). Unless specifically prohibited in the individual designs, materials identified as Spray-applied Fire-resistive Materials (CHPX) may be applied to primed or similarly painted wide-flange steel shapes and pipe and tube-shaped columns provided: (A) the beam flange width does not exceed 12 in.; (B) the column flange width does not exceed 16 in.; (C) the beam or column web depth (defined as inside of top flange to inside of bottom flange) does not exceed 16 in.; (D) the pipe outer diameter or tube width does not exceed 12 in.; (E) bond tests conducted in accordance with ASTM E736, "Standard Test Method for Cohesion/ Adhesion of Sprayed Fire Resistive Materials Applied to Structural Members," should indicate a minimum average bond strength of 80% and a minimum individual bond strength of 50% when compared to the bond strength of the fire-resistive coating as applied to clean uncoated 1/ 8 in. thick steel plate. The average and minimum bond strength values should be determined based upon a minimum of five bond tests conducted in accordance with ASTM E736.

The bond tests need only be conducted when the fire-resistive coating is applied to a primed or similarly painted surface for which acceptable bond strength performance between the primer or other similar material and the fire-resistive coating has not been measured. A bonding agent may be applied to the primed or similarly painted surface to obtain the minimum required bond strength where the bond strengths are found to be below the minimum acceptable values.

As an alternative to the bond test conducted on control samples applied to an uncoated steel plate, the following method may be used for unknown coatings in existing structures. Sections of painted steel are to be coated with a bonding agent compatible with the sprayed material being used on the project. The treated and untreated substrates should be coated with material, cured, and subjected to five bond tests each, in accordance with ASTM E736. If the failure mode of the sections treated with the bonding agent is 100% cohesive in nature, it will be acceptable to use this bond test value as the control bond strength. The value obtained on the untreated painted section should be compared to the control value using the minimum 80% average, 50% individual bond strength acceptance criteria established in ASTM E736.

If condition (E) is not met, a mechanical bond may be obtained by wrapping the structural member with expanded metal lath (minimum 1.7 lbs per sq yd).

If any of the conditions specified in (A), (B), (C) or (D) are not met, a mechanical break should be provided. A mechanical break may be provided by mechanically fastening one or more minimum 1.7 lbs per sq yd metal lath strips to the flange, web or tube and pipe surface either by weld, screw, or powder-actuated fasteners, on maximum 12 in. centers, on each longitudinal edge of the strip, so that the clear spans do not exceed the limits established in conditions (A), (B), (C) or (D) as appropriate. No less than 25% of the width of the oversize flange or web element should be covered by the metal lath. No strip of metal lath should be less than 3-1/ 2 in. wide.

As an alternative to metal lath, the mechanical break may be provided by the use of minimum 12 gauge steel studs with minimum 28 gauge galvanized steel disks if such a system is described in a specific design (usually a bottomless trench in an electrified floor design) for the fire-resistive coating being applied. The studs should be welded to the oversize element in rows such that the maximum clear span conforms to conditions (A), (B), (C) or (D) as appropriate. The spacing of studs along each row should not exceed 24 in. and a minimum one stud per 256 sq in. should be provided.

Where metal lath strips or steel studs and disks are used, acceptable bond strength as described in item (E) should also be provided. A bonding agent may be applied to the painted surface to obtain the required minimum bond strength where bond strengths to a painted surface are found to be below minimum acceptable values.

The dry density at which sprayed material should be applied to building elements is specified in the individual designs. Dry-density measurements may be determined by removing at least 6 in. sq sections randomly selected from the building, subjecting the samples to 120°F in an oven until constant weight is obtained, followed by accurate weighing, measuring and calculation of the density in lb per cu ft. Constant weight is usually obtained after 24 to 48 h exposure within a 120°F oven.

The spray-applied fire-resistive material thickness specification in a design should be considered the minimum average thickness of the individual thickness readings measured in accordance with ASTM E605, "Standard Test Methods for Thickness and Density of Sprayed Fire Resistive Material Applied to Structural Members." When spray-applied fire-resistive material is applied to metal lath, the spray-applied fire-resistive material thickness should be measured to the face of the lath unless specified otherwise in the individual designs.

Individual measured thickness, which exceeds the thickness specified in a design by 1/ 4 in. or more, should be recorded as the thickness specified in the design plus 1/ 4 in. For design thicknesses 1 in. or greater, the minimum allowable individual thickness should be the design thickness minus 1/ 4 in. For design thicknesses less than 1 in., the minimum allowable individual thickness should be the design thickness minus 25%.

The thickness of the spray-applied fire-resistive material should be corrected by applying additional material at any location where: (1) the calculated average thickness of the material is less than that required by the design or (2) an individual measured thickness reading is more than 1/ 4 in. less or more than 25% less (for design thicknesses greater than 1 in. and less than 1 in., respectively) than the specified thickness required by the design.

Areas of the structural frame and/ or floor area are to be selected to obtain representative average thicknesses. Thickness readings on the floor or wall area are to be taken symmetrically over the selected area. The average of all measurements is to be considered the average thickness of the area. Thickness measurements on beams and/ or columns are to be made around the member at sections within 12 in. of each other. The average thickness is to be considered the average of the readings taken at both sections.

Screw tips penetrating the steel roof deck in all P700 and P800 Series designs require spray-applied fire-resistive material. The spray-applied fire-resistive material specified in the design should be applied to cover the tips at a minimum thickness of 1/ 2 in.

Mixing and spraying instructions are included with each container of material.