

# SIPLAST LIGHTWEIGHT INSULATING CONCRETE

## THE NVS SYSTEM



### Siplast Lightweight Insulating Concrete Systems

Siplast Lightweight Insulating Concretes are composite systems that combine the unique properties of lightweight insulating concrete and Insulperm premium expanded polystyrene foam insulation board. The polystyrene insulation board can be installed in thicknesses necessary for high insulation values and in stair-step fashion, facilitating prompt drainage of water from the roof surface.

By design, Siplast Lightweight Insulating Concrete Systems encapsulate the insulation board in insulating concrete. All constructions provide superior fire protection and wind resistance, resist air infiltration and are fully bonded to the substrate, resulting in a stable, monolithic insulation system built for the long term.

### The NVS System Concept

The NVS (Non-Vented Substrate) System has been engineered for use over concrete substrates, reroofing and, where appropriate, re-cover applications. In these applications, NVS Lightweight Insulating Concrete, combined with Insulperm insulation board, provides slope-to-drain over flat or irregular substrates.

Typically, there are inherent difficulties in achieving slope with concrete substrates, and in reroofing and re-cover applications. Cast-in-place concrete is usually poured dead-level. On the other hand, precast concrete has camber in the slabs and variations in joint heights. In reroofing, proper slope is difficult to achieve because of roof deck deflection or an initial flat design. In re-cover applications, surface irregularities are common. The use of NVS Lightweight Insulating Concrete and stair-stepped Insulperm eliminates substrate irregularities and achieves a positive slope-to-drain design.

The NVS System is more economical than installing tapered rigid board systems or sloping the structural concrete. Depending on the condition of the existing roof system, the NVS System can also eliminate the need for costly tear-off and simplify surface preparation.

### NVS Lightweight Insulating Concrete

NVS Concrete is a 1:3.5 volume ratio of Portland cement to patented NVS Concrete Aggregate. NVS Insulating Concrete has a minimum dry density of 35 pounds (13.61 kg), and provides a minimum compressive strength of 300 psi (2068.44 kPa). Because of its high compressive and tensile strength, NVS requires only a 1-inch (25 mm) minimum thickness over the top of the substrate or Insulperm insulation board if used.

### Insulperm Insulation

Insulperm is a patented, premium quality nominal 1 pcf (16 kg/m<sup>3</sup>) density expanded polystyrene insulation board. It serves as the primary insulator and, when used in a stair-stepped configuration, is the base for the system's slope-to-drain capability.

Insulperm insulation is supplied in 2-foot by 4-foot (.61 m x 1.22 m) boards in thicknesses from 1 inch (25 mm). This product is configured to give the system composite strength and ensure release of moisture vapor. Insulperm is a lightweight expanded polystyrene insulation board; it adds little dead load to the assembly.

### Fire Rated Construction

NVS System is approved by Factory Mutual as a non-combustible rated roof substrate. The NVS System is listed in the *Factory Mutual Approval Guide* for new and reroofing applications over structural concrete decks.

The NVS System is listed by Underwriters Laboratories for hourly fire rated designs over structural concrete substrates. Designs published in the Underwriters Laboratories *Fire Resistance Directory* include:

Concrete Deck Roof Assembly Design No.	Hourly Rating
P708	2
P810	2
P905	2
P910	2
P913	2
P916	2
D708	3
D916	3
D923	3
D925	3
D927	3

### Wind Rated Construction

NVS Lightweight Insulating Concrete with up to a 12-inch (305 mm) thickness of Insulperm insulation board over structural concrete decks or properly prepared existing built-up roofs over structural concrete meets the requirements of Factory Mutual windstorm constructions.

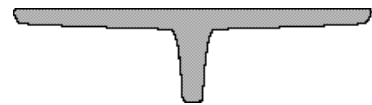
### Approvals and Guide References

Underwriters Laboratories Listed  
 Factory Mutual Approved  
 ICC Evaluation Service, Inc. Report Number 2309  
 Metro-Dade Product Control No. 07-0122.06 and 03-1211.06  
 Other local and regional approvals available

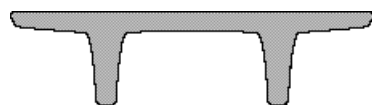
### Structural Bases

The NVS System may be used over a variety of structural bases which include:

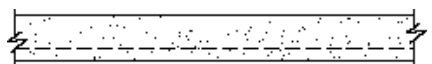
Pre-stressed single tees



Pre-stressed double tees



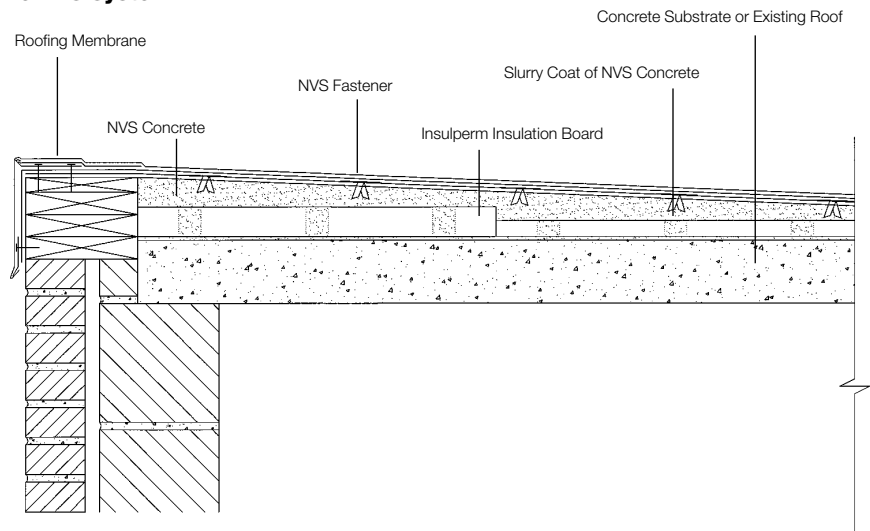
Structural Concrete



Channel Slabs



### The NVS System



## Insulation Value Table for Reroofing and Concrete Substrate Designs

(Includes roof membrane, 1 inch of NVS Concrete, and optional thicknesses of Insulperm over the substrate.)

Thickness of Insulperm	Values Based on 1 Inch of NVS Concrete				
	Dry Weight of Insulperm & NVS Concrete (PSF)	Wet Weight of Insulperm & NVS Concrete (PSF)	U-Factor No Ceiling Heat Flow		R-Factor
			Up	Down	
0"	2.9	5.7	0.498	0.417	0.9
1"	3.4	6.6	0.168	0.158	4.8
1 1/2"	3.5	6.7	0.128	0.122	6.7
2"	3.6	6.9	0.103	0.099	8.6
2 1/2"	3.7	7.0	0.087	0.084	10.4
3"	3.8	7.1	0.075	0.073	12.3
3 1/2"	3.9	7.2	0.066	0.064	14.1
4"	3.9	7.4	0.059	0.057	16.0
5"	4.1	7.6	0.048	0.047	19.6
6"	4.3	7.8	0.041	0.040	23.3
7"	4.4	8.1	0.036	0.035	26.9
8"	4.6	8.3	0.032	0.031	30.6
9"	4.7	8.6	0.028	0.028	34.2
10"	4.9	8.8	0.026	0.025	37.8
11"	5.1	9.1	0.024	0.023	41.5
12"	5.2	9.3	0.022	0.021	45.1

\*Includes air films and roofing membrane.

Notes:

- NVS Lightweight Insulating Concrete properties are based on the material at minimum dry density. The thermal conductivity data is derived from independent testing of materials in accordance with ASTM Specification C 177. Thermal conductivity of Insulperm is based on 40° F mean temperature and NVS Concrete is based on 75°F mean temperature. U-factors are based on series-parallel heat flow calculations defined in the ASHRAE *Handbook of Fundamentals* and are shown in constant thickness insulation. All values shown are intended only as guidelines. Insulation performance for all materials and/or systems is affected by building environment, installation and design procedures which may cause variations from calculated values.
- A roofing membrane will add the following typical weights to the system weight listed above:

Modified Bitumen	2 pounds per sf
4 ply built-up roof with gravel	6 pounds per sf
Mechanically fastened single ply	0.5 pounds per sf

When using NVS in a re-cover or reroofing application, Siplast strongly recommends that a registered structural engineer evaluate the design and verify that the existing structure is capable of supporting the added weight of the new assembly.

## PART 1: GENERAL

### 1.01 SECTION INCLUDES:

- A. Lightweight Insulating Concrete Application to Prepared Substrate

### 1.02 RELATED SECTIONS

- Section [---] - Testing Laboratory Services
- Section [---] - Rough Carpentry
- Section [---] - Roof Deck
- Section [---] - Roofing
- Section [---] - Sheet Metal Flashing and Trim

### 1.03 REFERENCE STANDARDS

References in these specifications to standards, test methods and codes, are implied to mean the latest edition of each such standard adopted. The following is an abbreviated list of associations, institutions, and societies that may be used as references throughout these specifications.

