28 October 2020

Luke Street
Estimator/Project Manager
Norkote
2330 106th Street SW
Everett, WA 98204
O: 425-212-3813/M: 206-571-6595
Email: luke@norkote.com

RE: Project: Lincoln High School
Location: Portland, OR
Contractor: Norkote
Isolatek Engineering Judgment: 06BC20282, dated 8 October 2020

Dear Mr. Street:

We have received and reviewed the Engineering Judgment documentation 06BC20282, prepared by Robert Casteel, Isolatek International, dated 8 October 2020, regarding the use of CAFCO BLAZE-SHIELD HP Spray-Applied Fire Resistive Material (SFRM) on tubular, structural steel members at the above referenced project. It is desired that the fire-resistance rating of the structural steel member be maintained in accordance with ASTM E119/UL 263, "Standard Test Methods for Fire Tests of Building Construction and Materials."

UL has not tested for this application. As a result, an Alternative Method per Section 703.3 of the 2014 Oregon Construction Specialty Code is required in the form of an Engineering Judgment to address the firestopping of this condition. Section 703.3 states, "The application of any of the alternative methods listed in this section shall be based on the fire exposure and acceptance criteria specified in ASTM E119 or UL 263. The required **fire resistance** of a building element, component or assembly shall be permitted to be established by any of the following methods or procedures: 1. Fire-resistance designs documented in sources; 2. Prescriptive designs of fire-resistance-rated building elements, components or assemblies as prescribed in Section 721; 3. Calculations in accordance with Section 722; 4. Engineering analysis based on a comparison of building element, component or assemblies designs having *fire-resistance ratings* as determined by the test procedures set forth in ASTM E119 or UL 263; 5. Alternative protection methods as allowed by Section 104.11."

It is standard industry practice to determine SFRM thicknesses based on calculated A/P and W/D rations. These ratios are determined by dividing the weight, W, of the steel section in lbs./ft. (or the cross-sectional area, A, of the steel member) by the heated perimeter, D (or P), of protection at the interface

of the protection material through which heat is be transferred to the steel, in inches. A/P ratio equation for steel members is provided in the Underwriters Laboratories, Inc. (UL) Directory. UL has also not tested for miscellaneous shapes such as C-channels and L-angles. It is typical industry practice to utlize a conservative thickness based on a UL column design (X- or Y-Series). The thickness are derived from the W/D ratio of the miscellaneous shape. Thicknesses shown in the following table were determined based on the derived W/D ratio of the coped/notched steel member and the corresponding beam design thickness from the indicated UL Design.

Steel Size	W/D	Thickness	Hourly Rating	UL Design Basis
HSS 5 x 5 x 3/8	0.35	1-1/4"	2	X827
HSS 6 x 6 x ¼	0.24	1-15/16"	2	X827
HSS 6 x 6 x 3/8	0.35	1-1/4"	2	X827
HSS 12 x 6 x ½	0.47	1-1/16"	2	X827
HSS 16 x 8 x ½	0.48	1"	2	X827
HSS 16 x 12 x ½	0.48	1"	2	X827
HSS 16 x 12 x 5/8	0.59	11/16"	2	X827
HSS 10 x 6 x ¼	0.24	¾"	1	X827

Pursuant to our review of the evaluation presented, we find the report provides substantial justification to support the conclusions drawn that the required fire-resistance rating in accordance with ASTM E119 would be maintained, provided that the CAFCO BLAZE-SHIELD HP SFRM is installed in accordance with manufacturer's written application installation instructions and methods.

This review is limited to those specific assemblies depicted and only for use as part of the above referenced project and cannot be extended to other assemblies or projects. The rating of the fireproofing system is dependent on the performance of the surrounding structure under fire exposure. The contractor is responsible for the compliant installation of the referenced engineering judgment.

Reviewed by: John D. Campbell, P.E.

