



Below Grade Insulation

The Foundation of effective energy-savings.



INTRODUCTION

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STYROFOAM™ brand insulation is a rigid, blue coloured, closed-cell polystyrene foam, manufactured by a unique extrusion process exclusive to The Dow Chemical Company.

IMPORTANT: Other insulation products that offer higher initial R-values may seem to be a better choice. But before you choose any insulation material, check its water resistance performance. If it doesn't score high in water resistance, its R-value will quickly dissipate when exposed to moisture.

The Need For Below Grade Insulation.

With the uncertainty of future energy supplies and the certainty of escalating energy costs, the key to long-term energy efficiency for architects, builders and home-owners alike is better insulation.

This is why home construction today stresses building techniques that improve energy efficiency. These include weather stripping, improved sill plate gaskets and more efficient vapour barriers, all aimed at minimizing air leaks.

Most of these techniques focus only on above grade applications, in the walls and ceilings. Yet air infiltration above the ground is not the only source of heat loss in a home. A poorly insulated basement or foundation can contribute as much as 25% to 30% of a home's total energy loss. Although



the great mass of soil surrounding a basement will buffer it to some extent from fluctuations in outside temperatures, the soil cannot be relied on for any effective insulation.

When it comes to true energy-efficiency, basement insulation is the next logical step.

In all cases, construction details must conform to appropriate building codes and must be applied in accordance with recognized construction practice, but generally, the "Design Considerations" outlined on the following pages are the important items to be kept in mind.

The Dow Chemical Company has been in the business of manufacturing STYROFOAM™ brand insulation products for over 50 years. The STYROFOAM brand name you know and trust is your assurance that you're getting the best insulation material available and the best value for your money.

Applications

The unique properties of STYROFOAM insulation make it ideal for a wide variety of applications. STYROFOAM insulation may be used in roofs, walls, and below grade for all types of residential, commercial and industrial buildings.

In engineered construction it has been used to insulate railroads, highways, utility lines, transmission towers, airfields and pipelines. It has also been used successfully in Arctic construction as below grade insulation to protect the permafrost layer.

Characteristics

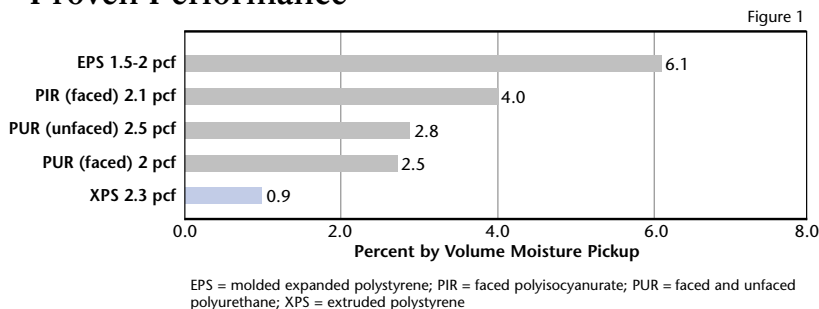
All STYROFOAM™ brand insulation products have the following general characteristics:

- high thermal resistance
- high compressive strength
- very low water absorption
- does not provide nutrients to sustain mold growth
- light weight
- have no food value for rodents, vermin or insects
- maintain the same high quality insulation characteristics over time and extreme weather conditions



INTRODUCTION

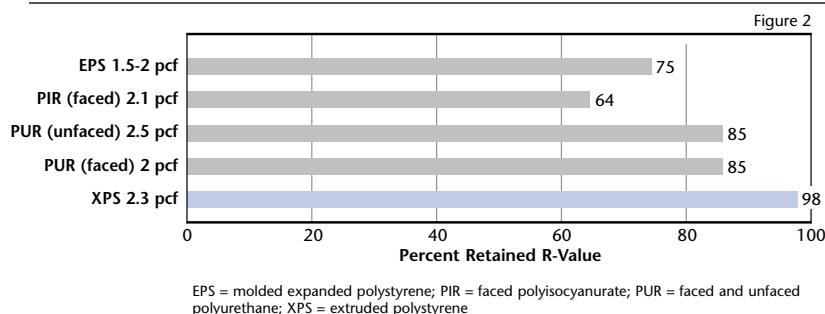
Proven Performance



¹ Ovstaas, G., Smith, S., Strzepek, W., and Tittle, G., "Thermal Performance of Various Insulations in Below-Earth-Grade Perimeter Application, Thermal Insulation, Materials, and Systems for Energy Conservations in the '80s," ASTM STP789, F.A. Govan, D.M. Greason, and J.D. McAllister, Eds., American Society for Testing and Materials, 1983, pp. 435-454.

Water Submersion

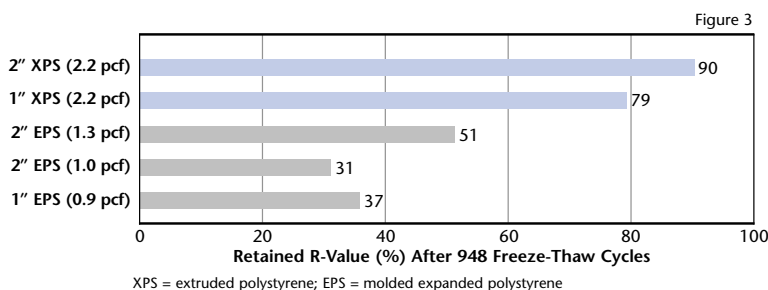
Indicates how much water an insulation product absorbs when subjected to moisture in a liquid form. (Test Method ASTM D2842)



² Ovstaas, G., Smith, S., Strzepek, W., and Tittle, G., "Thermal Performance of Various Insulations in Below-Earth-Grade Perimeter Application, Thermal Insulation, Materials, and Systems for Energy Conservations in the '80s," ASTM STP789, F.A. Govan, D.M. Greason, and J.D. McAllister, Eds., American Society for Testing and Materials, 1983, pp. 435-454.

R-Value Retention

Indicates the retained thermal resistance of insulation products when subjected to moisture in a liquid form for two hundred hours. (Test Method ASTM C518, C-177)



³ Tobiaasson, Wayne, Young and Greateorex, Alan, "Freeze-thaw durability of common roof insulation" U.S. Army Cold Regions Research and Engineering Laboratory (CRREL), Hanover, N.H.; Proc. Fourth International Symposium on Roofing Technology, 1997, pp. 352-359.

Length of service for materials cannot be determined using the data from ASTM C 666. Not all climates experience freeze-thaw conditions and not all applications are affected in the same manner. The conclusions from this CRREL study are relevant to "wet" environments such as below-grade insulation.

Freeze-Thaw Cycle

Indicates how an insulation product performs when subjected to wet freeze-thaw cycling. (Test Method ASTM C666)

Tests were conducted by an accredited third party facility.

Impressive as these tests may be, STYROFOAM™ insulation products have been proven performers in the real world throughout North America, in residential, institutional, commercial and industrial buildings.

As well, STYROFOAM insulation products have been used in other wet environments such as roofs, roads, and flotation applications.

