Concrete Sandwich Panel Applications
Rigid Foam Insulation

The unique properties of STYROFOAM™ SM insulation and STYROFOAM™ PERIMATE™ insulation give them exceptionally good qualities for a wide variety of uses. In particular, STYROFOAM™ insulation products outperform all other products in exterior foundation applications.

Advantages
There are several advantages to insulating the exterior surface of foundation walls. The block or concrete wall insulated on the exterior surface is not subjected to large temperature differences and so will not act as a thermal bridge. Block walls insulated on the exterior 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, adfreezing forces are prevented from acting directly on the basement wall. And finally, unlike interior applications, no living space is lost.

DESIGN CONSIDERATIONS
Insulation
The use of STYROFOAM™ SM insulation meeting CAN/ULC S701 Type 4 is recommended. Where additional drainage is required, STYROFOAM™ PERIMATE™ insulation meeting CAN/ULC S701 Type 4 should be considered. The insulation boards are applied vertically to the wall (horizontally for slab on grade or shallow foundation applications) and are secured at the top with a compatible adhesive or by nailing to the wall. Backfilling against the insulation will hold the lower portion of the boards in place. The insulation should extend from the bottom of the floor slab to the top of the footing. STYROFOAM™ PERIMATE™ insulation is a CCMC Class A Type 2 drainage layer.

Waterproofing And Damp-Proofing
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 the solvents in some of these materials may attack polystyrene insulation.

Protective Covering
It is important that the abovegrade portion of STYROFOAM™ SM insulation be protected from physical damage and direct exposure to sunlight (i.e., ultraviolet degradation). Depending on the extent of protection needed, your options include a cementitious or thin stucco coating, application of a fiberglass reinforced plastic or vinyl sheet, or a metallic covering. Flashing should be installed over the top edge of the insulation and protective covering.

SLAB ON GRADE
Insulation
The use of STYROFOAM™ SM insulation is recommended. The insulation boards are applied vertically to the inside of the foundation wall and are initially secured at the top with an adhesive compatible with polystyrene insulation based on 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 to the top of the footing.

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

*R means resistance to heat flow. The higher the R-value, the greater the insulating power.
UNDER SLAB
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™ Highload 40, 60 or 100 insulation.

The insulation boards should be placed snugly around the perimeter of the foundation wall and laid directly over the well-compacted porous fill. The insulation is laid loose with the 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
The vapour barrier, if used, is laid over the top of the insulation and under the entire floor slab area.

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

**TABLE 1: Physical Properties of STYROFOAM™ SM Insulation and STYROFOAM™ PERIMATE™ Insulation**

<table>
<thead>
<tr>
<th>Property and Test Method</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Thermal Resistance(1) per in. (25 mm), ASTM C518, C177, 75°F (24°C) mean temp., ft²•h•°F/Btu (m²•°C/W), R-value (RSI), min.</td>
<td>5.0 (87)</td>
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<tr>
<td>Compressive Strength(2), ASTM D1621, psi (kPa), min.</td>
<td>30 (210)</td>
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<tr>
<td>Water Absorption, ASTM D2842, % by volume, max.</td>
<td>0.7</td>
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<tr>
<td>Maximum Use Temperature, °F (°C)</td>
<td>165 (74)</td>
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<tr>
<td>Coefficient of Linear Thermal Expansion, ASTM D696, in/in•°F (mm/mm•°C)</td>
<td>$3.5 \times 10^{-5}$ ($6.3 \times 10^{-2}$)</td>
</tr>
</tbody>
</table>

(1) Values are consistent with criteria of ASTM C578.
(2) Vertical compressive strength is measured at 10 percent deformation or at yield, whichever comes first. Since STYROFOAM™ extruded polystyrene insulations are visco-elastic materials, adequate design safety factors should be used to prevent long-term creep and fatigue deformation. For static loads, 3:1 is suggested. For dynamic loads, 5:1 is suggested.