

SECTION 078100 - APPLIED FIREPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
  - 1. Concealed SFRM.
  - 2. Exposed SFRM.
- B. Related Sections include the following:
  - 1. Division 05 Section "Structural Steel Framing" for surface conditions required for structural steel receiving SFRM.
  - 2. Division 07 Section "Penetration Firestopping" for fire-resistance-rated firestopping systems.

1.3 DEFINITIONS

- A. SFRM: Sprayed fire-resistive material.
- B. Concealed: Fire-resistive materials applied to surfaces that are concealed from view behind other construction when the Work is completed.
- C. Exposed: Fire-resistive materials applied to surfaces that are exposed to view when the Work is completed.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals: Follow submittal requirements of Division 01 Section "Submittal Requirements" and provide product data on the LEED Materials Documentation Cover Sheet attached as an Appendix to Division 01 Section "Sustainable Design and LEED Requirements."
- C. Shop Drawings: Structural framing plans indicating the following:
  - 1. Locations and types of surface preparations required before applying SFRM.
  - 2. Extent of SFRM for each construction and fire-resistance rating, including the following:

- a. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
    - 1) For steel joist assemblies, include applicable fire-resistance design designations, with each steel joist tested with the same maximum tensile stress as each steel joist indicated on Drawings. Design designations with steel joists tested at lower maximum tensile stress than those indicated are not permitted.
  - b. Minimum thicknesses needed to achieve required fire-resistance ratings of structural components and assemblies.
3. Treatment of SFRM after application.
- D. Samples for Selection: For each type of colored, exposed SFRM indicated.
- E. Product Certificates: For each type of SFRM, signed by product manufacturer.
- F. Compatibility and Adhesion Test Reports: From SFRM manufacturer indicating the following:
  1. Materials have been tested for bond with substrates.
  2. Materials have been verified by SFRM manufacturer to be compatible with substrate primers and coatings.
  3. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for proposed SFRM.
- H. Research/Evaluation Reports: For SFRM.
- I. Field quality-control test reports.
- J. Warranties: Special warranties specified in this Section.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by SFRM manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements. A manufacturer's willingness to sell its SFRM to Contractor or to an installer engaged by Contractor does not in itself confer qualification on the buyer.
- B. Source Limitations: Obtain SFRM through one source from a single manufacturer.
- C. SFRM Testing: By a qualified testing and inspecting agency engaged by Contractor or manufacturer to test for compliance with specified requirements for performance and test methods.

1. SFRMs are randomly selected for testing from bags bearing the applicable classification marking of UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
  2. Testing is performed on specimens of SFRMs that comply with laboratory testing requirements specified in Part 2 and are otherwise identical to installed fire-resistive materials, including application of accelerant, sealers, topcoats, tamping, troweling, rolling, and water overspray, if any of these are used in final application.
  3. Testing is performed on specimens whose application the independent testing and inspecting agency witnessed during preparation and conditioning. Include in test reports a full description of preparation and conditioning of laboratory test specimens.
- D. Compatibility and Adhesion Testing: Engage a qualified testing and inspecting agency to test for compliance with requirements for specified performance and test methods.
1. Test for bond per ASTM E 736 and requirements in UL's "Fire Resistance Directory" for coating materials. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
  2. Verify that manufacturer, through its own laboratory testing or field experience, has not found primers or coatings to be incompatible with SFRM.
- E. Fire-Test-Response Characteristics: Provide SFRM with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify bags containing SFRM with appropriate markings of applicable testing and inspecting agency.
1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" acceptable to authorities having jurisdiction, for SFRM serving as direct-applied protection tested per ASTM E 119.
  2. Surface-Burning Characteristics: ASTM E 84.
- F. Provide products containing no detectable asbestos as determined according to the method specified in 40 CFR 763, Subpart E, Appendix E, Section 1, "Polarized Light Microscopy."
- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to SFRM including, but not limited to, the following:
1. Review products, exposure conditions, design ratings, restrained and unrestrained conditions, calculations, densities, thicknesses, bond strengths, and other performance requirements.
  2. Review and finalize construction schedule and verify sequencing and coordination requirements.
  3. Review weather predictions, ambient conditions, and proposed temporary protections for SFRM during and after installation.
  4. Review surface conditions and preparations.
  5. Review field quality-control testing procedures.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to Project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, shelf life if applicable, and fire-resistance ratings applicable to Project.
- B. Use materials with limited shelf life within period indicated. Remove from Project site and discard materials whose shelf life has expired.
- C. Store materials inside, under cover, and aboveground; keep dry until ready for use. Remove from Project site and discard wet or deteriorated materials.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply SFRM when ambient or substrate temperature is 40 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.
- B. Ventilation: Ventilate building spaces during and after application of SFRM. Use natural means or, if they are inadequate, forced-air circulation until fire-resistive material dries thoroughly.