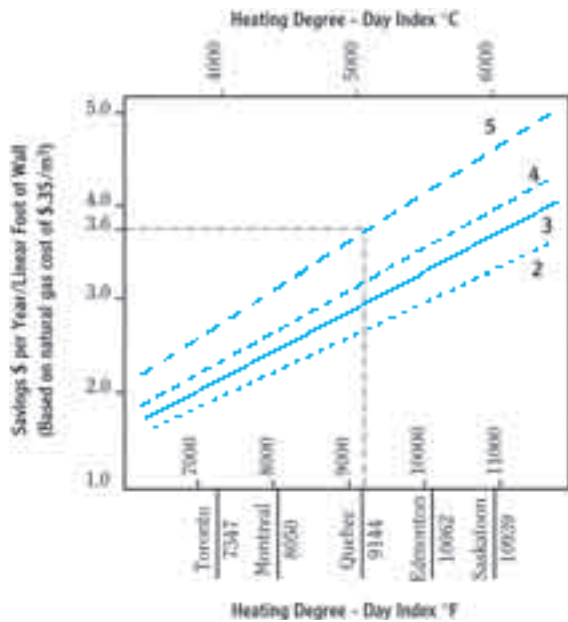
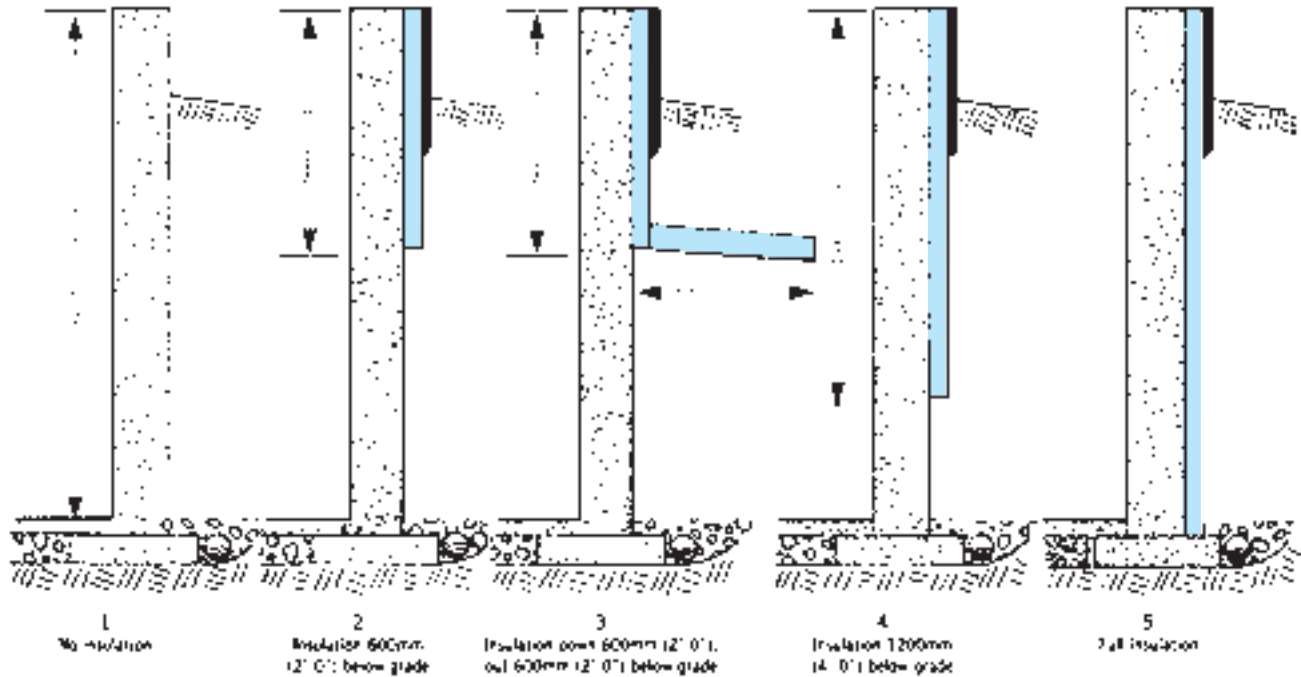
Dow Helps

In selecting STYROFOAM brand insulation, you're not only getting a superior product, you're tapping into Dow's vast resources. For example, a simple phone call can put you in touch with one of our insulation material specialists – highly skilled professionals who can provide architects, engineers, owners, and contractors with technical assistance all along the way, from the blueprint stage right through to project completion.

For more information, call the Dow Sales office in your area.

BUILDING FOUNDATIONS

Build Long-Term Savings for the Building Owner



Energy Savings with 50mm (2") of
STYROFOAM™ SM RSI 1.74 (R=10)
compared to scenario 1 (no insulation)

Physical Properties of STYROFOAM™ SM Insulation

Property and Test Method	Value
Thermal Resistance per inch (25 mm), ASTM C518 @ 75°F (24°C) mean temp., ft ² •h•°F/Btu (m ² •°C/W) min., R-value (RSI)	5.0 (.87)
Compressive Strength ⁽¹⁾ , ASTM D1621, psi (kPa), min.	30 (210)
Water Absorption, ASTM D2842, % by volume, max.	<0.7
Water Vapour Permeance, ASTM E96, perm (ng/Pa•s•m ²)	0.9 (50)
Maximum Use Temperature, °F (°C)	165 (74)
Coefficient of Linear Thermal Expansion, ASTM D696, in/in•°F (mm/m•°C)	3.5 x 10 ⁻⁵ (6.3 x 10 ⁻²)
Flexural Strength, ASTM C203, psi (kPa), min.	50 (350)

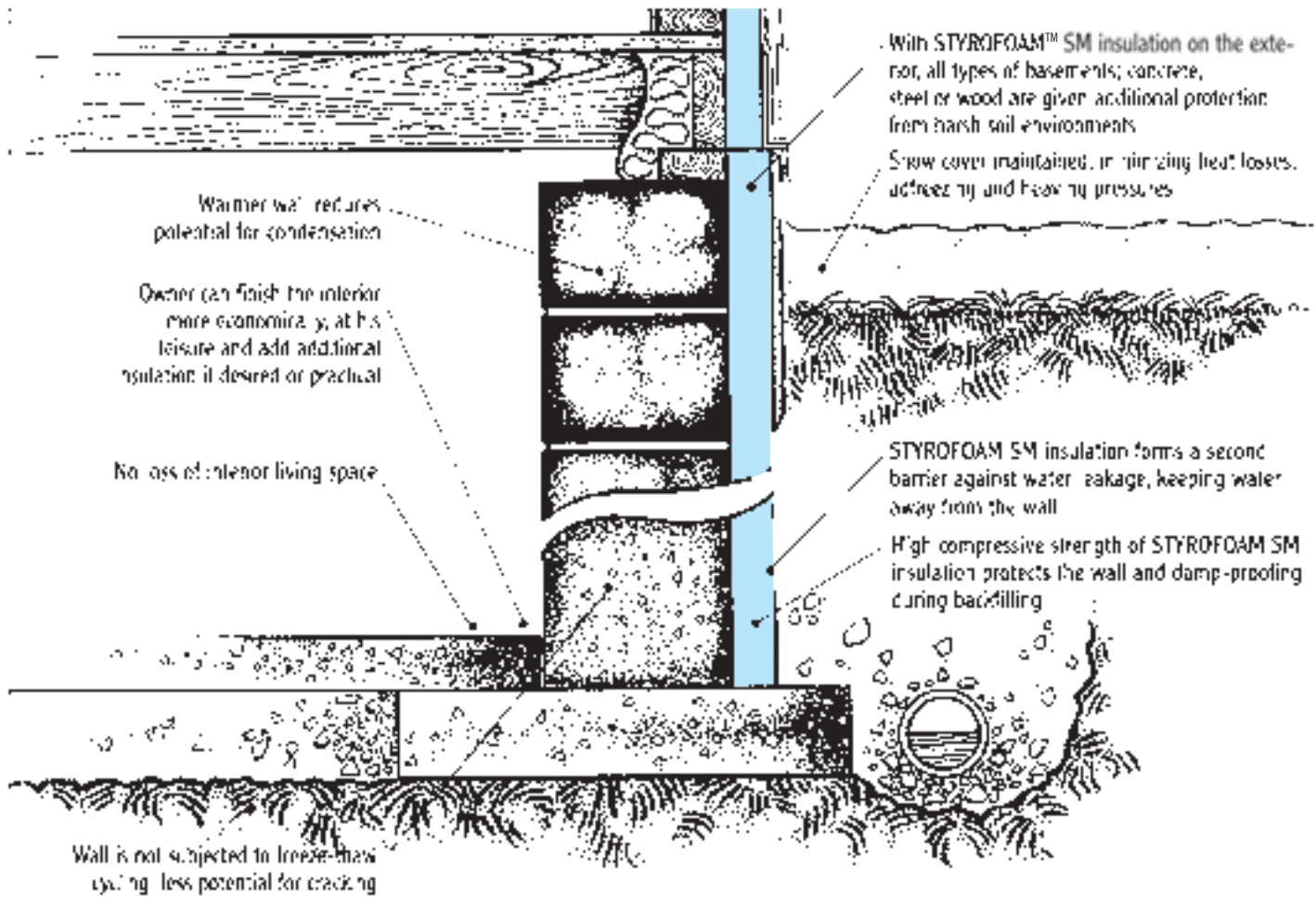
(1) Vertical compressive strength is measured at 10 percent deformation or at yield, whichever occurs first.

Physical Properties of STYROFOAM™ WALLMATE™ Insulation

Property and Test Method	Value
Thermal Resistance per inch (25 mm), ASTM C518 @ 75°F (24°C) mean temp., ft ² •h•°F/Btu (m ² •°C/W) min., R-value (RSI)	5.0 (.87)
Compressive Strength ⁽¹⁾ , ASTM D1621, psi (kPa), min.	16 (110)
Water Absorption, ASTM D2842, % by volume, max.	<0.9
Water Vapour Permeance, ASTM E96, perm (ng/Pa•s•m ²)	1.5 (90)
Maximum Use Temperature, °F (°C)	165 (74)
Coefficient of Linear Thermal Expansion, ASTM D696, in/in•°F (mm/m•°C)	3.5 x 10 ⁻⁵ (6.3 x 10 ⁻²)
Flexural Strength, ASTM C203, psi (kPa), min.	35 (240)

(1) Vertical compressive strength is measured at 10 percent deformation or at yield, whichever occurs first.

EXTERIOR INSULATION



Eight Great Advantages with STYROFOAM™ SM Brand Insulation

Basement Insulation: The Environment

It gets wet underground. On the outside of a foundation wall, soil absorbs moisture from rain, melting snow and dew. Inside, as warm air from the interior meets the colder wall, condensation can occur.

