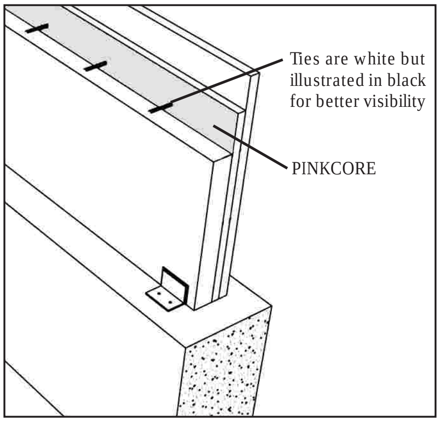
Technical Bulletin

PINKCORE™ XPS Rigid Foam Insulation and Low-Conductivity Ties

Figure 1



Available Sizes

☐ 1.5 in	37.5 mm	Insulation & Ties
☐ 2.0 in	50.0 mm	Insulation & Ties
☐ 2.5 in	62.5 mm	Insulation & Ties
☐ 3.0 in	75.0 mm	Insulation & Ties
☐ 3.5 in	87.5 mm	Insulation & Ties
☐ 4.0 in	100.0 mm	Insulation & Ties

Description

PINKCORE XPS rigid foam insulation and ties are specifically designed for use in site-cast or precast insulated concrete sandwich wall panels. These products provide a fast, efficient, cost-effective method of improving the thermal performance of commercial buildings. Typical concrete wall panels must be insulated after casting and erection. Using PINKCORE insulation and ties, the panel is insulated during casting, prior to erection. Thus, the insulation is integral to the wall, which results in easier and faster construction. In addition, since the insulation is "sandwiched" between the interior concrete wythe and the fascia wythe, the panel maintains hard, durable concrete surfaces, both inside and out.

PINKCORE Insulation

Manufactured from extruded polystyrene foam (XPS), PINKCORE insulation provides a stable R-value of 5.0 per inch. Since an uninsulated eight-inch layer of concrete has an R-value of less than 1, the addition of 1.5, 2 or 3 inches of PINKCORE insulation (R-values of 7.5, 10 and 15 respectively) dramatically improves the thermal performance of a building. The tight, closed cell structure of PINKCORE insulation also resists moisture penetration, which insures that the thermal performance is maintained over the life of the building. Lightweight properties mean ease of handling.

PINKCORE Ties

Manufactured from a high-performance, engineered thermoplastic resin, PINKCORE ties feature high strength and low thermal conductivity. Unlike other sandwich panel designs which rely on metal or solid concrete connections, the use of PINKCORE ties minimizes the energy-draining effects of thermal bridging and results in a sandwich panel with maximum thermal performance.

Installation

PINKCORE insulation and ties are specifically designed for fast, accurate installation. The PINKCORE insulation is clearly marked with a 16-inch on center dot pattern to ensure accurate placement of the PINKCORE connector ties into the insulation. After casting the exterior concrete wythe, the PINKCORE insulation and ties are placed in the fresh concrete. The design of the connector tip also ensures easy penetration through the foam, as well as a mechanical interlock into the concrete once it cures.

Once the PINKCORE insulation and ties are in place, construction of the inner concrete wythe continues. Reinforcement, imbeds and lifting inserts are all set in place on top of the PINKCORE insulation and then the concrete is poured. With a compressive strength of 25 psi (3,600 psf), the PINKCORE insulation provides damage resistance from foot traffic and other abuse.

Performance During Lifting

Because the lifting inserts are located on the inner wythe, the PINKCORE connector ties are designed to support the fascia wythe during the lift. A typical three-inch concrete fascia wythe weighs 37.5 lbs/ft^2. Suction force between the casting bed and the fascia wythe is approximately 25 lbs/ft^2. With the connector ties spaced 16-inches on center, each connector tie is required to support 111 lbs.

Calculation for Stress on Connector Ties During Lifting

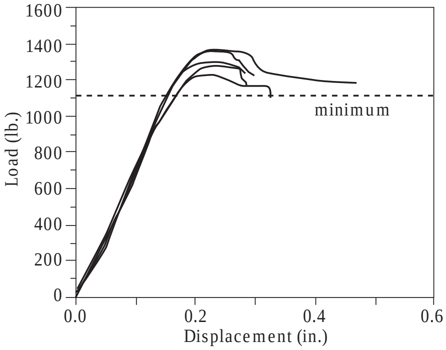
(37.5 lbs. + 25 lbs.) x 1.77 ft^2/tie = 110.63 lbs.

