Product Performance Sheet

WARM-N-DRI® Insulation-Protection-Drainage Board

WARM-N-DRI® insulation-protection-drainage board is a dense fiberglass board engineered for use on the exterior of foundation walls. WARM-N-DRI board is a unique product that provides a combination of protection against damage due to harsh backfill, a drainage path to the drain tile, and thermal insulation for the protected space.

Questions arise in the marketplace from builders, architects, general contractors, specifiers, code officials, building inspectors and homeowners as to the long-term performance of WARM-N-DRI board. The following information will explain how these properties are retained over time.

WARM-N-DRI Construction:

WARM-N-DRI insulation-protection-drainage board consists of glass fibers, somewhat intertwined, but predominantly oriented in laminar layers parallel to the plane of the board. There is a small degree of intertwining of fibers from layer to layer, but the greatest amount of entanglement occurs among the fiber bundles in each lamina. Binder droplets that collect and cure at the fiber intersections give the board its strength and resiliency. The predominantly laminar orientation of the fibers gives the board excellent in-plane drainage capability while the fiber entanglement provides sufficient compressive strength and abuse resistance to stand up to the random impact and shear loads that occur during the backfilling and settling of the soil.

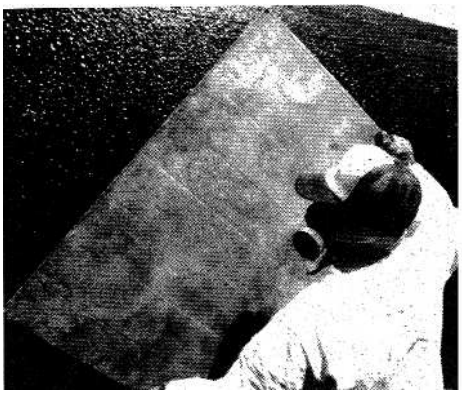
History of Fiberglass Boards in Canada and Sweden

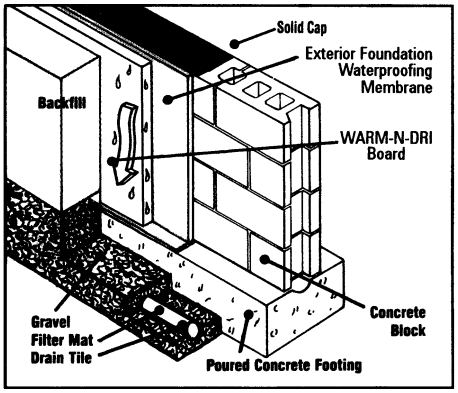
Glass fiber board insulation has been used in below-grade applications for the past 30 years in Europe and for over 25 years in Canada. Research verifying the in-service performance of glass fiber insulation appeared in technical documents published in technical documents published in Sweden in 1972 and in Canadian technical journals in 1976.

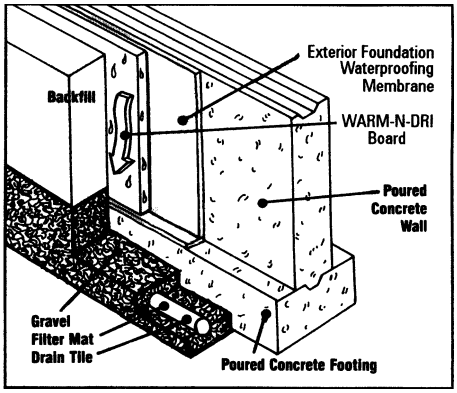
This initial research demonstrated that, after an extended period in service:

1. The drainage ability of the fiber glass insulation had not been significantly altered.
2. Small amounts of silt collected on the outmost layers of fibers but did not measurably affect the drainage capacity.
3. The depth of soil penetration into the fiberglass material was significantly small, 2 to 3 mm on the average, even though a part of the material surface was intentionally torn or cut with grooves to increase soil penetration.
4. The drainage rate in the plane of the fiber board continued to be 200 to 300 percent greater than the drainage rate through the face of the board.

Since 1981, ongoing testing of WARM-N-DRI board has been conducted at the Owens-Corning Technical Center. This testing continues to confirm these performance properties.







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Typical installation of WARM-N-DRI board on concrete block wall.

Typical installation of WARM-N-DRI board on poured concrete wall.

Granville Test Program — Verification of WARM-N-DRI® Board in Service Performance

Performance:

WARM-N-DRI board retains its long-term thermal insulation property due to the rapid drainage of water from the internal air spaces in the board. To ensure the long-term, below-grade drainage and thermal performance of WARM-N-DRI board, the internal air spaces must not be excessively compressed due to backfill pressures or become filled with silt and clog the drainage paths.