Because of this, any insulation used below grade must be able to resist moisture if it is to retain its R-value over the long-term.

Since superior water resistance is the key to below grade insulation, STYROFOAM™ SM brand insulation is the proven leader in delivering long-term R-value. In fact, over the long run, there's no better value than STYROFOAM brand insulation for your

below grade insulation dollar. What's more, STYROFOAM brand insulation is tough, delivering long-term durability. It's also lightweight, easy to transport and easy to cut, handle and install.

Keeping a foundation constantly warm and dry is the key to its long-term performance. Moisture resistant STYROFOAM SM insulation will help you keep foundations in great shape.

There are several advantages to insulating the exterior surface of basement or foundation walls. The block or concrete wall insulated on the exterior surface is not subjected to large temperature differences. As a result, thermal cycling and stress in the wall – the major causes of foundation damage may be reduced.

A continuous layer of STYROFOAM SM insulation around the entire foundation will significantly reduce thermal bridges. At the same time, by keeping moisture away from the wall, it will also provide a second level of protection should cracks develop.

Block walls insulated in this way undergo less air convection in block cavities. At nearly room temperature, the basement walls act as a heat reservoir, buffering interior temperature fluctuations. In some instances, the possible freeze-thawing forces are prevented from acting directly on the basement walls. Finally, unlike interior applications, no living space is lost.

Design Considerations

Insulation

Due to its high compressive strength, moisture resistance and proven long-term performance, STYROFOAM™ SM brand insulation is recommended for all exterior foundation wall insulation applications. The insulation should extend from the top of the foundation wall to the top of the footing.

The insulation boards are applied vertically to the wall and are secured at the top by nailing the insulation to the sill plate or mechanically fastening to the foundation wall. They should be tightly butted together, in close contact with the wall. Trim the board by scoring and snapping, or cut directly through it with an ordinary handsaw or utility knife.

Backfill against the insulation will hold the lower portion of the insulation boards in place. Fasten the boards at the top of the wall to prevent movement during the backfilling operation. Fasteners include galvanized concrete nails and washers, self-tapping concrete screws, high powered Ramset, Remington or Hilti systems or galvanized common nails and washers (for use with wood nailers, sill plates, header joists or wood foundations).



Waterproofing and Damp-Proofing

A layer of STYROFOAM SM insulation placed over the waterproofing or damp-proofing will protect it and eliminate damage during construction.

Waterproofing and damp-proofing materials should not be used for adhering the insulation. The insulation should be installed once the damp-proofing has cured sufficiently, as solvents in some damp-proofing materials may attack polystyrene insulation.

Protective Covering

For both practical and aesthetic purposes, it is important that the above grade portion of insulation be protected from physical damage and direct exposure to sunlight (i.e. ultra-violet degradation).

Depending on the extent of protective covering required, the covering material may be of ordinary or Latex-modified Portland cement compositions, directly applied to the insulation or to a mechanically fastened metal lath or plastic mesh. Asbestos cement board, painted metal, appropriately treated plywood, or some other type of protective coating acceptable to local authorities may also be used.

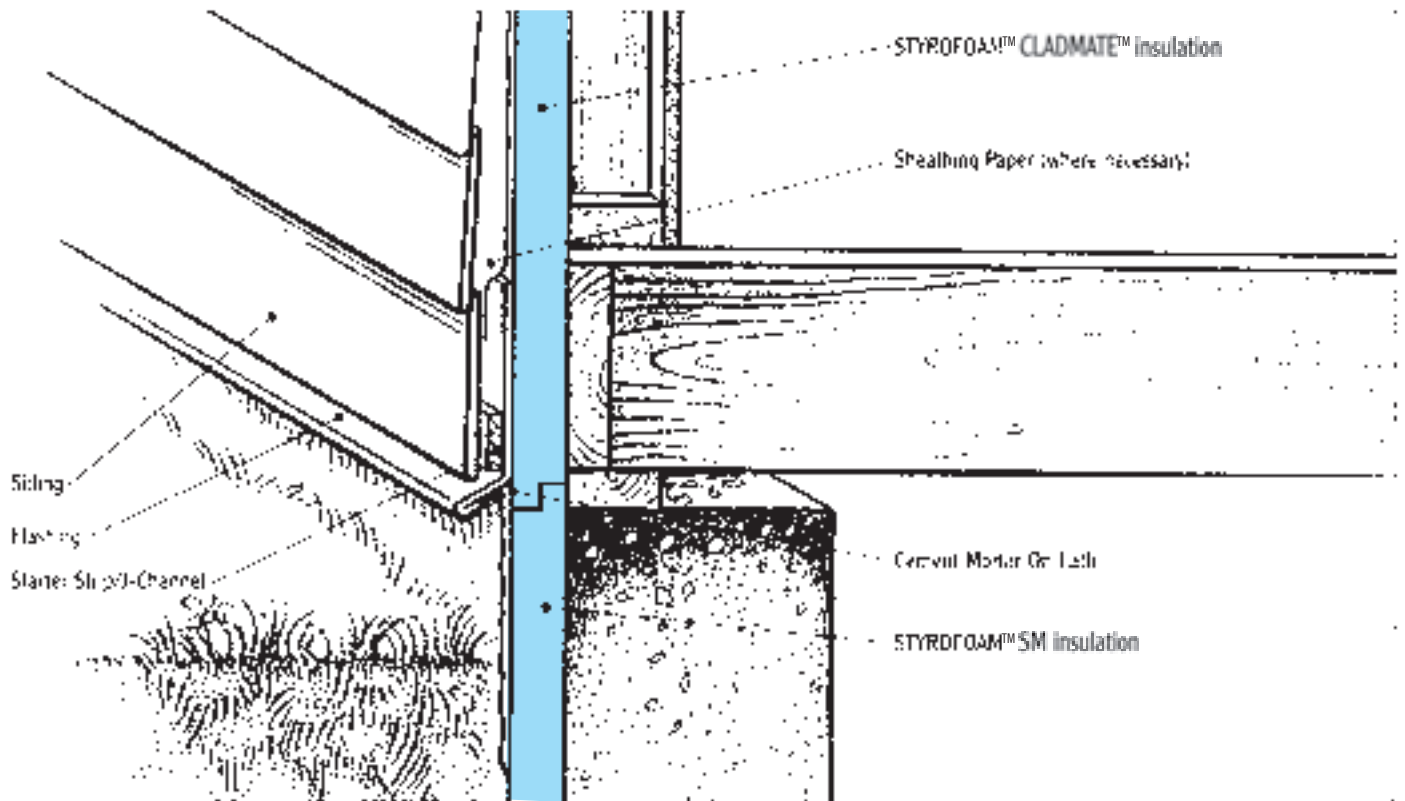
Flashing should be provided over the top edge of the insulation and the protective covering. Coping blocks or other details may be suitable for the transition to the exterior cladding of the structure.

Manufacturers and suppliers of exterior protective coverings are responsible for the design, integrity and endurance of their finished system applied over STYROFOAM SM insulation. Ask your building supply dealer or a Dow representative to help you identify available products.

