SECTION 07 2100 – THERMAL INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Foam plastic insulating sheathing used in [perimeter foundation], [below-grade] and [below-slab] applications.

B. Foam plastic insulating sheathing used in [above-grade] and [cavity wall] applications.

C. Foam plastic insulating sheathing used in continuous wall insulation for [new construction] or [existing building] applications.

D. Foam plastic insulating sheathing used in exterior insulation and finish system (EIFS) applications.

E. Foam plastic insulating sheathing used in one coat stucco applications.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete slabs and foundations.

B. Section 04 2723 - Cavity Wall Unit Masonry: Masonry walls enclosing insulation.

C. Section 05 4000 – Cold-Formed Metal Framing: Board insulation as wall sheathing.

D. Section 06 1000 – Rough Carpentry: Board insulation as wall insulation.

E. Section 07 2400 – Exterior Insulation and Finish Systems: Board insulation as wall insulation.

F. Section 07 2500 - Weather Barriers: Separate air barrier and vapor retarder materials.

1.03 REFERENCE STANDARDS

A. ASTM International - American Society for Testing and Materials; www.astm.org:

B. AWPA – American Wood Protection Association; www.awpa.com:
   1. AWPA E7 - Standard Field Test for Evaluation of Wood Preservatives to be Used in Ground Contact (UC4A, UC4B, UC4C); Stake Test; 2015.

C. CAN/ULC - Underwriters Laboratories of Canada; www.ulc.ca:

D. ICC - International Code Council, Acceptance Criteria (AC); www.shop.iccsafe.org:
   1. AC239 - Termite-Resistant Foam Plastics; 2008(Revised 2014).

E. NFPA - National Fire Protection Association; www.nfpa.org:

1.04 SUBMITTALS
A. See Section 01 3000 – Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. Shop Drawings: Provide drawings indicating typical installation.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Test and Evaluation Reports:
   1. ICC-ES or UL report for building code compliance.
   2. Material Environmental Product Declaration.
   3. [Copy of Approval Report for use in “very heavy termite infestation” areas].

F. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

G. Manufacturer’s Qualification Statement.

H. Installer’s Qualification Statement.

I. Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturers Qualifications: Company specializing in manufacturing products specified in this section, with not less than [ten] years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least [three] years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original, unopened, undamaged containers with identification labels intact.

B. Store materials protected from exposure to harmful environmental conditions as recommended by manufacturer.
   1. Avoid prolonged exposure to sunlight of GX Series products; cover with opaque tarp or inside original packaging.
   2. Avoid exposure of insulation to temperatures exceeding 165 degrees F (74 degrees C).
   3. Avoid exposure of insulation to heated asphalt or coal tar.

C. Handling: Rigid foam insulation may be cut, drilled, sawn, rasped or otherwise handled similar to other construction materials, such as wood.
   1. Field test compatibility with waterproofing mastics or other materials prior to use; examples of non-compatible compounds include products containing ketones, gasoline or diesel solvents.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer shall warrant rigid foam insulation for the life of installation it is originally installed for the following:
   1. Thermal insulation value will not vary more than ten (10) percent from the published R-value
   2. Insulation will meet the physical performance requirements within ten (10) percent of the minimum requirements for Types as indicated in compliance with ASTM C578, or CAN/ULC S701.
   3. [Insulation will retain a termite resistance of seven (7) or greater in compliance with AWPA E7].

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Atlas Molded Products, a Division of Atlas Roofing Corporation:
   1. Address: 8240 Byron Center Ave SW, Byron Center, Michigan 49315.
2. Phone: (800) 917-9138; Fax: (616) 878-9942.

B. Products:
1. ThermalStar X-Grade Rigid Insulation for Below Grade Applications.
2. ThermalStar X-Grade Rigid Insulation for Cavity Wall and Above Grade Applications.
3. ThermalStar X-Grade GX Rigid Insulation for Below Grade Applications.
4. ThermalStar X-Grade GX Rigid Insulation for Cavity Wall and Above Grade Applications.
5. ThermalStar LCI (Laminated Continuous Wall Insulation) for New Construction Applications.
6. ThermalStar LCI GX (Laminated Continuous Wall Insulation) for Crawlspace Applications.
7. ThermalStar LCI (Laminated Continuous Wall Insulation) for Retrofit Applications.
9. ThermalStar T&G Continuous Wall Insulation for One Coat Stucco Applications.

