SECTION 072100 - THERMAL INSULATION Updated 5/2020

This Section may be edited and revised by inserting or deleting text to meet requirements specific to your project. The Document is provided in a modified format.

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

Fiberglass board insulation; Rigid, Semi-Rigid

Fiberglass blanket insulation; Flexible

Fiberglass Loose-fill insulation.

Spray-On Fiberglass

High-Performance Ventilated Attic Insulation

Concealed / Interstitial Space insulation

Vapor retarders.

Fluid Applied Joint Seal Air Barriers.

* + - 1. REFERENCES
				1. ASTM E 90 – “Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements”; 2009.
				2. ASTM E 84 – “Standard Test Method for Surface Burning Characteristics of Building Materials”; 2000a.
				3. ASTM C 423 – “Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method”; 2000.
				4. ASTM C 518 – “Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus”; 1998.
				5. ASTM C 612 – “Standard Specification for Mineral Fiber Block and Board Thermal Insulation”; 2000a.
				6. ASTM C 665 – “Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing”; 1998.
				7. ASTM C 764 – “Standard Specification for Mineral Fiber Loose-Fill Thermal Insulation”; 1999.
				8. ASTM C 1136 – “Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation”; 2000.
				9. ASTM E 96 – “Standard Test Methods for Water Vapor Transmission of Materials”; 2000.
				10. ASTM E 136 – “Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C”; 1999.
				11. ASTM D 5116 – “Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions From Indoor Materials/Products”.
				12. ASHRAE 189.1 – “Standard for the Design of High-Performance Green Buildings Except
				Low-Rise Residential Buildings”.
				13. UL 723 – “Standard for Test for Surface Burning Characteristics of Building Materials”.
				14. NAIMA – “Recommendations for Installation in Residential and Other Light Frame Construction Fiber Glass Building Insulation; North American Insulation Manufacturers Association”; 1999.
				15. NAIMA – “Recommendations for Installation in Residential and Other Light Frame Construction Fiber Glass Loose Fill Insulation; North American Insulation Manufacturers Association”; 1997.
				16. TAPPI T 803 – “Puncture Resistance of Container Board”; TAPPI; 1999.
				17. MEA #498-90-M
				18. State of Minnesota
				19. California Energy Commission
				20. Environment UL 2818 – GREENGUARD Certification Program for Chemical Emissions For Building Materials, Finishes, and Furnishings, Edition 1. Standard used in the Certification for GREENGUARD and GREENGUARD Gold.
				21. NFPA 13 – Standard For The Installation Of Sprinkler Systems
				22. California Title 24, Section 150.1(C).1.ii – Option B High-Performance Ventilated Attic Code Requirement.
				23. California Department of Public Health - "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 16.5 mcg/cu. m or 13.5 ppb, whichever is less, except for insulation manufactured without formaldehyde.
				24. RESNET – Residential Energy Services Network - a recognized national standards-making body for building energy efficiency rating and certification systems in the United States.
			2. DEFINITIONS
				1. Thermal Conductivity (K value): Heat flow property of a homogeneous material; the lower the “k” the better the insulating value. Expressed in units of Btu-inch/hour per square foot per degree F.
				2. Underwriters Laboratories Environment (UL Environment): independent, third-party green claims validation, product assessment and certification.

1. Environmental Claim Validation (ECV): Independent third-party review to single attribute environmental claims.

 a. Formaldehyde Free: Independent third-party validation of claim that a product does not contain formaldehyde (or formaldehyde precursors) using a combination of auditing raw material input and testing of chemical emission from the product.
 b. Recycled Content:

 1. Pre-Consumer - materials used or created from one manufacturing process which are collected as scrap and placed back into another manufacturing process rather than being placed in a landfill or incinerated.
 2. Post-Consumer - materials such as bottled glass collected at curbside or other collection sites after consumer use.

2. GREENGUARD Certification: Health based emission testing criteria for chemicals; requiring total VOC emission levels for products.
3. GREENGUARD Gold: Emission testing criteria for chemicals requiring lower total VOC emission limit levels for products acceptable for use in environments such as schools and healthcare facilities. Complies with California’s Department of Public Health (CDPH) “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers”; Version 1.1 (2010), also known as California Section 01350 .
4. Environmental Product Declaration (EPD): Independently verified and registered document providing information about the life-cycle impact of products.

* + - * 1. Health Product Declaration (HPD): Product disclosure document containing an inventory of the contents of a product for its end use and the associated health hazards.
				2. EPA: Environmental Protection Agency.
				3. WHO: World Health Organization.
				4. ILFI: International Living Institute; an international sustainable building certification program.

