

SECTION 072100
THERMAL INSULATION

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

- A. Attention is directed to the CONTRACT AND GENERAL CONDITIONS and all Sections within DIVISION 01 - GENERAL REQUIREMENTS which are hereby made a part of this Section of the Specifications.

1.2 DESCRIPTION OF WORK

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
1. Rigid insulation, under slabs-on-grade and at perimeter foundation walls.
 2. Blanket insulation, at framing.
 3. Spray polyurethane foam insulation.
 4. Spray-applied cellulose insulation.
 5. Smart vapor retarders.
- B. Sustainable Design Intent: Refer to Section 018113 - SUSTAINABLE DESIGN REQUIREMENTS for certification level and certification requirements.
- C. Related Work: The following items are not included in this Section and are specified under the designated Sections:
1. Section 033000 - CAST-IN-PLACE CONCRETE for underslab vapor barrier.
 2. Section 072700 - AIR BARRIERS for air and vapor barrier membrane.
 3. Section 075300 - EPDM ROOFING for roofing insulation.
 4. Section 092110 - GYPSUM BOARD ASSEMBLIES for acoustic insulation in gypsum board assemblies.
 5. Division 22 - PLUMBING for plumbing insulation.
 6. Division 23 - HEATING, VENTILATING, AND AIR CONDITIONING for mechanical insulation.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
1. Include product data, installation instructions, performance criteria, and product limitations.
- B. LEED Submittals:
1. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD):
 - a. Option 1: For insulation, submit EPDs.

2. Building Product Disclosure and Optimization, Sourcing of Raw Materials:
 - a. General: For credit achievement calculation, submit location of products sourced (extracted, manufactured, and purchased), indicating number of miles from the project site.
 - b. Option 1: For insulation, submit corporate sustainability reports (CSR).
 - c. Option 2, Leadership Extraction Practices:
 - 1) Recycled Content: For insulation, submit percentages by weight of postconsumer and preconsumer recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
 3. Building Product Disclosure and Optimization, Material Ingredients:
 - a. Option 1, Material Ingredient Reporting: For mineral wool blanket insulation, submit Declare product labels.
 4. Low-Emitting Materials, General Emissions Evaluation: Building products must be tested and determined compliant in accordance with California Department of Public Health (CDPH) Standard Method v1.2-2017, using the applicable exposure scenario.
 - a. For insulation, submit GreenGuard Gold certification.
 - b. For adhesives, submit test results, including TVOC emissions and VOC content.
 - c. For wet-applied products, submit volume used.
- C. Qualification Data: For Installer of spray-applied products and Testing Agency.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.
- B. Installer Qualifications: A qualified installer who has been trained by and is acceptable to spray polyurethane foam insulation manufacturer to install manufacturer's products.
- C. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- D. Fire Test Performance for Insulation in Cavity Wall: Passes NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.
- E. Testing Agency Qualifications: An independent agency qualified as a "Certified Infrared Thermographer" per ASNT SNT-TC-1A guidelines, Level I certification minimum.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store in a dry and secure location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect plastic and spray polyurethane foam insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver materials to Project site before installation time.
3. Complete installation and concealment of materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 RIGID INSULATION AT FOUNDATION WALL AND UNDER SLAB

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. DuPont (formerly Dow Chemical); Reduced GWP Styrofoam series (gray color).
 2. Kingspan; Greenguard LG XPS series.
 3. Owens Corning; Foamular NGX (Next Generation Extruded) series.
- B. Extruded-Polystyrene (XPS) Board Insulation: ASTM C 578, square edged of type, density, and compressive strength indicated below:
1. For vertical applications, Type IV, 1.6-lb/cu. ft. minimum density and 25-psi minimum compressive strength.
 2. For horizontal applications, pedestrian traffic, Type VII, 2.2-lb/cu. ft. minimum density and 60-psi minimum compressive strength.
 3. For horizontal applications, vehicular traffic, Type V, 3-lb/cu. ft. minimum density and 100-psi minimum compressive strength.
 4. Thermal Resistivity (R-value): ASTM C 518, 5.0 per inch.
 5. Blowing Agent: Honeywell; Solstice Liquid Blowing Agent, low global warming potential (GWP) hydrofluoro-olefin (HFO) or approved equal.
 - a. Other insulation manufacturers may be considered, if they have adopted the HFO blowing agents by start of construction.
 6. Recycled Content: 20 percent min.