<b>ASTM</b>	American Society for Testing and Materials Philadelphia, PA
<b>FM</b>	Factory Mutual Engineering and Research Norwood, MA
<b>UL</b>	Underwriters Laboratories Northbrook, IL

### 1.04 SUBMITTALS

All submittals that do not conform to the following requirements will be rejected.

- A. Submittal of Equals:** Submit lightweight

insulating concrete systems to be considered as equals to the specified roof system no less than 10 days prior to bid date. Primary lightweight insulating concrete systems that have been reviewed and accepted as equals to the specified system will be listed in an addendum prior to bid date; only then will equals be accepted at bidding. Submittals shall include the following:

- Submit manufacturer's instructions for proper placement of the proposed lightweight insulating concrete roof insulation system.
- Submit documentation confirming compliance with FM 1-[---] Windstorm Resistance Classification utilizing the specific roof membrane system proposed for use on this project.
  - Submit documentation confirming that the specific expanded polystyrene proposed for use on this project is approved by Factory Mutual for use in conjunction with the proposed lightweight insulating concrete system.
- Submit a letter from the supplier of the proposed lightweight insulating concrete system confirming that the expanded polystyrene used as a component in the lightweight insulating concrete system is to be furnished by the supplier of the proposed lightweight insulating concrete system.
- Submit shop drawings including a roof plan, roof slopes, and thickness of insulation.

- Submit a sample copy of the warranty covering the proposed lightweight insulating concrete system.

\* NOTE: The above item is applicable when a performance warranty for the lightweight concrete is required.

- Submit a sample copy of the roof system guarantee covering the proposed lightweight insulating concrete system and roof membrane system.
- Submit a letter from the roof membrane manufacturer confirming the intention to issue the roof system guarantee covering the proposed lightweight insulating concrete system and roof membrane system at project completion.

\* NOTE: The above items 6 and 7 are applicable when a single source roof system guarantee covering the lightweight insulating concrete system and roof membrane system is required.
- Submit a letter from the proposed lightweight insulating concrete system supplier confirming that the Contractor is approved to install the proposed lightweight insulating concrete system.

## 1.05 QUALITY ASSURANCE

**A. Acceptable Contractor:** The contractor must be certified in writing prior to bid by the supplier to install the proposed lightweight insulating concrete system.

**B. Agency Approvals:** The proposed lightweight insulating concrete system shall conform to the following requirements. No other testing agency approvals will be accepted.

**1. Underwriters Laboratories:** Tested by Underwriters Laboratories in accordance with the procedures of ASTM E 119 and listed in the most recent Underwriters Laboratories Fire Resistance Directory. Lightweight insulating concrete roof insulation components are defined by Underwriters Laboratories under sections CCWW for foamed plastic and CJZZ for vermiculite aggregate in the latest edition of the Underwriters Laboratories Fire Resistance Directory.

**2. Factory Mutual:** Tested by Factory Mutual Research and listed in the most recent Factory Mutual Approval Guide as non-combustible or Class 1, and for 1-[---] windstorm classification utilizing the specific roof membrane system proposed for use on this project.

## 1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

**A. Delivery:** Deliver materials in the supplier's original unopened packages, fully identified as to manufacturer, brand or other identifying data and bearing the proper Underwriters Laboratories label.

**B. Storage:** Store bagged concrete aggregate products in a dry location until ready for application. Expanded polystyrene board should not be stored in areas of standing water prior to application but can be exposed to rainwater before application. Boards must be clean and free from foreign substances.

## 1.07 PROJECT/SITE CONDITIONS

### A. Requirements Prior to Job Start

- 1. Notification:** Give a minimum of 5 days notice to the Owner and manufacturer prior to commencing any work and notify both parties on a daily basis of any change in work schedule.
- 2. Permits:** Obtain all permits required by local agencies and pay all fees that may be required for the performance of the work.
- 3. Safety:** Familiarize every member of the application crew with all fire and safety regulations recommended by OSHA, NRCA and other industry or local governmental groups.

### B. Environmental Requirements

- 1. Precipitation:** Do not apply materials during precipitation or in the event there is a probability of precipitation during application. Take adequate precautions to ensure that materials and building interiors are protected from possible moisture damage or contamination.
- 2. Temperature Restrictions:** When air temperatures of 40°F (4.4°C) or above are predicted to occur within the first 24 hours after placement, normal mixing and application procedures may be used. When air temperatures of 32°F to 40°F (0°C - 4.4°C) are predicted to occur within the first 24 hours after placement, warm water may be used. The mix temperature should not exceed 100°F (37.8°C) at the point of placement. Do not install the lightweight insulating concrete system when air temperatures are below 32°F (0°C).