Tensile Strength

A tie was placed in an Instron machine and tested until failure occurred. As shown on the graph below, the nominal tensile strength of each PINKCORE connector tie exceeds the 1,100 lbs. minimum performance, which provides a safety factor of 10 to 1. (Note that standard safety factors on wall panel lifting hardware are typically 5 to 1 or less).

Graph 1

Connector Tie: Tensile Strength



Tie Pullout in Concrete

The tie used in sandwich panel wall construction is subjected to tensile loads during the stripping and erection phases. The magnitude of loading depends on the thickness of the bottom concrete wythe, tie spacing and the suction forces present between the forming bed and the concrete surface.

There are two failure modes seen in tie pullouts. If concrete strength is not sufficiently developed, the tie may pull out with a concrete cone attached. With nominal concrete strengths, PINKCORE ties are designed to interlock mechanically in concrete and designed to fail at the minimum cross section when the pullout force reaches the ultimate tensile strength of the tie. Thus the pullout strength of the PINKCORE tie is typically equal to the tensile strength of the tie itself.

Test Specimens

To investigate this, a series of pullout tests were conducted by Owens Corning. A total of thirty specimens were tested. For each sample, a PVC mold was used to form the concrete. The concrete molds had a diameter of 6 inches and a thickness of 2 inches (see Fig. 2). Twenty specimens were prepared by inserting ties through a 2-inch insulation board, following the standard PINKCORE tie installation procedure. The remaining ten specimens were prepared with a pre-drilled hole in the insulation for comparison with the standard installation of boards and ties. Concrete cylinders were cast to determine the strength of the concrete at the time of testing. The specimens were tested when the concrete reached approximately 2,300 to 3,000 psi.

Test Results

The specimens were tested at two different intervals. The first batch of five pre-drilled and ten standard installation samples were tested after one day. The concrete strength at the time of testing was 2,300 psi. The remaining samples were tested after two days when the concrete strength reached 3,000 psi.

Figure 2 – *Specimens before testing.*

Figure 3 – *A test setup for pullout testing.*

The load was applied to the specimens using an Instron machine with a special jig attached (see Fig. 3). A summary of the concrete strengths and average ultimate pullout strengths at each day of testing are given in Table 1.

In each case, the average ultimate load, regardless of insertion method, was in excess of the nominal tie strength of 1,100 pounds.

Table 1 – Summary of Test Results

Insertion Method	Concrete Age of Testing	Concrete Strength	Number of Specimens	Average Ultimate Load
Pre-drilled	1 day	2300 psi	5	1215 lb
Standard method	1 day	2300 psi	10	1110 lb
Pre-drilled	2 day	3000 psi	5	1220 lb
Standard method	2 day	3000 psi	10	1150 lb

The tensile load on the ties during stripping and lifting depends on the concrete wythe thickness, tie spacing, and suction forces present in the casting bed. These can be quantified as follows for a 3-inch fascia.

Assumption for Calculation of Stress on Ties During Lifting

Area weight of concrete (lbs/sf/in)	12.5
Thickness of fascia (in)	3
Suction force (lb)	25
Ties per square foot (16 in. spacing)	0.5625

Conclusion

These results confirm that the PINKCORE tie has a high factor of safety during stripping and lifting at the concrete strength commonly specified for concrete sandwich panels. A safety factor of approximately 10 is maintained whether the foam is pre-drilled or not.

Shear Strength

As the wall panels are lifted from a horizontal to a vertical position, the load on the PINKCORE connector tie shifts from a tensile load to a shear or flexural load. Because a bond forms between the PINKCORE insulation and the concrete, the samples for testing shear strength were constructed in two different ways:

1. To measure the shear strength of the PINKCORE ties with the concrete-foam bond intact, 4 ft. x 8 ft. test panels were constructed by first pouring the three inches of concrete, then placing 2" thick PINKCORE insulation on the fresh concrete and inserting 18 connector ties. Another three-inch layer of concrete was then poured on top of the foam in each test panel. Thus, the final assembly was representative of standard wall panel with PINKCORE insulation.

