SECTION 072100 - THERMAL INSULATION

Spec Note: Verify and retain required measurement unit required for project.

1. GENERAL
	* + 1. RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

* + - * 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
			1. SUMMARY
				1. Section Includes:

Extruded polystyrene foam-plastic board insulation.

Molded (expanded) polystyrene foam-plastic board insulation.

Polyisocyanurate foam-plastic board insulation.

Mineral-wool blanket insulation.

Mineral-wool board insulation.

Loose-fill insulation.

* + - 1. SUBMITTALS
				1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
				4. Product Data: For the following:

Extruded polystyrene foam-plastic board insulation.

Molded (expanded) polystyrene foam-plastic board insulation.

Polyisocyanurate foam-plastic board insulation.

Mineral-wool blanket insulation.

Mineral-wool board insulation.

Loose-fill insulation.

* + - * 1. Samples:

Blanket, Batt or Roll: 12-inch-square.

Rigid Type: 12-inch-square.

Loose Type: 1 pint.

Retain “Sustainable Design Submittals” paragraph below if project is intended for LEED certification or has sustainable design requirements.

* + - * 1. Sustainable Design Submittals:

Use below only with extruded polystyrene insulation.

* + - * 1. Quality Control Submittal:

Certificate: Affidavit required under Quality Assurance Article.

"Installer's Certification" Paragraph below is required by the International Energy Conservation Code unless insulation materials are labeled by manufacturer to indicate R-value. Retain for loose-fill insulation and spray-applied cellulosic-fiber loose-fill insulation. Retain if deleting labeling requirements for other types of insulation material specified in Part 2.

* + - * 1. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.

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.

Sign, date, and post the certification in a conspicuous location on Project site.

* + - * 1. Product Test Reports: For each product, for tests performed by a qualified testing agency.
				2. Research Reports: For foam-plastic insulation, from UNIFORM CODE-ES.

Design Consultant to review code references and verify that the referenced sections/tables are current. Note that code references shall be based on the current version of the Uniform Code.

* + - 1. QUALITY ASSURANCE
				1. Allowable Thickness Variations: Manufacturer’s standard units which vary slightly from the thickness indicated may be acceptable, subject to the approval of the Director’s Representative.
				2. Thermal Resistance: The thicknesses shown are for the thermal resistance (R-Value in accordance with ASTM C 177 or ASTM C 518) specified for each material. The R-Values specified are minimum acceptable. Provide adjusted thicknesses as directed for the use of material having a different thermal resistance.

Use below only with extruded polystyrene insulation.

* + - * 1. Certification: Affidavit by the polystyrene thermal insulation manufacturer, certifying that the insulation was manufactured with CFC and HCFC-free blowing agents.
			1. DELIVERY, STORAGE, AND HANDLING
				1. 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.

Retain paragraph below for foam-plastic board insulation. Delete below if no flammable insulation.

* + - * 1. Protect foam-plastic board insulation as follows:

Do not expose to sunlight except to necessary extent for period of installation and concealment.

Protect against ignition. Do not deliver foam-plastic board materials to Project site until just before installation time.

Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

* + - 1. PROJECT CONDITIONS
				1. Do not proceed with the installation of insulation on walls or under slabs until the Work which follows (and which conceals the insulation) is ready to be performed.
				2. Examination of Substrate: Examine the substrate and the conditions under which the insulation Work is to be performed. Do not proceed with the insulation Work until unsatisfactory conditions have been corrected.
1. PRODUCTS

Delete insulation types below if not required for the project. board insulation must be protected following UL recommendations.

* + - 1. EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

Extruded polystyrene boards in this article are also called "XPS boards." Roman numeral designators in ASTM C578 are assigned in a fixed random sequence, and their numeric order does not reflect increasing strength or other characteristics.

* + - * 1. Extruded Polystyrene Board Insulation, Type IV: ASTM C578, Type IV, 25-psi minimum compressive strength; unfaced.

Edges and Ends: Square or tongue-and-groove at manufacturer’s option.

Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.

Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.

Retain "Fire Propagation Characteristics" Subparagraph below if required. Tested products are not available from all manufacturers for all types of assemblies.

Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

Identification mark in "Labeling" Subparagraph below is required by the International Energy Conservation Code unless insulation installer is providing certification specified in "Informational Submittals" Article.

Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

* + - 1. MOLDED (EXPANDED) POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

Molded (expanded) polystyrene board insulation in this article are also called "EPS boards," "expanded polystyrene boards," or "beadboards." Roman numeral designators in ASTM C578 are assigned in a fixed random sequence, and their numeric order does not reflect increasing strength or other characteristics.

* + - * 1. Molded (Expanded) Polystyrene Board Insulation, Type I: ASTM C578, Type I, 10-psi minimum compressive strength.

Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

* + - 1. POLYISOCYANURATE FOAM-PLASTIC BOARD INSULATION
				1. Polyisocyanurate Board Insulation, Foil Faced: ASTM C1289, foil faced, Type I, Class 1 or 2.

Retain "Fire Propagation Characteristics" Subparagraph below if required. Tested products are not available from all manufacturers for all types of assemblies.

Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

Identification mark in "Labeling" Subparagraph below is required by the International Energy Conservation Code unless insulation installer is providing certification specified in "Informational Submittals" Article.

Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

* + - * 1. Polyisocyanurate Board Insulation, Glass-Fiber-Mat Faced: ASTM C1289, glass-fiber-mat faced, Type II, Class 2.

Retain "Fire Propagation Characteristics" Subparagraph below if required. Tested products are not available from all manufacturers for all types of assemblies.

Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

Identification mark in "Labeling" Subparagraph below is required by the International Energy Conservation Code unless insulation installer is providing certification specified in "Informational Submittals" Article.

Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

* + - 1. MINERAL-WOOL BOARD INSULATION

Copy paragraphs below and re-edit for each type of insulation required. Insert drawing designations to identify each product. Use these designations on Drawings to show where each insulation type is required.

Delete Thermal Resistivity if not required. Edit as necessary

* + - * 1. Mineral-Wool Board Insulation, Types IA and IB, Unfaced: ASTM C612, Types IA and IB; passing ASTM E136 for combustion characteristics.

Nominal Density: 4 lb/cu. ft.

Flame-Spread Index: Not more than 15 when tested in accordance with ASTM E84.

Smoke-Developed Index: Not more than zero when tested in accordance with ASTM E84.

Identification mark in "Labeling" Subparagraph below is required by the International Energy Conservation Code unless insulation installer is providing certification specified in "Informational Submittals" Article.

Labeling: Provide identification of mark indicating R-value of each piece of insulation inches and wider in width.

* + - * 1. Mineral-Wool Board Insulation, Types IA and IB, Faced: ASTM C612, Types IA and IB; faced on one side with foil-scrim or foil-scrim-polyethylene vapor retarder.

Nominal Density: 4 lb/cu. ft.

Flame-Spread Index: Not more than 15 when tested in accordance with ASTM E84.

Smoke-Developed Index: Not more than zero when tested in accordance with ASTM E84.

Identification mark in "Labeling" Subparagraph below is required by the International Energy Conservation Code unless insulation installer is providing certification specified in "Informational Submittals" Article.

Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

* + - * 1. Mineral-Wool Board Insulation, Type II, Unfaced: ASTM C612, Type II; passing ASTM E136 for combustion characteristics.

Nominal Density: 6 lb/cu. ft.

Flame-Spread Index: Not more than 15 when tested in accordance with ASTM E84.

Smoke-Developed Index: Not more than zero when tested in accordance with ASTM E84.

Identification mark in "Labeling" Subparagraph below is required by the International Energy Conservation Code unless insulation installer is providing certification specified in "Informational Submittals" Article.

Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

* + - * 1. Mineral-Wool Board Insulation, Type II, Faced: ASTM C612, Type II; faced on one side with foil-scrim or foil-scrim-polyethylene vapor retarder.

Nominal Density: 6 lb/cu. ft.

Flame-Spread Index: Not more than 15 when tested in accordance with ASTM E84.

Smoke-Developed Index: Not more than zero when tested in accordance with ASTM E84.

Identification mark in "Labeling" Subparagraph below is required by the International Energy Conservation Code unless insulation installer is providing certification specified in "Informational Submittals" Article.

Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

* + - 1. MINERAL-WOOL BLANKET INSULATION

Copy paragraphs below and re-edit for each type of insulation required. Insert drawing designations to identify each product. Use these designations on Drawings to show where each insulation type is required.