2.02 PERFORMANCE REQUIREMENTS
A. Flame Spread Index (FSI): Class A – 25 or less, when tested in accordance with ASTM E84.
B. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
C. Complies with fire resistance requirements shown on the drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
D. Comply with criteria or NFPA 286 local building code for use of foam plastic insulation in interior wall, ceiling, and floor locations, without thermal or ignition barriers applied over the foam plastic.
E. Maximum Use Temperature: Short term of 10 to 15 minutes, maximum temperature of 180 degrees F (82 degrees C); long term maximum temperature of 165 degrees F (74 degrees C).
F. Provide termite resistant insulation materials, when applicable, in accordance with ICC-AC239 acceptance criteria.
G. Insulation materials containing formaldehyde, chlorofluorocarbon (CFCs), hydro chlorofluorocarbons (HCFCs), or other volatile organic compounds (VOCs) are not permitted.

2.03 RIGID EXPANDED POLYSTYRENE (EPS) INSULATION [FOR BELOW GRADE] [AND] [FOR CAVITY WALL AND ABOVE GRADE] APPLICATIONS
A. Description: Expanded polystyrene (EPS) insulation without any facing material.
B. Classification “Types” in compliance with ASTM C578 and the following characteristics:
1. Type and Compressive Resistance: At 10 percent deformation in accordance with ASTM D1621.
   a. Type II, 15 psi (104 kPa), X-Grade 15.
   b. Type II, 25 psi (172 kPa), X-Grade 25.
   c. Type XIV, 40 psi (276 kPa), X-Grade 40.
   d. Type XV, 60 psi (414 kPa), X-Grade 60.
2. Type and Thermal Resistance: Rated per inch at 75 degrees F (24 degrees C) in accordance with ASTM C518.
   a. Type II, R-value of 4.2 per inch, X-Grade 15.
   b. Type II, R-value of 4.2 per inch, X-Grade 25.
   c. Type XIV, R-value of 4.4 per inch, X-Grade 40.
   d. Type XV, R-value of 4.5 per inch, X-Grade 60.
3. Type and Flexural Strength: Tested in accordance with ASTM C203 at 1 inch (25.4 mm) or less in thickness.
   a. Type II, 42 psi (290 kPa), X-Grade 15.
   b. Type II, 50 psi (345 kPa), X-Grade 25.
   c. Type XIV, 75 psi (517 kPa), X-Grade 40.
   d. Type XV, 95 psi (655 kPa), X-Grade 60.
4. Type and Water Absorption Percentage by Volume after Immersion for 24 Hours: Tested in accordance with ASTM C272 on 12 inch by 12 inch by 1 inch thick (305 mm by 305 mm by 25.4 mm thick) test specimen.
RIGID EXPANDED POLYSTYRENE (EPS) INSULATION

A. Description: Graphite enhanced expanded polystyrene (GPS) insulation, giving it a distinct grey color, and properties that reflect radiant heat energy increasing the thermal resistance (R-value).