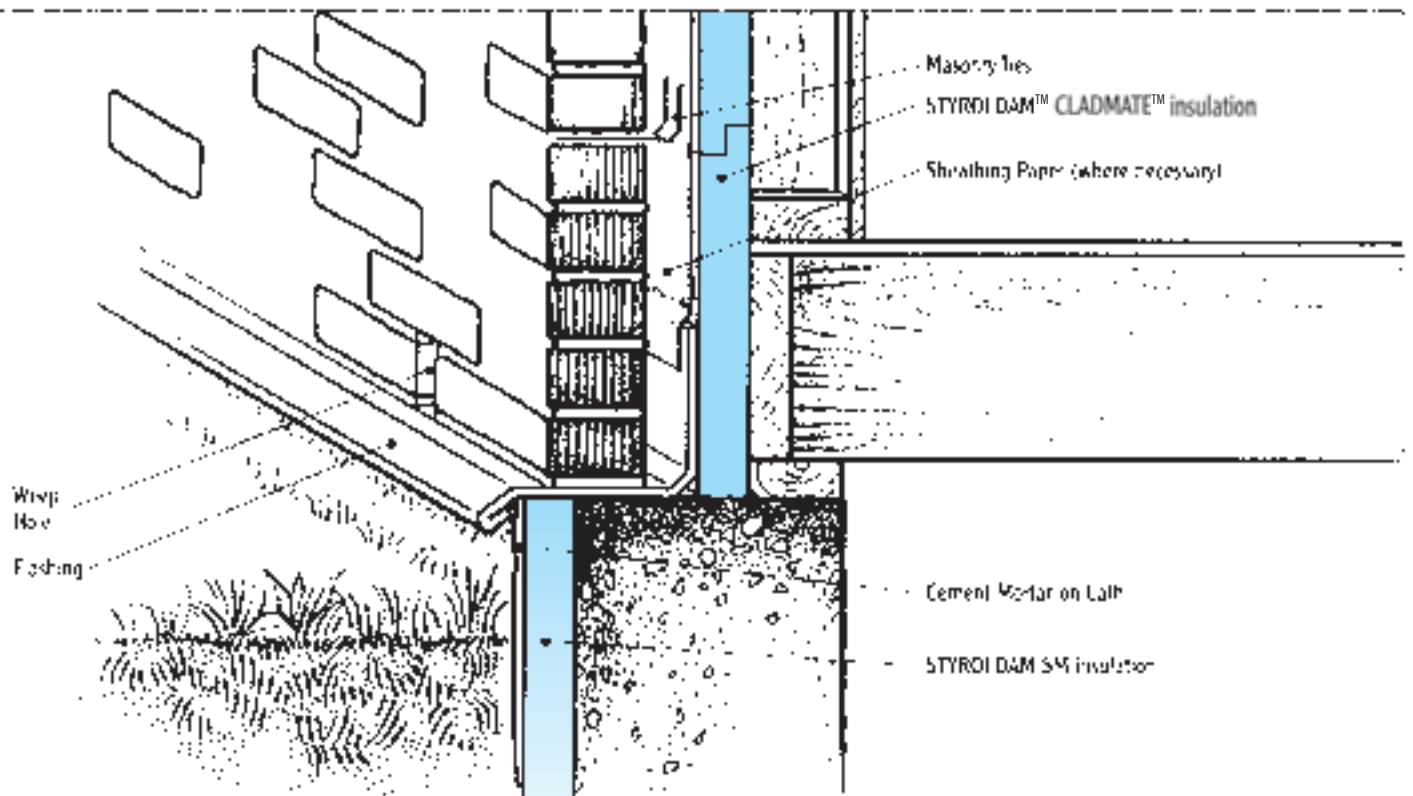
Continuous Application Above Grade

The use of this foundation wall insulation placement, in conjunction with an exterior masonry or frame wall insulation, allows the insulation to be installed continuously down the exterior wall surface, thus eliminating thermal bridging at the foundation wall/floor intersection.

FOUNDATION WALL/EXTERIOR

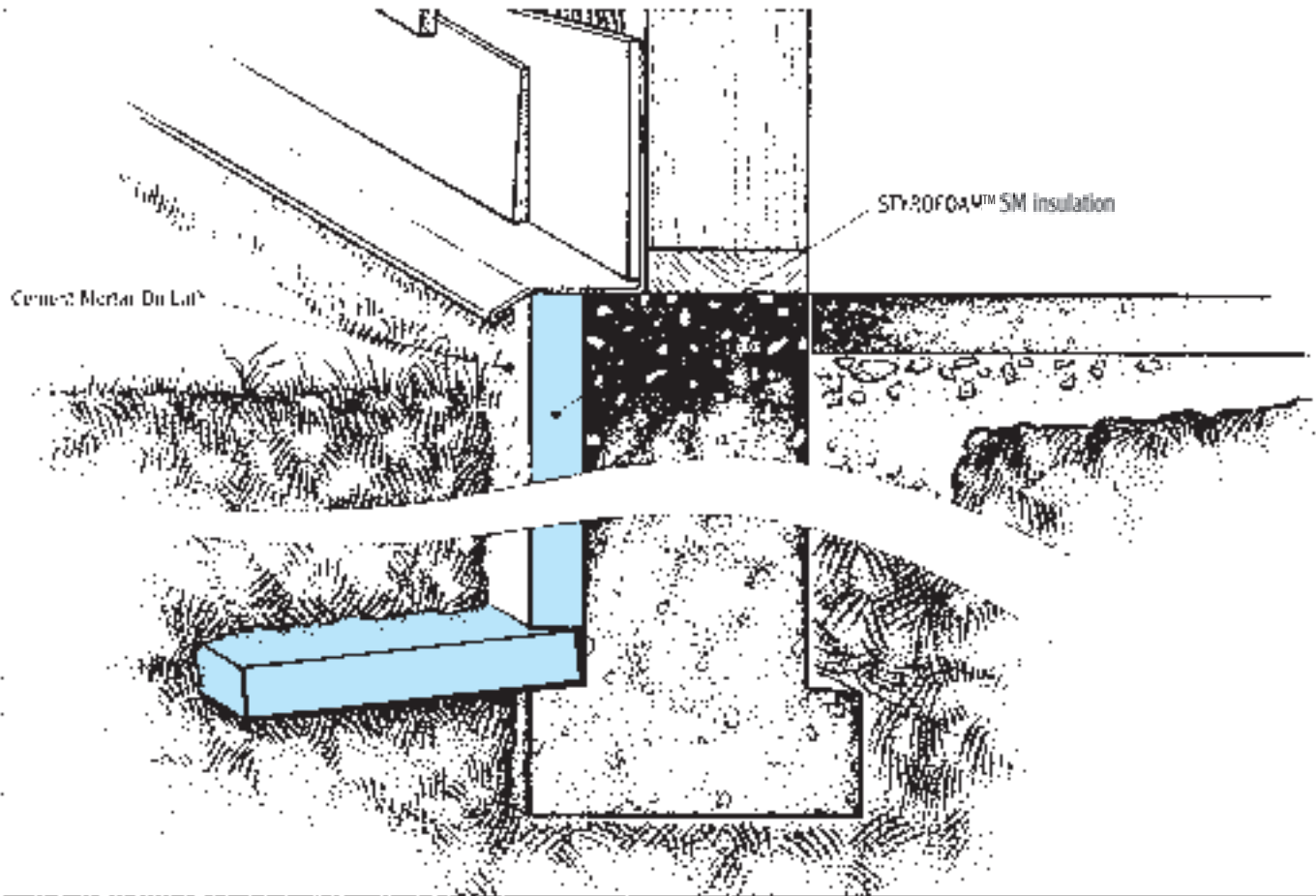


Continuous Application Above Grade for Basement Walls



Exterior Basement Insulation with Brick Veneer Frame Wall

SHALLOW FOUNDATION



Typical Shallow Foundation Insulation For Heated Buildings

Insulated, frost protected shallow foundations for slab-on-grade construction are a practical alternative in regions where more costly, conventional deep foundation methods are usually used. A frost protected shallow foundation relies on strategically placed insulation to resist frost penetration around buildings by regulating heat loss and hence the depth of frost penetration into the soil. And since frost can no longer get at the building foundation, the damaging effects of frost action on the building foundation do not occur!

Design Considerations

Insulation

In frost protected shallow foundations, STYROFOAM™ SM brand insulation can be specified with confidence. It has excellent resistance to soil moisture and freeze-thaw cycling.

In heated frost protected shallow foundations, STYROFOAM SM insulation is placed horizontally in the soil adjacent to the foundation and completely around the perimeter of the building. In unheated frost protected shallow foundations, in addition to being placed horizontally around the perimeter of the building, STYROFOAM SM insulation is also placed completely beneath the floor slab.

The insulation boards are applied vertically to the inside

of the foundation wall and are initially secured at the top with an adhesive which complies with CGSB specification #71-GP-24M. Backfilling against the insulation will hold the boards firmly in place.

The insulation should extend from the bottom of the floor slab down to the top of the footing.

Contact your Dow representative for further details on the design of insulated frost protected shallow foundations for slab-on-grade construction using STYROFOAM SM insulation.

Vapour Barrier

A vapour barrier, if used, should be installed along the underside of the floor slab and over the top edge of the insulation.

UNDER SLAB

Design Considerations

Insulation

The use of STYROFOAM™ SM insulation is recommended, except where the slab will be expected to sustain very high loading (from mechanical equipment, etc.). In that case, a higher compressive strength insulation should be considered, such as STYROFOAM™ HI-40, HI-60 or HI-100 insulation.