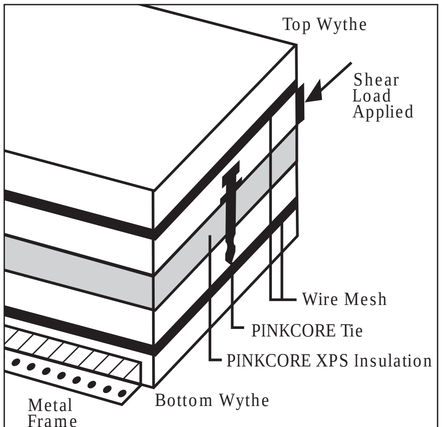
2. In order to determine the strength of the PINKCORE ties alone (without the effects of the concrete-insulation bond), panels were constructed as above, but with two sheets of polyethylene between one concrete-insulation interface.

Application of the shear load on both types of panels was accomplished with a test apparatus that was custom-made for that purpose. A reinforced metal frame held the bottom wythe in place while a hydraulic ram applied pressure to the top wythe. The load was evenly distributed across the four-foot width of the top wythe.

Graph 2 shows the shear strength of the 18 connectors in the 4 ft. x 8 ft. panels, with and without the polyethylene film. A significant concrete-foam bond is formed in the conventional panel, without polyethylene. This bond eventually breaks at a displacement greater than 0.2 inches. While the bond can be seen as beneficial, the strength of the PINKCORE connector tie alone is sufficient to support the concrete fascia during lifting and installation.

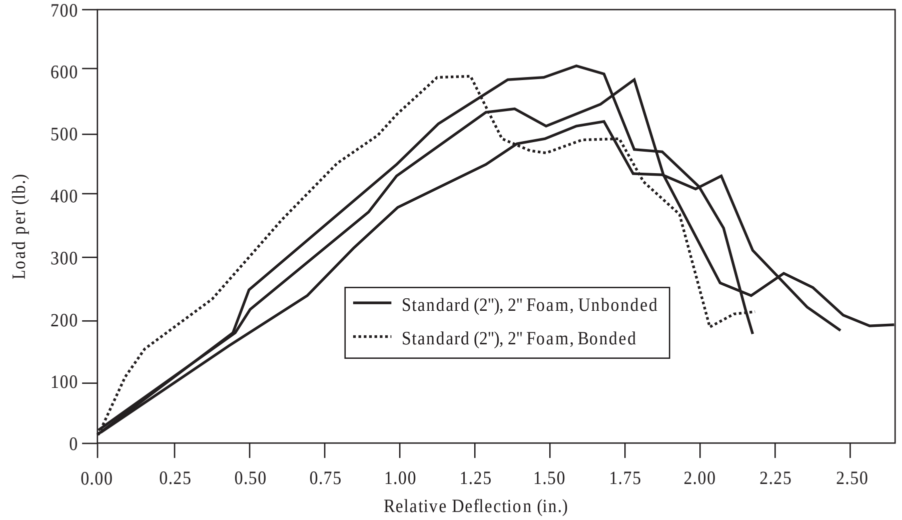
Figure 4

Shear Testing Apparatus Illustration



Actual panel was 4' x 8' and contained 18 connectors.

Graph 2 – *Load-Deflection Curve for 4' x 8' Sandwich Panel in Shear*



The weight of a 3-inch thick, 4 ft. x 8 ft. wythe is 1,200 lbs. During testing, the test panel exhibited a minimum shear strength of approximately 9,000 lbs. and a maximum of 11,000 pounds, with the variance depending on the presence or absence of the concrete-foam bond. Thus, the PINKCORE connector ties will easily support the weight of the concrete, whether or not the concrete-foam bond is considered.

Full Scale Testing for Composite Action

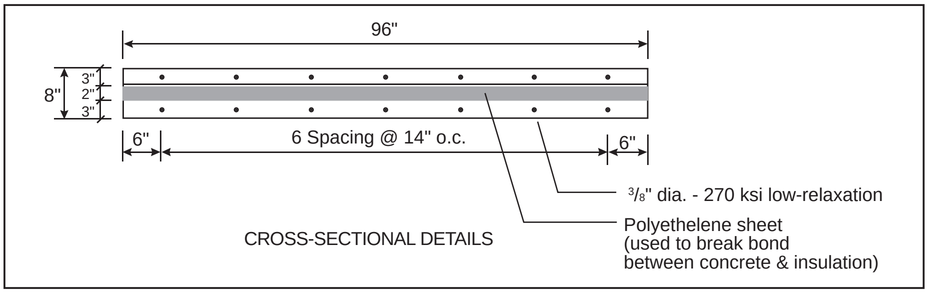
The primary function of ties in sandwich wall panel construction is to hold the two concrete wythes together. Composite action occurs when the ties are capable of transferring shear forces from one concrete wythe to the other. The degree of composite action varies depending on the stiffness of the ties and their capacity to transfer forces. This important property needs to be considered in the design calculations. The Precast/Prestressed Concrete Institute's (PCI) Precast Sandwich Wall Panels Committee recommends designing a panel in three different ways, i.e. fully composite, noncomposite and semi-composite[1] depending on the manufacturer's testing of the system.