B. Classification “Types” in compliance with ASTM C578 and the following characteristics:
   1. Type and Compressive Resistance: At 10 percent deformation in accordance with ASTM D1621.
      a. Type I, 10 psi (69 kPa), X-Grade 10 GX.
      b. Type II, 15 psi (103 kPa), X-Grade 15 GX.
      c. Type IX, 25 psi (172 kPa), X-Grade 25 GX.
   2. Type and Thermal Resistance: Rated per inch at 75 degrees F (24 degrees C) in accordance with ASTM C518.
      a. Type I, R-value of 5.0 in nominal 1 inch thick panel, X-Grade 10 GX.
      b. Type II, R-value of 5.0 in nominal 1 inch thick panel, X-Grade 15 GX.
      c. Type IX, R-value of 5.0 in nominal 1 inch thick panel, X-Grade 25 GX.
   3. Type and Flexural Strength: Tested in accordance with ASTM C203 at 1 inch (25.4 mm) or less in thickness.
      a. Type I, 25 psi (172 kPa), X-Grade 10 GX.
      b. Type II, 42 psi (290 kPa), X-Grade 15 GX.
      c. Type IX, 55 psi (379 kPa), X-Grade 25 GX.
   4. Type and Water Absorption Percentage by Volume after Immersion for 24 Hours: Tested in accordance with ASTM C272 on 12 inch by 12 inch by 1 inch thick (305 mm by 305 mm by 25.4 mm thick) test specimen.
      a. Type I, 1.1 percent, X-Grade 10 GX.
      b. Type II, 1.1 percent, X-Grade 15 GX.
      c. Type IX, 1.1 percent, X-Grade 25 GX.
   5. Type and Water Vapor Permeance: Tested in accordance with ASTM E96/E96M on 1 inch (24.5 mm) test specimen at 75 degrees F (24 degrees C) using desiccant method.
      a. Type I, 4.0 perms, X-Grade 10 GX.
      b. Type II, 2.5 perms, X-Grade 15 GX.
      c. Type IX, 2.5 perms, X-Grade 25 GX.

C. Board Thickness: [1/16 inch (1.5 mm)] [1-1/16 inch (19 mm)] [1 inch (25 mm)] [1-3/16 inch (30 mm)] [1-1/2 inch (38 mm)] [2 inch (51 mm)] [2-3/8 inch (60 mm)] [3-5/8 inch (92 mm)] [4 inch (102 mm)] [4-7/8 inch (124 mm)] or [6 inch (152 mm)], or [specify thickness].

D. Board Width and Length: 48 inch (1219 mm) wide by 96 inch (2438 mm) long.

E. Board Edges: Square edge.

RIGID EXPANDED POLYSTYRENE (EPS), LAMINATED CONTINUOUS WALL INSULATION FOR
NEW CONSTRUCTION APPLICATIONS

A. Description: Expanded polystyrene (EPS) insulation with non-perforated polymeric film facers on both sides [and reflective barrier (available upon request)].

B. Classification “Types” in compliance with ASTM C578 and the following characteristics:
   1. Type and Compressive Resistance: At 10 percent deformation in accordance with ASTM D1621.
      a. Type I, 10 psi (69 kPa), LCI 10.
      b. Type II, 15 psi (103 kPa), LCI 15.
      c. Type IX, 25 psi (172 kPa), LCI 25.
   2. Type and Thermal Resistance: Rated per inch at 75 degrees F (24 degrees C) in accordance with ASTM C518.
      a. Type I, R-value of 3.2 per inch, LCI 10.
      b. Type II, R-value of 4.2 per inch, LCI 15.
      c. Type IX, R-value of 4.4 per inch, LCI 25.
   3. Type and Flexural Strength: Tested in accordance with ASTM C203 at 1 inch (25.4 mm) or less in thickness.
      a. Type I, 25 psi (172 kPa), LCI 10.
      b. Type II, 35 psi (345 kPa), LCI 15.
      c. Type IX, 50 psi (414 kPa), LCI 25.
   4. Type and Water Absorption Percentage by Volume after Immersion for 24 Hours: Tested in accordance with ASTM C272 on 1 inch (25.4 mm) test specimen.
      a. Type I, 3.0 percent, LCI 10.
      b. Type II, 2.5 percent, LCI 15.
      c. Type IX, 1.25 percent, LCI Grade 25.
   5. Type and Water Vapor Permeance: Tested in accordance with ASTM E96/E96M on 1 inch (25.4 mm) test specimen at 75 degrees F (24 degrees C) using desiccant method.
      a. Type I, less than 0.5 perms, LCI 10.
      b. Type II, less than 0.5 perms, LCI 15.
      c. Type IX, less than 0.5 perms, LCI 25.

C. Board Thickness: [3/4 inch (19 mm)] [1 inch (26.9 mm)] [1-3/16 inch (30.2 mm)] [1-1/2 inch (38 mm)] [2 inch (51 mm)] [2-3/8 inch (60.3 mm)] or [3 inch (76 mm)], or [specify thickness].