REGISTERED PROFESSIONAL ENGINEER
74880PE
OREGON
MAY 11, 2004
JOHN D. CAMPBELL
EXPIRES: Dec 31, 2021

JOHN D CAMPBELL Digitally signed by JOHN D CAMPBELL
Date: 2020.10.28 11:29:04 -05'00'

Design No. X827
BXUV.X827
Fire-resistance Ratings - ANSI/UL 263

Page Bottom

Design/System/Construction/Assembly Usage Disclaimer

- Authorities Having Jurisdiction should be consulted in all cases as to the particular requirements covering the installation and use of UL Certified products, equipment, system, devices, and materials.
- Authorities Having Jurisdiction should be consulted before construction.
- Fire resistance assemblies and products are developed by the design submitter and have been investigated by UL for compliance with applicable requirements. The published information cannot always address every construction nuance encountered in the field.
- When field issues arise, it is recommended the first contact for assistance be the technical service staff provided by the product manufacturer noted for the design. Users of fire resistance assemblies are advised to consult the general Guide Information for each product category and each group of assemblies. The Guide Information includes specifics concerning alternate materials and alternate methods of construction.
- Only products which bear UL's Mark are considered Certified.

BXUV - Fire Resistance Ratings - ANSI/UL 263 Certified for United States

BXUV7 - Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada

See General Information for Fire-resistance Ratings - ANSI/UL 263 Certified for United States
Design Criteria and Allowable Variances

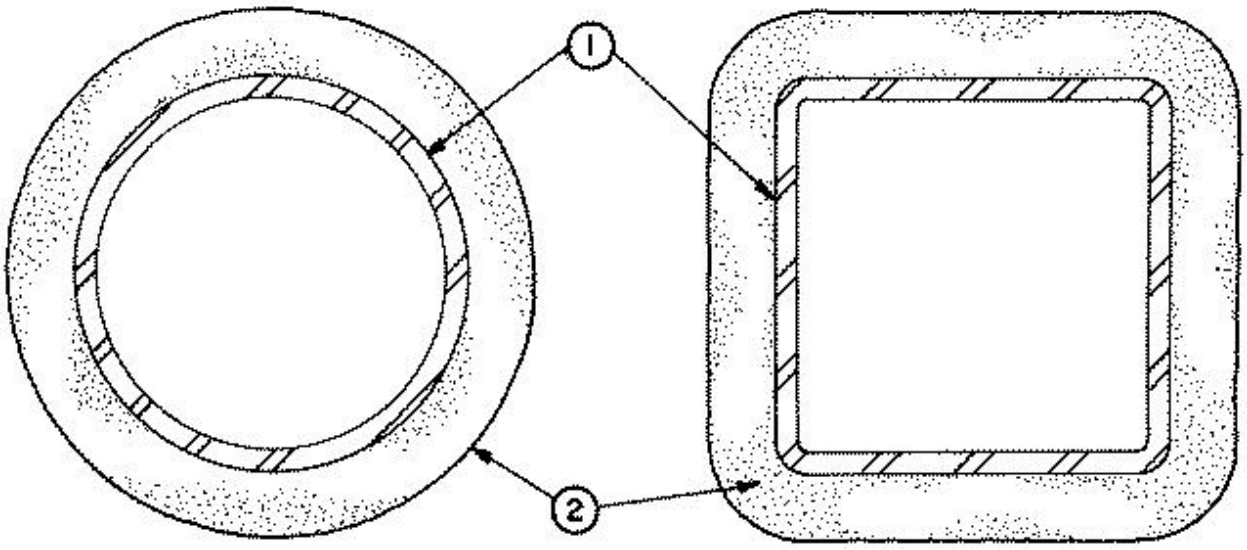
See General Information for Fire Resistance Ratings - CAN/ULC-S101 Certified for Canada
Design Criteria and Allowable Variances

Design No. X827

May 03, 2018

Ratings — 1, 1-1/2, 2, 3 and 4 Hr.

*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**



1. **Steel Pipe or Tube Column —** Steel circular pipe (SP) with diameter (ID) ranging from a minimum of 3 in. to a maximum of 32 in. with a minimum wall thickness of 3/16 in.

