SECTION 07 21 00 – THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Provide the Work of this Section in accordance with requirements of the Contract Documents.

B. Section Includes but is not limited to:

1. Foam-plastic board insulation **INS-01C**.
2. Mineral-rock wool board insulation **INS-01, INS-03A, INS-03B.**
3. Mineral-rock wool blanket insulation **INS-06A**.
4. High performance insulation **INS-09**.
5. Spray polyurethane foam insulation **INS-08**.

C. This Section includes the following insulation uses:

1. Perimeter wall insulation (supporting backfill).
2. Cavity-wall insulation.
3. Concealed building insulation
4. With Curtainwall spandrel back-pan.

D. Related Work:

1. Division 04, Section 04 20 00 "Unit Masonry" for insulation installed in cavity walls.
2. Division 07, Section 07 21 50 "Sprayed Thermal Insulation" for spray applied fiberglass and mineral wool installation installed over spray fireproofing.
3. Division 07, Section 07 27 26 "Fluid Applied Air and Water Barriers" for air barrier systems required for continuity of air barriers.
4. Division 07, Section 07 52 16 "Modified Bituminous Membrane Roofing" for insulation specified as part of roofing construction.
5. Division 07, Section 07 84 46 "Fire-Resistive Joint Firestopping" for insulation installed as part of a perimeter fire-resistive joint system.
6. Division 08, Section 08 40 00 “Exterior Enclosure System Requirements”.
7. Division 08 Section “Curtainwall” for metal back pan in conjunction with INS-01 where indicated on Drawings.
8. Division 09, Section 09 21 00 “Gypsum Board Assemblies” for sound attenuation fire blankets (SAFB), and acoustical blanket insulation.
9. Division 21, Section 21 07 00 "Fire-Suppression Systems Insulation."
10. Division 22, Section 22 07 00 "Plumbing Insulation."
11. Division 23, Section 23 07 00 "HVAC Insulation."

1.2 DEFINITIONS

A. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Sustainable Design 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 required to comply with requirements for regional materials, 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: Building Products must be tested and compliant with the California Department of Public-Health (CDPH) Standard Method V1.1-2010, using the applicable exposure scenario.
a. For Insulation products, submit documentation of VOC emissions testing compliance in the form of GreenGuard Gold certification, SCS Indoor Advantage Gold certification or CDPH Standard Method v1.2 compliance verification.
b. Adhesives and Sealants wet applied on site: Submit printed statement of showing compliance with the applicable chemical content requirements of SCAQMD Rule 1168-2005.
c. Alternative tests for VOC include ASTM D2369-10, ISO 11890, ASTM D6886-03; or ISO 11890-2.
d. Methylene Chloride and perchloroethylene may not be added to paints, coating, adhesive or sealants
e. Insulation: Submit documentation showing that insulation used in the project has low formaldehyde emissions that meet the California Air Resources Board ATCM for formaldehyde requirements for ultra-low emitting formaldehyde (ULEF) resins or no added formaldehyde resins.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Copies of certified test reports showing compliance with specified performance values, including R-values (aged values for plastic insulations), densities, compression strengths, fire performance characteristics, per ratings, water absorption ratings and similar properties. Submit product data based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

B. Sustainable Design Submittals:

1. Building Product Disclosure and Optimization - Sourcing of Raw Materials:

a. Raw Material Sources and Extraction Reporting: Submit Raw materials supplier corporate Sustainability Reports (CSRs); documenting responsible extraction;

including extraction locations, long term ecologically responsible land use, commitment to reducing environmental harms from extraction and manufacturing processes, and a commitment to meeting applicable standards or programs that address responsible sourcing criteria

1) Submit manufacturers' self-declared reports
2) Submit third party verified corporate sustainability reports (CSR) using one of the following frameworks"

a) Global Reporting Initiative (GRI) Sustainability Report
b) Organization for Economic Co-operation and Development (OECD) Guidelines for Multinational Enterprises
c) UN Global Compact
d) ISO 26000
e) USGBC approved program.