1.8 COORDINATION

- A. Sequence and coordinate application of SFRM with other related work specified in other Sections to comply with the following requirements:
  - 1. Provide temporary enclosure as required to confine spraying operations and protect the environment.
  - 2. Provide temporary enclosures for applications to prevent deterioration of fire-resistive material due to exposure to weather and to unfavorable ambient conditions for humidity, temperature, and ventilation.
  - 3. Avoid unnecessary exposure of fire-resistive material to abrasion and other damage likely to occur during construction operations subsequent to its application.
  - 4. Do not apply fire-resistive material to metal roof deck substrates until concrete topping, if any, has been completed. For metal roof decks without concrete topping, do not apply fire-resistive material to metal roof deck substrates until roofing has been completed; prohibit roof traffic during application and drying of fire-resistive material.
  - 5. Do not apply fire-resistive material to metal floor deck substrates until concrete topping has been completed.
  - 6. Do not begin applying fire-resistive material until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
  - 7. Defer installing ducts, piping, and other items that would interfere with applying fire-resistive material until application of fire protection is completed.
  - 8. Do not install enclosing or concealing construction until after fire-resistive material has been applied, inspected, and tested and corrections have been made to defective applications.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form, signed by Contractor and by Installer, in which manufacturer agrees to repair or replace SFRMs that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Cracking, flaking, spalling, or eroding in excess of specified requirements; peeling; or delaminating of SFRM from substrates.
    - b. Not covered under the warranty are failures due to damage by occupants and Owner's maintenance personnel, exposure to environmental conditions other than those investigated and approved during fire-response testing, and other causes not reasonably foreseeable under conditions of normal use.
  - 2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CONCEALED SFRM

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Concealed Cementitious SFRM:
    - a. Carbolite Co., Fireproofing Products Div.; Pyrolite 15 High Yield.
    - b. Grace, W. R. & Co. - Conn., Construction Products Div.; Monokote Type MK-6/HY.
    - c. Isolatek International Corp.; Cafco 300.
- B. Material Composition: Manufacturer's standard product, as follows:
  - 1. Concealed Cementitious SFRM: Factory-mixed, dry formulation of gypsum or portland cement binders, additives, and lightweight mineral or synthetic aggregates mixed with water at Project site to form a slurry or mortar for conveyance and application.
- C. Physical Properties: Minimum values, unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property as follows:
  - 1. Dry Density: 15 lb/cu. ft. for average and individual densities, or greater if required to attain fire-resistance ratings indicated, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method."
  - 2. Thickness: Minimum average thickness required for fire-resistance design indicated according to the following criteria, but not less than 0.375 inch, per ASTM E 605:
    - a. Where the referenced fire-resistance design lists a thickness of 1 inch or more, the minimum allowable individual thickness of SFRM is the design thickness minus 0.25 inch.

- b. Where the referenced fire-resistance design lists a thickness of less than 1 inch but more than 0.375 inch, the minimum allowable individual thickness of SFRM is the greater of 0.375 inch or 75 percent of the design thickness.
  - c. No reduction in average thickness is permitted for those fire-resistance designs whose fire-resistance ratings were established at densities of less than 15 lb/cu. ft..
3. Bond Strength: 200 lbf/sq. ft. minimum per ASTM E 736 based on laboratory testing of 0.75-inch minimum thickness of SFRM.
  4. Compressive Strength: 5.21 lbf/sq. in. minimum per ASTM E 761. Minimum thickness of SFRM tested shall be 0.75 inch and minimum dry density shall be as specified but not less than 15 lb/cu. ft..
  5. Corrosion Resistance: No evidence of corrosion per ASTM E 937.
  6. Deflection: No cracking, spalling, or delamination per ASTM E 759.
  7. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM E 760.
  8. Air Erosion: Maximum weight loss of 0.005 g/sq. ft. in 24 hours per ASTM E 859. For laboratory tests, minimum thickness of SFRM is 0.75 inch, maximum dry density is 15 lb/cu. ft., test specimens are not prepurged by mechanically induced air velocities, and tests are terminated after 24 hours.
  9. Fire-Test-Response Characteristics: Provide SFRM with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
    - a. Flame-Spread Index: 10 or less.
    - b. Smoke-Developed Index: 0.
  10. Fungal Resistance: No observed growth on specimens per ASTM G 21.