Delete Thermal Resistivity if not required. Edit as necessary

Typical mineral-fiber thermal insulation is classified into the following types, classes, and categories: Type I, Blankets without membrane coverings, unfaced insulation; Type II, blankets with a non-reflective vapor retarder membrane covering one principle face, typically kraft faced (Class A, Class B, and Class C (Category 1 and Category 2)); and Type III, blankets with a reflective vapor retarder membrane covering one principle face, foil faced(Class A, Class B, and Class C (Category 1 and Category 2)).

Class A, membrane faced surface with flame spread of 25 or less. For use in exposed applications meeting building code requirements. Class B, membrane faced surface with flame propagation resistance critical radiant flux of 0.12 W/cm2 or greater. Class C, membrane faced surface not rated for flame propagation resistance (for use in non-exposed applications only).

* + - * 1. Mineral-Wool Blanket Insulation, Unfaced: ASTM C665, Type I (blankets without membrane facing); consisting of fibers; passing ASTM E136 for combustion characteristics.

Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.

Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.

Identification mark in "Labeling" Subparagraph below is required by the International Energy Conservation Code unless insulation installer is providing certification specified in "Informational Submittals" Article.

Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

Below is standard Kraft-Faced Vapor Barrier. Use in non-exposed applications only.

* + - * 1. Mineral-Wool Blanket Insulation, Faced: ASTM C665, Type II, Class C, Category I (blankets with nonreflective membrane facing); consisting of fibers.

Below is special fire resistive foil-faced vapor barrier.

* + - * 1. Mineral-Wool Blanket Insulation, Reinforced-Foil Faced: ASTM C665, Type III (reflective faced); Class A.

Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.

Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.

Identification mark in "Labeling" Subparagraph below is required by the International Energy Conservation Code unless insulation installer is providing certification specified in "Informational Submittals" Article.

Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

Below is a standard foil-faced vapor barrier.

* + - * 1. Mineral-Wool Blanket Insulation, Reinforced-Foil Faced: ASTM C665, Type III (reflective faced); Class B, faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.

Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.

Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.

Identification mark in "Labeling" Subparagraph below is required by the International Energy Conservation Code unless insulation installer is providing certification specified in "Informational Submittals" Article.

Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

Below is standard foil-faced vapor barrier. Use in non-exposed applications only.

* + - * 1. Mineral-Wool Blanket Insulation, Reinforced-Foil Faced: ASTM C665, Type III (reflective faced); Class C, Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.
			1. LOOSE-FILL INSULATION

Copy paragraphs below and re-edit for each type of insulation required. Insert drawing designations to identify each product. Use these designations on Drawings to show where each insulation type is required.

* + - * 1. Cellulosic-Fiber Loose-Fill Insulation: ASTM C739, chemically treated for flame-resistance, processing, and handling characteristics.
				2. Glass-Fiber Loose-Fill Insulation: ASTM C764, **[Type I for pneumatic application] [or] [Type II for poured application]**

Description: Rock, slag, or glass processed into fiber and formed into loose resilient wool mass or granular nodules.

Flame-Spread Index: Not more than 5 when tested in accordance with ASTM E84.

Smoke-Developed Index: Not more than 5 when tested in accordance with ASTM E84.

Use below where masonry unit cores are to be filled and wherever rigid types cannot be successfully installed. Also retain below for filling inaccessible spaces which cannot be reached by other forms of insulation.

* + - * 1. Loose Granular Insulation: Perlite (expanded volcanic aggregate); ASTM C 549.
			1. INSULATION FASTENERS
				1. Mechanical Anchors: Type and size shown or, if not shown, as recommended by the insulation manufacturer for the type of application shown and condition of substrate.
				2. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.
			2. ACCESSORIES
				1. Vapor Barrier: Polyethylene sheeting; ASTM D 4397; 6 mils minimum thickness, 3.7 g/m2 per 24 hr. maximum water vapor transmission rate.

Retain "Insulation for Miscellaneous Voids" Paragraph below for miscellaneous voids if needed for thermal protection or air-infiltration reduction.

* + - * 1. Insulation for Miscellaneous Voids:

Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.

Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

Polyurethane Pour-In-Place Insulation: Closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84, specifically formulated for pour-in-place applications.

Retain "Adhesive for Bonding Insulation" Paragraph below for insulation adhesively bonded to substrates.

* + - * 1. 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.
1. EXECUTION
	* + 1. PREPARATION
				1. 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.

