SECTION 07 21 00 – THERMAL INSULATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including the Conditions of the Contract and Division 01 Specification Sections apply to this section.

1.2 SUMMARY

A. Provide a thermal, water and air resistance barrier wall system for exterior cold-formed metal wall assemblies. Work includes:
   1. Provide continuous exterior wall insulation.

B. Provide a thermal, water and air resistance barrier wall system for concrete foundation wall assemblies. Work includes:
   1. Provide continuous exterior insulation.

C. Related Sections:
   1. Section 05 40 00 Cold-Formed Metal Framing: Non Load-bearing, metal exterior wall framing assemblies.
   2. Section 09 21 16 Gypsum Board Assemblies: Interior gypsum board wall finish.

1.3 REFERENCES

A. American Society for Testing and materials (ASTM):
   1. ASTM C1289 – Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation
   2. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials
   3. ASTM E 119 – Test method for Fire Resistance Rating
   4. ASTM E 136 – Test method for Combustion Characteristics
   5. ASTM C518 – Test method for Thermal Resistance
   6. ASTM D1621 – Test method Compressive Strength
   7. ASTM C209 – Test method for Water Absorption
   8. ASTM C203 – Test method for Flexural Strength
   9. ASTM D5 - Standard Test Method for Penetration of Bituminous Materials.
   10. ASTM D36 - Standard Test Method for Softening Point of Bitumen (Ring and Ball Apparatus).
   11. ASTM D312 - Standard Specification for Asphalt Used in Roofing.
   12. ASTM D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
   13. ASTM D1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics.
   14. ASTM D2126 - Standard Test Method for Response off Rigid Cellular Plastics to Thermal Humid Aging.

15. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
16. ASTM E119 – Test method for Fire Resistance Rating.

B. Underwriters Laboratories, Inc. (UL):
1. UL 723 – Surface Burning characteristics of Building Materials

C. National Fire Protection Association (NFPA):
1. NFPA 259 – Standard Test Method for Potential Heat of Building Materials
2. NFPA 285 – Standard Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non Load Bearing Wall Assemblies Containing Combustible Components
3. NFPA 286 – Standard Test Method of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth

1.4 SYSTEM DESCRIPTION

A. Furnish and install an exterior wall system that effectively controls thermal, air, vapor and water performance and provides continuity of the building envelope enclosure. The system shall include the following:
1. Insulated sheathing secure to the exterior of the metal wall framing assembly or concrete foundation wall assembly.
2. Joint, penetration and gap sealing material for sealing component joints, penetrations through the wall system and gapes between the building envelope enclosure components and wall opening frames.

B. Performance Characteristics:
1. Thermal performance:
a. Exterior insulation: ASTM C518, Stabilized R-value of 6.5 at one inch of thickness with maximum six month exposure capability to outdoor elements
2. Air barrier performance: When tested in accordance with ASTM E2357, at a test pressure on not less than 6.24 psf, air infiltration shall not exceed 0.04 cfm per square foot (0.2L/*m2) of fixed wall area. Testing should be conducted at positive and negative sustained wind loading of 12.5 psf (600Pa) for one-hour duration in each direction, pressure cycling of the wall at 2000 cycles in both the positive and negative direction, ending with wind gust loading at 25psf.
3. Water penetration: when tested in accordance with ASTM E331, no uncontrolled water penetration shall occur at a minimum differential pressure of 6.24 psf for minimum test duration of 2 hours.
4. Mold resistance: Wall system components shall provide non-food source for fungal growth.

C. Code Compliance: Wall system and component materials shall comply with the following requirements:
1. Exterior Insulation:
a. Class B classified at Max. thickness per UL 723 criteria or ASTM E84 criteria.

b. Fire Performance Evaluation as a component of an NFPA 285 approved wall assembly per the requirements of the International Building Code.

2. System complies with ASTM E2357: Test Method for determining Air Leakage of Air Barrier Assemblies.
3. System complies with NFPA 285: Standard method of Testing for the Evaluation of Flammability Characteristics of Exterior Non-Load-Bearing Wall Assemblies containing Combustible components using the Intermediate Scale, Multi-Story Test Apparatus.

D. All joints, penetrations and gaps of the wall system shall be made water and air resistive.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's specification data sheets for each product in accordance with Division 01 Section Submittal Procedures. 01300.

B. Provide approval letters from insulation manufacturer for use of their insulation within this particular system type.

C. Provide a sample of each insulation type.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: The installer shall be, during the award period as well as for the duration of the installation, officially recognized as a Certified Installer by the wall system Manufacturer (Certified Installer). The Certified Installer shall carry liability insurance and bonding.