Steel square or rectangular tube (ST) with outside wall dimensions ranging from minimum 3 in. to a maximum of 36 in. and a minimum wall thickness of 3/16 in.

2. **Spray-Applied Fire Resistive Materials* —** Applied by spraying with water to the final thicknesses shown below. Crest areas shall be filled with Spray-Applied Fire Resistive Materials above the beam. Beam surfaces must be clean and free of dirt, loose scale and oil. Min average density of 13 pcf with min. ind density of 11 pcf for Types II, II HS, or DC/F. Min avg and min ind densities of 22 and 19 pcf, respectively, for Type HP. For method of density determination, refer to Design Information Section.

The min thickness of Spray-Applied Fire Resistive Material required for various fire resistance ratings of contour sprayed steel pipes or tubes are shown in the tables below.

Tube Steel Columns, Min Thkns, In.						
Min Column Size	**A/P**	**Rating, Hr.**				
		1	**1-1/2**	**2**	**3**	**4**
ST 3x3x0.188	0.18	1	1-3/4	2-9/16	—	—
ST 4x4x0.188	0.18	15/16	1-9/16	2-3/16	3-1/2	4-13/16
ST4x4x0.25	0.24	3/4	1-5/16	1-15/16	3	4-13/16
ST 4x4x0.375	0.34	9/16	13/16	1-1/4	2-3/16	3
ST 4x4x0.5	0.44	7/16	3/4	1-1/16	1-11/16	2-5/16
ST 36x24x0.5	0.49	3/8	7/16	11/16	1-1/8	1-5/8

Pipe Columns, Min Thkns, In.						
Min Column Size	**A/P**	**Rating, Hr.**				
		1	**1-1/2**	**2**	**3**	**4**
SP 3x0.188	0.18	1	3-3/4	2-9/16	—	—
SP 4x0.237	0.22	13/16	1-7/16	2-1/16	3-3/8	4-13/16

ISOLATEK INTERNATIONAL — Type HP, D-C/F, II, or II HS. Investigated for exterior use. Type EBS or Type X adhesive/sealer optional.

As an alternate to the above tables, the required thickness of Spray-Applied Fire Resistive Materials to be applied to all surfaces of the steel pipes or tubes for all rating periods may be determined from the following equation:

The thickness of sprayed for ratings of 1, 1-1/2, 2, 3, and 4 h of a steel pipe or tube may be determined by the equation:

$$h = \frac{R - 0.38}{3.58\ (A/P)}$$

Where:

R = the hourly rating (hrs).

h = the thickness of protection material, min 0.35 - max 3.50 in.

A = the cross sectional area (sq in.)

P = the heated perimeter (in.)

The A/P ratio of the steel pipe or tube (see Item 2) shall range from 0.18 to 2.0.

The A/P ratio of a circular pipe is determined by:

$$A/P = \frac{t\ (d - t)}{d}$$

Where:

d = the outer diameter of the pipe (in.)

t = the wall thickness of the pipe (in.)

The A/P ratio of a rectangular tube is determined by:

$$A/P = \frac{t\,(a + b - 2t)}{a + b}$$

Where:

a = the outer width of the tube (in.)

b = the outer length of the tube (in.)

t = the wall thickness of the tube (in.)

*** Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.**

Last Updated on 2018-05-03

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ISOLATEK® INTERNATIONAL

CAFCO® BLAZE-SHIELD HP
(Americas)

ISOLATEK® Type HP
(Worldwide)

Spray-Applied Fireproofing

DESCRIPTION

CAFCO BLAZE-SHIELD HP / ISOLATEK Type HP is an inorganic, Portland cement based, medium density Spray-Applied Fire Resistive Material (SFRM) designed to provide fire protection for structural steel in commercial construction. Tested and classified by UL as "investigated for exterior use", CAFCO BLAZE-SHIELD HP's / ISOLATEK Type HP's durable surface and cement based formula enable it to withstand indirect weather exposure conditions and limited physical abuse, thus allowing for application in parking garages, mechanical rooms, elevator shafts, etc.

