

Rigid Foam Insulation in Precast Sandwich Panel Applications

SYSTEM OVERVIEW

General Information

Concrete is a strong and highly durable material and a good choice in both commercial and multistory residential applications. However, precast concrete panel walls can absorb moisture from rain and vapor drive. Condensation buildup can reduce the effectiveness of the insulation and may cause other problems, including mold and mildew.

In precast sandwich wall construction, DuPont™ Styrofoam™ Brand Square Edge extruded polystyrene and DuPont™ Isocast™ R polyisocyanurate insulations combine superior insulating capabilities and dew point control with the additional strength of concrete. The closed-cell, rigid plastic foam insulations manufactured exclusively by DuPont provide dependable and predictable performance, even in severe moisture environments. Both are well-suited for use in precast concrete walls.

Precast Wall Assemblies

To form precast concrete walls, concrete is poured on both sides of the foam and the finished panel is held together structurally with connectors.

Precast concrete panels provide thermal mass, which can store considerable amounts of thermal energy. Rigid foam insulation isolates the thermal mass provided by the concrete panels, minimizing building interior temperature fluctuations under outside temperature swings.

This reduces energy consumption in hot and cold climates. For example, a 7" thick slab of concrete has the same R-value* as a pane of glass (R-1.5). A 2" thick layer of Styrofoam™ Brand Square Edge insulation, R-10, increases the total thermal value of the precast sandwich panel to R-11.5, almost eight times the value without it. A 2" thick layer of Isocast™ R polyisocyanurate insulation, R-13.0, increases the total thermal value of the precast sandwich panel to R-14.5, 10 times the value without it. (See Figure 1).

Buildings that incorporate precast sandwich panels made with Styrofoam™ Brand Square Edge or Isocast™ R insulation will perform more efficiently over time because of the insulations' superior long-term thermal performance and unparalleled moisture control qualities.

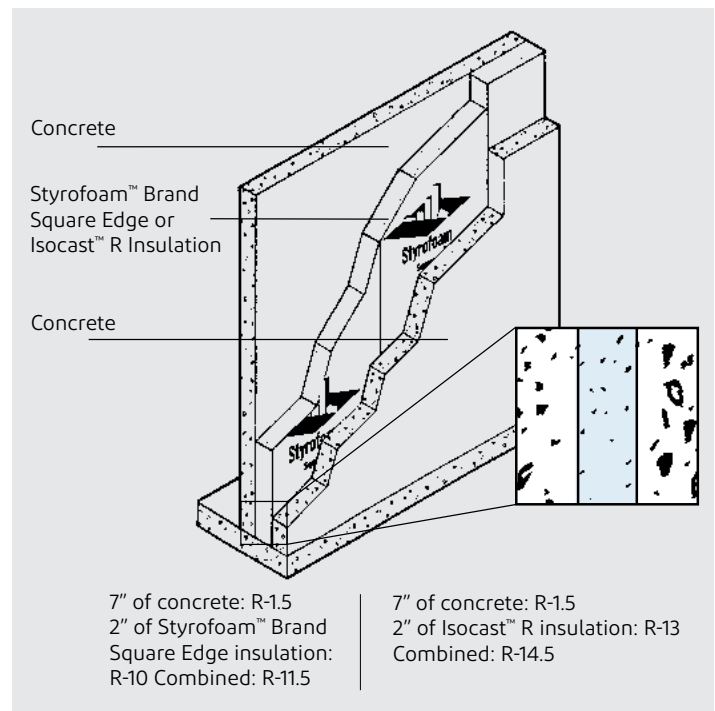


Figure 1. Precast sandwich panel wall with Styrofoam™ Square Edge or Isocast™ R insulation

Why Rigid Foam Insulation from DuPont?

Precast concrete wall manufacturers recognize the need for high-performance insulation in this application. Styrofoam™ Brand Square Edge insulation is an ASTM C578 Type IV extruded polystyrene insulation with smooth, high-density skins that make it virtually moisture resistant.

It has no facings that are susceptible to corrosion or delamination. Plus, Styrofoam™ Brand Square Edge insulation offers superior economical long-term thermal performance under the harsh conditions of freeze-thaw cycling, a common phenomenon exhibited in precast concrete panels in cold climates. Isocast™ R insulation is an ASTM C1289 Type I.

*R means resistance to heat flow. The higher the R-value, the greater the insulating power

on both sides that makes it virtually moisture resistant. It has no exposed metallic facings that are susceptible to corrosion or chemical reaction with the concrete, as the aluminum facer is completely covered by a polymer layer. Plus, DuPont™ Isocast™ R insulation offers superior economical thermal performance under the harsh vapor drive conditions often exhibited in precast concrete panels in cold climates.

Boards of both DuPont™ Styrofoam™ Brand Square Edge and Isocast™ R insulation are lightweight and easy to handle, cut and install. Refer to Tables 1 and 2 for physical properties of Square Edge and Isocast™ R insulations.

TABLE 1: Physical Properties of Styrofoam™ Square Edge Extruded Polystyrene Insulation

Property and Test Method	Value
Thermal Resistance, ASTM C518 ⁽¹⁾ , C177, Aged R-value per inch, ft ² ·h·°F/Btu	
@ 75°F mean temp.	5.0
@ 40°F mean temp.	5.4
@ 25°F mean temp.	5.6
Compressive Strength ⁽²⁾ , ASTM D1621, psi (kPa), min.	25
Flexural Strength, ASTM C203, psi, min.	50
Water Absorption, ASTM C272, % by volume, max.	0.1
Water Vapor Permeance ⁽³⁾ , ASTM E96, perm., max.	1.1
Coefficient of Linear Thermal Expansion, ASTM D696, in/in·°F	3.5 x 10 ⁻⁵
Maximum Use Temperature, °F	165

⁽¹⁾ Values are consistent with the criteria of ASTM C578 and the requirements of the FTC R-value rule (16 CFR Part 460).

⁽²⁾ Vertical compressive strength is measured at 10 percent deformation or at yield, whichever occurs first. Since Styrofoam™ Brand extruded polystyrene insulations are visco-elastic materials, adequate design safety factors should be used to prevent long-term creep and fatigue deformation.

⁽³⁾ Based on 1" thickness.

TABLE 2: Physical Properties of Isocast™ R Polyisocyanurate Insulation

Property and Test Method	Value
Thermal Resistance, ASTM C518 ⁽¹⁾ , C177, Aged R-value per inch, ft ² ·h·°F/Btu	
@ 75°F mean temp.	6.5
Compressive Strength ⁽²⁾ , ASTM D1621, psi (kPa), min.	25
Water Absorption, ASTM C272, % by volume, max.	0.05
Flexural Strength, ASTM C203, psi, min.	40
Water Vapor Permeance ⁽³⁾ , ASTM E96, perm., max.	<0.03
Dimensional Stability, 158°F, 97% RH, percent linear change, length, max.	1.0
Maximum Use Temperature, °F	190

⁽¹⁾ In accordance with ASTM C518.

⁽²⁾ Vertical compressive strength is measured at 10 percent deformation or at yield, whichever occurs first.



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

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