SECTION 07 81 00 - APPLIED FIRE PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Provide the Work of this Section in accordance with requirements of the Contract Documents.

B. This Section includes, but is not limited to:

1. Light density sprayed fire-resistive materials for interior applications concealed and exposed to view **FP-01**.
2. High density sprayed fire resistive materials for exterior exposed and exposed interior applications subject to abuse and for untampered areas **FP-02**.

C. Related Work:

1. Division 05, Sections 05 12 00 "Structural Steel Framing", Section 05 31 00 "Steel Decking", for surface conditions required for structural steel receiving fireproofing.
2. Division 07, Section 07 21 00 "Thermal Insulation" for fire-safing insulation.
3. Division 07, Section 07 84 13 "Penetration Firestopping" for fire-resistance-rated firestopping systems.
4. Division 07, Section 07 84 46 "Fire-Resistive Joint Firestopping" for fire-resistance-rated joint systems.

1.2 DEFINITIONS

A. SFRM: Sprayed fire-resistive materials.

B. Cementitious: Sprayed fire-resistive material using cementitious binders and adhesive materials complying with ASTM E1513.

C. Concealed: Fire-resistive materials applied to surfaces that are concealed from view behind other construction when the Work is completed and have not been defined as exposed. Concealed fire resistive materials may be accessible through suspended ceilings, which may be in elevator shafts and machine rooms, mechanical rooms, air-handling plenums, and structural steel encapsulated by wall construction.

D. Exposed: Fire-resistive materials applied to surfaces that are exposed to view when the Work is completed. It also includes applied fire resistive materials that are in exterior installations, or are in interior mechanical bulkheads, loading docks, garages, that exposed to abuse, and must withstand damage from equipment, or that are identified as exposed on Drawings.

1.3 PREINSTALLATION MEETINGS

A. 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 fireproofing 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 fireproofing during and after installation.
4. Review surface conditions and preparations or bare steel and steel with shop primers. Determine what repairs and preparations are required to ensure adequate bond.
5. Review field quality-control testing procedures including Special inspections, which are different than QC testing.

1.4 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's product data for the following, showing compliance with performance requirements specified. Include manufacturer's technical data sheets, printed instructions, and specifications for handling, mixing, protection of adjacent surfaces, heating requirements, and cleanup:

1. Sprayed fire-resistive material.
2. Substrate primers.
3. Bonding agent.
4. Metal lath.
5. Reinforcing fabric.
6. Reinforcing mesh.
7. Sealer.
8. Topcoat.

B. Sustainable Design Submittals:

1. Building Product Disclosure and Optimization - Sourcing of Raw Materials:
    a. Leadership Extraction Practices
        1) Extended Producer Responsibility (EPR): Submit documentation indicating that manufacturers have a take back or recycling program for the product purchased.
        2) Recycled Content: For products having recycled content, indicate percentages by weight of post-consumer and pre-consumer recycled content.
            a) Include statement indicating costs for each product having recycled content.
    b. Sourcing of Raw Materials: For products that are required to comply with requirements for regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material.
        1) Include statement indicating distance to Project, cost for each regional material and the fraction by weight that is considered regional.
2. Indoor Environmental Quality, Low Emitting Materials: Building Products must be tested and compliant with the California Department of Public-Health (CDPH) Standard Method V1.1-2010, using the applicable exposure scenario.
    a. Adhesives: For wet applied on site products, submit printed statement showing compliance with the applicable chemical content requirements of SCAQMD Rule 1168, effective July 1, 2005 and rule amendment date of January 7, 2005.

b. Methylene Chloride and perchloroethylene may not be added to paints, coating, adhesive or sealants

C. Applied Fireproofing Schedule: Provide a schedule for structural elements proposed to receive spray-on fireproofing noting the following:

1. Locations and types of surface preparations required before applying applied fireproofing material.
2. Extent of sprayed fire resistive material for each construction and fire resistive rating including the following:

a. Minimum thicknesses needed to achieve required fire-resistance ratings of structural components and assemblies based on manufacturer's UL testing for each size and shape of structural framing required.
b. Hourly ratings and corresponding UL Standard No.