2. Building Product Disclosure and Optimization - Material Ingredients

a. Material Ingredient Optimization: Submit manufacturer's Environmental Product Declaration (EPD) and at least one of the following:

1) GreenScreen V1.2 Benchmark: Third party report prepared by a licensed GreenScreen List Translator, or a full GreenScreen Assessment.
2) Cradle to Cradle: Manufacturer's published literature for the product bearing the Cradle-to-Cradle logo.
3) International Alternative Compliance Path - REACH Optimization
4) Declare: Manufacturer's completed Product Declaration Form
5) Other programs approved by USGBC

b. Material Ingredient Optimization: Submit documentation confirming chemical inventory of products to at least 0.01 % (100pm) 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. Research/Evaluation Reports: For foam-plastic insulation.

1.5 QUALITY ASSURANCE

A. Mockup: Prior to installing exterior wall systems, construct exterior wall thermal insulation as part of composite mockup indicated on Mockup Elevation Sheet. Incorporate each type of exterior wall construction and finish to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Coordinate with Exterior Wall Contractor and each of the contractors listed in Summary Paragraph of "Exterior Enclosure Systems". Provide materials in this section to create the composite mockup indicated

1. Provide thermal insulation, fire safing, spandrel insulation for incorporation in composite curtain wall assembly.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
4. Demolish and remove mockups when directed, unless otherwise indicated.

1.6 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 as follows:

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

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not install insulation during inclement weather or when surfaces are moist.

B. Do not install insulation in exterior wall assemblies until exterior sheathing has been installed and joints sealed in accordance with Division 06, Section 06 16 00 "Sheathing", and air barrier has been fully applied to exterior face of sheathing in accordance with applicable Division 06.

1. Insulation that is exposed to moisture due to inadequate or compromised environmental protections, or that becomes wet or moist by other means subsequent to installation, shall be completely removed and discarded, and replaced with new materials.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Resistivity: Where thermal resistivity properties of insulation materials are designated by R-values, they represent the rate of heat flow through a homogenous material exactly 1” thick, measured by test method included in referenced material standard or otherwise indicated. They are 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.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having

jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Surface-Burning Characteristics: ASTM E84.
2. Fire-Resistance Ratings: ASTM E119.
3. Combustion Characteristics: ASTM E136.

C. Source Limitations: Obtain each type of building insulation through one source.

2.2 MATERIALS, GENERAL

A. Recycled Content:

1. Unless otherwise indicated in articles below, provide glass, and slag-wool-fiber/rock-wool-fiber insulation with recycled content so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
2. Unless otherwise indicated in articles below, provide polystyrene insulation with recycled content so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 10 percent.

B. Regional Materials: Provide a minimum of 20 percent of building materials (by cost) that are regionally extracted, processed, and manufactured materials within a radius of 100 miles.

C. Formaldehyde Free: Provide formaldehyde-free products, or low emitting products when tested according to ASTM D5116 and shown to emit less than 0.05-ppm formaldehyde.

D. Low-Emitting Materials:

1. Architectural paints and coatings wet-applied inside the weather-proofing system must meet the VOC general emissions testing criteria of CDPH Standard Method v1.2.
2. All paints and coatings 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 "Sustainable Design Requirements - LEED v4 BD+C."
3. Adhesives and Sealants wet-applied inside the weather-proofing system must meet the VOC general emissions testing criteria of CDPH Standard Method v1.2.
4. 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."
5. Provide non-structural composite wood products that contain either No Added Formaldehyde (NAF) resins or Ultra Low Emitting Formaldehyde (ULEF) resins per CARB ATCM criteria noted in Division 01 Section 01 81 13.14 "Sustainable Design Requirements - LEED v4 BD+C.".
6. Provide structural composite wood products tested per EN 717-1:2014 as compliant with emissions class E1. Structural composite wood, with no added urea-formaldehyde resins or surface treatments and certified per the following: PS 1-09 or PS 2-10 for plywood, PS 2-10 for OSB, ASTM D 5446-13 for structural composite lumber.