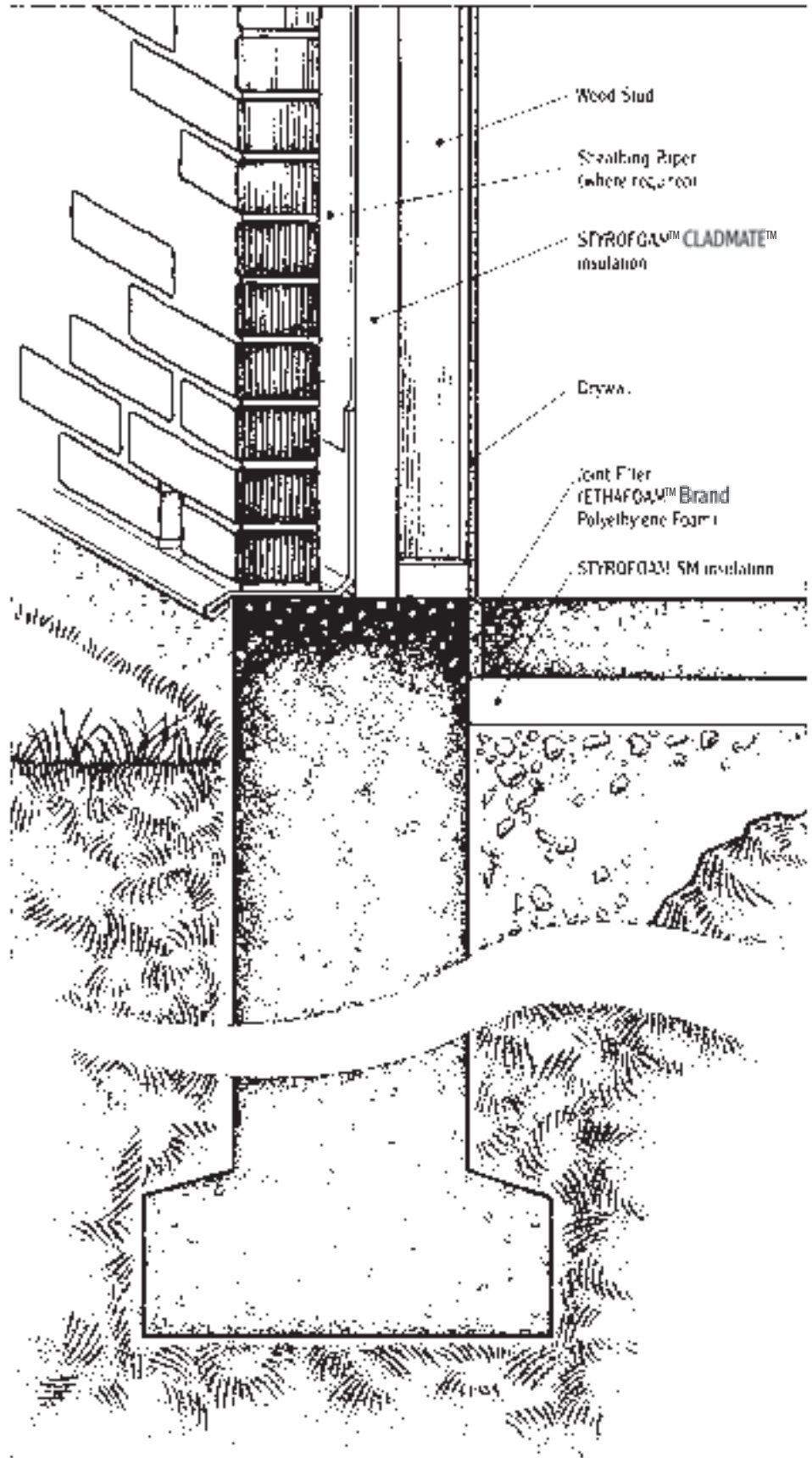
The insulation boards should be placed snugly around the perimeter of the foundation wall and laid directly over well compacted porous fill. The insulation is laid loose with edges butted tightly together. However, if wind uplift may be a problem before the concrete slab is poured, secure the insulation boards to the ground with 6 mm (1/4") diameter wood skewers which should be at least 75 mm (3") longer than the thickness of the STYROFOAM insulation.

Vapour Barrier

A vapour barrier, if used, is laid over the top of the insulation and under the entire floor slab area.

Weeping Tiles

Weeping tiles should be included on the inner face of the foundation wall if the soil conditions do not provide sufficient drainage.



Typical Under Slab Insulation

FOUNDATION WALL/INTERIOR

Every inch of STYROFOAM™ brand insulation represents an insulating value of R5. By insulating your basement with specially designed STYROFOAM™ WALLMATE™ insulation, your energy savings and home comfort increase proportionately with the thickness of the board you use.

STYROFOAM WALLMATE insulation is extremely easy to install as it goes right over the masonry wall. No studs or vapour barrier are required, saving important interior living space and time of installation. The wood furring strips used to fasten the slotted WALLMATE™ insulation to the masonry wall make ideal anchors for drywall nails or screws, making its installation a snap as well.

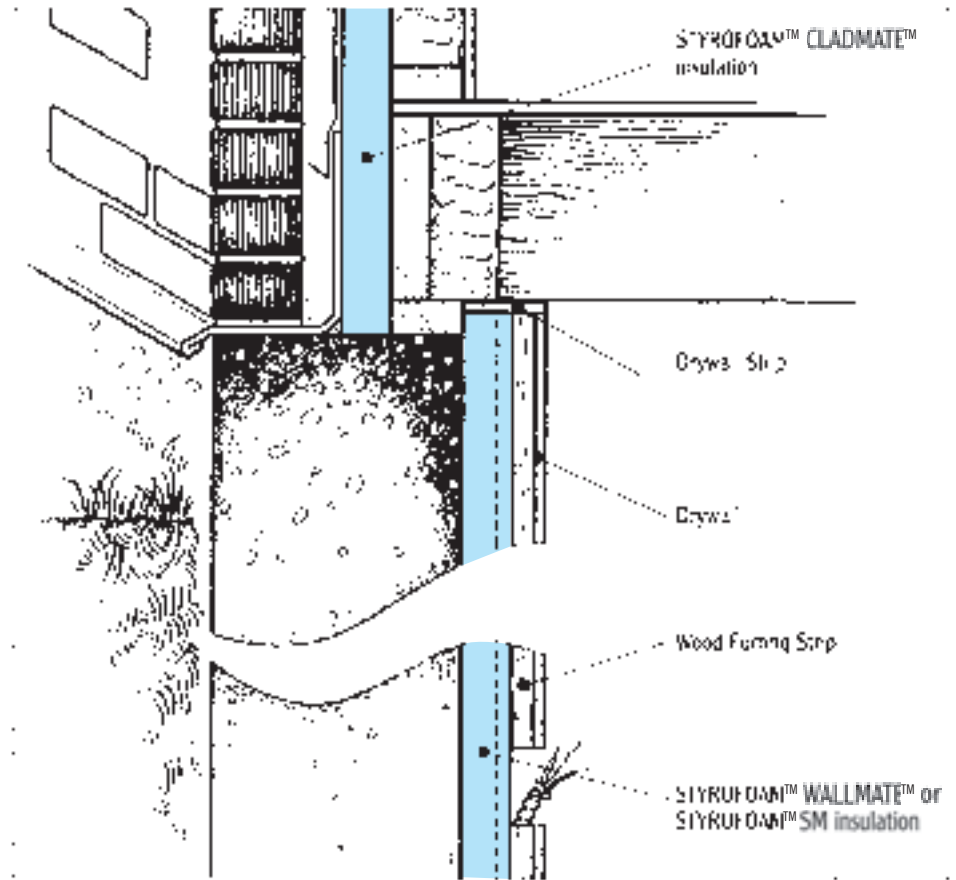
Another benefit of not having to use wood studs is the elimination of “thermal shorts”. These shorts occur because batt insulation is placed in between studs. As a result the actual studs are uninsulated and act as conduits, allowing heat to pass between the insulation batts, to the concrete wall and out. STYROFOAM WALLMATE insulation covers the entire wall, ensuring heat stays where it belongs, in the home.

STYROFOAM WALLMATE insulation is also extremely moisture resistant. Even basement leaks have little effect on its insulating abilities, unlike batt insulation which absorbs water, severely reducing its ability to deliver sustained R-values.

Design Considerations

Insulation

STYROFOAM WALLMATE brand insulation is recommended for all interior foundation wall applications. Before the insulation is installed, a strip of drywall (the width of which should be at least equal to the thickness of the insulation plus the drywall finish) must be nailed to the underside of the joists, tight against the sill plate. This will provide fire protection for the top surface of the insulation. The drywall strip may be omitted when continuous wood furring is used.



Typical Interior Basement Wall Insulation

The insulation boards may be adhered to the foundation wall with an adhesive conforming to CGSB specification #71-GP-24M or may be mechanically fastened with one of the wood furring strip systems described on page 14.

The insulation should extend from the underside of the drywall strip, if used, to the top of the basement slab.

Interior Finish

The insulation must be covered with 12.7 mm (1/2") drywall or another equivalent fire resistant material on all exposed surfaces. This finishing material must be mechanically fastened to the furring, if provided, or through the insulation to the basement wall.

Electrical Work

Wiring is easy when applying slotted STYROFOAM WALLMATE insulation. When working with 1" x 3" wood

furring strips, simply cut a 1/2" deep channel into the back of the board to accommodate wires using a 1/2" router bit or regular utility knife. When using 2" x 3" wood furring strips, a 3/4" gap is left between the WALLMATE insulation and outside face of the wood strip to which the drywall is fastened. In this case the wiring can be run in these gaps.

To cut openings for electrical boxes, simply place the WALLMATE insulation board in position against the box and tap the outside face of the board with your hand. An imprint of the box will then be left on the back of the board, showing the area to be cut out.