A higher degree of composite action provides a good shear transfer between the concrete wythes allowing a thinner panel. But it may also result in excessive bowing of the panel due to thermal deformations of the exterior wythe when subjected to varying temperature swings. Thus, for taller panels, noncomposite action is desirable where the growth of the outside wythe is independent and does not affect the panel deflections. Noncomposite ties are primarily used to resist tensile loads during the stripping, transportation and erection stages. Hence, to control deflections in a panel caused by thermal swings, a noncomposite panel would be ideal though it may not be structurally efficient.

To evaluate the load-deflection capacity of the panels with the PINKCORE system, full-scale testing on three panels was conducted by an independent testing laboratory. The panels were 8' wide by 30' 8" long with a 3"- 2"- 3" cross-section. Detailed descriptions of the panels and the test methodology follows. A comparison of the test results to theoretical calculations is given at the end.

[1]PCI Committee on Precast Sandwich Wall Panels, "State-of-the-Art of Precast/Prestressed Sandwich Wall Panel," *PCI Journal*, V. 42, No. 2, March-April 1997, pp. 92-134.

Figure 5 Ð Typical Cross-Sectional Details of Test Panel



Panel Casting

Three panels were cast by the precaster following the same procedure as their production panels. Figure 5 illustrates the typical cross-sectional details of the test panel. Descriptions common to all panels and the material strengths used are given below.

Width	8'	
Length	30' 8"	
Thickness	8" (3"- 2"- 3")	
Concrete density	Normal weight (145 pcf)	
Concrete strength		
At prestress transfer		5,400 psi
At 28 days		5,720 psi
Reinforcement per wythe		
Prestressing strands		7 Ð 3/8" diameter 270 ksi low-lax
Welded wire fabric		6 x 6-W2.9 x W2.9
Initial prestressing force:	17.2 kip	
Insulating system:	PINKCORE XPS & Ties	
Lifting anchors:	Burke Ð 8 per panel with two U-loops for top lifting	

Two out of three of the panels were made with two slip-sheets (polyethelene) to break the concrete-to-insulation bond. The standard tie spacing of 16" on center was used for all panels. Table 2 summarizes the details of each panel tested. Figure 6 shows panel reinforcements on the precast bed before the concrete was poured.

Table 2 Ð Details of Test Panels

Panel Number	Bond Present	Tie Spacing
1	Yes	16"
2	No	16"
3	No	16"

Figure 6 Ð Test Panels During Casting

The panels were stripped flat from the casting bed using 8 lift points after 6 days of curing and were moved outside for storage before shipping them to the test site. Panels were shipped with supports at lift points in flat-bed trailers stacking two on each trailer. The panels had been cured for 6 to 7 weeks when they were tested.

Test Chamber and Setup

A new steel vacuum test chamber specifically designed for testing these panels was built. The chamber was 5' deep to accommodate large deflections and to allow for visual inspection by personnel after the test was completed. The top and bottom of the panel were supported on steel channel beams which were allowed to rotate during the test. The panels were first flat-lifted with 8 lift points using a crane. Once air-lifted, they were rotated to a vertical position using the two top U-hooks for positioning into the test chamber. The gap between the panel edges and chamber walls was sealed to make it airtight for testing. Two linear variable displacement transducers (LVDT) were attached at mid-height and quarter points to record the deflections. Strain gauges were also installed at various locations in the panel to measure the strain on the concrete surface. All instrumentation was connected to a data acquisition system using a computer for recording the data. Figure 7 shows a specimen in the test chamber before the load application.

Figure 7 Ð Full Scale Panel Subjected to Wind Loading During Test

Panel Testing

A uniformly distributed load (udl) was applied using suction force in the chamber to simulate wind loads. The load was increased incrementally until a large midspan deflection occurred and released to let the panel recover back to its original position. Thus the load-unload was repeated for at least 4 cycles to record the load-deflection data. The panel could not be loaded to failure for safety reasons.