1. DECLARE: Ingredients label for Building Products

 a. Red List Free: 100% ingredients disclosure to 100 ppm to not contain any Red List chemicals of concern.
 b. LBC Red List Compliant: Ingredients disclosure to meet 99% of Red List chemicals at 100 ppm and may contain one or more exceptions for meeting Living Building Challenge (LBC) criteria.
 c. Declared: 100% ingredients disclosure to 100 ppm, but contains one or more Red List chemicals that are covered by an existing exception.

* + - * 1. LEED: Leadership in Energy and Environmental Design, a voluntary rating system for high performance green buildings developed by the US Green Building Council (USGBC).
				2. Sustainable Minds (SM) Transparency Catalog: Designed as an educational marketing platform to provide access to products with environmental and material disclosures that qualify for Collaborative for High Performance Schools, LEED v4, Green Globes, the Well Building Standard and the Living Building Challenge ­– from all manufacturers, all program operators and all material disclosure rating systems. Available at: [**www.transparencycatalog.com/showroom/knauf-insulation**](http://www.transparencycatalog.com/company/knauf-insulation).
				3. EUCEB: The European Certification Board for Mineral Wool Products, a voluntary certification of the conformity to meet the bio-solubility criteria of mineral wool fibers.
				4. Polybrominated diphenyl ethers (PBDE) such as Penta-BDE, Octa-BDE or Deca-BDE fire retardants: used in the manufacture of some insulation facings.
				5. UL Classified: Underwriters Laboratory product label of fire resistance testing that includes
				on-going evaluation of the product to assure it continues to meet the Fire Hazard Classification (FHC) 25 Flame Spread; 50 Smoke Developed rating; unlike other FHC testing which is a
				one-time only test.
				6. ASJ+: All Service Jacket composed of aluminum foil reinforced with glass scrim bonded to a kraft paper interleaving with an outer film layer leaving no paper exposed.
				7. ASJ: All Service Jacket (no outer film).
				8. FSK: Foil Scrim Kraft; jacketing.
				9. KSK: Kraft Scrim Kraft; jacketing.
				10. FSP: Foil Scrim Polyester; jacketing.
			1. ACTION SUBMITTALS
				1. Product Data: For each type of product indicated.

				1. Individual Data Sheet and Submittal Sheet.
				2. EPD Submittals: Third Party Validated.

				1. EPD or HPD Product Summary Sheet.
				3. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and pre-consumer recycled content and cost.
2. Product Data: For adhesives, indicating VOC content.

3. Laboratory Certificates or Validations: For adhesives, indicating compliance with
 requirements for low-emitting materials.
4. Laboratory Certificates or Validations : For insulation, indicating compliance with
 requirements for low-emitting materials.

* + - * 1. LEED v 4 Submittals:

Product Data for Credit Energy and Atmosphere (EA) – Minimum Energy Performance, Optimize Energy Performance.

Product Data for Credit Materials and Resources (MR) – Building Product Disclosure & Optimization – EPD, Building Product Disclosure & Optimization – Source of Raw Materials, Building Product Disclosure & Optimization – Material Ingredients.

3. Product Data for Credit Indoor Environmental Quality (EQ) – Minimum Indoor Quality Performance, Minimum Acoustic Performance, Low Emitting Materials.

* + - 1. INFORMATIONAL SUBMITTALS
				1. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency; as required for each product.
			2. QUALITY ASSURANCE
				1. Bio-Based Binder: a plant based sustainable chemistry bond that holds the fiberglass product together; replacing the phenol/formaldehyde (PF) binder traditionally used in fiberglass products.
				2. Surface Burning Characteristics: For insulation and related materials UL/ULC Classified per UL 723 or meeting ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

Insulation Installed Indoors: Flame spread index of 25 or less, and smoke developed index of 50 or less.

Insulation Installed Outdoors: Flame spread index of 75 or less, and smoke developed index of 150 or less.

* + - * 1. Products shall not contain formaldehyde, asbestos, lead, mercury, or mercury compounds
				**[if** **available]**. Products shall be Certified UL GREENGUARD Gold or Indoor Advantage Gold **[if** **available].**
				2. Biosoluble Fiber: Certified by European Certification Board for Mineral Wool Products (EUCEB).
				3. Recycled Content: A minimum of 50 percent recycled glass content certified and UL Validated.
				4. Declare LBC Red List Compliant; minimum.