CAUTION! Some provinces do not allow you to do your own electrical work, or at least require you to obtain a permit. Check your local building code for rules and regulations. Dow recommends that electrical work be undertaken only by qualified individuals.

CRAWL SPACES

A crawl space is, for the purpose of this brochure, considered to be the space between the ground floor assembly and the ground cover (or slab) directly below, which has a clearance of less than 1,800 mm (6'-00"). Crawl spaces generally fall under one of the two following categories:

Unheated

Relatively small/narrow crawl space areas which will neither be heated nor used for storage or services.

Heated

Larger areas which will be heated and may accommodate mechanical services, but will not be used for storage.

Design Considerations

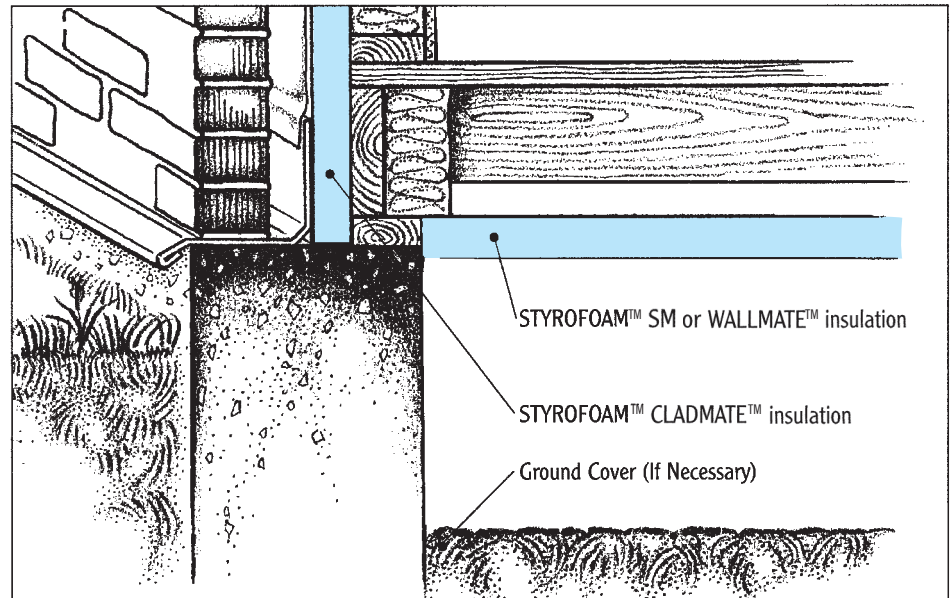
Insulation

The use of STYROFOAM™ SM or WALLMATE™ insulation is recommended for all crawl space insulation applications. Depending on the nature of the application, the high compressive strength of STYROFOAM SM may not be required. As a result, either STYROFOAM SM or WALLMATE insulation can be used.

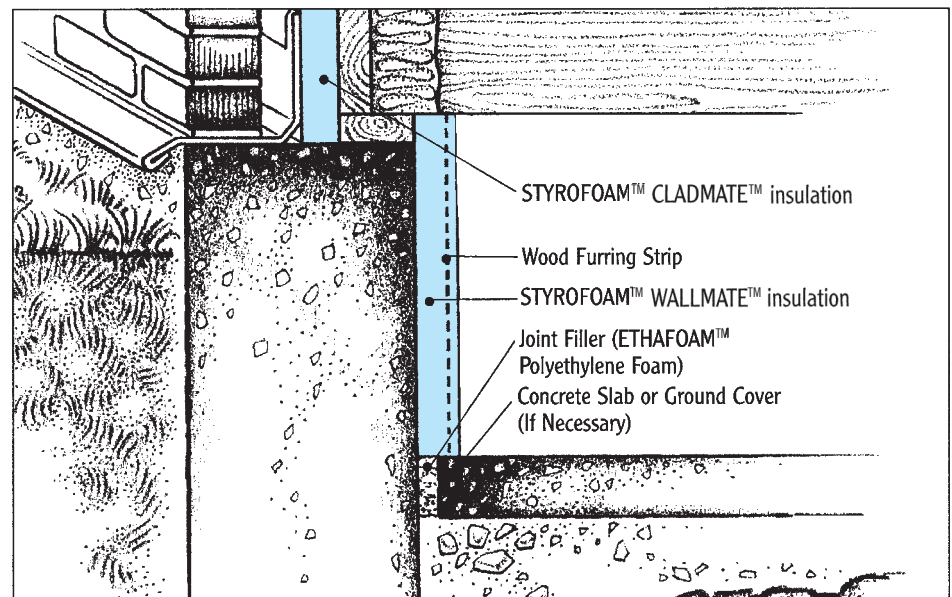
The insulation boards should be either mechanically fastened with suitable fasteners or one of the wood furring strip systems, or adhered (with an adhesive conforming to CGSB #71-GP-24M) to the foundation wall. The insulation should extend from the bottom of the drywall strip, if used, to a minimum of 600mm (2') below grade and should be brought to the top of the footing, if possible, for improved heat loss reduction.

Vapour Barrier

The vapour barrier, if used, should be installed on the warm side of the insulation.

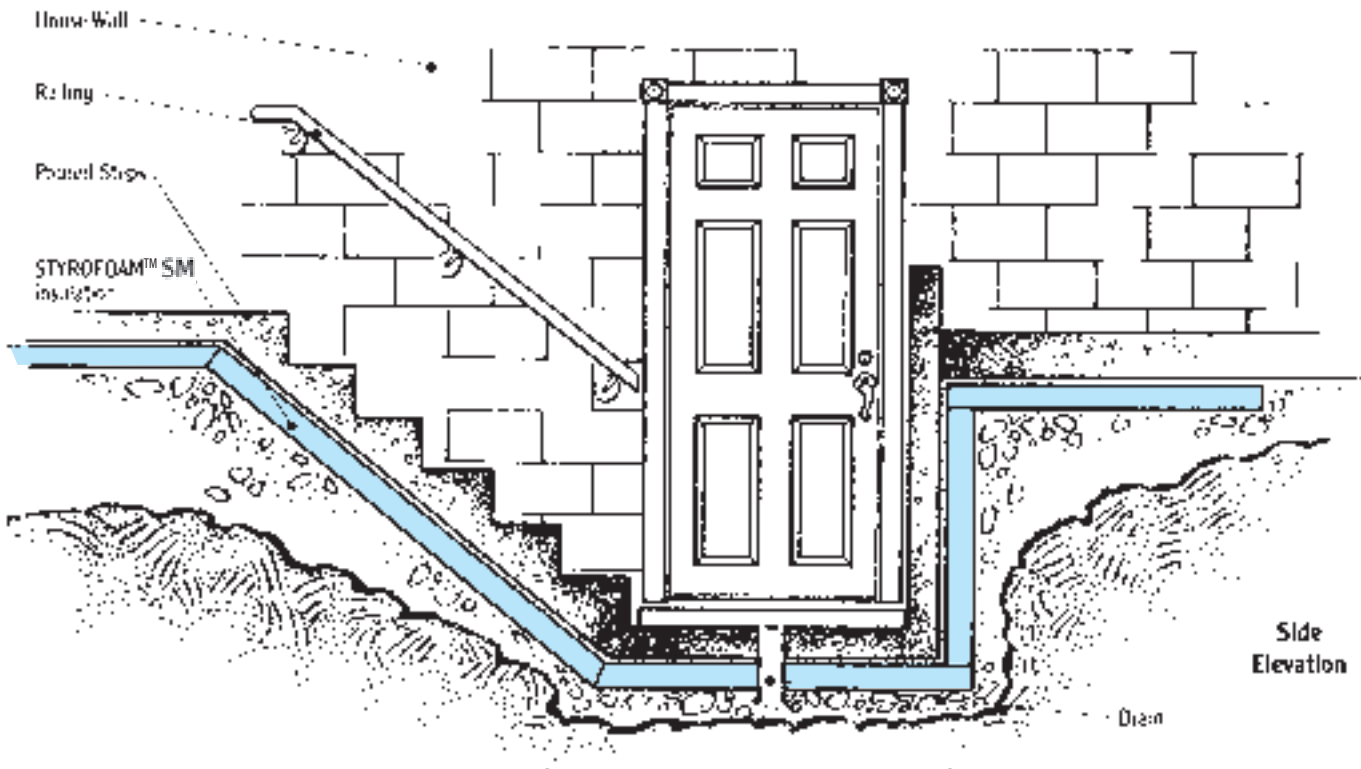


Crawl Space Category 1 (Unheated)



Crawl Space Category 2 (Heated)