3. Designation of restrained and unrestrained conditions based on definitions in ASTM E119, Appendix X3 as determined by a qualified Professional Engineer.
4. Treatment of sprayed fire resistive material after application
5. Locations of elements to receive sealer.

D. Shop Drawings: Structural framing plans or schedules, or both, indicating the following:

1. Locations and types of surface preparations required before applying fireproofing.
2. Extent of fire protection 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.
b. Minimum sprayed fire-resistive material thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
c. Treatment of sprayed fire-resistive material after application.

3. Base all design designations on unrestrained members or submit designation of restrained and unrestrained conditions based on definitions in ASTM E119, Appendix X3 as determined by a Structural (Professional) Engineer licensed in the state of Texas.
4. Treatment of sprayed fire resistive material after application

E. Samples: For each type of exposed sprayed fire resistive material and for each color and texture specified, 4 inches square in size. Where finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, manufacturer, professional engineer, and testing agency. Submit manufacturer's notification of acceptance of the entity performing the application work of this section.

B. Sustainable Design Submittals:

1. Building Product Disclosure and Optimization - Environmental Product Declarations

a. Submit product specific type III EPDs or Industry wide (generic) EPDs, USGBC approved program declaration or products with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that have at least a cradle to gate scope.

2. Building Product Disclosure and Optimization - Material Ingredients

   a. Material Ingredient Reporting: Submit documentation confirming chemical inventory of products to at least 0.1 % (1000pm) with at least one of the following:

      1) Submit published manufacturer inventory of ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
      2) Submit documentation that product has been certified as Cradle-to-Cradle v3 at the Bronze Level or better
      3) Submit Declare product label indicating that all ingredients have been disclosed down to 1000 ppm or designated as Red List Free or Declared
      4) Living Product Challenge
      5) Product Lens Certification
      6) USGBC approved program.

   b. Material Ingredient Optimization: Submit documentation confirming chemical inventory of products to at least 0.01 % (100pm) and/or that has a compliant material ingredient optimization report with at least one of the following:

      1) Submit GreenScreen V1.2 Benchmark: Third party report prepared by a licensed GreenScreen List Translator, or a full GreenScreen Assessment.
      2) Submit third-party verified documentation that product has been certified as Cradle-to-Cradle v3 at the Bronze Level or better
      3) Submit third-party verified Cradle to Cradle v3 Material Health certificate at the Bronze Level or better
      4) Submit third-party verified Declare product label indicating that all ingredients have been disclosed down to 100 ppm
      5) Submit third-party verified documentation that product is Living Product Challenge certified with a Red List Free or LBC Red List Free Declare label.
      6) Submit documentation that product has a manufacturer prepared action plan with material inventory to at least 1000 ppm.

C. Product Certificates and Test Reports: For each type of sprayed fire-resistive material, signed by product manufacturer, indicating compliance with performance requirements.

   1. Submit test reports based on evaluation of comprehensive tests performed by a qualified testing agency, for proposed fireproofing.
   2. Submit test reports showing compliance with ASTM E1513 for cementitious content of fireproofing.

D. Manufacturer Letter: Verifying that the UL Designs selected for the project are not load restricted.

E. Engineering Judgment: Copies of engineering judgment review, signed by the applied fireproofing manufacturer's professional fire safety Engineer, licensed to practice in the jurisdiction of the Project, and approval by local authorities having jurisdiction for fireproofing applications for which no UL tested design is available.

F. Compatibility and adhesion test reports: From fireproofing manufacturer indicating the following:

   1. Materials have been tested for bond with substrates.
   2. Materials have been verified by fireproofing 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: Indicate that physical properties of proposed sprayed fire resistive materials comply with specified requirements based on evaluation of comprehensive tests performed by a qualified testing agency, for proposed fireproofing.