2.3 FOAM-PLASTIC BOARD INSULATION

A. Extruded-Polystyrene Board Insulation **INS-01C**: Rigid, closed-cell extruded expanded polystyrene with integral high-density skin complying with ASTM C578, of type and minimum

compressive strength indicated below, with R-values of 5.4 per inch at 40 deg F and 5 per inch at 75 deg. F.; maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

1. ASTM C578, Type VI, 1.8 lbs./cu ft. density, and 40 psi compressive strength; manufacturer's standard sizes; thickness as shown; one of the following:

   a. "Styrofoam Brand Highload 40" (DuPont PBS).
   b. "Foamular 400" (Owens Corning Foam Insulation, LLC).
   c. "GreenGuard Type VI 40 PSI XPS Insulation Board" (Kingspan Insulation).

B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

2.4 MINERAL-WOOL BOARD INSULATION

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.

B. Unfaced, Mineral-Wool Board Insulation **INS-01**: ASTM C612; Types IA, IB, III, IVA, IVB, composed of rock-wool fibers, slag-wool fibers, with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E84; passing ASTM E136 for combustion characteristics Nominal density of 4.5 lb/cu. ft. , R-Value of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F. Provide one of the following:

1. "Thermafiber Rainbarrier 45" (Thermafiber Inc., Division Owens Corning).
2. "CavityRock" (Rockwool).
3. "JM Rainscreen" (Johns Manville).
4. "Rainscreen Duo Slab" (Rock Wool Manufacturing Co.)

C. Foil-Faced, Mineral-Wool Board Insulation **INS-03A**: Insulation specifically produced for use in curtain walls utilizing rock-wool fibers, slag-wool fibers combined with thermosetting resins; complying with ASTM C612 Type IA, IB, II, III, ICA, ASTM C665 Class A, Category I; faced on one side with foil-scrim or foil-scrim-polyethylene vapor retarder; with maximum flame-spread and smoke-developed indexes of 25 and 5, respectively, per ASTM E84; manufacturer's standard sizes;; thickness as shown; and of nominal density of 8 lb/cu. ft.(128 kg/cu. m), Type III, thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F. (30.2 K x m/W at 24 deg C). Provide one of the following:

1. "Thermafiber FireSpan 90, Formaldehyde Free" (Thermafiber Inc., Division Owens Corning).
2. "Curtain Wall CW 90 Insulation" (Fibrex, Inc.).
3. "Delta CW8A Board" (Rock Wool Manufacturing Co).
4. "CurtainRock 80" (Rockwool).
5. "JM MinWool Curtain Wall" (Johns Manville).

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D. Unfaced, Mineral-Wool Board Insulation **INS-03B**: Insulation specifically produced for use in curtain walls utilizing rock-wool fibers, slag-wool fibers combined with thermosetting resins; complying with ASTM C612; Type IA, IB, III, ICA, ASTM C665 Class A, Category I: faced on one side with foil-scrim or foil-scrim-polyethylene vapor retarder; with maximum flame-spread and smoke-developed indexes of 15 and 5, respectively, per ASTM E84; in manufacturer's standard sizes ; in thickness as shown; and of nominal density of 8 lb/cu. ft. (128 kg/cu. m), Type III, with thermal resistivity of 4.3 deg F x h x sq. ft./BTU x in. at 75 deg F (30.2 K x m/W at 24 deg C). Provide one of the following:

1. "Thermafiber FireSpan 90, Formaldehyde Free" (Thermafiber Inc., Division Owens Corning).
2. "Curtain Wall CW 90 Insulation" (Fibrex, Inc.).
3. “Delta CW8A Board” (Rock Wool Manufacturing Co).
4. "CurtainRock 80" (Rockwool).
5. “JM MinWool Curtain Wall" (Johns Manville).