INSULATED STAIRWELL

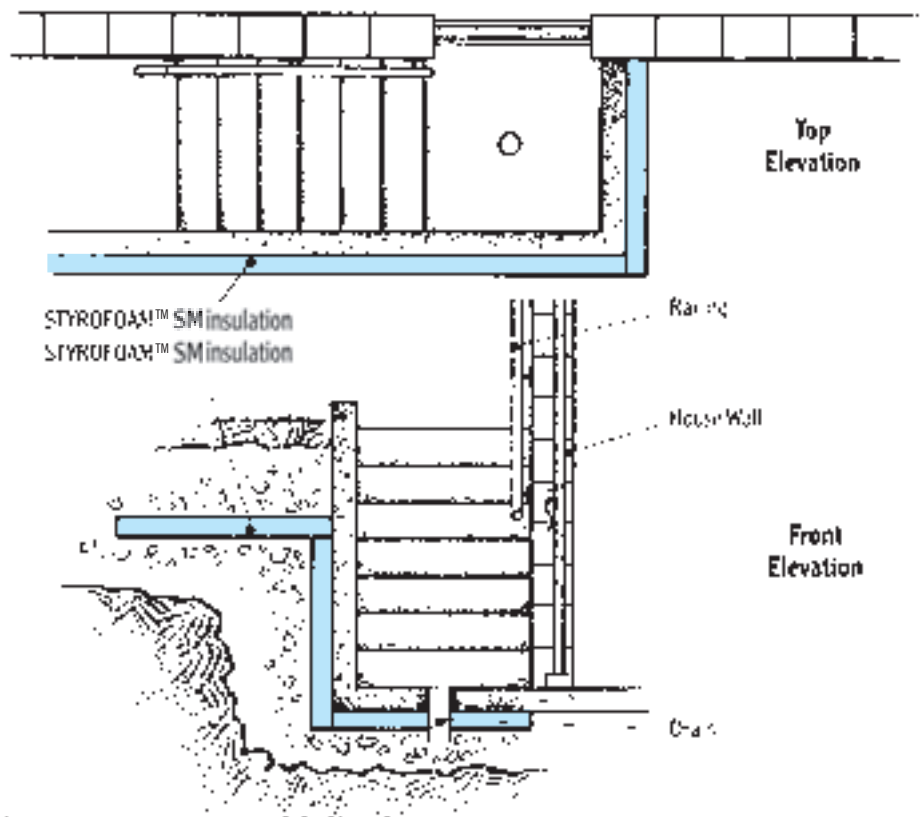


Typical Insulated Basement Access Stairwell

Design Considerations

Sometimes, access to a basement is by an exterior stairwell, which can be constructed with pour-in-place concrete, concrete blocks or precast units. In the winter, cold air in the stairwell can cause frost penetrations which may result in heaving and cracking, causing damage to both the stairwell and the basement wall.

Placing STYROFOAM™ SM brand insulation beneath the stairwell can reduce frost penetration adjacent to and beneath it, reducing the risk of frost damage.



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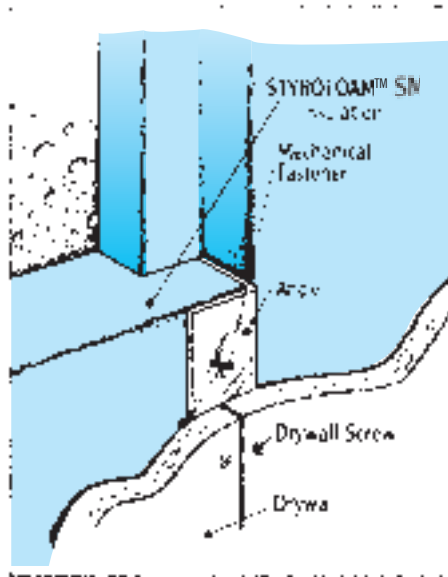
FASTENING SYSTEMS

Fastening to Framing

STYROFOAM™ SM or STYROFOAM™ WALLMATE™ brand insulation should be fastened to framing at not less than 150 mm (6") centers along its vertical edges and on not less than a 300 mm × 600 mm (12" × 24") grid for the remainder of each sheet. Fasteners shall have heads or washers at least 12.7 mm (1/2") in diameter.

Fastening to Masonry Walls

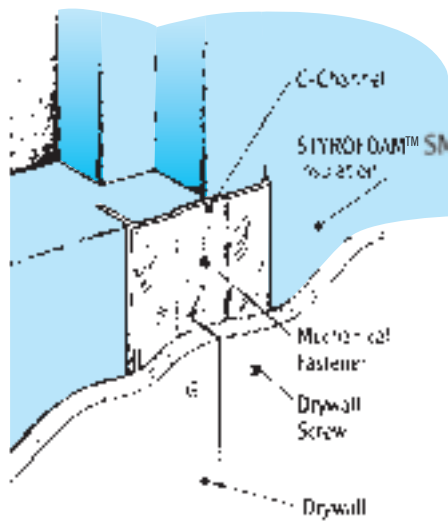
In all of the following furring systems, the furring member is mechanically fastened through the STYROFOAM SM or STYROFOAM WALLMATE insulation to the structure. Generally, three mechanical fasteners are required per furring strip.



Angle

Advantages of Angle Fasteners

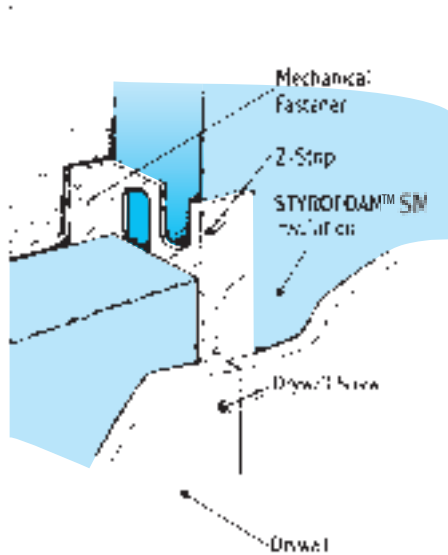
- Good contact between insulation boards and wall
- Reduces thermal shorts
- No insulation thickness limitation
- Employs either butt or shiplapped edges
- Offers a fastening base for either interior drywall or exterior cladding
- Can be used vertically or horizontally
- Ideal for use at wall corners and intersections



C-Channel

Advantages of C-Channel Fasteners

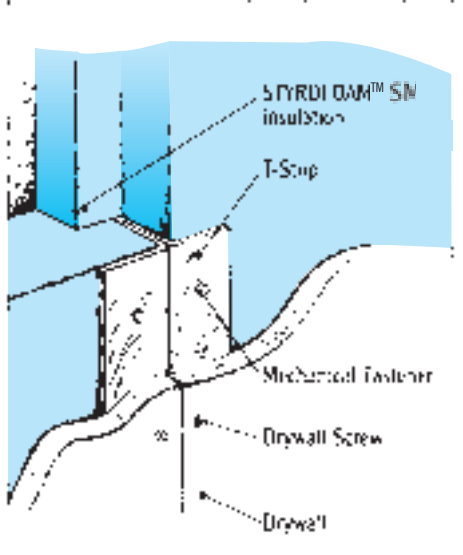
- Good contact between wall and lateral restraint between insulation boards
- Reduces thermal shorts
- No insulation thickness limitation
- Employs butt or shiplapped edges
- Offers a fastening base for either interior drywall or exterior cladding
- Can be used vertically or horizontally
- Ideal for use on underside of concrete decks or slabs



Z-Strip

Advantages of Z-Strip Fasteners

- Good contact between insulation boards and wall
- Reduces thermal shorts
- Can be used vertically or horizontally



T-Strip

Advantages of T-Strip Fasteners

- Good contact between insulation boards and wall
- Reduces thermal shorts
- No insulation thickness limitation
- Employs a fastening base for either interior drywall or exterior cladding
- Can be used vertically or horizontally

FASTENING SYSTEMS

Advantages of Slotted STYROFOAM™ WALLMATE™ and Wood furring

- Good contact between insulation boards and wall
- Eliminates thermal short
- No insulation thickness limitation
- Employs either butt or shiplapped edges