1. Independent laboratory test reports of physical properties
2. U.L. Test Reports.

H. Research and Evaluation Reports: For sprayed fire-resistive material, from ICC-ES or other agency acceptable to DFW Airport Building Department.

I. Preconstruction Test Reports: For fire protection.

J. Field quality-control and special inspection reports.

K. Warranties: Samples of special warranties specified in this Section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual with at least five (5) years successful experience in application of type of fireproofing specified and certified, licensed, or otherwise qualified by sprayed fire-resistive material manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.

1. Submit detailed listing of five most current projects with location, names, and telephone numbers of Owner, Architect, and General Contractor.
2. A manufacturer's willingness to sell it's fireproofing to Contractor or to an installer engaged by Contractor does not in itself confer qualification on the buyer.

B. Regulatory Requirements: Conform to the applicable building code requirements of all authorities have jurisdiction. Products, execution, and sprayed fire-resistive material thicknesses shall conform to the applicable code requirements for the required fire resistance ratings.

1. Degree of Restraint: Provide sprayed fire-resistive materials for restrained criteria as defined in ASTM E119, Appendix X3, unless otherwise designated on drawings.
2. ICC International Building Code, 2015 Edition with DFW ammendments.

C. Mockups: Build mockups to set quality standards for materials and execution and for preconstruction testing.

1. Build mockup of each type of fire protection and different substrate and each required finish as shown on Drawings.
2. Extent of Mockups: Approximately 100 sq. ft. of surface for each product indicated to be review by the Architect. The mock-up installation will be at the site, at a location as mutually agreed upon by the Architect and the Applicator. Include in sample application typical columns, truss, beams, girders and decking if specified to be fireproofed. Provide material finishes complying with project requirements as to density and finish where exposed to view. Notify the Architect 48 hours I advance of mock-up review. Do not proceed with work until review of mock-up sample has been completed by the Architect.
3. After review of the mockup, its location will be recorded and it will be retained and used as a standard of quality for the remainder of the fireproofing application.
4. The Architect's review of the mock-up sample installation will be for final acceptance of material finish appearance, conformance with design and general quality does not relieve the applicator from the responsibility and conformance with all specified requirements.

5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on field mockups of fire protection.

1. Provide test specimens and assemblies representative of proposed materials and construction.
2. Applied fire-resistive materials 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.
3. Testing is performed on specimens of applied fire-resistive materials that comply with laboratory testing requirements specified in Part 2 and are otherwise identical to installed fire-resistive materials, including application of accelerant, tamping, troweling, rolling, and water overspray, if any of these are used in final application.
4. 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.

B. Preconstruction Adhesion and Compatibility Testing: Engage a qualified testing and inspection agency to test for compliance with requirements for specified performance and test methods.

1. Bond Strength: Test for cohesive and adhesive strength according to ASTM E736 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. Density: Test for density according to ASTM E605. Provide density indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
3. Verify that manufacturer, through its own laboratory testing or field experience, attests that primers or coatings are compatible with sprayed fire-resistive material.
4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, obtain sprayed fire-resistive material manufacturer's written instructions for corrective measures including the use of specially formulated bonding agents or primers.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not apply fire protection when ambient or substrate temperature is 44 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 fire protection, providing complete air exchanges according to manufacturer's written instructions; introducing fresh air and exhausting air continuously during and 24 hours after application to maintain nontoxic, unpolluted, safe working area. Use natural means or, if they are inadequate, forced-air circulation until fire protection dries thoroughly. Provide temporary enclosures to prevent spray from contaminating air

1. Protect adjacent surfaces and equipment from damage by overspray, fall out and dusting off of sprayed materials.

2. Provide fire extinguisher and post caution signs warning against smoking and open flame when working with flammable materials.