Several observations were made in addition to gathering test data:

¥ The panels experienced one to two cracks on interior concrete wythe near the mid-span and cracks closed when unloaded.
¥ A small residual deflection was observed at mid-height after the test was completed.
¥ The insulation-to-concrete bond was broken at the top and bottom of the panel to one third of the height.
¥ No concrete spalling was observed during the test.
¥ The panel was intact in one piece even after being removed from the chamber and laid horizontally on the ground.

The same test procedure was repeated for all panels and the recorded data was analyzed to evaluate the degree of composite action provided by the PINKCORE ties. The LECWall program[2]

[2] LECWall - Precast Concrete Wall and Column Design Program, Release 10, Losch Engineering Corporation, Palatine, IL, 1999

(by Losch Engineering Corporation) was used to develop the theoretical load-deflection curves for comparison.

Test Results and Evaluation

The recorded data was used to plot load-deflection curves to compare with the theoretical results. The load-deflection curves for the three panels with 16" tie spacing are shown in Graph 3. Note that the curves are based on the raw data from testing and curtailed to fit the chart scale.

Using the LECWall program, a series of load-deflection curves were developed for various degrees of composite action (in increments of 10%) in addition to noncomposite and fully composite behavior. Actual material properties from the test specimens were used in the program. The program was run with suction loads increasing from zero to failure. Graph 4 shows a comparison of load-deflection behavior between actual data and the theoretical predictions using the program. The unbonded curve is an average of two panels tested with a similar configuration.

In Service

The tie is exposed to wind loads, and a highly alkaline environment while in service.

Wind Loads

Wind loads are derived from tables published by Factory Mutual.* For example, here is a typical wind load determination for central Ohio:

Wind Force:	**Central Ohio**
100 year max	90 mph
Ground roughness	Type C
Building height	30 feet

From table: Wind pressure 27 lb/ft^2.

Data Sheet 1-7, *"Wind forces on Buildings and other Structures,"* Factory Mutual Loss Prevention.

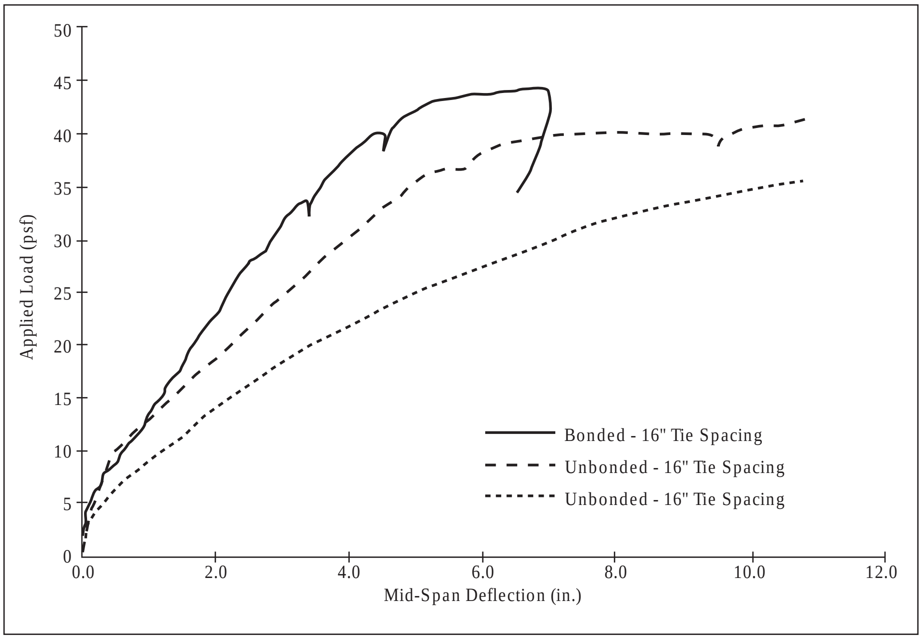
The maximum stress on the building comes at the corners. To calculate the corner stress, multiply the panel wind pressure by a factor of two; in this case, the result is 54 pounds per square foot.

