SIPLAST LIGHTWEIGHT INSULATING CONCRETE BULLETIN:

COLD WEATHER PLACEMENT

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SIPLAST*FLASH*

Insulating concrete has been installed in North America since the early 1940s in all types of weather conditions, with the resulting application performing its function as a stable substrate for the roofing membrane while providing insulation value to the roof system. Cold weather application of lightweight insulating concrete concerns some users because of the fear of the concrete freezing, which they believe will cause roofing problems and construction delays. To address those concerns, this bulletin will discuss:

- Issues relating to cold weather applications.
- Time-proven techniques for successful cold weather applications.
- The temperature range associated with cold weather applications.
- The effects of cold weather on lightweight insulating concrete after application.

Cold Weather Conditions

The American Concrete Institute defines cold weather as "a period when, for more than three consecutive days, the mean temperature drops below 40°F." Normal placement techniques are appropriate at temperatures above 40°F. When temperatures are expected to be 32°F to 40°F within 24 hours after placement, the contractor may opt to employ one or more of the recommended precautions reviewed below.

Effects of Freezing Temperatures

Mild freezing temperatures during the first 24 hours after application only affect the top surface of a lightweight insulating concrete application. Freezing temperatures will reduce the rate of strength development, and may cause ice crystals to be formed in the cement matrix of the top surface. Both of these conditions may result in the top 1/8-inch of the surface disbonding from the remaining thickness of insulating concrete. Removing this loose material will leave a hard surface that will provide the designed support and required fastener withdrawal resistance and result in excellent performance throughout the life of the application.

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Over the years, many applications have demonstrated that the insulating concrete below this top surface is not affected. Insulating concrete contains 80-85% air cells by volume. This high volume of air content provides more than sufficient space for water to expand when it freezes without damaging the remaining thickness of insulating concrete. By contrast, structural concrete that has been freeze-thaw stabilized contains only 5-7% air cell volume and functions quite adequately under freezing conditions.

In the case of Insulcel RT lightweight insulating concrete, the applications have bituminous pellets broadcast into the top surface of the lightweight insulating concrete. Proper curing of this topping surface with no delamination is imperative to maintain the pellet attachment to the lightweight insulating concrete. For this reason, the Siplast Technical Department should be contacted when temperatures on the Insulcel RT surface may get below freezing at any point during the first 24 hours of installation. Considerations should be made for wind, rain, dew, frost and other environmental effects that could cause the temperature of the Insulcel RT surface to drop below freezing.

Providing Resistance to Freeze Damage during Application

The actions required to reduce freeze damage during application relate to increasing the rate of strength gain during the first 24 hours after application. Several factors affect the rate of strength gain. They are:

Higher air temperature. The higher the air temperature above 32°F, the higher the rate of strength gain. Cloudy conditions will result in higher temperatures than a clear night. Clear nights will cause evaporative cooling of the deck surface to temperatures below that of the outside ambient air.

Increased quantity of cement. Increasing the quantity of cement increases the rate of strength gain and slightly increases the temperature of the concrete.

Increased fineness of cement. Portland cement is produced as Type I to Type V. Type I and Type II are the recommended cements for use with lightweight insulating concrete under normal conditions. Type III cements are ground to a finer size and, therefore, increase the rate of strength gain as compared to Types I and II.

Higher initial concrete temperature. The higher the placement temperature of the concrete, the longer it takes for the mass to cool to freezing conditions. In addition, higher placement temperatures increase the rate of chemical action of the cement, resulting in a faster rate of strength gain.

Chemical admixtures. Today many chemical admixtures are sold as accelerators for use with cement. These materials are designed to be used with structural concrete that has a very low air content when compared to lightweight insulating concrete. None of these materials have been found to be cost effective in accelerating the set time of lightweight insulating concrete. Further, some of these materials contain chloride, which will attack metal and cause it to fail.

DO NOT USE CHLORIDE CONTAINING ACCELERATORS WITH LIGHTWEIGHT INSULATING CONCRETE!

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Recommendations

The recommendations listed below are time-proven methods of reducing the effects of freezing temperatures on lightweight insulating concrete applications. The following recommendations apply when the temperatures at time of application are 32-40°F and are not expected to drop below 25°F during the first 24 hours after application. Siplast Lightweight Insulating Concrete Systems should not be placed if temperatures are expected to drop below 25°F during the first 24 hours. Because all of the recommendations may not apply to all types of insulating concrete, a table follows that defines which recommendation is applicable to each product.

1. Increase the thickness of the pour. As stated, the top 1/8-inch thickness may be damaged by freezing conditions. Therefore, increasing the thickness of the top pour to compensate for this lost top 1/8-inch thickness will result in an application that still meets the minimum thickness specified for the project once the loose surface is removed. This does not apply to Insulcel RT Systems.

2. Increase the application water temperature. Research and field application have demonstrated that heating the mix water to approximately 100°F increases the rate of strength development during the first 24 hours by over 100% for aggregate-based lightweight insulating concrete. This is not recommended for use with cellular concrete. Increasing the mix water temperatures for non-aggregate based lightweight insulating concrete creates conditions of early air cell expansion followed by collapse of the total cement matrix when the mix water cools down. In addition, if the water is too hot, the air cells may burst during the mixing process.

3. Increase the quantity of cement. Increasing the quantity of cement will increase the rate of strength development. Increasing the quantity of cement is product specific since some products already use high quantities of cement. See the chart below for specific recommendations.

4. Use Type III Portland cement. Type III cement is a finer grind cement and will increase the rate of strength development.

5. Increase the temperature of the deck underside. If the building is heated, keeping the structural deck underside warm will increase the rate of strength development. Heat rises, so the temperature of the lightweight insulating concrete above the deck will remain warmer.

6. Install the roofing membrane soon after application. The roofing membrane should be installed as soon as the lightweight insulating concrete can bear foot traffic without causing surface damage and a minimum fastener withdrawal resistance of 40 lbs. can be achieved. With the exception of Insulcel RT, the membrane should always be installed over a nailed base sheet.

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Siplast Product Specific Recommendations

As stated, the above recommendations may not apply to all lightweight insulating concrete products. The following table indicates with an “X” which recommendation is applicable to the mix design of each Siplast Lightweight Insulating Concrete System.

RECOMMENDATIONS	SIPLAST MIX DESIGNS				
	1:6	1:4	NVS	Zonocel	Insulcel and Insulcel RT
1. Increase Pour Thickness	X	X	X	X	X
2. Increase Mix Water Temperature	X	X	X	N/A	N/A
3. Increase Quantity of Cement	Add 15%	N/A	N/A	Add 15%	Add 15%
4. Use Type III Cement	X	X	X	X	X
5. Increase Underside Deck temperature	X	X	X	X	X
6. Stop pouring 6 hours before freezing temperature	X	X	X	X	X

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