1.9 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, aboveground, and kept dry until ready for use. Remove from Project site and discard wet or deteriorated materials.

1.10 COORDINATION

A. Sequence and coordinate application of fireproofing 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.
9. Apply fireproofing after field touch up of shop primed steel and field priming of connections prior to application of fireproofing for steel that is located below the flood elevation.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form, signed by Contractor and by Installer, in which manufacturer agrees to repair or replace fire-resistive materials 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 fireproofing from substrates.

2. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Assemblies: Provide applied fire protection, including auxiliary materials, identical to those tested according to requirements of each fire-resistance design, inspecting organizations acceptable to authorities having jurisdiction and manufacturer's written instructions.

B. Regional Materials: Provide a minimum of 20 percent of building materials (by cost) that are regionally extracted, processed and manufactured materials within a radius of 100 miles.

C. Recycled Content: Building materials shall have an averaged recycled content such that postconsumer recycled content plus one-half of preconsumer recycled content for Project constitutes the following percentages of material:

1. Applied Fireproofing: 100%

D. Source Limitations: Obtain fire protection from single source.

E. Thickness and Density: ASTM E605, thickness and density as required by UL test to attain the fire endurance rating shown or as required by governing authorities for the application shown. Thickness shown is the minimum thickness required solely to determine clearances and, in case of conflict, the fire endurance rating prevails. For structural members of sizes not included in the UL beam and column designs, calculate the required fireproofing thickness in accordance with the equation listed in the UL “Fire Resistance Directory” for adjustment of applied protection material thickness.

F. Fire-Test-Response Characteristics: Provide fireproofing 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 fireproofing with appropriate markings of applicable testing and inspecting agency.

1. Fire-Resistance Design: Indicated by design designations from UL's "Fire Resistance Directory or from the listings of another testing and inspection agency acceptable to authorities having jurisdiction, for fireproofing serving as direct applied protection, tested according to ASTM E119 or UL 263; testing by a qualified testing agency.

a. Surface-Burning Characteristics: ASTM E84.
b. Identify products with appropriate markings of applicable testing agency.
c. Steel members are to be considered restrained unless specifically noted otherwise.

1. UL design listings shall state that the loading was determined by Allowable Stress Design Method or Load and Resistance Factor Design Method. UL design listings requiring a load restriction factor are not allowed.

G. VOC Content: For field applications, verify coatings comply with VOC content limits of authorities having jurisdiction and the following VOC content limits, when calculated according to 40 CFR59, Subpart D (EPA Method 24):

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 50 g/L.
3. Primers, Sealers, and Undercoaters: 100 g/L.
4. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.

H. Asbestos: 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."

I. Dry mix sprayed fire resistive materials containing mineral fibers are not allowed.

J. Engineering Judgment: For those fireproofing applications shown for which no UL tested design is available through a manufacturer, an engineering judgment signed and sealed by the applied fireproofing manufacturer's Professional Fire Safety Engineer, licensed to practice in the Project State, derived from similar UL system designs or other tests is to be obtained and submitted to local authorities having jurisdiction for their review and approval prior to installation. Submit documentation to substantiate such review and approval.

K. Low-Emitting Materials:

1. Adhesives and Sealants wet-applied inside the weather-proofing system must meet the VOC general emissions testing criteria of CDPH Standard Method v1.2.
2. All adhesives and sealants wet-applied inside the weather-proofing system must have VOC content in compliance with the applicable VOC limits (g/L) found in tables in Division 01 Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C."

2.2 LIGHT DENSITY SPRAYED FIRE-RESISTIVE MATERIALS

A. Location: Interior applications concealed and exposed to view **FP-01**.

B. Provide light density sprayed fire resistive materials, complying with ASTM E1513; Manufacturer's standard, factory-mixed, gypsum binders, additives, and lightweight aggregates, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and for interior concealed and interior exposed application.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Carboline Company; a subsidiary of RPM International; Pyrolite 15.
b. Grace Construction Products; W.R. Grace & Co. -- Conn.; Grace Construction Products; Monokote MK-6 Series.
c. Isolatek International; Cafco 300 Series.
d. Southwest Fireproofing Products Co.; Type 5GP.