D. Board Width and Length: 48 inch (1219 mm) wide by 96 inch (2438 mm) long.

E. Board Edges: Square edge.

2.06 RIGID EXPANDED POLYSTYRENE (EPS), LAMINATED CONTINUOUS WALL INSULATION FOR CRAWLSPACE APPLICATIONS, GRAPHITE ENHANCED (GX SERIES)

A. Description: Graphite enhanced expanded polystyrene (GPS) insulation, with distinct grey color, reflects radiant heat energy increasing the thermal resistance (R-value). Used for new construction or retrofit continuous insulation crawlspace applications with a non-perforated polymeric film facer on one side and a reflective facer on the other.

B. Classification “Types” in compliance with ASTM C578 and the following characteristics:
   1. Type and Compressive Resistance: At 10 percent deformation in accordance with ASTM D1621.
      a. Type I, 10 psi (69 kPa), LCI 10 GX.
   2. Type and Thermal Resistance: Rated per inch at 75 degrees F (24 degrees C) in accordance with ASTM C518.
      a. Type I, R-value of 5.0 in nominal 1 inch thick panel, LCI 10 GX.
   3. Type and Flexural Strength: Tested in accordance with ASTM C203 with facers at 1 inch (25.4 mm) or less in thickness.
      a. Type I, 25 psi (172 kPa), LCI 10 GX.
   4. Type and Water Absorption Percentage by Volume after Immersion for 24 Hours: Tested in accordance with ASTM C272 on 12 inch by 12 inch by 1 inch thick (305 mm by 305 mm by 25.4 mm thick) test specimen.
      a. Type I, 1.1 percent, LCI 10 GX.
5. Type and Water Vapor Permeance: Tested in accordance with ASTM E96/E96M on 1 inch (24.5 mm) test specimen at 75 degrees F (24 degrees C) using desiccant method.
   a. Facers not perforated, all types, less than 0.3 perms, LCi GX.

C. Board Thickness: [11/16 inch (17.5 mm)] [1-1/16 inch (27 mm)] [1-19/32 inch (40.4 mm)] [2-1/8 inch (54.1 mm)] or [3-3/16 inch (81 mm)], or [specify thickness].

D. Board Width and Length: 48 inch (1219 mm) wide by 96 inch (2438 mm) long.

E. Board Edges: Square edge.

2.07 RIGID EXPANDED POLYSTYRENE (EPS), LAMINATED CONTINUOUS WALL INSULATION FOR RETROFIT APPLICATIONS

A. Description: Expanded polystyrene (EPS) continuous insulation, for use in retrofit applications, with perforated polymeric film facers on both sides [and reflective barrier (available upon request)].

B. Classification “Types” in compliance with ASTM C578 and the following characteristics:
   1. Type and Compressive Resistance: At 10 percent deformation in accordance with ASTM D1621.
      a. Type I, 10 psi (69 kPa), LCi 10 Perforated.
   2. Type and Thermal Resistance: Rated per inch at 75 degrees F (24 degrees C) in accordance with ASTM C518.
      a. Type I, R-value of 3.2 per inch, LCi 10 Perforated.
   3. Type and Flexural Strength: Tested in accordance with ASTM C203 at 1 inch (25.4 mm) or less in thickness.
      a. Type I, 18 psi (124 kPa), LCi 10 Perforated.
   4. Type and Water Absorption Percentage by Volume after Immersion for 24 Hours: Tested in accordance with ASTM C272 on 1 inch (25.4 mm) test specimen.
      a. Type I, 3.0 percent, LCi 10 Perforated.
   5. Type and Water Vapor Permeance: Tested in accordance with ASTM E96/E96M on 1 inch (24.5 mm) test specimen at 75 degrees F (24 degrees C) using desiccant method.
      a. Type I, greater than 1.0 perms, LCi 10 Perforated.