In addition to fire resistance, CAFCO BLAZE-SHIELD HP / ISOLATEK Type HP also provides thermal and acoustical benefits. As a thermal insulator, it is effective in reducing heat loss, particularly when applied to the underside of a roof deck. The R-value added by CAFCO BLAZE-SHIELD HP / ISOLATEK Type HP may also allow a reduction in roof insulation. As an efficient sound absorbing material, it adds value to the fire protection application in areas where high noise levels are anticipated.

With a simple one-step application process, CAFCO BLAZE-SHIELD HP / ISOLATEK Type HP is able to provide complete passive fire protection for most construction conditions at reduced costs and in less time.

PRODUCT ADVANTAGES

- *UL "Investigated for exterior use"*
- *Meets current IBC high rise bond strength requirement of 430 psf*
- *Inorganic Portland cement based formulation*
- *Highest recycled content in its class (56% pre-consumer)*

FIRE TEST PERFORMANCE

CAFCO BLAZE-SHIELD HP / ISOLATEK Type HP has been extensively tested for fire resistance and is rated for up to 4 hours for floor assemblies, beams, joists, columns, roof assemblies and walls and partitions.

- Classified by UL in accordance with ANSI/UL 263 (ASTM E119)
- Classified by UL in accordance with CAN/ULC-S101 (ASTM E119)

CODE COMPLIANCES

CAFCO BLAZE-SHIELD HP / ISOLATEK Type HP satisfies the requirements of the following:

- IBC® - INTERNATIONAL BUILDING CODE®
- City of Los Angeles (LADBS, Category 1 Material)
- NBC - National Building Code of Canada
- ICC-ES, AC23 and AC10 Requirements (UL ER13348-01)

MAJOR SPECIFICATIONS

CAFCO BLAZE-SHIELD HP / ISOLATEK Type HP complies with the requirements of the following specifications:

- MasterSpec®, Section 078100 APPLIED FIREPROOFING (AIA)
- MasterFormat® 2014, Section 07 81 00 Applied Fireproofing (CSC,CSI)
- Unified Facilities Guide Specification, UFGS 07 81 00 Spray-Applied Fireproofing (USACE, NAVFAC, AFCEC, NASA)
- Master Construction Specifications, Number 07 80 10 Applied Fireproofing (VA)
- Code of Federal Regulations, Title 40 Protection of the Environment (EPA)
- PBS-P100 Facilities Standards for the Public Buildings Services (GSA)

Thermal Performance

Product	Conductivity(k)*	Resistance (R/inch)
BLAZE-SHIELD HP Type HP	0.41 BTU in/hr ft2° F @ 75° F (0.059 W/mK @ 24°C)	2.43

*When tested in accordance with ASTM C518

Acoustical Performance

Product	Thickness	Base	NRC Rating*
BLAZE-SHIELD HP Type HP	1/2 inch (13 mm)	Deck & Beam	0.85

*When tested in accordance with ASTM C423

Physical Performance

Characteristic	ASTM Method	Industry Standard Performance*	Laboratory Tested Performance**
Density	E605	22 pcf (352 kg/m^3)	24 - 26 pcf (384 - 416 kg/m^3)
Combustibility	E136	Noncombustible	Noncombustible
Cohesion/Adhesion	E736	430 psf (20.6 kPa)	1,525 psf (73.0 kPa)
Deflection	E759	No Cracks or Delaminations	No Cracks or Delaminations
Bond Impact	E760	No Cracks or Delaminations	No Cracks or Delaminations
Compressive Strength	E761	7,344 psf (351 kPa)	7,920 psf (379.2 kPa)
Air Erosion Resistance	E859	Less than 0.025 g/ft^2 (0.27 g/m^2)	0.000 g/ft^2 (0.000 g/m^2)
Corrosion Resistance	E937	Does Not Promote Corrosion of Steel	Does Not Promote Corrosion of Steel
Fungal Resistance	G21	No Growth After 28 Days	Passed

* Standard performance based on industry standards and practices. Refer to UL design for density requirement.
** Values represent independent laboratory tests under controlled conditions.