G. Products shall contain no polybrominated diphenyl ethers (PBDE) such as Penta-BDE, Octa-BDE or Deca-BDE fire retardants; whenever available.

H. All installations shall be Grade 1 Installation as developed by RESNET; and follows Manufacturer’s recommendations and specifications.

* + - 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.
1. PRODUCTS
	* + 1. FIBERGLASS BOARD INSULATION
				1. Recycled Content: A minimum of 50 percent recycled glass content; UL Environment Validated.
				2. Products shall comply with the standards in Section 1.7 – Quality Assurance.
				3. Unfaced, Flexible Fiberglass Board Insulation: ASTM C 612, Type IA or ASTM C 665, Type I; with maximum flame spread and smoke developed indexes of 25 and 50, respectively, per UL 723, passing ASTM E 136 for combustion characteristics; manufactured using a bio-based binder.

Basis-of-Design Product: Knauf Earthwool Insulation Board, 1.6 PCF.

Nominal density of not less than 1.6 lb./cu. ft. (26 kg/cu. m), thermal resistivity of 6.3 through 12.5 (R-SI range 1.1 through 2.2) depending on thickness.

Thickness: [**1.5 inch (38 mm)**] [**2 inches** **(51 mm)**] [**3 inches** **(76 mm)**].

* + - * 1. Unfaced, Rigid Fiberglass Board Insulation: ASTM C 612, Type IA; ASTM C 665, Type 1; with maximum flame spread and smoke developed indexes of 25 and 50, respectively, per UL 723 Certification, passing ASTM E 136 for combustion characteristics; manufactured using a bio-based binder.

Basis-of-Design Product: Knauf Earthwool Insulation Board; Plain 2.25, 3.0, 4.25, and 6.0 PCF.

Nominal density of 2.25 lb./cu. ft. (36 kg/cu. m), thermal resistivity of 4.3 through 17.4 (R-SI Range 0.8 through 2.3) depending on thickness.

Thickness: [**1 inch** **(25 mm)**] [**1.5 inch** **(38 mm)**] [**2 inches (51 mm)**]
[**3 inches (76 mm)**] [**4 inches** **(102 mm)**].

Nominal density of 3 lb./cu. ft. (48 kg/cu. m), thermal resistivity of 4.3 through 13.0
(R-SI Range 0.8 through 2.3) depending on thickness.

Thickness: [**1 inch (25 mm)]** [**1-1/2 inches (38 mm)**] [**2 inches (51 mm)**][**2-1/2 inches (64 mm)**] [**3 inches (76 mm)**].

Nominal density of 4.25 lb./cu. ft. (68 kg/cu. m), thermal resistivity of 4.3 through 10.9 (R-SI Range 0.9 through 1.9) depending on thickness.

a. Thickness: [**1 inch** **(25 mm)**] [**1-1/2 inches** **(38 mm)**] [**2 inches** **(51 mm)**]
 [**2-1/2 inches** **(64 mm)**].

Nominal density of 6 lb./cu. ft. (96 kg/cu. m), thermal resistivity of 4.5 through 9.1
(R-SI Range 0.8 through 1.6) depending on thickness.

a. Thickness: [**1 inch** **(25 mm)**] [**1-1/2 inches** **(38 mm)**] [**2 inches (51 mm)**].

* + - * 1. Foil Faced, Rigid Fiberglass Board Insulation: ASTM C 612, Type IA; faced on one side with foil scrim kraft or foil scrim polyethylene vapor retarder, with maximum flame spread and smoke developed indexes of 25 and 50, respectively, per UL 723; manufactured using a bio-based binder.

Basis-of-Design Product: Knauf Earthwool Insulation Board, FSK Faced, 2.25, 3.0, and 6.0 PCF.

Nominal density of 2.25 lb./cu. ft. (36 kg/cu. m), thermal resistivity of [**4.3 (R-SI 0.8) for 1 inch (25 mm) thickness**] [**8.7 (R-SI 1.5) for 2 inch (51 mm) thickness**].

Nominal density of 3 lb./cu. ft. (48 kg/cu. m), thermal resistivity of 4.3 to 8.7
(R-SI Range 0.8 to 1.5) depending on thickness.

Thickness: [**1 inch** **(25 mm)**] [**1-1/2 inches** **(38 mm)**] [**2 inches** **(51 mm)**].

Nominal density of 6 lb./cu. ft. (96 kg/cu. m), thermal resistivity of not less than 4.5 to 9.1 (R-SI Range 0.8 to 1.6) depending on thickness.