## 2.2 EXPOSED SFRM

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  1. Exposed Cementitious SFRM:
    - a. Carbolite Co., Fireproofing Products Div.; Pyrocrete 240 High Yield.
    - b. Grace, W.R. & Co. - Conn., Construction Products Div.; Monokote Type Z106.
    - c. Isolatek International Corp.; Cafco 400.
- B. Material Composition: Manufacturer's standard product, as follows:
  1. Exposed Cementitious SFRM: Factory-mixed, dry, cement aggregate formulation; or chloride-free formulation of gypsum or portland cement binders, additives, and inorganic aggregates mixed with water at Project site to form a slurry or mortar for conveyance and application.
- C. Physical Properties: Minimum values, unless otherwise indicated, or higher values required to attain designated fire-resistance ratings, measured per standard test methods referenced with each property as follows:

1. Dry Density: Values for average and individual densities as required for fire-resistance ratings indicated, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method," but with an average density of not less than 22 lb/cu. ft..
2. Bond Strength: 434 lbf/sq. ft. minimum per ASTM E 736.
3. Compressive Strength: 51 lbf/sq. in. minimum per ASTM E 761.
4. Corrosion Resistance: No evidence of corrosion per ASTM E 937.
5. Deflection: No cracking, spalling, or delamination per ASTM E 759.
6. Effect of Impact on Bonding: No cracking, spalling, or delamination per ASTM E 760.
7. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. per ASTM E 859.
8. Combustion Characteristics: Passes ASTM E 136.
9. Fire-Test-Response Characteristics: Provide SFRM with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
  - a. Flame-Spread Index: 10 or less.
  - b. Smoke-Developed Index: 0.
10. Fungal Resistance: No observed growth on specimens per ASTM G 21.
11. For exterior applications of SFRM, provide formulation listed and labeled by testing and inspecting agency acceptable to authorities having jurisdiction for surfaces exposed to exterior.

### 2.3 AUXILIARY FIRE-RESISTIVE MATERIALS

- A. General: Provide auxiliary fire-resistive materials that are compatible with SFRM and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.
- B. Substrate Primers: For use on each substrate and with each sprayed fire-resistive product, provide primer that complies with one or more of the following requirements:
  1. Primer's bond strength complies with requirements specified in UL's "Fire Resistance Directory" for coating materials based on a series of bond tests per ASTM E 736.
  2. Primer is identical to those used in assemblies tested for fire-test-response characteristics of SFRM per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
- C. Adhesive for Bonding Fire-Resistive Material: Product approved by manufacturer of SFRM.
- D. Sealer for Sprayed-Fiber Fire-Resistive Material: Transparent-drying, water-dispersible, tinted protective coating recommended in writing by manufacturer of sprayed-fiber fire-resistive material.
  1. Product: Subject to compliance with requirements, provide "Cafco Bond-Seal" by Isolatek International Corp.
- E. Topcoat: Type recommended in writing by manufacturer of each SFRM for application over exposed SFRM.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of work. A substrate is in satisfactory condition if it complies with the following:
  - 1. Substrates comply with requirements in the Section where the substrate and related materials and construction are specified.
  - 2. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, incompatible paints, incompatible encapsulants, or other foreign substances capable of impairing bond of fire-resistive materials with substrates under conditions of normal use or fire exposure.
  - 3. Objects penetrating fire-resistive material, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
  - 4. Substrates are not obstructed by ducts, piping, equipment, and other suspended construction that will interfere with applying fire-resistive material.
- B. Verify that concrete work on steel deck has been completed.
- C. Verify that roof construction, installation of roof-top HVAC equipment, and other related work are completed.
- D. Conduct tests according to fire-resistive material manufacturer's written recommendations to verify that substrates are free of substances capable of interfering with bond.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Cover other work subject to damage from fallout or overspray of fire-resistive materials during application.
- B. Clean substrates of substances that could impair bond of fire-resistive material, including dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, and incompatible primers, paints, and encapsulants.
- C. Prime substrates where recommended in writing by SFRM manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive SFRM.
- D. For exposed applications, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of SFRM. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION, GENERAL

- A. Comply with fire-resistive material manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and spray on fire-resistive

material, as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

- B. Apply SFRM that is identical to products tested as specified in Part 1 "Quality Assurance" Article and substantiated by test reports, with respect to rate of application, accelerator use, sealers, topcoats, tamping, troweling, water overspray, or other materials and procedures affecting test results.
- C. Coat substrates with bonding adhesive before applying fire-resistive material where required to achieve fire-resistance rating or as recommended in writing by SFRM manufacturer for material and application indicated.
- D. Extend fire-resistive material in full thickness over entire area of each substrate to be protected. Unless otherwise recommended in writing by SFRM manufacturer, install body of fire-resistive covering in a single course.
- E. Spray apply fire-resistive materials to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by SFRM manufacturer.
- F. For applications over encapsulant materials, including lockdown (post-removal) encapsulants, apply SFRM that differs in color from that of encapsulant over which it is applied.
- G. Where sealers are used, apply products that are tinted to differentiate them from SFRM over which they are applied.