2.5 MINERAL WOOL BLANKET INSUALTION

A. Unfaced, Mineral-Wool Blanket Insulation **INS-06A**: Complying with ASTM C665, Type I (blankets without membrane facing); composed of rock-wool fibers, slag-wool fibers; with maximum flame-spread and smoke-developed indexes of 0 and 0, respectively, per ASTM E84; passing ASTM E136 for combustion characteristics. Provide one of the following:

1. "Thermafiber SAFB, Formaldehyde- Free" (Owens Corning).
2. “JM MinWool Safing” (Johns Manville)
3. "Roxul Safe" (Rockwool).

2.6 HIGH PERFORMANCE INSULATION

A. Insulation Type **INS-09**: Flexible, high performance, hydrophobic, silica type blanket insulation complying with ASTM C518, or based on Aerogel type technology, having Class A fire resistance in accordance with ASTM E84, permeability of 41 US Perms in accordance with ASTM E96, having minimum 0.31 lb/ft^3 density, 10 psi compressive strength and minimum R value of 9 per inch thickness, 3/8 inch thickness. Fibreglass or mineral wool type insulation is not acceptable.

1. Acceptable Manufacturers and Products: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Dow Corning Corporation; Dow Corning HPI-1000 Building Insulation Blanket.
    b. Cabot Corporation; Cabot Aerogel Thermal Wrap Insulation.
    c. Aspen Aerogels Inc.; Spaceloft Insulation.
    d. Slentex ; BASF.

2.7 SPRAY POLYURETHANE FOAM INSULATION

A. Closed-Cell Polyurethane Foam Insulation **INS-08**: Two component closed cell spray applied rigid polyurethane foam system, ASTM C1029, Type II, with maximum flame-spread and smoke-developed indexes of 12 and 400, respectively, per ASTM E84; Greenguard Gold Certified Low VOC, using recycled PET plastic materials, with Honeywell's Solstice HFO liquid blowing agent with ultra low global warming potential (GWP) of 1; and R value of 7.4 per inch.

1. Products: As a basis of Design Spray Foam insulation shall be "HEATLOK HFO Pro" as manufactured by Huntman Building Solutions. Equivalent Products by one of the following will be considered:

    a. BASF Corporation.
    b. DuPont BPS.
    c. Henry Company.
    d. SWD Urethane Company.

B. Properties:

1. Density: Nominal 2.1 lbs/cf per ASTM D1622
2. Design R-Value: R-7.4 per inch thickness per ASTM C518
3. Air Leakage: <0.02L/sm2 @ 75 Pa @ 1 inch per ASTM E283/ASTM E2178
4. System Air Leakage: <0.0022 L/sm2 per ASTM E2357
5. Water Vapor Permeance: <1 perm @1.42 inch per ASTM E96
6. Closed-cell content: Greater than 90% per ASTM D2856
7. Compressive strength: 28.7 psi per ASTM D1621
8. Tensile strength: 46.2 psi per ASTM D1623 Type C

2.8 MISCELLANEOUS ITEMS

A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by insulation manufacturer for sealing joints and penetrations in foil faced insulation, which has the perm rating and fire resistance characteristics similar to that of the insulation.

1. 3M “Venture Aluminum Foil Tape 1520CW” or approved equal for use at intersections of foil to foil and foil to metal.
2. 3M “Air and Vapor Barrier 3015” or approved equal for use at intersections of foil face insulation to concrete surfaces.

B. Primers: Provide tape manufacturer recommended primer to properly prepare concrete and metal surfaces to bond vapor retarding tape with foil faced insulation to metal and concrete substrates.

2.9 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
   b. North Insulation Fastener Co. Ltd., Perforated Insulation Hangers
   c. Gemco; Spindle Type.

2. Plate: Perforated, galvanized carbon-steel sheet, 0.030-inch (0.762 mm) thick by 2 inches (50 mm) square.
3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation indicated.