Thickness: [**1 inch (25 mm)**] [**1-1/2 inches (38 mm)**] [**2 inches** **(51 mm)**].

* + - * 1. ASJ+ Faced (All Service Jacket Plus) or ASJ Faced (All Service Jacket), Rigid Fiberglass Board Insulation: ASTM C 612, Type IA; faced on one side with a flame resistant coated (ASJ+) or uncoated (ASJ) all service jacket vapor barrier consisting of fiberglass yarn reinforced high density white kraft paper, with maximum flame spread and smoke developed indexes of 25 and 50 respectively, per UL 723; manufactured using a bio-based binder.
				ASJ+ has a kraft paper interleaving with an outer file layer leaving no paper exposed.

Basis-of-Design Product: Knauf Earthwool Insulation Board, ASJ+ or ASJ Faced; 3.0, 4.25, and 6.0 PCF.

Nominal density of 3 lb./cu. ft. (48 kg/cu. m), thermal resistivity of 4.3 to 8.7
(R-SI Range 0.8 to 1.5) depending on thickness.

Thickness: [**1 inch** **(25 mm)**] [**1-1/2 inches** **(38 mm)**] [**2 inches (51 mm)**].

Nominal density of 4.25 lb./cu. ft. (68 kg/cu. m), thermal resistivity of 10.9
(R-SI Range 1.9).

Thickness: 2.5 inches (64 mm).

Nominal density of 6.0 lb./cu. ft. (96 kg/cu. m), thermal resistivity of
[**6.8 (R-SI Range 1.2) for 1.5 inches (38 mm) thickness**] [**9.1 (R-SI Range 1.6) for
2 inch (51 mm) thickness**].

Thickness: [**1-1/2 inches** **(38 mm)**] [**2 inches** **(51 mm)**].

* + - * 1. Dark Surfaced, Rigid Fiberglass Board Insulation: ASTM C 1338, G 21, 22; faced on one side with black glass fiber mat finish; maximum flame spread and smoke developed indexes of 25 and 50 respectively, per UL 723; manufactured using a bio-based binder.

Basis-of-Design Product: Knauf Insulation Black Acoustical Board.

Nominal density of 2.25 lb./cu. ft. (36 kg/cu. m), thermal resistivity of 8.7
(R-SI Range 1.53).

Thickness: 2 inches (51 mm).

Nominal density of 3.0 lb./cu. ft. (48 kg/cu. m), thermal resistivity of 4.3 to 8.7
(R-SI Range 0.76 to 1.53) depending on thickness.

Thickness: [**1 inch (25 mm)**] [**1.5 inches** **(38 mm)**] [**2 inches** **(51 mm)**].

* + - * 1. Sustainability Requirements: Provide fiberglass board insulation as follows:

Free of Formaldehyde: Insulation manufactured with 100 percent bio-based binders.

Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05 ppm formaldehyde. Certified to UL GREENGUARD Gold standards.

* + - 1. FIBERGLASS BLANKET INSULATION
				1. Recycled Content: A minimum of 50 percent recycled glass content; UL Environment Validated.
				2. Unfaced, Fiberglass Blanket Insulation: ASTM C 665, Type I; with maximum flame spread and smoke developed indexes of 25 and 50, respectively per UL 723; passing ASTM E 136 for combustion characteristics; manufactured using a bio-based binder.

Basis-of-Design Product: Knauf Insulation; EcoBatt, Unfaced Batts.

R-value per plans and specifications.

* + - * 1. Kraft Faced, Fiberglass Blanket Insulation: ASTM C 665, Type II (non-reflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier); manufactured using a bio-based binder.

Basis-of-Design Product: Knauf Insulation; EcoBatt, Kraft Faced Batts.

R-value per plans and specifications.

* + - * 1. Reinforced Foil Faced, Fiberglass Blanket Insulation: ASTM C 665, Type III (reflective faced), Class A (faced surface with a flame spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil scrim kraft; manufactured using a bio-based binder.

Basis-of-Design Product: Knauf Insulation; EcoBatt, FSK Faced Batts.

R-value per plans and specifications.

* + - * 1. Foil Faced, Fiberglass Blanket Insulation: ASTM C 665, Type III (reflective faced), Class B (faced surface with a flame propagation resistance of 0.12 W/sq. cm); Category 1 (membrane is a vapor barrier), faced with standard foil facing (no scrim reinforcement); manufactured using a bio-based binder.

Basis-of-Design Product: Knauf Insulation; EcoBatt, Standard Foil Faced Batts.