To substantiate the long-term performance of the WARM-N-DRI board, tests have been ongoing since 1981 in the basement-wall test facility at the Owens-Corning Technical Center in Granville, Ohio. There, WARM-N-DRI boards have been installed on an eight-foot-deep masonry unit foundation. The boards are instrumented with thermocouples, compression indicators, and thermal flux meters. The WARM-N-DRI boards are mounted flush against the vertical walls and rest in a slotted plastic pipe at the footing. The drainage from each section of boards is carried through plastic pipe to separate sumps so drainage flows can be monitored. The data from these instruments shows that the R-value and drainage capacity of the boards have not changed since installation in 1981.

This data substantiates several of the benefits of the fiberglass-insulation-protection board:

1. R-value is based upon the thickness of the fiber insulation board and is a result of the voids within the board. The constancy of the monitored R-value of the board verifies that the thickness is not changing and that the voids in the fiber insulation are not being filled with water or silt.
2. The constancy of drainage to the sumps substantiates that the board is not being compressed and the board's void spaces remain open and freely draining.

Verification of WARM-N-DRI Board Drainage Rates:

The drainage of WARM-N-DRI board is due to the laminar orientation of the fibers. Water can enter the board either through the top surface (if the board is cut off at grade) or through the face of the board. Due to the greater degree of entanglement in the laminar planes, the water flow through the face and across the thickness of the board is much less than the flow of water down along the laminar fiber layers.

Samples of WARM-N-DRI board taken from production runs are periodically tested in a laboratory drainage rate tester. Water is introduced to the top of a board that is compressed between two vertical parallel plates. The incoming water is maintained at a constant level above the top surface of the board (1/8 to 1/4 inch) and the amount of water flowing through the board after a period of time is measured. The length of the sample and height of the water above the board define the hydraulic gradient. The compression force on the board, simulating backfill loading, is directly related to the compressed thickness of the board. The drainage rates cited here in the product literature are the *minimum* drainage rates measured for a particular board thickness.

Samples of WARM-N-DRI board were went to GeoSyntec Consultants, Inc., a geotextile consulting and testing firm in Atlanta, GA. Vertical hydraulic transmissivity tests of WARM-N-DRI board samples were performed in accordance with ASTM D 4716 Test Method for Determining Hydraulic Transmissivity (in-plane flow) of Geotextiles and Related Products. A copy of the test results and details of the test procedure are available upon request. GeoSyntec Consultants also performed tests to measure through-face hydraulic transmissivity and face silting tests. The results of these tests show that the through-face transmissivity is approximately twice the in-plane transmissivity and that the WARM-N-DRI board *does not* become clogged with silt which would prevent the board from draining. The silting tests were done with two graded soils: 10 percent and 30 percent of the soil particles were finer than the equivalent opening size of the board.

The silting test results show approximately a 10 percent decrease in transmissivity over time, after which steady state drainage was achieved. This result also verifies that WARM-N-DRI board *does not* become clogged with silt that would prevent drainage.

The drainage capacity of WARM-N-DRI board on a per-unit basis is equivalent to fine gravel. To maintain performance over the life of the structure, it is mandatory that the WARM-N-DRI board be connected to a perimeter-foundation-drainage system. The usual approach to meeting this requirement is to install a foundation footing drain tile and gravel system, with the gravel covering the drain tile 8 to 12 inches high and extending to and up the face of the WARM-N-DRI board. If the tile is placed off the footing, the gravel should cover the tile, the footing, and 8 to 12 inches up the face of the WARM-N-DRI board.

Resistance to Silting:

WARM-N-DRI board, being a three-dimensional fabric, has more volume of porous material than a single layered filter fabric. Particles may embed or become trapped among the surface fibers of the WARM-N-DRI board; however, since the particles can be at various depths in the board, WARM-N-DRI board should continue to provide a drainage function long after a single layered fabric is plugged. Note that if the soil placed against the WARM-N-DRI is clay or highly silty, and the percolation rates through this soil exist at a sufficient rate for a long period of time, WARM-N-DRI board could also become plugged.

WARM-N-DRI boards installed on the foundation walls of the Basement Test Facility in 1983 have not shown any evidence of plugging.