B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Gemco; 90-Degree Insulation Hangers.
   b. AGM Industries, Inc.; 90-degree Insulation Angle Hangers.
   c. North Insulation Fastener Co. Ltd.; 90 deg Angle Hangers.

2. Angle: Formed from 0.030-inch- (0.762-mm-) thick, perforated, galvanized carbon-steel sheet with each leg 2 inches (50 mm) square.
3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation indicated.

C. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates. Provide product approved by anchor manufacturer and compliant with local VOC standards.

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 that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

1. Verify if concrete, steel and other substrates are properly prepared for use of vapor retarder tape, and prime surfaces where necessary to provide a suitable surface for application of vapor retarder tape.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. 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. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Water-Piping Coordination: If water piping is located on inside of insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

E. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF PERIMETER AND BELOW-GRADE INSULATION

A. On vertical surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) below exterior grade line.

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

1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) in from exterior walls.

3.5 INSTALLATION OF FOUNDATION WALL INSULATION

A. Butt panels together for tight fit.

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

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. Apply insulation standoffs to each spindle to create cavity width indicated on Drawings between concrete substrate and insulation.
3. 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.
4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

C. Adhesive Installation: Install with adhesive or press into tacky waterproofing according to manufacturer's written instructions.

3.6 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation within cavity created between sheathing panels/CMU and enclosure skins by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to sheathing/CMU substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Foam-Plastic Board Insulation: Seal joints between units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. 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. 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.

D. 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, 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 insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.
2. Mineral Wool Fiber Blanket Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.

3.7 INSTALLATION OF INSULATION FOR CONCRETE SUBSTRATES

A. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:

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 indicated.
2. Apply insulation standoffs to each spindle to create cavity width indicated between concrete substrate and insulation.
3. 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 below indicated thickness.
4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

3.8 INSTALLATION OF CURTAIN-WALL INSULATION

A. Install board insulation in curtain-wall construction where indicated on Drawings according to curtain-wall manufacturer's written instructions.

1. Hold insulation in place by securing metal clips and straps or integral pockets within 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 between insulation and glass.
2. Install insulation where it contacts perimeter fire-containment system to prevent insulation from bowing under pressure from perimeter fire-containment system.
3. Foil-Faced Insulation: At spandrel panels that do not have metal back pan enclosures and elsewhere as shown, provide foil faced insulation panels. Tape joints and ruptures in vapor-retarder facings and seal each continuous area of insulation to ensure airtight installation.

a. Exterior Walls: Set units with facing toward the warm side of construction unless otherwise indicated on Drawings.
b. Tape ends of insulation to adjacent surfaces to seal vapor barrier.
c. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape.

3.9 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.

3.10 INSULATION SCHEDULE

A. General: The following list identifies where each type of insulation is generally used. Except as otherwise shown on drawings, provide the following types of insulation in locations listed below and where indicated:
1. Insulation Type **INS-01**: Unfaced mineral wool-fiber board insulation for use in exterior walls beneath metal panel systems above grade where visibility requires the insulation to be black colored.
2. Insulation Type **INS-01C**: Extruded polystyrene board insulation Type VI, fabricated for high compression installations in plaza decks requiring 40 psi compressive strength
3. Insulation Type **INS-03A**: Foil-faced mineral-wool-fiber board insulation for use in curtain wall installations and in spandrel panels.
4. Insulation Type **INS-03B**: Unfaced mineral-wool-fiber board insulation for use in curtain wall installations and in spandrel panels.
5. Insulation Type **INS-06A**: Unfaced, mineral-wool blanket insulation for use in miscellaneous filler installations as shown on drawings.
6. Insulation Type **INS-08**: Spray applied polyurethane insulation for use in tight cavities, in exterior wall cavities, curtain wall mullions and elsewhere as necessary to maintain the continuity of insulation.
7. Insulation Type **INS-09**: Install high performance insulation in narrow spaces that are required to provide insulation but cannot meet the project mandated R value.

END OF SECTION