R-value per plans and specifications.

* + - * 1. Dark Surfaced, Semi-Rigid Fiberglass Blanket Insulation: ASTM C 1071 Type I; ASTM D 5116; faced on one side with black glass fiber mat finish; maximum flame spread and smoke developed indexes of 25 and 50, respectively, per UL 723; manufactured using a
				bio-based binder

Basis-of-Design Product: Knauf Insulation; Wall and Ceiling Liner M.

Nominal density of 1.5 lb./cu. ft. (24 kg/cu. m), thermal resistivity of [**5.4 (R-SI 0.95) for 1.5 inch (38 mm) thickness**] [**7.1 (R-SI 1.25) for 2 inch (51 mm) thickness**].

Thickness: [**1-1/2 inches (38 mm)**] [**2 inches** **(51 mm)**].

Nominal density of 1.5 lb./cu. ft. (24 kg/cu. m), thermal resistivity of 2.0 to 8.0
(R-SI Range 35 to 1.41) depending on thickness.

Thickness: [**1/2 inches** **(13 mm)**] [**1 inch (25 mm)**] [**1-1/2 inches** **(38 mm)**]
[**2 inches** **(51 mm)**].

Nominal density of 2 lb./cu. ft. (32 kg/cu. m), thermal resistivity of [**2.1 (R-SI 0.37) for 0.5 inch (13 mm) thickness**] [**4.2 (R-SI 0.74) for 1 inch (25 mm) thickness**].

Thickness: [**1/2 inch** **(13 mm)**] [**1 inch (25 mm)**].

* + - * 1. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves.
				2. Sustainability Requirements: Provide fiberglass blanket insulation as follows:

				1. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05 ppm formaldehyde. Certified to UL GREENGUARD Gold standards.
				2. Free of Formaldehyde: Insulation manufactured with 100 percent bio-based binders.
			1. LOOSE FILL INSULATION (FOR USE IN ATTICS AND CLOSED CAVITIES)
				1. Fiberglass Loose Fill Insulation: manufactured using a bio-based binder, ASTM C 764; with maximum flame spread and smoke developed indexes of 5, per ASTM E 84. For cavity fill applications where loose fill insulation is installed using a fabric or netting type retainer system: ASTM C 764, Type I.

Basis-of-Design Product: Knauf Insulation; Jet Stream Ultra or EcoFill Wx Loose Fill insulation.

R-value dependent on installed density per plans and specifications.

* + - * 1. Sustainability Requirements: Provide fiberglass loose fill insulation as follows:

				1. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05 ppm formaldehyde. Certified to UL GREENGUARD Gold standards.
				2. Free of Formaldehyde: Insulation manufactured with 100 percent bio-based binders.
			1. HIGH-PERFORMANCE VENTILATED ATTIC INSULATION
				1. KSK (Kraft Scrim Kraft) Faced, Fiberglass Blanket Insulation: ASTM C 665, Type II (non-reflective faced), Class C (faced surface not rated for flame propagation); Category 2 (membrane is a vapor barrier); manufactured using a bio-based binder.

1. Basis-of-Design Product: Knauf Insulation; EcoBatt Integrated Roof Deck (IRD) ,
 Kraft Scrim Kraft Faced Batt.
2. R-value per plans and specifications.

* + - * 1. Sustainability Requirements: Provide fiberglass blanket insulation as follows:

				1. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05 ppm formaldehyde. Certified to UL GREENGUARD Gold standards.
				2. Free of Formaldehyde: Insulation manufactured with 100 percent bio-based binders.
			1. SPRAY-ON FIBERGLASS
				1. Fiberglass Spray-On Insulation System: meets or exceeds the requirements of ASTM C 1014 and ASTM C 764, Type 1; non-combustible per ASTM E 136; with maximum flame spread of 25 and smoke developed of 50 per ASTM E 84; non-corrosive per ASTM C 665; does not support microbial growth per ASTM C 1338. Thermal resistivity (R – value) is determined using industry standard test method ASTM C 518.

1. Basis-of-Design Product: Knauf Insulation; JetSpray Thermal Insulation.
2. R-value per plans and specifications.
3. Installed by Knauf factory-trained contractors only.