Maximum Wind Load Calculation

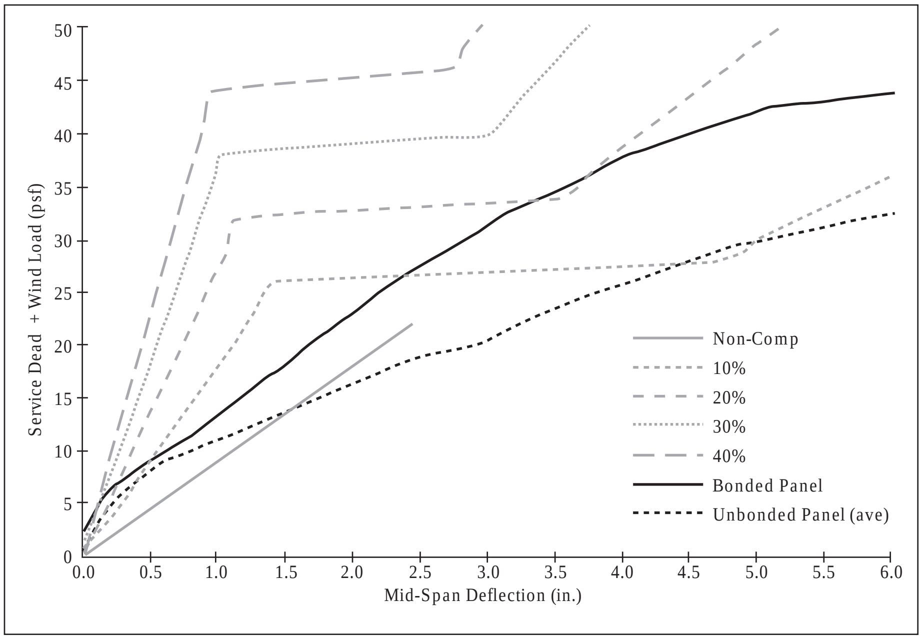
The calculation for maximum load on the connector tie becomes:

54 lbs/ft^2 x 1.77 ft^2/tie = 96 pounds per tie

Graph 3 – *Load-Deflection Curves from Testing*



Graph 4 – *Comparison of Load-Deflection Behavior Between Actual Data and Theoretical Predictions*

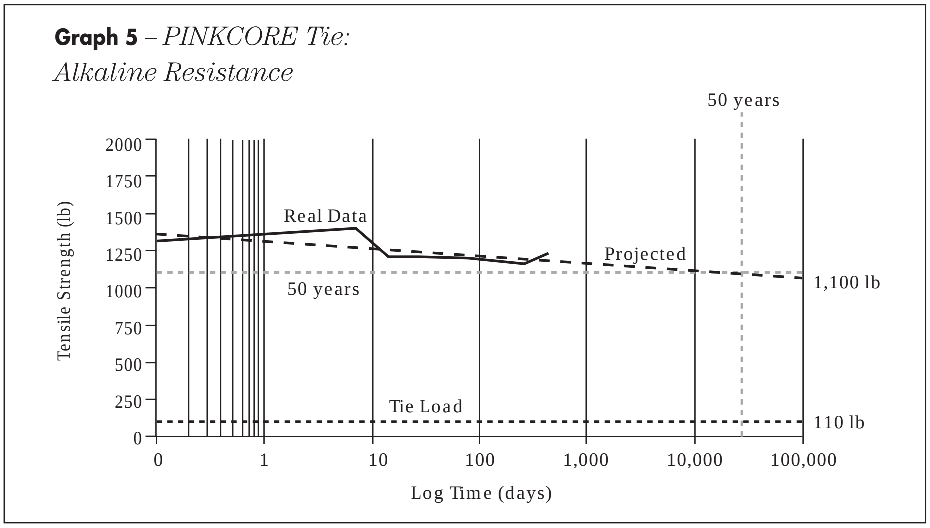


As these calculations show, PINKCORE ties allow for a safety factor in excess of 10:1 in most parts of the United States.

Alkaline Environment

The tie must retain its strength even after being exposed to an alkaline environment while under stress. To simulate this condition, the PINKCORE connector tie was put in a jig which placed the tie under stress. The tie and jig combinations were then put into a bath of cement extract at an elevated temperature to accelerate the test.

At regular intervals of time, the ties were removed and tested for tensile strength. After 365 days of this accelerated testing, the tensile strength of the connector ties continued to be in excess of the nominal value of 1,100 pounds (Graph 5). In fact, extrapolation of this severe test confirms the exceptional alkaline resistance of this resin, as substantial safety factors are maintained for many years.



Fire Performance of Concrete Sandwich Panels

The fire resistance of concrete is well understood. Major building codes allow for a calculated method of fire resistance when concrete construction is specified. This includes the fire resistance of multi-layered panels that have concrete in at least one layer. These calculated resistances may be used to satisfy building code requirements for all hourly fire ratings.

In addition, Owens Corning has performed its own testing at the Owens Corning Science & Technology Center in Granville, Ohio.

