

## **SECTION 07 21 80 – FLUID APPLIED THERMAL INSULATION**

### **PART 1 - GENERAL**

#### **1.1 CONTROLLING DOCUMENTS**

- A. This specification is controlled by Division 08, Section 08 40 00 "Exterior Enclosure System Requirements". In addition to the requirement of this documents, all requirement of Controlling Documents must also be met. This more onerous conditions of this document or the Controlling Document must be met.

#### **1.2 SUMMARY**

- A. Provide the Work of this Section in accordance with requirements of the Contract Documents.
- B. This Section is for fluid applied thermal coating system for application to steel structures and supports, including is not limited to:
  - 1. Corrosion protection primer material.
  - 2. Fluid applied acrylic thermal break.
  - 3. Topcoat for Fluid applied thermal break acrylic
- C. Related Work
  - 1. Division 05, Section 05 12 00 "Structural Steel Framing"
  - 2. Division 05, Section 05 50 00 "Miscellaneous Metal Fabrications"

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: Submit product data including manufacturers technical data indicating product performance characteristics, performance and limitation criteria.
- B. Sustainable Design Action 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 responsibly sourced within 10 miles of project stie, 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:
  - a. Laboratory Test Reports: For adhesives, sealants, paints, coatings wet applied on site, indicating testing and compliance with the California Department of Public-Health (CDPH) Standard Method V1.2-2017, using the applicable exposure scenario.
  - b. Paints, and Coatings: For wet applied on site products, include printed statement of VOC content, showing compliance with the applicable VOC limits of the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, effective February 5, 2016.
  - c. Alternative tests for VOC above include ASTM D2369-10; ISO 11890 part 1; ASTM D6886-03; or ISO 11890-2.
  - d. Methylene Chloride and perchloroethylene may not be added to paints, coating, adhesive or sealants
- C. Design Data: Submit published design listings for insulation value ratings and product thickness. Include evidence that the fluid thermal break testing was sponsored by the manufacturer and that the material tested was produced at the manufacturer's facility under the supervision of technical personnel.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Informational LEED Submittals:
- B. Sustainable Design Informational 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.
    - b. EPD Optimization: For materials indicating embodied carbon/LCA optimization report or action plan
  2. Building Product Disclosure and Optimization - Material Ingredients
    - a. Material Ingredient Reporting: Submit documentation confirming chemical inventory of products to at least 0.1 % (1000ppm) 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 % (100ppm) 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. Manufacturer's Instructions: Submit manufacturer written installation instructions.
- D. Applicator Qualifications: Submit applicators current certification as a manufacturer trained applicator.
- E. Manufacturers Qualifications: Submit manufacturer documentation that the insulative product complies with the specific contract requirements.

## 1.5 QUALITY ASSURANCE

- A. Manufacturer: Provide fluid applied thermal insulation manufactured by a company specializing in manufacturing products specified with a minimum of 2 years documented experience in manufacturing isolative technology.
- B. Applicator: Company specializing in applying the work of this section with documented experience and trained and approved by the manufacturer for application of specified system.
- C. Sole Source: Fluid applied thermal insulation coating system shall be the complete system from a sole source consisting of primer, acrylic thermal break material and topcoat. All materials shall be LEED compliant.
- D. Reference Standards: Except as modified by local building codes and requirements of authorities having jurisdiction, provide the work of this section in accordance with following industry reference standards:
  - 1. American Institute of Steel Construction (AISC)
    - a. AISC 303-05 Section 10 – Erection and storage of coated material during shipment and site handling shall be protected to minimize field touch up.
  - 2. American Society of Testing and Materials (ASTM)
    - a. ASTM D638 - Standard Test Method for Tensile Strength
    - b. ASTM D695 - Standard Test Method for Compressive Strength
    - c. ASTM D790 - Standard Test Method for Flexural Strength
    - d. ASTM D4624/ISO 4624 - Standard Test Method for Bond Strength
    - e. ASTM D2240 - Standard Test Method for Determining Durometer Hardness

- f. ASTM E84 - Surface Burning Characteristics
    - g. ASTM C 1057 - Safe to Touch
  - 3. Association of the American Walls and Ceilings Industries (AWCI)
  - 4. The Society of Protective Coatings (SSPC)
    - a. SSPC SP-6: Commercial Blast Cleaning Standard
    - b. SSPC PA-1: Shop, Field and Maintenance coatings
    - c. SSPC PA-2: Measurement of Dry Paint Thickness with Magnetic Gauges
- E. Mock-up: Provide Mock-up of thermal break materials, a minimum of 30 days prior to scheduled application, in accordance with the following requirements:
  - 1. Provide minimum two square feet on representative substrate, where directed by the Architect, for each different desired R-Value and finish required for the work.
  - 2. Mock-up shall provide thickness, density application, finish texture, and color required for final installed work.
  - 3. Applicator shall inspect mock-up areas within one hour of application for variance due to shrinkage, temperature, and humidity. Where shrinkage and cracking are evident, adjust mixture and method of application as necessary to meet required installation, R Value, finish, and color requirements. Continue to provide mock-up areas until acceptable areas are produced.
  - 4. Acceptable areas shall constitute standard of acceptance for method of application, thickness, finish texture, and color requirements, for fluid applied thermal insulation coating system applications.