## 1.08 WARRANTY/GUARANTEE

**A. Insulation System Warranty:** Upon successful completion of the project, and after all post installation procedures have been completed, furnish the Owner with the insulation system manufacturer's 10-year labor and materials warranty. The insulation system warranty shall include the composite roof deck system consisting of pregenerated foam and polystyrene insulation panels. All repair or replacement costs covered under the guarantee shall be borne by the insulation system manufacturer. The guarantee shall be a term type, without deductibles or limitations on coverage amount, and be issued at no additional cost to the Owner. Specific items covered during the term of the insulation system warranty include:

1. The actual resistance to heat flow through the roof insulation will be at least 80% of the design thermal resistance, provided that the roofing membrane is free of leaks.
2. The roof insulation will remain in a reroofable condition should the roof membrane require replacement (excluding damage caused by fastener pullout during removal of the old membrane.)

3. The Insulating Concrete Warranty will not limit, by geographic location, the owners rights for claims, actions, and/or proceedings.
4. The roof insulation material will not cause structural damage to the building as a result of expansion from thermal or chemical action.
  - > *Siplast Ten-Year Roof Insulation Performance Warranty*  
*\* NOTE: The above specification item is applicable when a performance warranty for the lightweight concrete only is required.*

**B. Roof System Guarantee:** Upon successful completion of the project, and after all post installation procedures have been completed, furnish the Owner with a labor and materials endorsement to the roof membrane manufacturer's guarantee confirming that a single guarantee covers both the lightweight insulating concrete system and the roof membrane/flashing system. The roof system guarantee shall include both the roofing and flashing membrane, and the specified new lightweight insulating concrete system consisting of pregenerated foam, patented-preformed polystyrene panels, base sheet, and base sheet fasteners. All repair or replacement costs covered under the guarantee shall be borne by the roof membrane/flashing manufacturer. The guarantee shall be for a 10 year term, without deductibles or limitations on coverage amount, and be issued at no additional cost to the Owner. Specific items covered under the roof system guarantee include:

1. The actual resistance to heat flow through the roof insulation will be at least 80% of the design thermal resistance, provided that the roofing membrane is free of leaks;
2. The roof insulation will remain in a reroofable condition should the roof membrane require replacement (excluding damage caused by fastener pullout during removal of the old membrane.)
3. The roof insulation will remain in place even if the roof membrane sustains wind damage covered by the guarantee.
4. The base sheet, base sheet fasteners and polystyrene panels will be covered by the guarantee.
5. The roof system guarantee will not limit, by geographic location, the Owner's rights for claims, actions, and/or proceedings.
6. The roof insulation material will not cause structural damage to the building as a result of expansion from thermal or chemical action.
  - > *Siplast Ten-Year Roof System Guarantee*  
*\* NOTE: The above specification item is applicable when a roof system guarantee covering both the lightweight concrete system and roof membrane system is required.*

## PART 2: PRODUCTS

### 2.01 MATERIALS

**A. Acceptable Manufacturer:** Provide a lightweight insulating concrete roof insulation system incorporating vermiculite aggregate and expanded polystyrene board supplied by a single manufacturer.

- > *NVS Roof Insulation System by Siplast, Inc., Irving, TX*

### 2.02 SYSTEM DESCRIPTION

#### A. Lightweight Concrete System

**Description:** Provide materials used in the lightweight concrete roof insulation system conforming to the following.

1. Portland Cement: Portland cement conforming to Type I, II, or III as defined by ASTM C 150.
2. Vermiculite Aggregate: Vermiculite concrete aggregate conforming to ASTM C 332.
  - > *NVS Concrete Aggregate by Siplast, Inc., Irving, TX*
3. Expanded Polystyrene Insulation Board: Expanded polystyrene (EPS) insulation board having a nominal density of 1 pcf (16 kg/m<sup>3</sup>) defined as Type I by ASTM C 578 and containing approximately 3% open area. Each bundle of board shall be delivered to the job site with clear identification as to manufacturer and shall carry the Factory Mutual approval label and the Underwriter's Laboratories Classified label on each bundle.
  - > *Insulperm Insulation Board by Siplast, Inc., Irving, TX*
4. Water: Potable water that is clean and free of deleterious amounts of acid, alkali and organic materials.