2. 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:

a. Bond Strength: Minimum 150-lbf/sq. ft. (7.18-kPa) cohesive and adhesive strength based on field testing according to ASTM E736.

b. Dry Density: Not less than 15 lb/cu. ft. (240 kg/cu. m) values for average densities, as required to attain fire-resistance ratings indicated, per ASTM E605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method."

c. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E605, whichever is thicker, but not less than 0.375 inch (9 mm).

1) Where the referenced fire-resistance design lists a thickness of 1 inch (25 mm) or more, the minimum allowable individual thickness of SFRM is the design thickness minus 0.25 inch (6 mm).

2) Where the referenced fire-resistance design lists a thickness of less than 1 inch (25 mm) but more than 0.375 inch (9 mm), the minimum allowable individual thickness of SFRM is the greater of 0.375 inch (9 mm) or 75 percent of the design thickness.

3) 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. (240 kg/cu. m).

d. Combustion Characteristics: ASTM E136.

e. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1) Flame-Spread Index: 10 or less.

2) Smoke-Developed Index: 0 or less.

f. Compressive Strength: Minimum 20 lbf/sq. in. according to ASTM E761. Minimum thickness of SFRM tested shall be 0.75 inch (19 mm) and minimum dry density shall be as specified but not less than 15 lb/cu. ft. (240 kg/cu. m).

g. Corrosion Resistance: No evidence of corrosion according to ASTM E937.

h. Deflection: No cracking, spalling, or delamination according to ASTM E759.

i. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E760.

j. Air Erosion: Maximum weight loss of 0.0215 g/sq. ft. in 24 hours according to ASTM E859. For laboratory tests, minimum thickness of SFRM is 0.75 inch (19 mm), maximum dry density is 15 lb/cu. ft. (240 kg/cu. m), test specimens are not prepurged by mechanically induced air velocities, and tests are terminated after 24 hours.

2.3 HIGH DENSITY EXPOSED SPRAYED FIRE RESISTIVE MATERIALS

A. Location: High density sprayed fire resistive materials for exterior exposed and exposed interior applications subject to abuse and for untampered areas **FP-02**.

B. Provide high density spray applied fire resistive materials complying with ASTM E1513, factory-mixed, lightweight, cement aggregate formulation; chloride free formulation of Portland cement binders, additives and inorganic aggregates mixed with water at Project site to form a slurry or mortar before conveyance and application.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Carboline Company; a subsidiary of RPM International; Pyrocrete 40.

b. GCP Applied Technologies Inc.; Grace Construction Products; Monokote Z146 or Grace Construction Products; Monokote Z146T.

c. Isolatek International; Fendolite M-II.

d. Southwest Fireproofing Products Co Type 7HD.

2. Application: Provide formulations designated for exterior use, listed and labeled by a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
3. 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:

    a. Bond Strength: Minimum 7,000-lbf/sq. ft. cohesive and adhesive strength based on field testing according to ASTM E736.
    b. Density: Not less than 40 pcf density and as specified in the approved fire-resistance design, according to ASTM E605.
    c. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E605, whichever is thicker, but not less than 0.375 inch.
    d. Combustion Characteristics: ASTM E136.
    e. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

        1) Flame-Spread Index: 2 or less.
        2) Smoke-Developed Index: 2.5 or less.

    f. Compressive Strength: Minimum 300 lbf/sq. in. according to ASTM E761.
    g. Corrosion Resistance: No evidence of corrosion according to ASTM E937.
    h. Deflection: No cracking, spalling, or delamination according to ASTM E759.
    i. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E760.
    j. Air Erosion: Maximum weight loss of 0.0215 g/sq. ft. in 24 hours according to ASTM E859.