## **1.6 DELIVERY, STORAGE AND HANDLING**

- A. Delivery: Deliver materials in manufacturers' original, sealed, undamaged container with identification label intact. Packaged materials shall bear the appropriate labels, seals.
- B. Storage: Materials shall be stored in strict accordance with manufacturers documented instructions.
- C. Handling: Perform field erection/handling of coated steel members in accordance with AISC requirements for handling and erecting a finished product. Offset coated steel on dunnage to minimize damage to coatings.
- D. Documentation: All batch number, product identification and quantities shall be recorded on appropriate QC documents. A copy of the transport document and manufacturers conformance certificate shall be attached to the material delivery on site.

## **1.7 PROJECT/SITE CONDITIONS**

- A. Project Environmental Requirements: Substrate and air temperature shall be in accordance with the manufacturers' requirements and the following:
  - 1. Protect work area from windblown dust and rain.
  - 2. Protect adjacent areas from over spray of material.
  - 3. Provide ventilation in areas to receive work of this section during application and minimum 24 hours after application.

- B. Temperature and Humidity Requirements: Maintain air temperature and relative humidity in areas where products will be applied for a time period before during and after application as recommended by manufacturer.
1. Do not apply fluid applied thermal insulation coating system when temperature of substrate and/or surrounding ambient air temperature is below 45° F. Temporary protection and heat shall be maintained at this minimum temperature for 24 hours before, during and 24 hours after material application.
  2. Steel substrate temperature shall be a minimum of 5° F (3° C) above the dew point of the surrounding air for a period of 24 hours prior, during the application of the material and 24 hour cure period.
  3. Provide enclosures and heat to maintain proper temperatures and humidity levels in the application areas that are not thermally controlled with building HVAC systems.
  4. The relative humidity of the application area shall not exceed a maximum of 85% 24 hours prior, during and 24 hours after the application of the material. The relative humidity shall not exceed 75% throughout the application and curing of the decorative top coat finish.

## 1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace coatings that fail within specified warranty period.
1. Failures include, but are not limited to, the following:
    - a. Water penetration through the coating.
    - b. Deterioration of coating beyond normal weathering.
    - c. Loss of thermal value.
  2. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MATERIALS, GENERAL

- A. Material Compatibility: Provide primers; coating and accessory materials that are compatible with one another and with substrate under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. 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."
  3. All insulation products must meet the VOC general emissions testing criteria of CDPH Standard Method v1.2.
- C. Source Limitations:
1. Obtain fluid applied coatings from single source from single manufacturer.

## 2.2 PERFORMANCE REQUIREMENTS

- A. System Description: The fluid applied thermal break acrylic aerogel based coating system applied at the required thickness to provide the required R - Value of R - 0.10 to R-4.
1. Thickness of products specified shall not be less than and the following conductive K thermal values:
    - a. 35mW/mK/inch for Tnemec 971,
    - b. 52mW/mK/inch for Series 961.
  2. Manufacturer Tested R Values achievable with the following dry film thicknesses:

Series 971 Thickness	Approximate R-Value
40 mils (1/32 inch)	0.10
60 mils (1/16 inch)	0.25
120 mils (≈1/8 inch)	0.5
250 mils (≈1/4 inch)	1
380 mils (≈3/8 inch)	1.5
12.5mm (≈1/2 inch)	2
15mm (≈5/8 inch)	2.5
18.5mm (≈3/4inch)	3
22mm (≈7/8 inch)	3.5
25mm (≈1 inch)	4.0
  3. Project R value is for coating steel is R 0.5 at 120 mils
  4. Compatibility: Thermal Coating systems shall be compatible with
    - a. All WR Grace fireproofing products for all densities.
    - b. Dow Corning Sealant 790
    - c. Air Vapor Barriers.

## 2.3 MANUFACTURERS

- A. Insulation Type (**INS-11**): Provide fluid applied aerogel based thermal insulation coating as a complete system, including surface preparation, primer, intermediate thermal insulation coating and top coat (where necessary) as manufactured by Tnemec Company of Kansas City, MO. Subject to compliance with requirements equivalent aerogel based thermally insulation coating systems by BASF or Dow Corning will be considered. System specified below may be shop or field applied, and shall be coordinated with the requirements of Division 05, Section 05 12 00 "Structural Steel Framing" and Section 05 50 00 "Miscellaneous Metal Fabrications".
1. Primer: Tnemec, Series 90-97, 321 VOC, Two-component, Moisture-cured zinc rich epoxy conforming to the following requirements:
    - a. Bond strength: ASTM D4541 1320 psi
    - b. Abrasion Resistance ASTM 4060 181 mg
    - c. Cathodic Disbondment ASTM D G8- No disbondment 3000 Hrs.
    - d. Water Vapor Transmission ASTM D 1653 4.68 g/m<sup>2</sup> /24hrs/<0.22 prms
  2. Coating: Tnemec, Series 971/961 Aerolon: 76% Solids, one component, water based, thermal acrylic spray applied coating, applied with a film thickness of 40-300 mils in multiple applications to specified R Value; with the following performance requirements:

- a. VOC Content: 0.01 lbs./Gallon (1.0 grams /liter)
  - b. HAPS: 0 lbs. per gallon solids
  - c. Thermal Conductivity: ASTM C518, No more than 50 mW/ mK
  - d. Flame Resistance: ASTM E84 – Class A
  - e. Adhesion: ASTM D5894 – 4,00 hrs Prohesion
  - f. Resistance to Salt Spray: ASTM B117 – 4,000 hrs Salt Fog
  - g. Immersion: ASTM D870 – 4,000 hrs. Immersion
  - h. Humidity Resistance: ASTM D4585 – 4,000 hrs. Humidity
  - i. Water Immersion: ASTM D870 Method B – 2,000 hrs. 140°F D.I.
  - j. Abrasion Resistance: ASTM D4060 (CS-17 Wheel, 1,000g load) – No more than 50 mg loss after 1,000 cycles 5 Months Roof Exposure
3. Topcoats: Provide the following topcoats where exposed to view, in accordance with manufacturer's documented instructions:
  - a. Tnemec 1029 Enduratone or 750 Endura-Shield.
  - b. Tnemec Series 22 Epoxoline for areas where immersion is required.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verification: Verify that surfaces to receive the specified fluid applied thermal insulation coating are clean, dry and free of oil, grease, loose mill scale, dirt, dust or other foreign substances which would impair bond of the material to the substrate.
  1. Verify that substrate and workspace temperature and humidity conditions are in accordance with manufacturers recommendations.
- B. Substrate Acceptance: Do not apply primer, coating, or topcoat surfaces scheduled to receive coating system have been examined by the contractor, applicator and inspector and surfaces are acceptable to receive the primer and coating system. Commencement of application means acceptance of substrate.

### **3.2 PREPARATION**

- A. Protection of Adjacent Surfaces: Mask, provide drop cloths and other suitable protective coverings to prevent overspray onto adjacent surfaces not intended to be coated.
- B. Cleaning: Clean substrates free from dust, dirt, grease, paint or other foreign substances that would impair with the bond of the primer and coating system.
- C. Blasting: Shop abrasive blast-clean steel substrate in accordance with SSPC SP-6, and shop prime with specified primer. Surface profile shall be 2-3 mils.
  1. Grind weld spatter and defects smooth prior to application primer and fluid applied thermal break material.
- D. Remove blast products, dust and debris by vacuuming, and adequately vent area to remove air borne dust, prior to application of primer.

### **3.3 APPLICATION**

- A. Apply fluid applied thermal insulation coating system complying with manufacturer's written application instructions, including use of equipment and application procedures. Apply coating system at the required dry film thickness (DFT) required to achieve R- value specified.
  - 1. Application: Apply Aerolon 971 to steel members 18 inches from the exterior of the building facade and continuously back the width of wall section, (6-8 inches) plus 6 inches to the warm side of the wall section to the interior of the building past the Air Vapor Barrier to the inside face of the wall cavity.
  - 2. Apply Aerolon 961 (smooth) using same configuration above must be applied in 2 coats at 40 mils DFT per lift for a total of 80 mils DFT.
- B. Apply coating material at maximum 80 mils per wet film thickness (WFT) per lift, 60 mils DFT. Apply subsequent coats until final DFT is achieved for R value of 0.5 at 120 mils total thickness. When using Tnemec Aerolon 961 apply in two different color lifts (Yellow & White) to maximum thickness of 40 mils per lift dry for total 120 mils for R value of 0.5 Final DFT is measured with a dry film thickness gauge. More material required for tube steel accounting for heated perimeters.
- C. Do not spray steel deck, unless otherwise indicated. Coat other thermal break locations as indicated on the Contract Documents to an R value of 0.5 – 120mils.

### **3.4 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Representative. Engage manufacturer's field representative to attend preconstruction meetings, be at the site during installation, to approve substrate and first installation. Engage representative to train installer in installation of product.
- B. Engage an independent testing inspection agency to inspect and verify the application of coating system.
  - 1. Verify installed thickness to determine if thickness of installed material complies with that required in the contract documents.
  - 2. Perform pull test to determine if material meets bond strength specified.
- C. Inspection shall be performed at least 24 hours after completion of final application coat.
- D. Test results shall be made available to all parties at the completion of each pre-designated area and approval.
- E. Correct in-place material not in compliance with specified R Values prior to final approval.
- F. The dry film thickness (DFT) of the applied material shall be measured with a nondestructive coating thickness gage after material has completely cured. Measurements shall be documented in writing to the Owner.

### **3.5 CLEAN UP AND REPAIR**

- A. Upon completion of installation, remove excess material, overspray and debris and clean the job site.
- B. Remove overspray materials from surfaces not required to be thermally protected.



- C. Patching and repair of surfaces damaged by other trades shall be performed by the fluid applied thermal insulation applicator and back charged to the trade responsible for the damage. Patching shall be performed by applicators certified by the manufacturer and applied in accordance with the manufacturer application instructions.

**END OF SECTION**