

SECTION 07 21 00
THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Extruded polystyrene foam plastic board.
 2. Polyisocyanurate foam plastic board.
 3. Glass fiber blanket.
 4. Mineral wool blanket.
 5. Mineral wool board.
 6. Spray applied foam insulation.

1.2 ACTION SUBMITTALS

- A. Product Data: Technical data and installation instructions for each type of insulation product specified.

1.3 INFORMATIONAL SUBMITTALS

- A. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.
1. For blown in or sprayed fiberglass and cellulosic fiber loose fill insulation, indicate initial installed thickness, settled thickness, settled R-value, installed density, coverage area, and number of bags installed.
 2. Sign, date, and post the certification in a conspicuous location on Project site.
- B. Product Test Reports: Submit test report for tests performed by a qualified testing agency. based on tests performed by a qualified independent testing agency evidencing compliance of insulation products including thermal resistance, fire test response characteristics, water vapor transmission, water absorption, and other properties, based on comprehensive testing of current products.
- C. Evaluation Reports: Submit current ICC-ES report for foam plastic insulation.
- D. Written Certification of Foamed in Place Insulation being Free of hydrofluorocarbon (HFC) blowing agents.

1.4 QUALITY ASSURANCE

- A. Spray Polyurethane Foam Applicator Qualifications: Authorized Applicator having minimum 5 years documented experience and who is trained and licensed by the manufacturer.
- B. Single Source Responsibility for Insulation Products: Obtain each type of building insulation from single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of work.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam plastic board insulation:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam plastic board materials to Project site until just before installation time.
 - 3. Quickly complete installation and concealment of foam plastic board insulation in each area of construction.

1.6 DEFINITIONS

- A. Small Voids: Small spaces or voids created between fenestration and surrounding construction, other openings and penetrations for detailing.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire Performance Characteristics: Identify products with appropriate markings of applicable testing and inspecting organization.
 - 1. Surface Burning Characteristic: ASTM E 84.
 - a. Flame Spread Index: Maximum 25.
 - b. Smoke Developed Index: Maximum 450.
 - 2. Fire Resistance Ratings: ASTM E 119.
 - 3. Combustion Characteristics: ASTM E 136.
- B. National Fire Prevention Association (NFPA) 255 Test of Surface Burning Characteristics of Building Materials.
- C. Underwriter's Laboratories (UL) 723 Tests for Surface Burning Characteristics of Building Materials.

2.2 EXTRUDED POLYSTYRENE FOAM PLASTIC BOARD

- A. Extruded Polystyrene Board, Type IV: ASTM C 578, Type IV, 25-psi (173-kPa) minimum compressive strength; unfaced.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dow Chemical Company; Styrofoam Scored (SB).
 - b. Owens Corning. Foamular 250.
 - c. Pavtiv Building Products; GreenGuard Type IV.
 2. Smoke Developed Index: Not more than 450 when tested in accordance with ASTM E84.
 3. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
 4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.
 5. Thermal conductivity: R-value = R of 5.0 per inch; total R value or total thickness as indicated on the Drawings.
- B. Extruded Polystyrene Board, Type VI: ASTM C 578, Type VI, 40-psi (276-kPa) minimum compressive strength; fabricated with shiplap or channel edges and with one side having grooved drainage channels..
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Dow Chemical Company; High Load 40.
 - b. Owens Corning. Foamular 400.
 - c. Pavtiv Building Products; GreenGuard Type VI.
 2. Flame Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 3. Smoke Developed Index: Not more than 450 when tested in accordance with ASTM E84.
 4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.
 5. Thermal conductivity: R-value = R of 5.0 per inch; total R value or total thickness as indicated on the Drawings.

2.3 POLYISOCYANURATE FOAM PLASTIC BOARD

- A. Polyisocyanurate Board, Foil Faced: ASTM C 1289, foil faced, Type I, Class 1 or 2.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Atlas Roofing Corporation.
 - b. Hunter XCI; Carlisle Coatings & Waterproofing Inc.
 - c. Dow Chemical Company (The).
 - d. Firestone Building Products.
 - e. Rmax, Inc.
 2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

3. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.
4. Nominal thickness: 2 inches minimum unless indicated on the Drawings.
5. Thermal conductivity: R-value = R of 6.0 per inch; R of 12 minimum unless exceeded on the drawings.