2.4 PATCHING OF DAMAGED SPRAYED FIRE-RESISTIVE MATERIALS

A. Provide spray applied fire resistive materials complying with ASTM E1513 matching exact same sprayed fire-resistive materials that was originally installed.

B. Where the exact spray applied fire resistive material cannot be determined, use spray applied fire resistive materials purpose designed for patching existing spray applied fire resistive materials, minimum medium weight, factory-mixed, lightweight, cement aggregate formulation; chloride free formulation of Portland cement binders, additives and inorganic aggregates mixed with water at Project site to form a slurry or mortar before conveyance and application.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Universal Fireproofing Patch (UFP) by the Vellrath Group.

2. Application: Provide formulations designated for patching and repairing sprayed fire-resistive materials listed and labeled by a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
3. 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:

    a. Bond Strength: Minimum 2,700-lbf/sq. ft. cohesive and adhesive strength based on field testing according to ASTM E736.
    b. Density: Not less than 36 pcf density and as specified in the approved fire-resistance design, according to ASTM E605.

c. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E605, whichever is thicker, but not less than 0.375 inch.
d. Combustion Characteristics: ASTM E136.
e. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1) Flame-Spread Index: 2 or less.
   2) Smoke-Developed Ind

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that are compatible with sprayed fire-resistive material 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: : Ensure that paint on steel surfaces will not impair proper adhesion. Obtain determination of compatibility of paint or primer with spray fireproofing from spray fireproofing manufacturer. Primers approved by sprayed fire-resistive material manufacturer and complying with one or both of the following requirements:

1. Primer and substrate are identical to those tested per ASTM E119 in required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
2. Primer's bond strength in required fire-resistance design complies with specified bond strength for sprayed fire-resistive material and with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests according to ASTM E736.

C. Bonding Agent: Product approved by sprayed fire-resistive material manufacturer and complying with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.

D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required, according to fire-resistance designs indicated and sprayed fire-resistive material manufacturer's written instructions. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive sprayed fire-resistive material.

E. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by sprayed fire-resistive material manufacturer.

F. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by sprayed fire-resistive material manufacturer. Include pins and attachment.

G. Sealer: Transparent-drying, water-dispersible, tinted protective coating recommended in writing by sprayed fire-resistive material manufacturer for each fire-resistance design.

1. Products: Subject to compliance with requirements, provide the following:
   a. Isolatek International; Cafco Bond-Seal Type EBS.

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 the Work and according to each fire-resistance design. Verify compliance with the following:

1. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fire protection with substrates under conditions of normal use or fire exposure.
2. Objects penetrating fire protection, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
    a. Where these items are installed after application of spray fireproofing, return to the site and apply additional spray fireproofing to maintain fire rating of items to be fireproofed.
3. Substrates receiving fire protection are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fire protection application.
4. Concrete work on steel deck is complete before beginning Work.
5. Roof construction, installation of rooftop HVAC equipment, and other related work are complete before beginning Work.

B. Conduct tests according to sprayed fire-resistive material manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. 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 protection materials during application.

B. Clean substrates of substances that could impair bond of fire protection material, including dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, and incompatible primers, paints, and encapsulants.

C. Prime substrates where included in fire-resistance design and where recommended in writing by sprayed fire-resistive material manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fire protection.

D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fire protection. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION

A. Construct fire protection assemblies that are identical to fire-resistance ratings required and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, rate of application, accelerator use, tamping, troweling, water overspray, finishing, and other materials and procedures affecting fire protection Work.

B. Comply with sprayed fire-resistive material manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fire protection, as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

C. Coordinate application of fire protection with other construction to minimize need to cut or remove fire protection.

1. Do not begin applying fire protection until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
2. Defer installing ducts, piping, and other items that would interfere with applying fire protection until application of fire protection is completed.
3. Where items are attached to steel members to be spray fireproofed, and adjoining cross sectional area of items is greater than 4.65 inches square per 3 ft. or per linear meter, extend spray fireproofing over adjoining member a minimum of 18 inches in order to maintain fire resistance per UL requirements.