* + - * 1. Sustainability Requirements: Provide fiberglass spray insulation as follows:

				1. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05 ppm formaldehyde. Certified to UL GREENGUARD Gold standards.
				2. Free of Formaldehyde: Insulation manufactured with 100 percent bio-based binders.
			1. CONCEALED SPACE / INTERSTITIAL SPACE BATT INSULATION – MULTI-FAMILY CONSTRUCTION
				1. Fiberglass Concealed Space Batt Insulation: manufactured using bio-based binder, meets and exceeds NFPA 13 Standard requirements; Section 8.15.1.2.7 – allowing for a non-combustible substitution for sprinkler protection; non-combustible per ASTM E 136; with maximum flame spread of 25 and smoke developed of 50 per ASTM E 84; non-corrosive per ASTM C 665; does not support microbial growth per ASTM C 1338.

1. Basis-of-Design Product: Knauf Insulation; Inner-Safe Concealed Space Batt Insulation.
2. R-value per plans and specifications
3. Install per Knauf Insulation recommendations.

* + - * 1. Sustainability Requirements: Provide fiberglass batt insulation as follows:

				1. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05 ppm formaldehyde. Certified to UL GREENGUARD Gold standards.
				2. Free of Formaldehyde: Insulation manufactured with 100 percent bio-based binders.
			1. VAPOR RETARDERS
				1. Polyethylene Vapor Retarders: ASTM D 4397, [**6 mil (0.15 mm)**] [**10 mil (0.25 mm)**] thick, with maximum permeance rating of 0.13 perm (7.5 ng/Pa x s x sq. m).
				2. Reinforced Polyethylene Vapor Retarders: Two outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nylon cord or polyester scrim and weighing not less than 25 lb./1000 sq. ft. (12 kg/100 sq. m), with maximum permeance rating of 0.0507 perm (2.9 ng/Pa x s x sq. m).
				3. Fire Retardant, Reinforced Polyethylene Vapor Retarders: Two outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nonwoven grid of nylon cord or polyester scrim and weighing not less than 22 lb. /1000 sq. ft. (10 kg/100 sq. m), with maximum permeance rating of 0.1317 perm (7.56 ng/Pa x s x sq. m) and with flame spread and smoke developed indexes of not more than 5 and 60, respectively, per ASTM E 84.
				4. Foil Polyester Film Vapor Retarders: Two layers of 0.5 mil (0.013 mm) thick polyester film laminated to an inner layer of 1.0 mil (0.025 mm) thick aluminum foil, with maximum water vapor transmission rate in flat condition of 0.0 g/h x sq. m and with maximum flame spread and smoke developed indexes of 5, per ASTM E 84.
				5. Vapor Retarder Tape: Pressure sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.
				6. Vapor Retarder Fasteners: Pancake head, self-tapping steel drill screws; with fender washers.
				7. Single Component Non-sag Urethane Sealant: ASTM C 920, Type I, Grade NS, Class 25, use NT related to exposure, and Use O related to vapor barrier related substrates.
				8. Adhesive for Vapor Retarders: Product recommended by vapor retarder manufacturer and has demonstrated capability to bond vapor retarders securely to substrates indicated.
			2. INSULATION FASTENERS
				1. 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.

Plate: Perforated, galvanized carbon steel sheet, 0.030 inch (0.762 mm) thick by 2 inches (50 mm) square.

Spindle: Copper coated, low carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation indicated.

* + - * 1. 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.

Angle: Formed from 0.030 inch (0.762 mm) thick, perforated, galvanized carbon steel sheet with each leg 2 inches (50 mm) square.

Spindle: Copper coated, low carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation indicated.

* + - * 1. 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.

Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:

Crawl spaces.

Ceiling plenums.

Attic spaces.

Where indicated.

* + - * 1. Insulation Standoff: Spacer fabricated from galvanized mild steel sheet for fitting over spindle of insulation anchor to maintain air space of [**1 inch (25 mm)**] [**2 inches (50 mm)**]
				[**3 inches (76 mm)**] between face of insulation and substrate to which anchor is attached.
				2. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.
			1. ACCESSORIES
				1. Field Applied Joint Seal Air Barriers: Water based elastomeric spray, ASTM E 90; providing minimum 10dB reduction versus unsealed walls; Surface Burning Characteristics 25/50 per ASTM E 84.

Basis-of-Design Product: Subject to compliance with requirements, provide Knauf Insulation; ECOSEAL Plus.

1. EXECUTION
	* + 1. PREPARATION
				1. Clean substrates of substances that are harmful to insulationor vapor retarders, including removing projections capable of puncturing vapor retarders, or that interfere with insulation attachment.
			2. INSTALLATION, GENERAL
				1. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
				2. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
				3. 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.
				4. 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. INSTALLATION OF FIELD APPLIED JOINT SEAL AIR BARRIERS
				1. Install in strict accordance with manufacturer's recommended procedures – document BI-PL-84.
				2. Surface Application:

Apply directly from the bucket with no thinning or mixing.