2.4 GLASS FIBER BLANKET

- A. Glass Fiber Blanket, Unfaced: ASTM C 665, Type I; passing ASTM E 136 for combustion characteristics.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation.
 - b. Guardian Building Products, Inc.
 - c. Johns Manville; a Berkshire Hathaway company.
 - d. Knauf Insulation.
 - e. Owens Corning.
 2. Flame Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 3. Smoke Developed Index: Not more than 50 when tested in accordance with ASTM E84.
 4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.
 5. Thermal Resistance:
 - a. Walls: R value as indicated on the Drawings but no less than required by Code.
 - b. Ceilings and Soffits: R value as indicated on the Drawings but no less than required by Code.

2.5 MINERAL WOOL BLANKETS

- A. Mineral Wool Blanket, Unfaced: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame spread and smoke developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Rockwool (Roxul) Inc.
 - b. Thermafiber, Inc.; an Owens Corning company.
 2. Flame Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 3. Smoke Developed Index: Not more than 50 when tested in accordance with ASTM E84.
 4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.

5. Thermal Resistance:
 - a. Walls: R value as indicated on the Drawings but no less than required by Code.
 - b. Ceilings and Soffits: R value as indicated on the Drawings but no less than required by Code.

2.6 MINERAL WOOL BOARD

- A. Mineral Wool Board, Faced: ASTM C 612, Types IA and IB; water repellent, faced on one side with foil scrim or foil scrim polyethylene vapor retarder.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Rockwool.
 - b. Thermafiber, Inc.; an Owens Corning company.
 2. Flame Spread Index: Not more than 15 when tested in accordance with ASTM E84.
 3. Smoke Developed Index: Not more than zero when tested in accordance with ASTM E84.
 4. Nominal density of 4 lb/cu. ft. (64 kg/cu. m).
 5. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches (305 mm) and wider in width.
 6. Nominal thickness: 2 inches unless otherwise indicated on the Drawings..
 7. Thermal conductivity: R-value = R of 4.0 per inch; R of 8 for total thickness of 2 inches.
 8. Tape: As recommended by board manufacturer; bright aluminum polyethylene self-adhering type, mesh reinforced, 2 inches wide.

2.7 FOAMED IN PLACE INSULATION

- A. Foamed in place insulation as specified herein is intended for small voids only and shall not be used for larger area needs for thermal insulation.
- B. Closed Cell Spray Polyurethane Foam: ASTM C 1029, Type II, minimum density of 1.5 lb/cu. ft. (24 kg/cu. m) and minimum aged R-value at 1 inch (25.4 mm) thickness of 6.2 degrees F x h x sq. ft./Btu at 75 degrees F (43 K x sq. m/W at 24 degrees C)
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BASF Corporation.
 - b. CertainTeed Corporation.
 - c. Dow Chemical Company (The).
 - d. Gaco Western LLC.
 - e. Henry Company.
 - f. Johns Manville; a Berkshire Hathaway company.
 - g. NCFI Polyurethanes; a division of Barnhardt Manufacturing Company.
 - h. Volatile Free, Inc.

2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
3. Free of hydrofluorocarbon (HFC) blowing agents.
4. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.
5. Hydrofluorocarbon (HFC) blowing agent foam in place insulation is prohibited from Substitution without written documented prior approval by all Project Governing Authorities for the Jurisdiction including Federal, State and Local Municipality entities and acceptable to all Authorities Having Jurisdiction on the Project.

2.8 INSULATION FASTENERS

- A. Adhesively Attached, Spindle Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self locking washer in place.
 1. Plate: Perforated, galvanized carbon steel sheet, 0.030 inch (0.762 mm) thick by 2 inches (50 mm) square.
 2. Spindle: Copper coated, low carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation.
- B. Adhesively Attached, Angle Shaped, Spindle Type Anchors: Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self locking washer in place.
 1. Angle: Formed from 0.030 inch (0.762 mm) thick, perforated, galvanized carbon steel sheet with each leg 2 inches (50 mm) square.
 2. Spindle: Copper coated, low carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation.
- C. Insulation Retaining Washers: Self locking washers formed from 0.016 inch (0.41 mm) thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches (38 mm) square or in diameter.
 1. Protect ends with capped self locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
 - a. Crawl spaces.
 - b. Ceiling plenums.
 - c. Attic spaces.
- D. Insulation Standoff: Spacer fabricated from galvanized mild steel sheet for fitting over spindle of insulation anchor to maintain air space as indicated between face of insulation and substrate to which anchor is attached.
- E. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.