D. Metal Decks:

1. Do not apply fire protection to underside of metal deck substrates until concrete topping, if any, is completed.
2. Do not apply fire protection to underside of metal roof deck until roofing is completed; prohibit roof traffic during application and drying of fire protection.

E. Install auxiliary materials as required, as detailed, and according to fire-resistance design and sprayed fire-resistive material manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by sprayed fire-resistive material manufacturer.

F. Spray apply fire protection to maximum extent possible. After the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by sprayed fire-resistive material manufacturer.

G. Extend fire protection in full thickness over entire area of each substrate to be protected.

H. Install body of fire protection in a single course unless otherwise recommended in writing by sprayed fire-resistive material manufacturer.

I. Where sealers are used, apply products that are tinted to differentiate them from fire protection over which they are applied.

1. Mask off adjoining surfaces not scheduled to receive sealer and apply sealer evenly.

J. Install metal lath and reinforcing fabric, as required, to comply with fire-resistance ratings and fire-resistive material manufacturer's written recommendations for conditions of exposure and intended use. Securely attach lath and fabric to substrate in position required for support and reinforcement of fire-resistive material. Use anchorage devices of type recommended in writing

by fireproofing manufacturer. Attach accessories where indicated or required for secure attachment of lath and fabric to substrate.

K. Masking and Filling of Voids

1. Apply applied fireproofing to beams and girders under steel decking or concrete slabs that will be exposed in the finished construction so as to provide a minimum of two-inch coverage of the deck beyond the limits of the top flange of beam or girder. Accomplish by masking the portions of decking or slab not to be covered so as to provide straight lines parallel to the flanges.
2. Completely fill voids between metal deck ribs directly above the upper edge of steel beams or girders running perpendicular to the ribs with applied fireproofing or other approved method to achieve the required hourly protection of the upper flanges of beams and girders.

L. Coat substrates with bonding adhesive before applying fire-resistive material where required to achieve fire-resistance rating or as recommended in writing by fireproofing manufacturer for material and application indicated.

M. Apply fireproofing over clips, fasteners, attachments, outriggers and other fastenings required to support construction from steel that requires fireproofing. Encapsulate fastenings and extend fireproofing a min. of 12 inches onto surfaces of attached metal components. Thickness of fireproofing shall match assembly rating of steel that element is attached to.

N. Provide a uniform finish complying with description indicated for each type of fire protection material and matching finish approved for required mockups.

O. Cure fire protection according to sprayed fire-resistive material manufacturer's written instructions.

P. Do not install enclosing or concealing construction until after fire protection has been applied, inspected, and tested and corrections have been made to deficient applications.

Q. 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.

R. Repair or replace work that has not successfully protected steel.

3.4 APPLICATION, CONCEALED FIREPROOFING

A. Apply concealed fireproofing 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 Fireproofing" Article.

B. Finishes: Apply concealed fireproofing to produce the following finishes:

1. Spray-Textured Finish: Finish left as spray applied with no further treatment.

3.5 APPLICATION, EXPOSED FIREPROOFING

A. Apply exposed fireproofing 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.

B. Surfaces that will be exposed in the finished construction, including the top surfaces of bottom flanges of beams, shall be given a smooth troweled finish and shall be free of all bumps, drips and sags. Provide corner beads at exposed corners of trowel applied finishes to finish edges. Securely attach lath and fabric to substrate in position required for support and reinforcement of fire-resistive material. Use anchorage devices of type recommended in writing by fireproofing manufacturer. Attach accessories where indicated or required for secure attachment of lath and fabric to substrate.

1. 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.