Use an airless sprayer (min. 2.2 HP); capable of 3000 psi and highboy with a Graco Clean Shot Shut-Off Valve attached to the end of the gun/wand assembly.

Apply in temperatures between 20° F and 120° F.

When using ECOSEAL Plus in freezing temperatures, a heat source will need to be applied to the bucket so that the material stays fluid.

Application coverage of 2800 linear feet (LF) per bucket at 1/4 inch bead using a .513 tip size.

Ensure application surface is dry and clear of debris.

Adjust psi level depending on flow of material through the nozzle. A small stream of product indicates not enough pressure. Splattering of material indicates the pressure is too high.

Apply to the seam between double top plates or to the face of the plate just below the seam. If sealing off the entire attic plane, ECOSEAL Plus should be applied to the face of all top plates on the exterior and interior walls.

Apply to all horizontal seams/joints in framing. “Picture framing” each cavity should not be necessary.

Examples: Top plate to sheathing, bottom plate to sheathing, corners, bottom plate to subfloor, sheathing to sheathing but joint, rim joists, etc.

Apply at the junction between the bottom plate and the subfloor/slab. This application is to be done last.

If sealing between partition wall and interior walls for acoustics, or compartmentalizing before installation of drywall, apply ECOSEAL Plus to the face of the top plate, the face of the corner studs, face of the bottom plate and the bottom plate to subfloor connection. Special attention may need to be given to any through wall penetrations.

Since ECOSEAL Plus is compressible once cured it can be used in an airtight drywall approach (ADA) in conjunction with its regular cavity seal application.

The removal of excess material on the face of framing members is not necessary with ECOSEAL Plus as it compresses and acts as a gasket in its cured form.

Each room shall be completed prior to moving to the next.

Assure that no product remains on any finished surface. Wipe off any uncured material using a damp rag, prior to material drying. Any dry material will need to be removed mechanically.

If installing product from the attic to all ceiling penetrations, drywall joints and junctions of drywall to top plates, start from the outside edge of the attic area and work toward the center. An angled nozzle extension will make this application easier. Segment the attic into sections and complete each section prior to moving to the next.

Certain applications may require an angled nozzle extension in order to achieve the correct nozzle angle.

* + - 1. INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION
				1. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
				2. Fiberglass 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.

Comply with NAIMA's "Recommendations for Installation in Residential and Other Light Frame Construction Fiber Glass" (www.NAIMA.org), or manufacturer's written instructions, whichever is more stringent.

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

Fiberglass insulation shall be installed in six sided cavities, meaning that no surface of the insulation shall be left exposed.

Maintain 3 inch (76 mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

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

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.

For wood framed construction, install blankets according to ASTM C 1320 and as follows:

With faced batts or blankets having stapling flanges, secure insulation by inset, stapling flanges to sides of framing members. When using staple-free (no stapling flanges) kraft faced batts or blankets, insert the product into the cavity to produce a friction fit between the edges of the insulation and adjoining framing members.

With faced blankets having stapling flanges and the preferred application is to face staple the flanges, lap batt or 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 facings, and seal each continuous area of insulation to ensure airtight installation.

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

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

* + - * 1. Loose Fill Insulation: Apply according to ASTM C 1015 and manufacturer's written instructions. Level horizontal applications to uniform thickness as indicated, lightly settle to uniform density, but do not compact excessively.

For fiberglass loose fill insulation, comply with NAIMA’s “Recommendations for Installation in Residential and Other Light Frame Construction for Fiber Glass Loose Fill Insulation” (www.NAIMA.org) or manufacturer’s written instructions, whichever is more stringent.

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

Loose Fill Insulation in Closed Cavities: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb./cu. ft. (40 kg/cu. m).

Fiberglass Blankets: Measure and cut to desired measurement so as to fill gap completely with contact on all sides of surrounding insulation and no compression to finished thickness of material.

* + - 1. INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION
				1. Where Fiberglass blankets are indicated for sound attenuation above ceilings, install blanket insulation over entire ceiling area in thicknesses indicated. Extend insulation 48 inches (1219 mm) up either side of applicable partitions.
			2. INSTALLATION OF CURTAIN WALL INSULATION
				1. Install fiberglass board insulation in curtain wall construction where indicated on Drawings 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 between insulation and glass.