C. Board Thickness: 48 inch (1219 mm) wide by 96 inch (2438 mm) long.
   1. Thickness: [1/4 inch (6.4 mm)] [3/8 inch (9.5 mm)] or [1/2 inch (12.7 mm)], or [specify thickness].

D. Fanfolded Insulation Board: 48 inch (1219 mm) wide by 50 feet (15.24 m) long.
   1. Thickness: [1/4 inch (6.4 mm)] [3/8 inch (9.5 mm)] [1/2 inch (12.7 mm)] [3/4 inch (19 mm)] or [1 inch (25.4 mm)].

E. Board Edges: Square edge.

2.08 RIGID EXPANDED POLYSTYRENE (EPS), CONTINUOUS WALL INSULATION FOR EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS) APPLICATIONS

A. Description: Expanded polystyrene (EPS) continuous wall insulation, for use in EIFS applications.

B. Classification “Types” in compliance with ASTM C578 and the following characteristics:
   1. Type and Compressive Resistance: At 10 percent deformation in accordance with ASTM D1621.
      a. Type I, 10 psi (69 kPa), EIFS 10.
   2. Type and Thermal Resistance: Rated per inch at 75 degrees F (24 degrees C) in accordance with ASTM C518.
      a. Type I, R-value of 3.9 per inch, EIFS 10.
   3. Type and Flexural Strength: Tested in accordance with ASTM C203 at 1 inch (25.4 mm) or less in thickness.
      a. Type I, 25 psi (172 kPa), EIFS 10.
   4. Type and Water Absorption Percentage by Volume after Immersion for 24 Hours: Tested in accordance with ASTM C272 on 12 inch by 12 inch by 1 inch thick (305 mm by 305 mm by 25.4 mm thick) test specimen.
      a. Type I, 3.0 percent, EIFS 10.
5. Type and Water Vapor Permeance: Tested in accordance with ASTM E96/E96M on 1 inch (24.5 mm) test specimen at 75 degrees F (24 degrees C) using desiccant method.
   a. Type I, 2.5 perms, EIFS 10.

C. Board Thickness: [1/2 inch (13 mm)] [3/4 inch (19 mm)] [1 inch (25 mm)] [1-3/16 inch (30 mm)] [1-1/2 inch (38 mm)] [2 inch (51 mm)] [2-3/8 inch (60 mm)] [3-5/8 inch (92 mm)] [4 inch (102 mm)] [4-7/8 inch (124 mm)] or [6 inch (152 mm)], or [specify thickness].

D. Board Width and Length: 24 inch (610 mm) wide by 48 inch (1219 mm) long.

E. Board Edges: Square edge.

2.09 RIGID EXPANDED POLYSTYRENE (EPS), CONTINUOUS WALL INSULATION FOR ONE COAT STUCCO APPLICATIONS

A. Description: Expanded polystyrene (EPS) continuous wall insulation, for use in one coat stucco applications. Outward facing surface of insulation dimpled for bond, inward facing surface with drainage channels.

B. Classification “Types” in compliance with ASTM C578 and the following characteristics:
   1. Type and Compressive Resistance: At 10 percent deformation in accordance with ASTM D1621.
      a. Type II, 15 psi (103 kPa), T&G 15.
   2. Type and Thermal Resistance: Rated per inch at 75 degrees F (24 degrees C) in accordance with ASTM C518.
      a. Type II, R-value of 4.2 per inch for T&G 15.
   3. Type and Flexural Strength: Tested in accordance with ASTM C203 with facers at 1 inch (25.4 mm) or less in thickness.
      a. Type II, 40 psi (276 kPa), T&G 15.
   4. Type and Water Absorption Percentage by Volume after Immersion for 24 Hours: Tested in accordance with ASTM C272 on 1 inch by 12 inch by 1 inch thick (305 mm by 305 mm by 25.4 mm thick) test specimen.
      a. Type II, 2 percent, T&G 15.
   5. Type and Water Vapor Permeance: Tested in accordance with ASTM E96/E96M on 1 inch (24.5 mm) test specimen at 75 degrees F (24 degrees C) using desiccant method.
      a. Type II, 3.0 perms, T&G 15.