Preservation of R-value:

WARM-N-DRI board provides thermal insulating protection to a foundation wall in two ways. The fibers are small and not continuous, hence the conduction path is very long. The air spaces entrapped among the fibers are small, minimizing convective heat transfer. The temperature differences below grade are so small that radiative transfer is negligible. If the WARM-N-DRI board is not crushed or damaged so the thickness is reduced, the conductive transfer does not change. As long as the air spaces do not become filled with water or other material, the conductive transfer does not change. WARM-N-DRI board is basically providing a protective stagnant air space between the outside environment and the inside space. During the transient periods when water may be flowing through the pores while traveling down the board to the drain tile, there is a variation in the conductive transfer, but this change is of such sort duration that it is not detectable.

Even if the board should become filled with water for whatever reason, after the water drains out of the board, the conductive path returns. This is because the spaces between the entangled fibers empty and provide the insulating property of still air. WARM-N-DRI board can be immersed in water, removed from the water, and placed vertically, and the water drains from the board. The weight gain of the board after immersion is approximately two percent. This two-percent weight gain represents water molecules on the fiber surfaces and small droplets attached to the fiber crossover points. The air spaces remain and maintain the thermal insulating property of the board.

Exterior vs. Interior Placement of Insulation:

Foundation insulation is commonly applied to the inside of the foundation wall. In the case of an existing foundation where backfill and landscaping has been completed, this is the most cost-effective approach to insulating the foundation wall. This approach does have some drawbacks. The major temperature drop occurs across the insulation; therefore, the foundation wall temperature will be about the same as the surrounding soil temperature or, in the case of above-grade exposed areas, the surrounding air temperature. A vapor barrier is sometimes placed over top of the insulation. Moisture that diffuses through the foundation wall condenses on the inside of the wall and within the insulation, resulting in odor and mildew. during the winter months, ice may form in the insulation placed over the above grade portion of the wall.

Installing insulation to the exterior of the foundation wall results in the whole mass of the foundation being near the temperature of the interior space. The major temperature drop occurs across the insulation that is outside the foundation wall.

The condensation point, i.e., the dew point, is now located outside the foundation wall, hence no condensation occurs on the inside of the foundation and no ice forms during the winter months. Also, insulating the exterior of the foundation wall provides more usable space inside the foundation. To install interior finish to the walls such as paneling or gypsum board, thin furring strips may be used, since cavities to hold interior insulation are not needed.

Guidelines for WARM-N-DRI Use:

WARM-N-DRI glass fiber drainage and insulation board can be used in all areas of the country. Use of WARM-N-DRI is not limited by section 23041.4 of the SBCCI Building Code, which states:

> Foam plastics including, but not limited to, extruded or expanded polystyrene or polyisocyanurate shall not be installed below grade on the exterior of slab foundations where hazard of termite damage is very heavy.

WARM-N-DRI is also not subject to section 2304.2 of the SBCCI Building Code that requires:

> A minimum of 6" clearance between earth and foam plastics applied to above grade exterior walls.

For any further information on WARM-N-DRI board or any other waterproofing product from Koch Waterproofing Solutions, please call 800-DRY-BSMT.

Physical Property Data - WARM-N-DRI® Board

Type	Unfaced rigid fiber glass board	
Physical appearance	Pink, unfaced	
Board sizes	4 ft x 4 ft, 4 ft x 8 ft	
Board thickness	3/4 in., 1 3/16 in., 2 3/8 in.	
Thermal resistance [1]	3/4 in.	R=3.2
	1 3/16 in.	R=5.0
	2 3/8 in.	R=10.1
Drainage ability, hydraulic gradient 1.0	Board thickness	Gallons/hours/lineal foot
	3/4 in.	74
	1 3/16 in.	118
	2 3/8 in.	237

Compression properties [2], [3]

Depth, feet	% Reduction in board thickness		Soil Pressure, lbs./sq. ft	
	Clay	Wet Sand	Clay	Wet Sand
4	4	2	200	100
8	8	4	400	175
12	11	5	600	250
16	15	6	800	325

[1] R means resistance to heat flow. The higher the R-value, the greater the insulation power.

[2] WARM-N-DRI board should not be used as structural support element.

[3] For depths greater than 16 ft please contact Koch Waterproofing Solutions at 800-DRY-BSMT.

WARM-N-DRI board is manufactured by Owens-Corning. It is used as a component of the TUFF-N-DRI Basement Waterproofing System which is sold and warranted by Koch Waterproofing Solutions.

For more information on TUFF-N-DRI please call 800-DRY-BSMT.

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Makers of TUFF-N-DRI® and WATCHDOG WATERPROOFING®