

- 2 inches (50mm) Insulation & Ties
- 3 inches (75mm) Insulation & Ties
- 4 inches (100mm) Insulation & Ties

DESCRIPTION

PINKCORE foam insulation and connector ties are specifically designed for use in site-cast or precast insulated concrete tilt wall sandwich panels. These products provide a fast, efficient, cost-effective method of improving the thermal performance of commercial buildings.

Typical concrete tilt wall panels must be insulated after casting and erection. Using PINKCORE foam insulation and connector 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 structural 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 two, three or four inches of PINKCORE insulation (R-values of 10, 15 and 20, respectively) dramatically improves the thermal performance of a building. The tight, closed cell structure of PINKCORE foam insulation also resists moisture penetration, which insures that the thermal performance is maintained over the life of the building.

PINKCORE Connector Ties

Manufactured from a high-performance, engineered thermoplastic resin, PINKCORE connector 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 connector ties minimizes the energy-draining effects of thermal bridging and results in a sandwich panel with maximum thermal performance.

INSTALLATION

PINKCORE foam insulation and connector ties are specifically designed for fast, accurate installation. The PINKCORE foam insulation is clearly marked with a 16-inch on center dot pattern to ensure accurate placement of the PINKCORE connector ties into the foam insulation. After casting the reinforced exterior concrete wythe, the PINKCORE foam insulation and connector 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 foam insulation and connector ties are in place, construction of the structural concrete wythe continues in a manner similar to an uninsulated tilt wall panel. Rebar, imbeds and lifting inserts are all set in place on top of the PINKCORE foam insulation and then the concrete is poured. With a compressive strength of 25 psi (3,600 psf), the PINKCORE foam insulation provides damage resistance from foot traffic and other job site abuse.

PERFORMANCE DURING LIFTING

Because the lifting inserts are located on the structural 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/ft². Suction force between the casting bed and the fascia wythe is approximately 25 lbs/ft². With the connector ties spaced 16-inches on center, each connector tie is required to support 111 lbs.

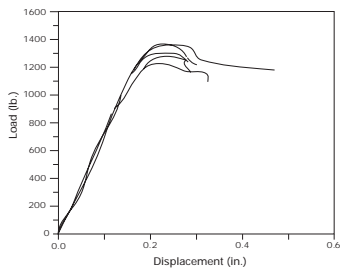
Calculation for Stress on Connector Ties During Lifting

$$(37.5 \text{ lbs.} + 25 \text{ lbs.}) \times 1.77 \text{ ties/ft}^2 = 110.63 \text{ lbs.}$$

Tensile Strength

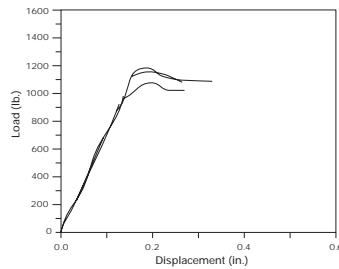
A connector tie was placed in an Instron machine and tested until failure occurred. As shown on the graph below, the nominal tensile strength of each PINKCORE connector tie exceeds 1,100 lbs., which provides a safety factor of 10 to 1. (Note that standard safety factors on tilt wall lifting hardware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

Connector Tie: Tensile Strength



connector heads were pulled in a tensile fashion until failure. As shown on the graph below, the pull-out strength of a single PINKCORE connector tie is nominally 1,100 lbs.

Connector Tie: Pull-out Strength



Shear Strength

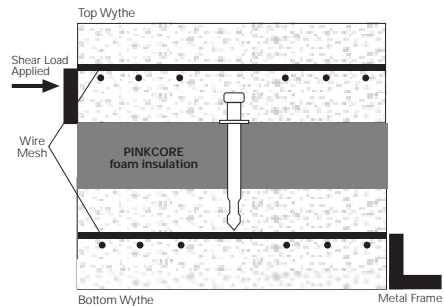
As the tilt wall panels are lifted from a horizontal to a vertical position, the load on the PINKCORE connector tie shifts from a tensile load to a shear or flexural load.