C. Board Thickness: [1/2 inch (12mm)], [15/16 inch (23.8 mm)], or [1-1/2" (38 mm)].

D. Board Width and Length: [24 inch (610 mm)] or [48 inch (1219 mm)] wide by 96 inch (2438 mm) long.

E. Board Edges: Tongue and groove.

2.10 ACCESSORIES

A. Insulation Fasteners: Provide corrosion resistant mechanical fasteners with large heads or washers as recommended by insulation manufacturers.

B. Cover exposed insulation above grade with wall cladding, or coating system such as stucco or EIFS specifically manufactured for use on rigid foam insulation.

C. Sealing Tape: Provide at least 3 inch (76 mm) wide, solvent acrylic adhesive backed sheathing tape.
   1. Products:
      b. 3M - 8087.
      c. Dow – Weathermate.

D. Flashing Tape: Provide flashing tape to flash windows, doorways, pipes, or transitions as necessary.
   1. Products:
      c. 3M – 8067.
E. Edge Covering: Provide J-channel edge protection for exposed insulation.

F. Adhesives: Provide adhesive compatible with rigid insulation board.
   1. Products:
      a. Liquid Nails - Ultra Quik Grip.
      b. Locktite - PL Premium.

PART 3 - EXECUTION

3.01 PREPARATION

A. Prepare concrete floor slab to be well drained and fully tamped.

B. Prepare [concrete] [concrete masonry unit (CMU)] foundation walls to be flat and free of protrusions to properly adhere or mechanically fasten rigid insulation board.

C. Ensure that backfill and surrounding grade is free of wood construction waste or other non-preserved wood that would serve as nest sites in “very heavy termite infestation” areas.

3.02 INSTALLATION

A. Install insulation in accordance with manufacturers written installation instructions.

B. Install insulation in a [single] or [double] layer as required to achieve thermal transmittance required, or as indicated on drawings.

C. Cut and fit insulation tightly around substrate projections and penetrations.

D. Joints: Stagger insulation board joints in one direction for each course, and abut edges and ends tightly to adjacent boards.

E. Secure insulation to substrate with [mechanical fasteners] or [spot adhesive applied to back side of board] in compliance with manufacturer’s requirements.

F. Sheathing and Underlayment Installation:
   1. Install on exterior side of stud framing with long dimension positioned [vertically] or [horizontally].
   2. Fasten insulation to stud framing at 24 inch (305 mm) on center, maximum, using mechanical fasteners as recommended by insulation manufacturer.
   3. Seal joints with approved tape at corners, transitions to adjacent walls, floors, ceilings, or foundation as applicable to insulated areas.
      a. Gravity lap the tape, starting at the bottom and working up the wall.
      b. In coastal zone applications, tape seal fastener penetrations.
   4. Install thermal barrier on interior side of insulation board as indicated on drawings; use minimum of 1/2 inch (12.7 mm) thick gypsum wallboard, except attics or crawlspaces where thermal and ignition barriers not required when installed per UL or ICC-ES report.

G. Cavity Wall Installation:
   1. Install on exterior face or interior width of cavity wall, fitting insulation boards between wall ties and other projections and penetrations.
   2. Install thermal barrier on interior side of insulation board as indicated on drawings; use minimum of 1/2 inch (12.7 mm) thick gypsum wallboard.

H. Perimeter Foundation Installation:
   1. Install insulation board on exterior surface of perimeter foundation walls.
      a. Secure board with spot adhesive applied to back of board.
      b. Fasten board with mechanical fasteners, using quantity and pattern as recommended by insulation manufacturer.
      c. Insulation board may be held against the foundation wall using backfill soil.

I. Slab-On-Grade Installation:
   1. Install insulation board under slab-on-grade and over properly prepared subgrade of compacted fill and vapor retarder, and abut edges and ends tightly to adjacent boards.
3.03 CLEANING
   A. Remove and legally dispose of waste materials and other construction debris.
   B. Clean EPS insulation may be recycled through a national program; http://www.epsrecycling.org/.

3.04 PROTECTION
   A. Protect installed products from damage during subsequent construction.

END OF SECTION