### 2.03 MIX DESIGN

**A. Density:** Mix Portland cement and vermiculite concrete aggregate in 1:3.5 volume ratio with water to achieve a wet density ranging from 60 to 68 pcf (960 to 1089 kg/m<sup>3</sup>), resulting in a minimum dry density of 35 pcf (561 kg/m<sup>3</sup>), and minimum compressive strength of 300 psi (2068 kPa).

## PART 3: EXECUTION

### 3.01 EXAMINATION

**A. General:** Ensure that all surfaces to receive lightweight insulating concrete are free of oil, grease, paints/primers, loose mill scale, dirt, or other foreign substances. Where necessary, cleaning or other corrections of surfaces to receive lightweight insulating concrete is the responsibility of the party causing the unacceptable condition of the substrate.

**B. Substrate Acceptance:** With the general contractor present, examine surfaces to receive the roof insulation system and determine that the surfaces are acceptable prior to placement of the lightweight insulating concrete system.



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### 3.02 PREPARATION

**A. General:** Remove water or any other substance that would interfere with bonding of the lightweight concrete system.

### 3.03 APPLICATION

**A. General:** Provide equipment and application procedures conforming to the material supplier's application instructions.

#### **B. Applications Not Incorporating**

**Expanded Polystyrene Panels:** Place *lightweight insulating concrete in a 1-inch (25 mm) minimum thickness over the top of a [concrete substrate, temporary roof]. Place **lightweight insulating concrete in a 1 1/4-inch (32 mm) minimum thickness over the top of a gravel surfaced substrate.***

**C. Applications Incorporating Expanded Polystyrene Panels:** When the specified expanded polystyrene insulation panels are to be incorporated into the lightweight insulating concrete system, place a 1/8-inch (3 mm) minimum thickness of insulating concrete slurry coat over top of the prepared substrate or for metal deck applications, fill the flutes and place a 1/8-inch (3 mm) minimum slurry over the top corrugation of metal deck before embedding the expanded polystyrene insulation panels. Place the thickness of expanded polystyrene insulation panels shown in the approved shop drawings within 30 minutes of applying the insulating concrete slurry coat to the substrate. The maximum allowable panel step in a stair-step design is 1 inch (25 mm). *[The following day, fill the holes in the expanded polystyrene insulation panels and place a 1-inch (25 mm) minimum thickness of insulating concrete over top of the expanded polystyrene insulation panels. Fill the holes in the expanded polystyrene insulation panels and place a 1-inch (25 mm) minimum thickness of insulating concrete over top of the expanded polystyrene insulation panels. The preferred method is to apply the insulating concrete top fill the same day. Other regulatory or jobsite sequencing issues may require application of the top fill the next day.]*

*\* NOTE: The italic text in Item B and C above is applicable for NVS systems requiring an Enhanced Windstorm Rated Construction. The bold italic text in Item B and C above is applicable for NVS systems not requiring an Enhanced Windstorm Rated Construction.*

**D. Thermal Resistance:** Install the specified lightweight insulating concrete system to provide for an [average/minimum] thermal value of R[— ]or as shown on the architectural details/drawings.

**E. Slope:** Install the specified lightweight insulating concrete system to provide for a minimum positive roof slope of [— —] inch per foot ([— —] %). See the structural drawings for slope provided by the roof framing system.

### 3.04 FIELD QUALITY CONTROL

**A. Protection:** Avoid roof-top traffic over the roof insulation system until one can walk over the surface without creating surface damage.

**B. Compressive Strength Testing:** The Architect has the option to select an independent testing laboratory to randomly sample the top placement of insulating concrete to verify the thickness and density, and to secure and test compressive strength cylinders in accordance with ASTM C 495. The Owner will be responsible for the cost and engagement of the independent testing laboratory services.

*\* NOTE: The above testing is only necessary when the lightweight insulating concrete system is designed as a diaphragm to resist seismic or wind loads.*

**C. Application Monitoring:** Monitor the thickness and wet density of the lightweight insulating concrete at the time of placement to determine conformance to the manufacturer's requirements. Monitor the placement of proper thickness of polystyrene insulation board in accordance with the contract documents.

**D. Fastener Withdrawal Testing:** Conduct a base ply fastener pull test 3 or more days following the application of the lightweight insulating concrete to ensure a minimum withdrawal resistance of 40 pounds (18 kg) per fastener.

### 3.05 PATCHING

**A. Patching:** Perform all patching and repairing of insulating concrete using Zono-Patch or other materials approved by the lightweight insulating concrete supplier.