3.6 APPLICATION, PATCHING EXISTING FIREPROOFING

A. During the course of the work, repair fire protection to maintain fire-resistance ratings.

B. Consult the sprayed fire-resistive material manufacturer's for field issues and project specific existing conditions.

C. Apply sprayed fire-resistive material to a thickness equivalent to that of the current sprayed fire-resistive material or thicker to maintain fire-resistive ratings.

3.7 FIELD QUALITY CONTROL

A. Testing and Inspections: The Work shall be tested and inspected as completed Work in successive stages; using methods and following areas of extent specified. Do not proceed with application of fire protection for the next area until test results for previously completed applications of fire protection show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

1. Thickness for Floor, Roof, and Wall Assemblies: Determined in accordance with ASTM E605, taking an average of not less than four measurements for each 1,000 sf, or partial area, on each floor, from a 144-sq. in. sample area, with sample width of not less than 6 inches .
2. Thickness for Structural Frame Members: Determined in accordance with ASTM E605, testing shall be performed on not less than 25 percent of the structural members per floor
    a. Beams and Girders: Taking and average of 9 thickness measurements at a single cross section
    b. Joists and Trusses: Taking an average of 7 thickness measurements of a single cross section
    c. Columns: taking an average of 12 thickness measurements of a single cross section.
3. Density for Floors, Roofs, Walls, and Structural Frame Members: At frequency of not less than one sample for every 2,500 sf or part thereof of each type of construction and structural framing member, per ASTM E605 or AWCI Technical Manual 12-A, Section 5.4.5, "Displacement Method."

4. Bond Strength: Test samples in accordance with ASTM E736, to determine the cohesive/adhesive bond strength of members as follows

   a. Floors, Roofs, Walls: At the rate of not less than one sample of each floor, roof and wall assembly for every 10,000 sf or part thereof of sprayed area in each story
   b. Structural Framing Members: At the rate of not less than one sample from each structural framing member (beam, girder, joist truss and column) for each 10,000sf of floor area, or part thereof in each story.
      1) Field test fireproofing 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.
   c. If surfaces of structural steel receiving fireproofing are primed or otherwise painted or coated, perform a series of bond tests specified in UL's "Fire Resistance Directory."
      1) Verify that minimum bond strength of 80% and a minimum individual bond strength of 50% is maintained when compared to the bond strength of fire resistive coatings applied to clean uncoated steel.
      2) The minimum bond strength of 150 pcf for low rise will not be reduced.
   d. Provide bond strength indicated in referenced UL fire-resistance criteria, but not less than 150 lbf/sq. ft. minimum per ASTM E736.
   e. Minimum thickness of sprayed fire-resistive material tested in laboratory shall be 0.75 inch.

5. The testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.
6. If testing finds applications of fireproofing are not in compliance with requirements, testing and inspecting agency will perform additional random testing to determine extent of noncompliance.

B. Fire protection will be considered defective if it does not pass tests and inspections.

   1. Remove and replace fire protection that does not pass tests and inspections, and retest.
   2. Apply additional fire protection, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

C. Repair or replace SFRM at all test areas, and within area(s) where test results indicate SFRM does not comply with requirements, at no additional cost to the Authority. Repair or replace to match existing

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

E. Prepare test and inspection reports.

3.8 CLEANING

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.

3.9 PROTECTION

A. Protect fire protection, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fire protection is without damage or deterioration at time of Substantial Completion.

B. Coordinate application of fireproofing with other construction to minimize need to cut or remove fire protection.

3.10 REPAIRS

A. As installation of other construction proceeds, inspect fire protection and repair damaged areas and fire protection removed due to work of other trades.

B. Repair fire protection damaged by other work before concealing it with other construction.

C. Repair fire protection by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

D. Provide patching and repairing of sprayed fireproofing damaged by other trades after application under the work for this section. Costs for such repair and patching will be borne by the trade or Subcontractor or Contractor causing the damage. The General Contractor is to coordinate the costs of repair work between the Subcontractors or Contractors for this repair and patch work with no additional cost to the Owner for such work

END OF SECTION