### 3.4 APPLICATION, CONCEALED SFRM

- A. Apply concealed SFRM in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition, but apply in greater thicknesses and densities if specified in Part 2 "Concealed SFRM" Article.
- B. Apply water overspray to concealed sprayed-fiber fire-resistive material as required to obtain designated fire-resistance rating.
- C. Cure concealed SFRM according to product manufacturer's written recommendations.

### 3.5 APPLICATION, EXPOSED SFRM

- A. Apply exposed SFRM in thicknesses and densities not less than those required to achieve fire-resistance ratings designated for each condition, but apply in greater thicknesses and densities if indicated.
  - 1. For steel beams and bracing, provide a thickness of not less than 1 inch.
  - 2. For metal floor or roof decks, provide a thickness of not less than 1/2 inch.
- B. Provide a uniform finish complying with description indicated for each type of material and matching Architect's sample or, if none, finish approved for field-erected mockup.
- C. Apply exposed cementitious SFRM to produce the following finish:

1. Spray-textured finish with no further treatment.
  2. Even, spray-textured finish, produced by rolling flat surfaces of fire-protected members with a damp paint roller to remove drippings and excessive roughness.
  3. Skip-troweled finish with leveled surface, smoothed-out texture, and neat edges.
  4. Smooth, troweled finish with surface markings eliminated and edges squared.
- D. Apply exposed sprayed-fiber fire-resistive material to produce the following finish:
1. Spray-textured finish.
- E. Cure exposed SFRM according to product manufacturer's written recommendations.

### 3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor will engage a qualified testing agency to perform tests and inspections and prepare test reports.
1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.
- B. Tests and Inspections: Testing and inspecting of completed applications of SFRM shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with application of SFRM for the next area until test results for previously completed applications of SFRM show compliance with requirements. Tested values must equal or exceed values indicated and required for approved fire-resistance design.
1. Thickness for Floor, Roof, and Wall Assemblies: For each 1000-sq. ft. area, or partial area, on each floor, from the average of 4 measurements from a 144-sq. in. sample area, with sample width of not less than 6 inches per ASTM E 605.
  2. Thickness for Structural Frame Members: From a sample of 25 percent of structural members per floor, taking 9 measurements at a single cross section for structural frame beams or girders, 7 measurements of a single cross section for joists and trusses, and 12 measurements of a single cross section for columns per ASTM E 605.
  3. Density for Floors, Roofs, Walls, and Structural Frame Members: At frequency and from sample size indicated for determining thickness of each type of construction and structural framing member, per ASTM E 605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method."
  4. Bond Strength for Floors, Roofs, Walls, and Structural Framing Members: For each 10,000-sq. ft. area, or partial area, on each floor, cohesion and adhesion from one sample of size indicated for determining thickness of each type of construction and structural framing member, per ASTM E 736.
    - a. Field test SFRM that is applied to flanges of wide-flange, structural-steel members on surfaces matching those that will exist for remainder of steel receiving fire-resistive material.
    - b. If surfaces of structural steel receiving SFRM are primed or otherwise painted for coating materials, perform series of bond tests specified in UL's "Fire Resistance Directory." Provide bond strength indicated in referenced UL fire-resistance criteria, but not less than 150 lbf/sq. ft. minimum per ASTM E 736.

PEARL PLACE 2

- 5. If testing finds applications of SFRM are not in compliance with requirements, testing and inspecting agency will perform additional random testing to determine extent of noncompliance.
- C. Remove and replace applications of SFRM that do not pass tests and inspections for cohesion and adhesion, for density, or for both and retest as specified above.
- D. Apply additional SFRM, per manufacturer's written instructions, where test results indicate that thickness does not comply with specified requirements, and retest as specified above.

3.7 CLEANING, PROTECTING, AND REPAIR

- A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.
- B. Protect SFRM, according to advice of product manufacturer and Installer, from damage resulting from construction operations or other causes so fire protection will be without damage or deterioration at time of Substantial Completion.
- C. Coordinate application of SFRM with other construction to minimize need to cut or remove fire protection. As installation of other construction proceeds, inspect SFRM and patch any damaged or removed areas.
- D. Repair or replace work that has not successfully protected steel.

3.8 SCHEDULE

Structural Component	Hourly Rating Requirement	Design Reference
Floor Beams	<u>2</u> hr.	<u>N606</u>
Columns	<u>2</u> hr.	<u>X772</u>
Unrestrained		

END OF SECTION 078100