Delete below if no loose insulation.

* + - * 1. Close off openings in areas to receive loose insulation to permanently prevent escape of insulation.
			1. INSTALLATION, GENERAL
				1. Comply with insulation manufacturer's written instructions applicable to products and applications. If printed instructions are not available or do not apply to the project conditions, consult the manufacturer’s technical representative for specific recommendations before proceeding with the work.
				2. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

First paragraph below is required by the International Energy Conservation Code unless insulation installer is providing certification specified in "Informational Submittals" Article.

* + - * 1. Install insulation with manufacturer's R-value label exposed after insulation is installed.
				2. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
				3. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, 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.
			1. INSTALLATION OF SLAB INSULATION
				1. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

If not otherwise indicated, extend insulation a minimum of **[24 inches] [36 inches] <Insert dimension>** below exterior grade line.

* + - * 1. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

If not otherwise indicated, extend insulation a minimum of **[24 inches] [36 inches] <Insert dimension>** in from exterior walls.

* + - 1. INSTALLATION OF FOUNDATION WALL INSULATION

Verify, with manufacturer, methods of installation of insulation for concrete substrates. Revise paragraph below to indicate type of concrete substrate, such as architectural precast concrete panels or cast-in-place concrete walls. Revise to include channels for exposed insulation if required.

* + - * 1. Butt panels together for tight fit.

Retain either "Anchor Installation" or "Adhesive Installation" Paragraph below to suit Project.

* + - * 1. Anchor Installation: Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:

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.

Show width of cavity on Drawings.

Apply insulation standoffs to each spindle to create cavity width indicated on Drawings between concrete substrate and insulation.

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.

Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

* + - * 1. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.
			1. INSTALLATION OF CAVITY-WALL INSULATION
				1. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face.

Fit courses of insulation between**[ wall ties and other]** obstructions, with edges butted tightly in both directions, and with faces flush.

Press units firmly against inside substrates.

Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 042000 "Unit Masonry."

Retain subparagraph below if insulation does not fill cavity. Coordinate with Section 042000 "Unit Masonry" where ties are specified.

* + - * 1. Mineral-Wool Board Insulation: Install insulation fasteners 4 inches from each corner of board insulation, at center of board.

Fit courses of insulation between**[ masonry wall ties and other]** obstructions, with edges butted tightly in both directions, and with faces flush.

Press units firmly against inside substrates.

* + - 1. INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION
				1. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

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.

Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

Retain first subparagraph below for eave ventilation.

Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.

Retain first subparagraph below for metal-framed construction.

For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

Retain first subparagraph below for wood-framed construction.

For wood-framed construction, install blankets according to ASTM C1320 and as follows:

With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facing and seal each continuous area of insulation to ensure airtight installation.

Specify location of vapor retarder in "Exterior Walls" Subparagraph below based on vapor-flow analysis of a construction assembly.

Exterior Walls: Set units with facing placed toward **[exterior of construction] [interior of construction] [as indicated on Drawings]**.

Retain "Interior Walls" Subparagraph below for interior walls around high-humidity areas such as shower rooms and swimming pools.

Interior Walls: Set units with facing placed **[as indicated on Drawings] [toward areas of high humidity] <Insert location>**.

* + - * 1. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.

Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

Retain "Loose-Fill Insulation" Paragraph below for loose-fill glass-fiber or cellulosic insulation.

* + - * 1. Loose-Fill Insulation: Apply according to ASTM C1015.

Level horizontal applications to uniform thickness as indicated, lightly settle to uniform density, but do not compact excessively.

Retain subparagraph below for cellulosic-fiber loose-fill insulation.

For cellulosic-fiber loose-fill insulation, comply with CIMA's Bulletin #2, "Standard Practice for Installing Cellulose Insulation."

Retain "Spray-Applied Cellulosic Insulation" Paragraph below for self-supported, spray-applied cellulosic insulation or spray polyurethane foam insulation.

* + - * 1. Spray-Applied Cellulosic Insulation:

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.

* + - 1. INSTALLATION OF CURTAIN-WALL INSULATION
				1. Install board insulation in curtain-wall construction according to curtain-wall manufacturer's written instructions.

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.

Maintain cavity width of dimension indicated on Drawings between insulation and glass.

Install insulation to fit snugly without bowing.

* + - 1. PROTECTION
				1. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.
				2. 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 072100