CAFCO BLAZE-SHIELD HP / ISOLATEK Type HP Guide Specification

SECTION 078100 - APPLIED FIREPROOFING

The following is an outline/short language specification. Complete specifications for Spray-Applied Fire Resistive Materials are available on various media upon request.

PART 1 – GENERAL

1.1 Work included

1.1.1 Provide all labor, materials, equipment and services necessary for, and incidental to, the complete and proper installation of all sprayed fire protection and related work as shown on the drawings or where specified herein, and in accordance with all applicable requirements of the Contract Documents.

1.1.2 The material and installation shall conform to the applicable building code requirements and the requirements of all authorities having jurisdiction.

1.2 Quality Assurance

1.2.1 Work shall be performed by a firm with expertise in the installation of fire protection or similar materials. This firm shall be recognized or otherwise approved by the spray-applied fire resistive material manufacturer.

1.2.2 Before proceeding with the fire protection work, approval of the proposed material thicknesses and densities shall be obtained from the architect and other applicable authorities having jurisdiction.

1.3 Related Sections

1.3.1 SECTION 051200 – STRUCTURAL STEEL FRAMING

1.3.2 SECTION 053100 – STEEL DECKING

1.3.3 SECTION 072100 – THERMAL INSULATION

1.3.4 SECTION 078123 – INTUMESCENT FIREPROOFING

1.3.5 SECTION 078443 – JOINT FIRESTOPPING

1.4 References

A. ASTM E84 – Surface Burning Characteristics of Building Materials.

B. ASTM E119 – Fire Tests of Building Construction and Materials.

C. ASTM E136 - (Noncombustibility) Behavior of Materials in a Vertical Tube Furnace at 750°C.

D. ASTM E605 – Thickness and Density of Sprayed Fire-Resistive Materials Applied to Structural Members.

E. ASTM E736 – Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members.

F. ASTM E759 – Effect of Deflection of Sprayed Fire-Resistive Materials Applied to Structural Members.

G. ASTM E760 – Effect of Impact on Bonding of Sprayed Fire-Resistive Materials Applied to Structural Members.

H. ASTM E761 – Compressive Strength of Sprayed Fire-Resistive Materials Applied to Structural Members.

I. ASTM E859 – Air Erosion of Sprayed Fire-Resistive Materials Applied to Structural Members.

J. ASTM E937 – Corrosion of Steel by Sprayed Fire-Resistive Materials Applied to Structural Members.

K. CAN / ULC–S101 – Standard Methods of Fire Tests of Building Construction and Materials.

L. CAN / ULC–S102 – Steiner Tunnel Test.

M. CAN4-S114 Standard Test Method for Determination of Noncombustibility in Building Materials.

1.4.1 Underwriters Laboratories (UL) Fire Resistance Directory.

1.4.2 Underwriters Laboratories of Canada (ULC) List of Equipment and Materials.

1.4.3 IBC® INTERNATIONAL BUILDING CODE® CHAPTER 17 STRUCTURAL TESTS AND SPECIAL INSPECTIONS, Section 1705 Special Inspections.

1.4.4 AWCI Publication: Technical Manual 12-A Standard Practice for the Testing and Inspection of Field Applied Sprayed Fire-Resistive Materials; an Annotated Guide.

1.5 Submittals

1.5.1 Manufacturer's Data: Submit Manufacturer's specification, including certification as may be required to show material compliance with Contract Documents.

1.5.2 Test Data: Independent laboratory test results shall be submitted for all specified performance criteria.

1.6 Delivery, Storage and Handling

1.6.1 Deliver materials to the project in manufacturer's unopened packages, fully identified as to trade name, type and other identifying data. Packaging shall bear the UL and ULC labels for fire hazard and fire-resistance classifications.