2.2 CAVITY WALL INSULATION, MINERAL-WOOL BOARD

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Johns Manville (JM); Clad Stone 45.
 2. Owens Corning; Thermafiber RainBarrier 45.
 3. Rockwool (formerly Roxul); Cavityrock DD.
- B. Unfaced, Mineral-Wool Board Insulation: ASTM C 612, Type IVB; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
1. Nominal density of 4 lb/cu. ft. Types IA and IB, thermal resistivity (R-value) of 4.0 deg F x h x sq. ft./Btu x in. at 75 deg F minimum.
 2. Fiber Color: Natural, except darkened where visible through joints in cladding.
 3. NFPA 285 Assembly Fire Propagation Characteristics Testing Results: Passing.

4. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Industry-wide EPD.

C. Attachment to Substrate, Masonry Veneers: Manufacturer's recommended mechanical attachment clip or disk.

D. Attachment to Substrate, Panel Veneers: Manufacturer's recommended adhesively attached, spindle-type insulation anchors.

E. Provide insulation strapping and clips, stud wall dimension is greater than insulation thickness.

2.3 BLANKET INSULATION, MINERAL-WOOL TYPE

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Johns Manville; TempControl Mineral Wool.
2. Owens Corning; Thermafiber UltraBatt FF.
3. Rockwool (formerly Roxul); ComfortBatt.

B. 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. Recycled Content: 70 percent min.
2. Building Product Disclosure and Optimization, Material Ingredients: Health Product Declaration (HPD) or Declare product labels.
3. Low-Emitting Materials, General Emissions Evaluation: GreenGuard Gold certification, formaldehyde-free.

C. Provide insulation strapping and clips, stud wall dimension is greater than insulation thickness.

2.4 CLOSED-CELL SPRAY POLYURETHANE FOAM INSULATION

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

1. BASF; WALLTITE LWP Series.
2. Huntsman Building Solutions (formerly Demilec and Icynene); Heatlok HFO Pro.
3. Johns Manville; JM Corbond IV.
4. NCFI Polyurethanes; InsulBloc.

B. Closed-Cell Polyurethane Foam Insulation: ASTM C 1029, Type I and II.

1. Minimum density of 2.0 lb/cu. ft., thermal resistivity (R-value) of 6.0 deg F x h x sq. ft./Btu x in. at 75 deg F.
2. Blowing Agent: Honeywell; Solstice Liquid Blowing Agent, low global warming potential (GWP) hydrofluoro-olefin (HFO) or approved equal.
 - a. Other insulation manufacturers may be considered, if they have adopted the HFO blowing agents by start of construction.
3. Fire Resistance: ASTM E 84 or UL 723, Flame Spread 75 max., and Smoke Developed 450 max.

4. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Industry-wide EPD.
5. Low-Emitting Materials, General Emissions Evaluation: GreenGuard Gold certification.

2.5 SPRAYED-FOAM INSULATION, AT GAPS AND VOIDS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
1. DuPont (formerly Dow Chemical); GreatStuff Pro.
 2. ICP Building Solutions Group: Handi-Foam E84 Low GWP.
- B. Sprayed-Foam Insulation: Water-cure closed cell polyurethane containing no urea-formaldehyde and no CFCs.
1. Minimum density of 2.0 lb/cu. ft., thermal resistivity (R-value) of 6.0 deg F x h x sq. ft./Btu x in. at 75 deg F.
 2. Blowing Agent: Honeywell; Solstice Liquid Blowing Agent, low global warming potential (GWP) hydrofluoro-olefin (HFO) or approved equal.
 - a. Other insulation manufacturers may be considered, if they have adopted the HFO blowing agents by start of construction.
 3. Fire Resistance: ASTM E 84 or UL 723, Flame Spread 75 max., and Smoke Developed 450 max.
 4. Building Product Disclosure and Optimization, Environmental Product Declarations (EPD): Industry-wide EPD.
 5. Low-Emitting Materials, General Emissions Evaluation: GreenGuard Gold certification.