Building Codes

All four national model building codes (UBC, SBC, NBC, and IBC) use the methodology for calculating fire resistances for concrete sandwich panels outlined in the Precast/Prestressed Concrete Institute's *Design Handbook*[3] and discussed in detail in the PCI's *Design for Fire Resistance of Precast Prestressed Concrete*[4].

This methodology allows for fire resistances to be established for each layer in the panel and for these resistances to be summed in such a way that results in the fire resistance of the whole panel. Use of these calculations is explicitly allowed as an alternative to fire tests of a specific wall assembly.

The Rational Design Method

The Rational Design Method for fire resistance is based on research conducted at the Portland Cement Association (PCA). Essentially, the method has two steps. First, the fire resistance of each layer of material is established from tabulated test data. Second, the individual resistances are summed using the following calculation.

Calculation of Fire Resistance for Multilayer Concrete Panels

$$R = (R_1^{0.59} + R_2^{0.59} + \ldots + R_n^{0.59})^{1.7}$$

R is the fire resistance for the panel in minutes. R_1, R_2…, R_n indicate the fire resistance for the individual components of the panel in minutes.

The fire resistances for the individual layers of concrete may be calculated using the equation cited above, and the data from model code tables such as IBC table 720.2.1.2. Table 3 shows fire resistance calculated using the IBC table for siliceous aggregate concrete curve.

Table 3 – *Approximate Fire Resistance of Concrete Layers*

Thickness of Individual Concrete Layer or Wythe	Fire Resistance in Minutes
2"	24
3"	46
4"	78
5"	120
6"	173
7"	230

Data from the Precast/Prestressed Concrete Institute,[3,4] footnoted below, indicates that for polystyrene foam insulation, a fire resistance of 5 minutes is most appropriate for foam thicknesses greater than one inch. Note that, as a result, changing the thickness of the foam has no impact on fire performance.

Fire Test Results

The hourly fire resistance rating for concrete walls is determined by the test standard ASTM E 119. In this test, one side of the full-size wall sample is exposed to the interior of the test furnace, while the other side is exposed only to ambient room conditions to an ultimate temperature of 2000 °F in 4 hours.

There are several criteria in the ASTM E 119 standard which determine the actual fire resistance rating for a given wall. However, the criteria which most often determines the rating for concrete walls is the temperature rise of the unexposed wall surface. This criteria states that the surface temperature of the unexposed side cannot increase 250 °F above the ambient room temperature. Thus, if the ambient room temperature is 70 °F, the maximum allowable surface temperature is 320 °F. The time to reach this maximum temperature determines the hourly rating for the wall assembly.

As a way of confirming the PCI results and the performance of the PINKCORE System, Owens Corning selected a 2.5" exterior layer of concrete and a 5.5" interior layer of concrete with 2" of PINKCORE XPS insulation in between. According to the Rational Design Method described previously, this combination should produce a fire resistance, as defined by the E 119 criteria, greater than four hours.

The E 119 procedures were followed as closely as possible given the capabilities of the Owens Corning facility; the application of the flame, the temperature curve and instrumentation were all in accordance with E 119 protocol, except the size of the sample.

In fact, at the end of four hours, the temperature at the face opposite the furnace had risen only 13 °F above ambient, far below the 250 °F maximum.

[3] *PCI Design Handbook,* 4th Edition, Sections 9.3.6., 4-5, pg 9-33 – 9-34, Precast/Prestressed Concrete Institute, Chicago, IL

[4] *Design for Fire Resistance of Precast Prestressed Concrete,* 2nd Edition, MNL-124-89, Precast/Prestressed Concrete Institute, Chicago, IL

Fire Resistance of Typical Panels

Table 5 shows the results of performing the calculations described using the information from Table 3. Please note that changing the thickness of the insulation does not change the fire resistance calculation result.

When designing an insulated panel with a particular fire rating, the roof and the walls must both achieve that rating since the roof typically provides the rigidity of the building.

Table 5

Calculated Fire Resistance for Typical Panel Cross Sections (in hours)

Thickness of Outside layer	Thickness of inside layer of concrete					
	2	3	4	5	6	7
2	1.8	2.3	3.2	4.2	5.3	6.6
3	2.3	2.8	3.7	4.9	6.1	7.4
4	3.2	3.7	4.8	6.1	7.4	8.9

Based on fire resistances from Table 1

Conclusion

Concrete sandwich panels with PINKCORE insulation and ties may be designed with any level of fire performance desired. The Rational Design Method gives the designer a way to design in-fire performance.