B. Pre-installation meeting: Prior to commencement of application of wall system, review and document methods and procedures related to installation, including the following:

1. Participants: Authorized representatives of the Contractor, [Construction Manager], [Owner], Architect, [Engineer], Applicator, [Independent Inspector], and Manufacturer.
2. Review metal wall framing assemblies for potential interference and conflicts and coordinate layout and support provisions for interfacing work.
3. Review insulated sheathing, flashing and [spray polyurethane foam] methods and procedures related to application including manufacturer's installation guidelines.
4. Review construction schedule and confirm availability of products, applicator personnel, equipment and facilities.
5. Review governing regulatory requirements, and requirements for insurance and certificates as applicable.
6. Review field quality control procedures.

C. Thermal Resistivity: Where thermal resistivity of insulation product are designated by “R-Values”, they represent the reciprocal of thermal conductivity (K-Values).

1. Thermal conductivity is the rate of heat flow through a homogenous material exactly 1-inch thick.

2. Thermal resistivity is expressed by the temperature difference in degrees F between the two exposed faces required to cause one BTU to flow through one square foot per hour at mean temperatures indicated.

D. Fire Performance Characteristics: Provide insulation materials identified to those whose indicated fire performance characteristics have been determined per ASTM test method indicated below, by UL, or other testing and inspection organizations acceptable to authorities having jurisdiction. Identify products with appropriate marking of applicable testing and inspecting organization.

1. Surface Burning Characteristics: ASTM E84

2. Fire Resistance Rating: ASTM E119

3. Fire Propagation characteristics: NFPA 285

4. Potential Heat from Foam Plastics: NFPA 259

5. Room Corner Tests: NFPA 286

6. Current Evaluation Reports may be submitted as substantiation of compliance with Fire performance claims.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site with seals and labels intact, in manufacturer’s original containers, dry and undamaged.

B. Store all insulation materials in a manner to protect them from the wind, sun and moisture damage prior to and during installation. Any insulation that has been exposed to any moisture shall be removed from the project site.

C. Keep materials enclosed in a watertight, ventilated enclosure (i.e. tarpaulins).

D. Store materials off the ground. Any warped, broken or wet insulation boards shall be removed from the site.

PART 2 – PRODUCTS

2.1 PRODUCTS, GENERAL

A. Refer to Division 01 Section “Common Product Requirements.”

B. Basis of Design: Materials, manufacturer's product designations, and/or manufacturer's names specified herein shall be regarded as the minimum standard of quality required for work of this Section. Comply with all manufacturer and contractor/fabricator quality and performance criteria specified in Part 1.

C. Substitutions: Products proposed as equal to the products specified in this Section shall be submitted in accordance with Bidding Requirements and Division 01 provisions.
   1. Proposals shall be accompanied by a copy of the manufacturer's standard specification section. That specification section shall be signed and sealed by a professional engineer licensed in the state in which the installation is to take place. Substitution requests containing specifications without licensed engineer certification shall be rejected for non-conformance.
   2. Include a list of three (3) projects of similar type and extent, located within a one hundred mile radius from the location of the project. In addition, the three projects must be at least five (5) years old and be available for inspection by the Architect, Owner or Owner's Representative.
   3. Equivalency of performance criteria, warranty terms, submittal procedures, and contractual terms will constitute the basis of acceptance.
   4. The Owner's decision regarding substitutions will be considered final. Unauthorized substitutions will be rejected.

2.2 FOAM BOARD INSULATION

A. Rigid Polyisocyanurate Thermal Insulation – 25 psi: ASTM C1289 Class A with facings on both sides with the following characteristics:

   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84
   2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84
   3. Board Edges: Square
   4. Thermal Resistance at 75 degrees F, ASTM C518 6.5/inch thickness minimum
   5. Compressive Strength, ASTM D1621: 25 psi minimum
   6. Water Absorption, maximum, ASTM C209, <0.06
   7. Flexural Strength, ASTM C203, 40 psi minimum
   8. Acceptable Manufacturers:
      a. Ox Engineered Products: Ox ISO RED MAX
         1255 N Fifth Street
         Charleston, IL 49042
         Contact: Lee Bybee
         Telephone: 303-748-0858
         Email: lbybee@oxindustries.com
   9. Facer Options:
      a. ISO RED MAX: Front Facer – 0.9 mil foil Back Facer – 0.9 mil foil
      b. ISO RED MAX WF: Front Facer – 1.25 mil white embossed Back Facer – 0.9 mil silver
      c. ISO RED LD: Front Facer – 1.25 mil white embossed Back Facer – 1.25 mil silver embossed

d. ISO RED HD: Front Facer – 3.4 mil white embossed Back Facer – 1.25 mil silver embossed
e. ISO RED MAX STRONG-R: Front Facer – 0.9 mil foil Back Facer – 1/8" laminated fibrous board

B. Rigid Polyisocyanurate Thermal Insulation – 25 psi: ASTM C1289 Class B with facings on both sides with the following characteristics:

1. Flame Spread Index: 75 or less, when tested in accordance with ASTM E84
2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84
3. Board Edges: Square
4. Thermal Resistance at 75 degrees F, ASTM C518 6.5/inch thickness minimum
5. Compressive Strength, ASTM D1621: 25 psi minimum
6. Water Absorption, maximum, ASTM C209, <0.06
7. Flexural Strength, ASTM C203, 40 psi minimum
8. Acceptable Manufacturers:
   a. Ox Engineered Products: Ox ISO RED CI
   1255 N Fifth Street
   Charleston, IL 49042
   Contact: Lee Bybee
   Telephone: 303-748-0858
   Email: lbybee@oxindustries.com
9. Facer Options:
   a. ISO RED CI: Front Facer – 3-ply (Poly/Kraft/Foil) Back Facer – 3-ply (Foil/Kraft/Foil)
   b. ISO RED CI FF: Front Facer – 2-ply (Foil/Kraft) Back Facer – 2-ply (Foil/Kraft)

2.3 ACCESSORIES

A. Insulation Fasteners:
   1. Wood Framing
      a. Stud Spacing: 16" or 24"
      b. Attachment Method: Capped nails, staples or roofing nails (~1" framing embedment)
      c. Fastener Spacing: 12" perimeter / 12" field
   2. Metal Framing
      a. Stud Spacing: 13" or 24"
      b. Attachment Method: Corrosion-resistant self-taping screws with 1" diameter cap or washer (~1" framing embedment)
      c. Fastener Spacing: 12" perimeter / 12" field
   3. Interior Masonry or Concrete
      a. Attachment Method: Suitable construction adhesive or masonry fasteners with 1" diameter cap or washer or combination of adhesive and mechanical fasteners. (~1" embedment into substrate)
      b. Fastener Spacing: Adhesive beads spaced 16" horizontally or full perimeter. Mechanical fasteners 12" perimeter and 12" field spaced 16"

horizontally or combination of adhesive and minimum fasteners to hold until adhesive sets.

4. Exterior Masonry or Concrete Below Grade
    a. Attachment Method: Granular water-draining fill.
    b. Fastener Spacing: Only as required to ensure intimate contact to masonry surface or water proofed surface.

B. Flashing Tape: Provide insulation manufacturer's recommended tape for counter-flashing and penetrations through the insulation layer.
    1. Acceptable Products:
        a. 3M "All Weather Flashing Tape 8067: 4 inch, 6 inch, 9 inch, at openings at heads, jambs, and sills.
        b. Other manufacturers that meet minimum requirements

C. Penetration Filler: Provide insulation sheathing manufacturer's recommended polyurethane foam for sealing penetrations of insulated sheathing.
    1. Acceptable Products:
        a. ICP Handi-Foam One Component Polyurethane
        b. Other manufacturers that meet minimum requirements

D. Gap Air Infiltration Filler: Two component, quick cure polyurethane foam.
    1. Acceptable Products:
        a. ICP Handi-Foam Two Component
        b. Other manufacturers that meet minimum requirements

PART 3 – EXECUTION

3.1 EXECUTION, GENERAL

A. Comply with requirements of Division 01 Section "Common Execution Requirements."

3.2 INSPECTOR OF SURFACES

A. Insulation contractor shall be responsible for preparing an adequate substrate to receive insulation.
    1. Examine surfaces for defects, rough spots, ridges, depressions, foreign material, moisture, and unevenness.
    2. Do not proceed until defects are corrected.
    3. Do not apply insulation until substrate is sufficiently dry.

3.3 INSTALLATION

A. Install in accordance with manufacturer's recommendations:
    1. Approved insulation board shall be fully attached to the structure with an approved mechanical fastening system. As a minimum, the amount of fasteners shall be in accordance with manufacturer's recommendation.
    2. Spacing pattern of fasteners shall be as per manufacturer's recommendations.
    3. Minimum penetration into structure shall be as recommended by the fastener manufacturer.

4. Install sheathing panels horizontally. Use maximum lengths to minimize number of joints. Locate edge joints parallel to and on framing. Center end joints over supports and stagger in each course. Provide additional framing wherever panel joints do not bear against framing plate or sill members.
5. Drive fasteners to bear tight and flush with surface of insulation. Do not overdrive fastener causing damage to the insulation board facer. Perimeter fasteners can be detailed to bridge the gap of abutting board joints due to the 2" diameter of the washer used to fasten the board to the studs. Maximum of two board joints may be bridged per fastener.
6. Install flashing at end and edge joints in accordance with sheathing manufacturer's joint sealing recommendations.
7. Install flashing behind wall tie and mechanical fastening assemblies for rain screen claddings according to manufacturer's recommendations.
8. Seal sheathing joints and penetrations of sheathing in accordance with sheathing manufacture's joint and penetration sealing recommendations.

3.4 CLEANING

A. Leave insulation clean and dry, ready to receive subsequent finish.

3.5 CONSTRUCTION WASTE MANAGEMENT

A. Remove and properly dispose of waste products generated during installation. Comply with requirements of authorities having jurisdiction.

END OF SECTION 07 21 00