2.9 ACCESSORIES

- A. Insulation for Miscellaneous Voids:
 - 1. Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame spread and smoke developed indexes of 75 and 450, respectively, per ASTM E 84.
- B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.
- C. Batt Insulation Supports:
 - 1. Steel wire, galvanized; type and size to suit application. Provide wires at 16 inches on center maximum between studs to retain insulation.
 - 2. Retainer Strips: For securing insulation between supports; 0.025 inch (0.64-mm) nominal thickness, formed, metallic-coated steel.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Board and Batt Insulation: Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications and selected from manufacturer's standard thickness, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 PERIMETER, UNDERSLAB, AND FOUNDATION WALL INSULATION

- A. Butt panels together for tight fit.
- B. On vertical surfaces, set insulation units using recommended adhesive or loosely laid according to manufacturer's written instructions. Unless otherwise indicated, extend insulation minimum of 36 inches (915 mm) below exterior grade line.
 - 1. Extruded Polystyrene Type IV unless otherwise indicated.

- C. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units. Unless otherwise indicated, extend insulation minimum of 24 inches (610 mm) in from exterior walls.
 - 1. Extruded Polystyrene Type VI unless otherwise indicated.
- D. Anchor Installation: Install board insulation on concrete substrates by adhesively attached, spindle type insulation anchors:
 - 1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application.
 - 2. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application.
 - 3. Apply insulation standoffs to each spindle to create cavity width indicated on Drawings between concrete substrate and insulation.
 - 4. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation retaining washers, taking care not to compress insulation.
 - 5. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.
- E. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

3.4 INSTALLATION - EXTERIOR WALLS

- A. Adhere 6 inch wide strip of polyethylene over joint with double bead of adhesive each side of joint, faced side outward. Tape seal joints between sheets. Extend sheet full height of joint.
- B. Apply adhesive to full bed 1/8 inch thick minimum. Daub adhesive tight to protrusions.
- C. Install boards on wall surface, horizontally. Place surface of insulation against adhesive.
- D. Place boards in method to maximize contact bedding, staggering end joints. Butt edges and ends tight to adjacent board and to protrusions with continuous adhesive.
- E. Place 6" wide polyethylene sheet at perimeter of wall openings, from adhesive vapor and air barrier bed to opening frames. Tape seal in place to ensure continuity of vapor and air barrier.
- F. Tape insulation board joints.

3.5 FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 3. Maintain 3 inch (76 mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 4. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
 5. For metal framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
 - a. For unfaced insulation, provide insulation supports as specified in this Section. Utilize steel wire or retainer strips as required to maintain insulation in place without voids or compression.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
1. Glass Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft. (40 kg/cu. m).
 2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.
- A. Foam in Place Insulation: Spray insulation to envelop entire area to be insulated and fill voids.
1. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.
 2. Framed Construction: Install into cavities formed by framing members to achieve thickness indicated on Drawings.
 3. Miscellaneous Voids: Apply according to manufacturer's written instructions.

3.6 CURTAIN WALL INSULATION

- A. Install board insulation in curtain wall construction according to curtain wall manufacturer's written instructions.
1. Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass.
 2. Maintain cavity width of dimension indicated on Drawings between insulation and glass.
 3. Install insulation to fit snugly without bowing.
 4. Provide foil tape in areas concealed from view.

3.7 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

3.8 SCHEDULE

- A. Perimeter Foundation Insulation: extruded polystyrene, Type IV adhesive and anchor application, with protection board.
- B. Above Grade Wall Insulation: Foil-faced polyisocyanurate board insulation.
- C. Grade Beams / Underslab: Extruded-polystyrene board insulation, Type VI.
- D. Below Grade Walls: Extruded-polystyrene board insulation, Type IV.
- E. Spandrel Glass: Mineral-wool foil faced semi-rigid board insulation with foil faced tape.

END OF SECTION