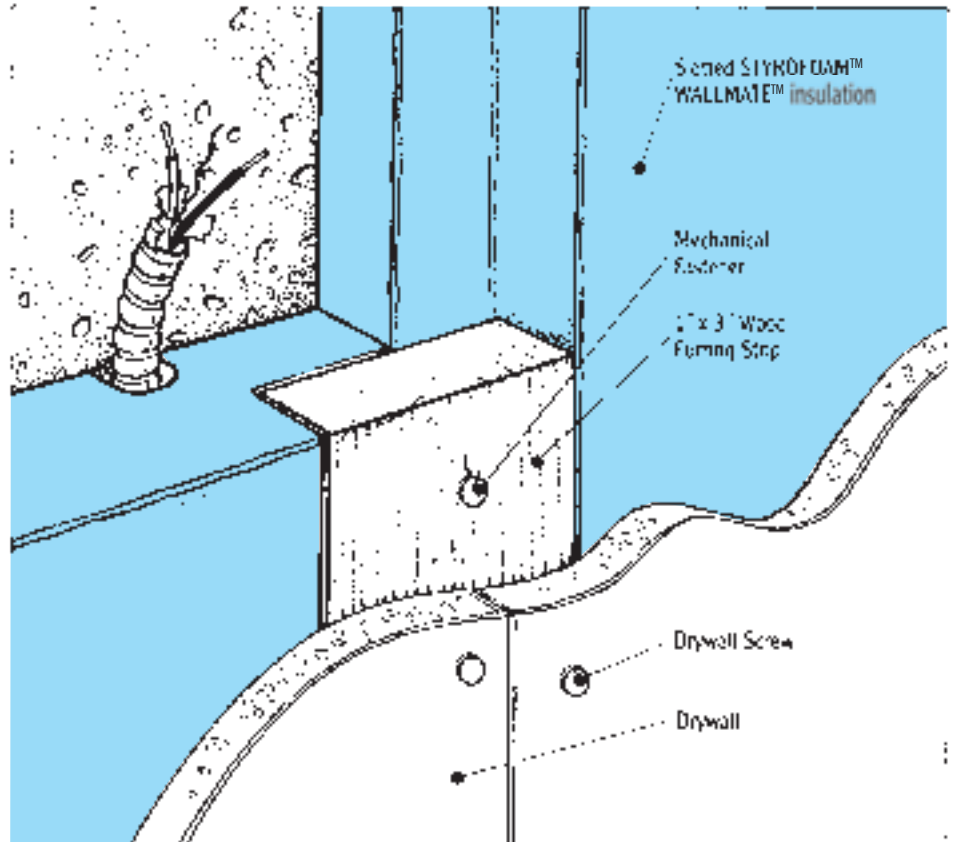
Wood Strip (1"×3")†

This fastening system is the basis for the design of slotted STYROFOAM™ WALLMATE™ brand insulation. Once installed, the wood strips are flush with the face of the WALLMATE board and are an ideal anchor for either drywall nails or screws.

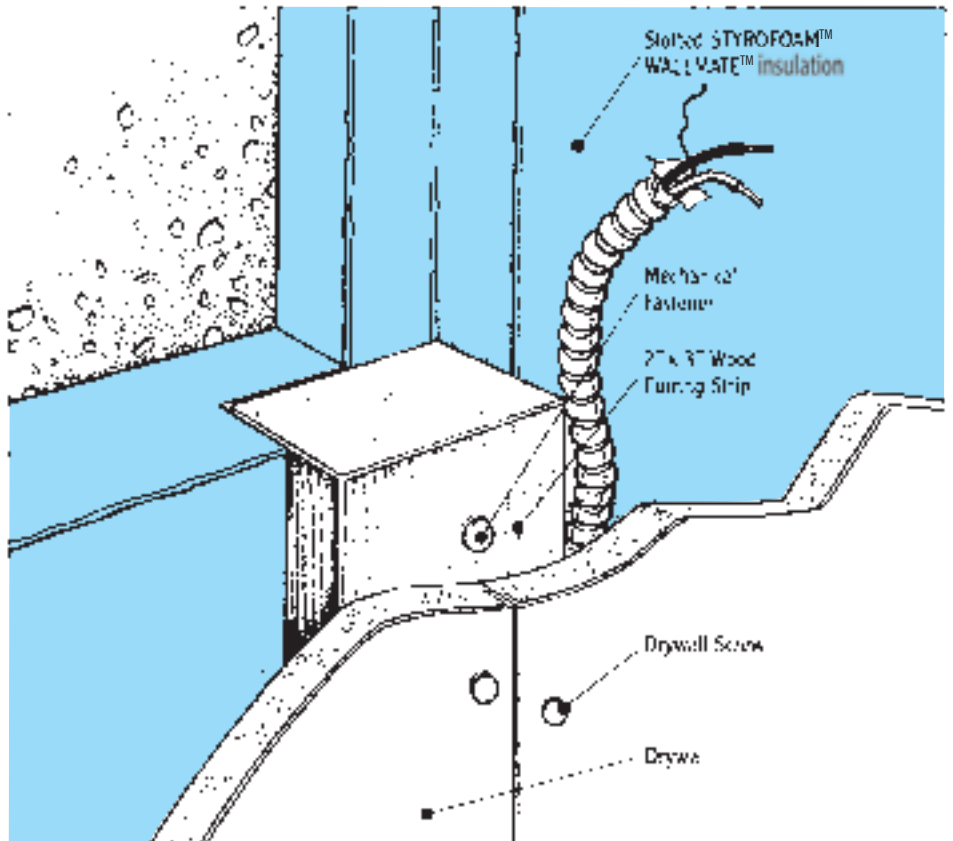
Wood Strip (2"×3")

This fastening system is ideal for application by the homeowner. The space between the slotted WALLMATE and the drywall provides both a space for electrical wiring and an additional insulating value.

† Slots to accommodate a 1" × 4" are used in some areas



Wood Strip (1"×3")



Wood Strip (2"×3")

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Chemical Resistance

The table below gives typical chemical resistance properties for STYROFOAM™ brand insulation.

Good Resistance

Acids (inorganic and organic)
Bases (caustics)
Brine, other salts
Bleach
Alcohol and alcohol based paints
Gases: NH_3 , CO_2 , CH_4 , fluorocarbons
Cements and mortars
Asphalt
Foodstuffs: milk
 beer
 fruit juices
 butter and lard
 mineral oil
 soybean oil
Parafin wax
Lanolin

Poor Resistance

Aromatic hydrocarbons
 (benzene, etc.)
Chlorinated hydrocarbons
 CCl_4
Olefins (ethylene, etc.)
Naphthas (common paint
 solvent-thinner)
Ketones (acetone, MEK, etc.)
Aldehydes (formaldehyde)
Ethers
Gasoline
Cut-back asphalts
Polyester resins
Oil base paints (solvents)
Insecticides
Oil of clove
Wood oils
Fuel oils

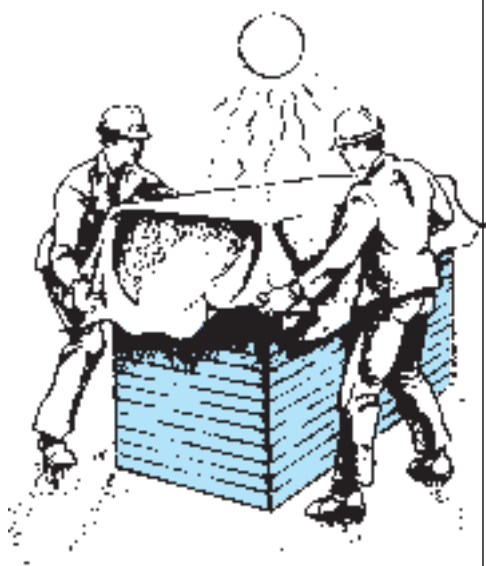


If products such as adhesives, mastics, vapour retarders, or air barriers are used that contain solvents that will attack (dissolve) STYROFOAM insulation, follow manufacturer's instructions regarding compatibility and recommended method of use.

UV Stability

Exposure of STYROFOAM insulation to direct sunlight will deteriorate the surface cellular structure. Protect it with a light coloured or white opaque covering in storage. Sunlight causes discolouration and a dusting of the surface. This dusty surface will impair any adhesive or finish bond, and the dust should be brushed off before applying these products.

Although STYROFOAM insulation offers no food value to rodents or insects, some burrowing vermin such as termites or carpenter ants may tunnel into it as they do to other construction materials. If such vermin are abundant then normal techniques to control the infestation are advisable.



Warning

STYROFOAM brand insulation is combustible and may constitute a fire hazard if improperly used or installed. Consult Dow for further information. The material contains a flame retardant additive to inhibit accidental ignition from small fire sources. During shipping, storage, installation and use, STYROFOAM insulation should not be exposed to open flame or other ignition sources. When used in buildings intended for human habitation, STYROFOAM insulation must be covered with 12.7 mm (1/2") gypsum board, or equivalent, on the interior of the building. This covering must be mechanically fastened and shall not depend on adhesive bond for support.



IN CANADA:

- For Technical Information (English): **1-866-583-BLUE (2583)**; (French): **1-800-363-6210**
- For Sales Information (English): **1-800-232-2436**; (French): **1-800-565-1255**

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COMBUSTIBLE: Protect from high heat sources. For more information, consult MSDS and/or call Dow at 1-866-583-BLUE (2583). In an emergency, call Dow (U.S.: 1-989-636-4400) (Canada: 1-519-339-3711). Local building codes may require a protective or thermal barrier. Contact your local building inspector for more information.

NOTE: Building and/or construction practices unrelated to insulation or housewrap could greatly affect moisture and the potential for mold formation. No material supplier, including Dow, can give assurance that mold will not develop in any specific system.

