TECH SOLUTIONS 601.0
STYROFOAM™ BRAND EXTRUDED POLYSTYRENE INSULATION FOR ICE RINKS

INTRODUCTION

Ice rink operations are defined as either "seasonal" or "continuous," the difference being the amount of time the rink is used. Seasonal ice rinks (Figures 1 and 2) typically run between seven and 10 months a year. The remaining two to five months consist of ice removal and a warm cycle so any accumulated subgrade frost can melt.

Continuously operated rinks are run year-round, so there is no time to melt accumulated subgrade frost. Instead, a separate heating system is placed below the ice slab in the subgrade to melt the frost (Figure 3). The heating system can be electric cables, a glycol system or rejected heat from the compressors used for refrigeration. (For drainage detail, see Figure 4.)

Figure 1: Seasonal Operation (Insulated)

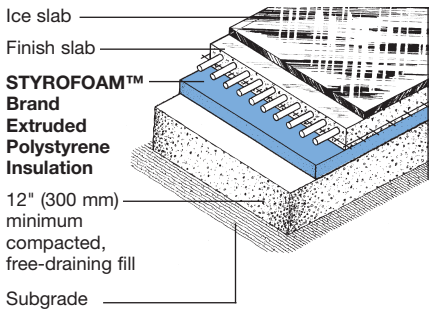


Figure 2: Seasonal Operation (Uninsulated)

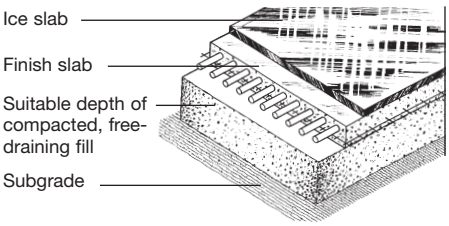


Figure 3: Continuous Operation (Insulated)

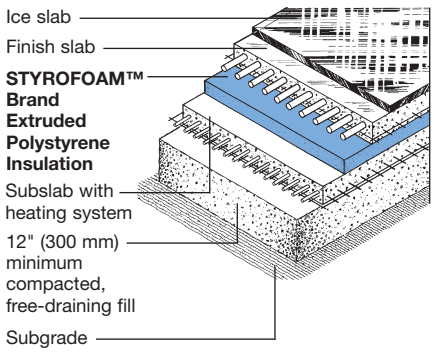
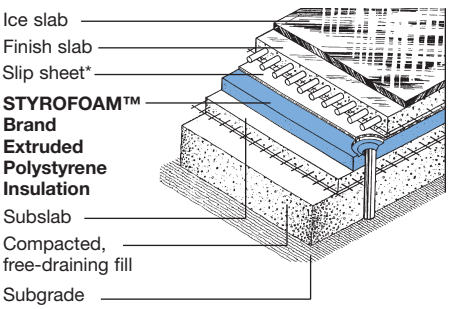


Figure 4: Drain Detail (Subslab Construction)



*If the optional slip sheet is omitted, the drains should be located at the subslab-insulation interface. To ease drainage through multiple-layer insulation applications, the joints of the second layer should not be offset more than 4" (100 mm). The second layer should be installed dry, skewered to the first layer.

WHY INSULATE ICE RINKS?

Adding insulation below the ice slab reduces:

- frost penetration into the subgrade and prevents heaving of the slab by slowing heat loss from the subslab, granular base and soil
- ice slab refrigeration capacity requirements, lowering energy costs for continuously operated rinks
- ice-making and deicing time for multi-purpose rinks

HOW DEEP CAN FROST PENETRATE?

Frost penetration depends on:

- amount of insulation used (Tables 1 and 2)
- soil characteristics
- ice temperature
- presence of subsoil heating systems
- amount of time the rink is operated

Ice is normally maintained at 22°F to 17°F (-5.6°C to -8.3°C), while the ground temperature deep below the ice slab is between 45°F and 55°F (7°C and 13°C), depending on the water table location, soil type and regional climate.

STYROFOAM™ Brand Extruded Polystyrene Insulation for Ice Rinks

How much insulation is needed to reduce frost penetration?

Field experience and studies have shown that in properly constructed ice rinks, frost prevention can be achieved using the thicknesses of STYROFOAM™ Brand Extruded Polystyrene Insulation shown in Table 3 with 12" (300 mm) of non-frost-susceptible fill under the insulation.

In continuously operated rinks, frost penetration is reduced by a subgrade heating system. The insulation between the ice slab and the heated subgrade limits the ice's heat gain.

Table 1: Estimated Frost Penetration, ft. (m), Beneath Uninsulated Ice Rinks

Season Duration (months)	Ice Temperature 22°F (-5.6°C)	Ice Temperature 17°F (-8.3°C)
5	3.74 (1.14)	4.76 (1.45)
6	4.20 (1.28)	5.41 (1.65)
7	4.66 (1.42)	6.07 (1.85)
8	5.09 (1.55)	6.69 (2.04)
9	5.54 (1.69)	7.35 (2.24)
10	6.00 (1.83)	8.01 (2.44)

Table 2: Estimated Frost Penetration, ft. (m), Beneath Insulated Ice Rinks, Assuming Different Thicknesses of STYROFOAM™ Brand Extruded Polystyrene Insulation

Season Duration (months)	Ice Temperature, 22°F (-5.6°C) Insulation Thickness, in. (mm)			Ice Temperature, 17°F (-8.3°C) Insulation Thickness, in. (mm)		
	2.0 (50)	2.5 (65)	3.0 (75)	2.0 (50)	2.5 (65)	3.0 (75)
5	0.42 (0.13)	-	-	1.41 (0.43)	0.59 (0.18)	-
6	0.85 (0.26)	-	-	2.07 (0.63)	1.25 (0.38)	0.43 (0.13)
7	1.31 (0.40)	0.49 (0.15)	-	2.72 (0.83)	1.90 (0.58)	1.08 (0.33)
8	1.74 (0.53)	0.92 (0.28)	0.10 (0.03)	3.35 (1.02)	2.53 (0.77)	1.71 (0.52)
9	2.20 (0.67)	1.38 (0.42)	0.56 (0.17)	4.00 (1.22)	3.18 (0.97)	2.36 (0.72)
10	2.66 (0.81)	1.84 (0.56)	1.02 (0.31)	4.66 (1.42)	3.84 (1.17)	3.02 (0.92)

Table 3: Thickness of STYROFOAM™ Brand Extruded Polystyrene Insulation, in. (mm), When Used With 12" (300 mm) of Non-Frost-Susceptible Fill Under the Insulation to Prevent Frost Penetration

Ice Temperature °F (°C)	Months of Operation					
	5	6	7	8	9	10
22 (-5.6)	2.0 (50)	2.0 (50)	2.5 (65)	2.5 (65)	3.0 (75)	3.0 (75)
17 (-8.3)	2.5 (65)	2.5 (65)	3.0 (75)	3.0 (75)	Design for continuous operation	

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