Install insulation where it contacts perimeter fire containment system to prevent insulation from bowing under pressure from perimeter fire containment system.

* + - 1. INSTALLATION OF SPRAY-ON FIBERGLASS
				1. Professional installers must be factory trained to ensure the highest levels of comfort and performance.
				2. Install in strict accordance with Knauf Insulation training and recommendations.
			2. INSTALLATION OF HIGH-PERFORMANCE VENTILATED ATTIC INSULATION
				1. Jobsite Prep

1. Preferably, install EcoBatt IRD prior to HVAC installation.
2. Clear area of debris. Make sure air lines and cords are free of snags or catch points.

3. Adjust the air compressor’s pressure to 110 – 115 psi.

4. Adjust the stapler’s pressure to leave roughly 1/8” of the staple crown exposed.

5. Set up scaffolding or ladder and ensure all parts are locked.

 B. Batt Installation

 1. Install IRD batts along the eave, working up the slope of the roof deck.

 2. Ensure the facing is tight against the roof deck. The friction fit will hold the batts in place until stapling.

 C. Stapling

 1. When 200 to 300 SF of IRD material is in place, a crew member should begin stapling.

 2. A total of six (6) staples per batt: one in each corner; a minimum of 6” from either edge, and two (2) additional down the center line of the batt, approximately 16” from both ends of the batt.

 3. The IRD batts will envelope the bottom of the 2 X 4 roof truss, so that the framing is hidden from view – creating a thermal break.

 D. Install the Insulation Stops

 1. Staple lower wings on the face of the truss.

 2. Staple upper wings against the roof deck and/or inside of the truss.

 3. Refer to the Knauf EcoBatt Integrated Roof Deck (IRD) Four-Step Installation Process brochure for further details.

* + - 1. INSTALLATION OF CONCEALED SPACE / INTERSTITIAL SPACE BATT INSULATION FOR MULTI-FAMILY CONSTRUCTION
				1. Estimation

1. Determine the number and width of Inner-Safe batts required to fill the cavity. **IMPORTANT NOTE:** NFPA 13, Section 8.15.1.2.7.1 permits a MAXIMUM AIR GAP OF TWO INCHES at the top of the interstitial space.

B. Insulation

 1. Inner-Safe Concealed Batt insulation is compression-packed and will expand to its labeled thickness.
 2. Install Inner-Safe batts between ceiling joists, butting it strongly at all joints. The product’s fiber design allows a secure friction fit.
 3. Occasionally, Inner-Safe may need cutting to fit around obstacles such as wiring, plumbing and bracing.
 4. DO NOT block vents.

C. Inspection

 1. Mark and install validated tag from packaging to ease inspection.

* + - 1. INSTALLATION OF VAPOR RETARDERS
				1. 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.
				2. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs.

Fasten vapor retarders to wood framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches (406 mm) oc.

Before installing vapor retarders, apply urethane sealant to flanges of metal framing including runner tracks, metal studs, and framing around door and window openings. 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.

Firmly attach vapor retarders to metal framing and solid substrates with vapor retarder fasteners as recommended by vapor retarder manufacturer.

* + - * 1. 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.
				2. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor retarder tape or another layer of vapor retarders.
			1. PROTECTION
				1. Protect installed insulationand 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.
			2. INSULATION SCHEDULE
				1. Insulation Type <**Insert number**>: Unfaced, Semi-Rigid Fiberglass board insulation.
				2. Insulation Type <**Insert number**>: Foil Faced, Semi-Rigid Fiberglass board insulation.
				3. Insulation Type <**Insert number**>: Unfaced, Rigid Fiberglass board insulation.
				4. Insulation Type <**Insert number**>: Foil Faced, Rigid Fiberglass board insulation.
				5. Insulation Type <**Insert number**>: Glass Mat Faced, Rigid Fiberglass board insulation.
				6. Insulation Type <**Insert number**>: Unfaced, Flexible Fiberglass blanket or batt insulation.
				7. Insulation Type <**Insert number**>: Faced, Flexible Fiberglass blanket or batt insulation.
				8. Insulation Type <**Insert number**>: Fiberglass loose fill insulation.
				9. Insulation Type <**Insert number**>: Fiberglass Spray-On Thermal insulation.
				10. Insulation Type <**Insert number**>: Fiberglass High-Performance Ventilated Attic insulation.
				11. Insulation Type <**Insert number**>: Fiberglass Concealed / Interstitial Space insulation.

END OF SECTION 072100