Because a bond forms between the PINKCORE foam 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 connector ties with the concrete-foam bond intact, 4 ft. x 8 ft. test panels were constructed by first pouring three inches of concrete, then placing a sheet of PINKCORE foam 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 a standard tilt-up wall with PINKCORE foam insulation.
2. In order to determine the strength of the PINKCORE connector ties alone (without the effects of the concrete-foam bond), panels were constructed as above, but with two sheets of polyethylene between each concrete-foam 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.

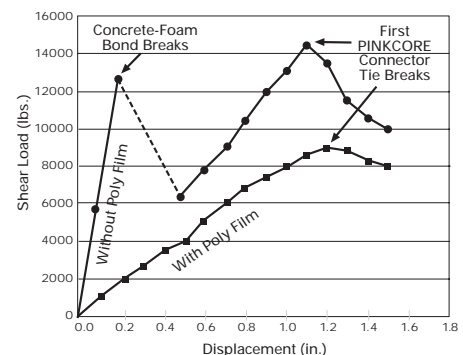
Shear Testing Apparatus Illustration



Actual panel was 4'x8' and contained 18 connectors.

The graph below 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 under the stress of lifting.

Stress-Strain Curve for 4' x 8' Sandwich Panel



The weight of a 3-inch thick, 4 ft. x 8 ft. wythe is 1,200 lbs. During testing, the PINKCORE connector ties exhibited a minimum shear strength of approximately 9,000 lbs. and a maximum of 14,000 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.

IN SERVICE

The connector 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/ ft².

* 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:

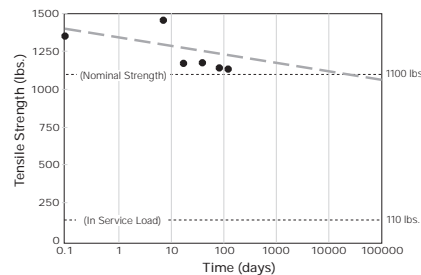
$$54 \text{ lbs/ft}^2 \times 1.77 \text{ ft}^2/\text{tie} = 96 \text{ pounds per tie}$$

Alkaline Environment

The connector 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 180 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. In fact, extrapolation of this severe test confirms the exceptional alkaline resistance of this resin, as substantial safety factors are maintained for many years.

Connector Tie:
Alkaline Resistance



Fire Resistance

The fire resistance of a concrete sandwich panel is provided by the concrete itself. With concrete walls, the typical failure mode in the ASTM E119 test procedure is the temperature on the outside of the wythe elevated 250°F above an ambient temperature of 70°F. The softening point of the engineered thermoplastic polymer used in PINKCORE connector ties is 420°F. Achieving the desired fire rating requires manipulating the thickness of the structural wythe.

The Southern Building Code Congress International provides a table listing the minimum thickness of site-cast or precast concrete walls by concrete type (Standard Building Code 1994, Table 709.2.1.1). Using this table, a typical six-inch thick structural wythe of carbonate aggregate concrete has a fire rating between three and four hours. This is offered as an example only, as other building codes may apply in your area.

In testing with 5.5-inch thick structural wythe, two inches of insulation and three-inch fascia wythe according to ASTM E119, the outside surface of the fascia wythe experienced a temperature elevated 100°F above ambient after four hours.

When designing a tilt-up building 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.

THERMAL PERFORMANCE

PINKCORE extruded polystyrene rigid foam insulation meets ASTM Standard Specification C-578, Type IV and has thermal resistance of 5.0°F h ft²/Btu per inch (R per inch).

PINKCORE Foam Insulation Thermal Performance

Insulation Thickness	R-Value
2 inches (50mm)	10
3 inches (75mm)	15
4 inches (100 mm)	20

AVAILABILITY

PINKCORE foam insulation and connector 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

PINKCORE extruded polystyrene rigid foam insulation and connector ties create an opportunity for the architect/engineer to take advantage of the speed and low cost of tilt-up construction, 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 tilt 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 foam insulation and connector ties.

PINKCORE foam insulation and connector ties are a part of Owens Corning's Integrated Thermal Tilt-wall System. When used with other components of this system, PINKCORE insulation and connector ties can lower the first cost of a building, achieve code compliance, and deliver superior operating performance and improved return on investment for the building owner.

OTHER INFORMATION

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



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