2.6 SMART VAPOR RETARDERS

- A. Available Products: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. CertainTeed Corp.; MemBrain Continuous Air Barrier & Smart Vapor Retarder.
 2. ProClima; Intello.
 - a. Building Product Disclosure and Optimization, Material Ingredients: Declare product label.
 3. SIGA; Majrex.
- B. Smart Vapor Retarders: Polyamide-based (nylon) or polyethylene copolymer sheet.
1. Water Vapour Permeance: ASTM E 96, Desiccant Method <1.0 perm.
 2. Water Vapour Permeance: ASTM E 96, Water Method >10 perm.
 3. Fire Resistance Rating: ASTM E 84, Class 1/A.
- C. Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.7 THERMAL AND IGNITION BARRIERS

- A. Thermal Barrier for Foam Plastic Insulation at Occupied Spaces: Provide thermal barrier recommended by foam plastic manufacturer and tested with the specific product. Product shall have an active building code evaluation report that lists report number and effective dates of product acceptance.
- B. Ignition Barrier for Foam Plastic Insulation at Attic and Crawl Spaces, including Areas not Separated from Occupied Spaces by a Thermal Barrier: Provide ignition barrier recommended by foam plastic manufacturer and tested with the specific product. Product shall have an active building code evaluation report that lists report number and effective dates of product acceptance.

2.8 AUXILIARY INSULATING MATERIALS

- A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.
 - 1. Low-Emitting Materials: Provide interior adhesives in compliance with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - 2. Do not use adhesives that contain urea formaldehyde.
 - 3. Methylene chloride and perchloroethylene may not be intentionally added to adhesives.
- B. Concrete Fasteners:
 - 1. Hardened nails, pneumatically-driven fasteners or other anchors recommended by insulation manufacturer, sufficient to penetrate substrate and permanently retain insulation.
 - 2. Self-adhering insulation stick pins: Galvanized steel plate welded to projecting steel spindle; capable of holding insulation thicknesses indicated securely in position indicated with self-locking galvanized steel washer in place. Backseal fastener penetrations.
- C. Tape: Adhesive tape recommended by insulation manufacturer, to tape joints and tears in faced insulation.
- D. Insulation Supports: Provide straps, or wire bat supports and clips at cavity wall insulation to retain insulation in stud space.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.
- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Spray Polyurethane Foam: Comply with recommendations of the American Chemistry Council, "Health and Safety Product Stewardship Workbook for High-Pressure Application of Spray Polyurethane Foam (SPF)."
 - 1. Spray Polyurethane Foam: Spray insulation no greater than 1-1/2 inch thickness per layer. Allow each layer to fully cure before spraying additional thickness.
 - 2. Contain and fully ventilate the area being sprayed with negative air machines, venting directly to the exterior. Do not operate permanent building HVAC system during installation. Continue ventilation during curing process.
 - 3. Install spray polyurethane foam insulation with uniform full thickness and with density which will not displace adjacent materials.
 - 4. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.
- E. Miscellaneous Voids: Install spray polyurethane foam insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation.
 - 1. Cure insulation with continuous natural or mechanical ventilation.
 - 2. Remove and dispose of over-spray.

3.4 INSTALLATION OF BELOW-GRADE INSULATION

- A. On vertical surfaces, set rigid insulation units in adhesive or tacky waterproofing surfaces, applied according to manufacturer's written instructions.
 - 1. If not otherwise indicated, extend insulation a minimum of 48 inches below exterior grade line.
- B. On horizontal surfaces, loosely lay rigid insulation units over vapor retarder sheet, according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.5 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- A. Glass-Fiber or Mineral-Wool 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 clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

- B. Spray-Applied Insulation: Apply spray-applied insulation according to manufacturer's written instructions. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.

3.6 INSTALLATION OF VAPOR RETARDERS

- A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- B. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs.
1. Attach vapor retarders to framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints.
 2. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
- C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.
- D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections indicated below and prepare test reports.
- B. Infrared Camera Survey: Perform an infrared camera scan of walls, floors, and ceilings to determine where insulation and air barrier are not continuous, after insulation has been installed, but prior to plaster patching or new gypsum board installation.
1. Provide complete digital report with images of test results with recommendations for repairs.
- C. Repair or replace work where test results and inspections indicate that it does not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 PROTECTION

- A. Protect installed insulation and vapor retarders 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.

END OF SECTION