1.6.2 Store materials above ground, in a dry location, protected from the weather. Damaged packages found unsuitable for use should be rejected and removed from the project.

1.7 Project Conditions

1.7.1 When the prevailing outdoor temperature at the building is less than 40° F (4°C), a minimum substrate and ambient temperature of 40° F (4°C) shall be maintained prior to, during, and a minimum of 24 hours after application of spray-applied fire resistive material. If necessary for job progress, General Contractor shall provide enclosures and heat to maintain proper temperatures and humidity levels.

1.7.2 General Contractor shall provide ventilation to allow proper drying of the sprayed fire protection during and subsequent to its application.

1.7.2.1 Ventilation must not be less than 4 complete air exchanges per hour until the material is dry. When spraying in enclosed areas such as basements, stairwells, shafts, and small rooms, additional air exchanges may be necessary.

1.8 Sequencing/Scheduling

1.8.1 All fire protection work on a floor shall be completed before proceeding to the next floor.

1.8.2 The Contractor shall cooperate in the coordination and scheduling of fire protection work to avoid delays in job progress.

PART 2 – PRODUCTS

2.1 Acceptable Manufacturers

2.1.1 The spray-applied fire resistive material shall be manufactured under the CAFCO® / ISOLATEK® brand name, by authorized producers.

2.2 Materials

2.2.1 Materials shall be CAFCO BLAZE-SHIELD® HP, (UL/ULC designation: ISOLATEK Type HP) applied to conform to the drawings, specifications and following test criteria:

2.2.1.1 Deflection: When tested in accordance with ASTM E759, the material shall not crack or delaminate when the non-concrete topped galvanized deck to which it is applied is subjected to a one time vertical centerload resulting in a downward deflection of 1/120th of the span.

2.2.1.2 Bond Impact: When tested in accordance with ASTM E760, the material shall not crack or delaminate from the concrete topped galvanized deck to which it is applied.

2.2.1.3 Cohesion/Adhesion (bond strength): When tested in accordance with ASTM E736, the material applied over uncoated or galvanized steel shall have an average bond strength of 430 psf (20.6 kPa)

2.2.1.4 Air Erosion: When tested in accordance with ASTM E859, the material shall not be subject to losses from the finished application greater than 0.025 grams per sq. ft. (0.27 grams per square meter).

2.2.1.5 Compressive Strength: When tested in accordance with ASTM E761, the material shall not deform more than 10 percent when subjected to a crushing force of 7,344 psf (351 kPa).

2.2.1.6 Corrosion Resistance: When tested in accordance with ASTM E937, the material shall not promote corrosion of steel.

2.2.1.7 Noncombustibility: When tested in accordance with ASTM E136 or CAN4-S114, the material shall be noncombustible.

2.2.1.8 Surface Burning Characteristics: When tested in accordance with ASTM E84 or CAN/ULC-S102, the material shall exhibit the following surface burning characteristics:
Flame Spread.....0
Smoke Developed.....0

2.2.1.9 Density: When tested in accordance with ASTM E605, the material shall meet the minimum individual and average density values as listed in the appropriate UL / ULC design or as required by the authority having jurisdiction.

2.2.2 The material shall have been tested and classified by Underwriters Laboratories (UL) or Underwriters Laboratories of Canada (ULC) in accordance with the procedures of UL 263 (ASTM E119) or CAN/ULC-S101.

2.2.3 Spray-applied fire resistive materials shall be applied at the appropriate minimum thickness and density to achieve the following ratings:
Floor assemblies ___hr.
Roof assemblies ___hr.
Beams ___hr.
Girders ___hr.
Columns ___hr.
Joists ___hr.

2.2.4 Potable water shall be used for the application of spray-applied fire resistive materials.

2.2.5 Spray-applied fire resistive materials shall contain no detectable asbestos. Material manufacturer shall provide certification of such upon request.