Thermal Performance

PINKCORE extruded polystyrene rigid foam insulation meets ASTM Standard Specification C-578, Type IV and has the thermal resistance of 5.0 °F h ft^2/Btu per inch (R per inch).

Table 4 – *PINKCORE Insulation Thermal Performance*

Thicknesses IN	MM	R-value
1.5	37.5	7.5
2.0	50.0	10.0
2.5	62.5	12.5
3.0	75.0	15.0
3.5	87.5	17.5
4.0	100.0	20.0

Availability

PINKCORE insulation and ties have been available for delivery since September, 1997. Shipments are made from the Owens Corning plant in Tallmadge, Ohio, or from Owens Corning's authorized distributors of FOAMULAR® insulation products.

Application Recommendations

While the energy standard ASHRAE 90.1 is a United States standard, and has been adopted into building codes in many areas of the USA, it is completely appropriate for buildings anywhere in the world. A building constructed using ASHRAE 90.1 principles – whether the code applies or not – will deliver the thermal performance the owner expects.

The requirements of Standard 90.1 call for increased energy efficiency in four primary areas:

- Lighting
- Building Envelope
- HVAC systems and equipment
- Service water heating

The answer to how much insulation a building needs and where should it be placed lies in the calculations that accompany ASHRAE 90.1. Using Owens Corning's proprietary software, designers can measure the "tradeoffs" between insulating the walls and insulating the roof. And when the determination is made, the designer may very well be able to downsize the HVAC requirements thus saving even more on both first costs and life-cycle costs for the building.

PINKCORE extruded polystyrene rigid foam insulation and ties create an opportunity for the architect/engineer to take advantage of the speed and low cost of insulated wall, while meeting owner and code demands for a thermally efficient building envelope.

In 65% of 211 major metropolitan areas studied by Owens Corning, no block wall or uninsulated block/concrete wall design met the ASHRAE 90.1 code requirement for maximum thermal usage with roof insulation rated less than R-45. ASHRAE 90.1 compliance can easily be met in all areas of the country with PINKCORE insulation and connector ties.

Other Information

Complete installation instructions for PINKCORE insulation and connector ties (Pub. No. 15-IN-22061) are available from your Owens Corning representative.

Shipping

PINKCORE insulation is shipped on open trucks, the same way the company's FOAMULAR® extruded polystyrene rigid foam insulation is shipped. The insulation may be shipped to the distributor's yard, a precast plant (in the case of a precast order) or the job site (in the case of a tilt-up order). The following chart shows square feet of insulation per truck based on 4 ft x 8 ft sheets:

Table 6 – *Loadout Data by Thickness for 4 ft x 8 ft Sheets*

Insulation Thickness	Square Feet per Truckload
1.5"	24,576
2.0"	18,432
2.5"	14,745
3.0"	12,288
3.5"	10,532
4.0"	9,216

The PINKCORE ties are packaged in cardboard boxes with 600 ties per box. For every 1,000 square feet of 16-inch on-center-marked insulation, Owens Corning will ship one box of ties. For odd square footage amounts, Owens Corning will ship enough ties to complete the job. If a customer requires additional ties for the job, Owens Corning will charge for the additional boxes of ties.

PINKCORE ties are shipped separately from the insulation via ground carrier. The ties may be shipped to the distributor's yard or to a precast plant, but may not be shipped to a job site where a permanent address has not been established. For tilt-up orders, the ties will be shipped to the distributor and the distributor will arrange for delivery to the job site.

PINKCORE™ XPS Rigid Foam Insulation and Connector Ties

Related Services

Owens Corning can provide fabrication and drafting services related to insulated concrete sandwich panel jobs. Please contact your Owens Corning representative.

Associate Member
Precast/Prestressed Concrete Institute

National Supplier-Association Member
Tilt-Up Concrete Association

OWENS CORNING WORLD HEADQUARTERS
ONE OWENS CORNING PARKWAY
TOLEDO, OHIO 43659

1-800-GET-PINK
www.owenscorning.com

Pub. No. UC-280-A Printed in U.S.A., August 2001

Disclaimer of Liability

It is the sole responsibility of the contractor to install the PINKCORE XPS Foam Insulation and Low-conductivity Ties in accordance with these published instructions. The presence of an Owens Corning representative at the job site does not relieve contractor from the responsibility to follow these published installation instructions. OWENS CORNING IS NOT RESPONSIBLE FOR ANY LIABILITY RESULTING FROM A FAILURE TO FOLLOW THESE INSTRUCTIONS