PART 3 – EXECUTION

3.1 Preparation

3.1.1 All surfaces to receive fire protection shall be free of oil, grease, loose mill scale, dirt, paints/primers or other foreign materials which would impair satisfactory bonding to the surface. Manufacturer shall be contacted for procedures on handling primed/painted steel. Any cleaning of surfaces to receive spray-applied fire resistive material shall be the responsibility of the General Contractor or Steel Erector, as outlined in the structural steel or steel deck section.

3.1.2 Clips, hangers, supports, sleeves and other attachments to the substrate are to be placed by others prior to the application of spray-applied fire resistive materials.

3.1.3 The installation of ducts, piping, conduit or other suspended equipment shall not take place until the application of spray-applied fire resistive materials is complete in an area.

3.1.4 The spray-applied fire resistive material shall only be applied to steel deck which has been fabricated and erected in accordance with the criteria set by the Steel Deck Institute.

3.1.5 When roof traffic is anticipated, as in the case of periodic maintenance, roofing pavers shall be installed as a walkway to distribute loads.

3.2 Application

3.2.1 Equipment, mixing and application shall be in accordance with the manufacturer's written application instructions.

3.2.2 The application of spray-applied fire resistive material shall not commence until certification has been received by the General Contractor that surfaces to receive sprayed fire protection have been inspected by the applicator and are acceptable to receive spray-applied fire resistive material.

3.2.3 All unsuitable substrates must be identified and made known to the General Contractor and corrected prior to application of the spray-applied fire resistive material.

3.2.4 Spray-applied fire resistive material shall not be applied to steel floor decks prior to the completion of concrete work on that deck.

3.2.5 The application of spray-applied fire resistive material to the underside of roof deck shall not commence until the roofing is completely installed and tight, all penthouses are complete, all mechanical units have been placed, and after construction roof traffic has ceased.

3.2.6 Proper temperature and ventilation shall be maintained as specified in 1.7.1, 1.7.2. and 1.7.2.1.

3.2.7 Provide masking, drop cloths or other suitable coverings to prevent overspray from coming in contact with surfaces not intended to be sprayed.

3.2.8 CAFCO BOND-SEAL / ISOLATEK Type EBS adhesive shall be applied as per the appropriate UL/ULC fire resistance design and manufacturer's written recommendations.

3.3 Repairing and Cleaning

3.3.1 All patching of and repair to spray-applied fire resistive material, due to damage by other trades, shall be performed under this section and paid for by the trade responsible for the damage.

3.3.2 After the completion of the work in this section, equipment shall be removed and all surfaces not to be sprayed shall be cleaned to the extent previously agreed to by the applicator and General Contractor.

3.4 Inspection and Testing

3.4.1 The spray-applied fire resistive material shall be tested for thickness and density in accordance with one of the following procedures:
ASTM E605 – Standard Test Method of Sprayed Fire-Resistive Materials Applied to Structural Members.
AWCI Publication: Technical Manual 12-A Standard Practice for the Testing and Inspection of Field Applied Sprayed Fire-Resistive Materials; an Annotated Guide.
IBC® INTERNATIONAL BUILDING CODE® CHAPTER 17 STRUCTURAL TESTS AND SPECIAL INSPECTIONS, Section 1705 Special Inspections.

Product Availability

Isolatek International Spray-Applied Fire Resistive Materials are available to trained, recognized applicators around the world from strategically located production and distribution points in the U.S., Canada, Mexico, Europe and the Pacific Basin.

ISOLATEK INTERNATIONAL is registered with the AIA Continuing Education System (AIA/CES)

We support our customers with unsurpassed technical expertise and customer service, complemented by an extensive global network of experienced sales representatives and recognized applicators. For detailed product information or for the name of the sales representative in your area please contact us.

Isolatek International provides passive fireproofing materials under the CAFCO® and FENDOLITE® trademarks throughout the Americas and under the ISOLATEK® trademark throughout the world.

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C-TDS-10/19