



CERAMIC TILE INSTITUTE OF AMERICA, INC.

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CTIOA REPORT 2005-4-15

By: CTIOA Inc. Floor Membrane Committee

SUBJECT: FLOOR CRACK ISOLATION MEMBRANES

In the building industry, a membrane usually refers to an underlayment that is a thin product providing separation or transition from one concrete material or application to another. In the ceramic floor tile industry, a membrane refers to an underlayment that is applied between the substrate and the flooring tile or tile assembly. Membranes are used for a variety of reasons so there are many types that are designed for specific functions. The purpose of this report is to identify and define crack isolation membranes and their intended use. Crack protection is limited to minor horizontal planar movement of the substrate (shrinkage cracks) and will not provide protection against vertical movement (structural cracks). See industry standards ANSI A118.12* for material and ANSI A108.17* for installation (*pending approval at the time of this report).

I – MEMBRANE CATEGORIES

LOAD BEARING, BONDED, CRACK ISOLATION MEMBRANES: (ANSI A118.12*)

Membrane strips are bonded to the substrate and are specifically designed to cover existing shrinkage cracks in the substrate per TCA F125. The membrane strips must cover three times the width of the floor tile used, with a minimum width of 6 inches. Check with the membrane manufacturer for the maximum crack width that is covered by their membrane warranty and any limitations. These types of membranes can also be used as “anti-fracture” membranes when they are applied to the entire surface of the substrate.

LOAD BEARING, BONDED, ANTI-FRACTURE MEMBRANES: (ANSI A118.12*)

This membrane is bonded to the substrate. It is only considered “anti-fracture” if it completely covers the substrate per TCA F125A. This is a full coverage membrane designed to manage both existing shrinkage cracks and future ones; it also provides some protection against shrinkage, thermal and moisture expansion/contraction of the substrate.

CLEAVAGE MEMBRANES: (ANSI A-2.1.8)

This is a full coverage membrane that is not bonded to the substrate with the purpose of separating the entire tile assembly from the substrate. This isolates both the wire-reinforced mortar bed and the tile installation from any instability in the wood or concrete substrate.

LOAD BEARING, BONDED, UNCOUPLING MEMBRANES:

This is a full coverage bonded membrane that differs from other “direct bond ‘anti-fracture’ membranes”

because it is a thicker material with air cavities pressed into its surface. The patterns are designed to “keylock” the thin-set into its upper surface, while the open air cavities underneath allow for some lateral movement without losing a bond per TCA F147/F148.

LOAD BEARING, BONDED, WATERPROOF MEMBRANES: (ANSI A118.10)

This type of membrane is not covered in this Field Report. If you require a waterproof membrane, please refer to CTIOA Field Report 82-1-3 (R-2002 ‘Waterproof Membranes & Underlayments’ available on the Web at www.ctioa.org.

II – TYPES OF INDIVIDUAL MEMBRANES

LOAD BEARING, BONDED, CRACK ISOLATION & ANTI-FRACTURE MEMBRANES:

1. Sheet membranes bonded to the substrate with some available in a “peel & stick” type of material.
2. Rolled liquid or trowel applied membranes that are bonded to the substrate with or without fabric. Some require fabric embedded over the entire substrate while others only require it over backer board joints and at all changes in plane. When cured, tiles are typically thin-set directly onto the membrane. Always refer to manufacturers’ instructions for performance levels and limitations, and be sure to follow the written instructions accurately to avoid problems.
3. Some trowel applied membranes can be used as a bonding agent for tiles as long as the tiles are applied before the membrane sets.
4. Cork underlayment on Concrete, TCA F135-03: “½-inch thick (+/- .010-inch) cork underlayment sheets. Consisting of a mix of pure cork granules combined with polyurethane binder, having a density of between 11.8 and 13.6 lbs. per cubic foot.”

NOTE: TCA states under F135-03 to use a Type 1 organic adhesive to bond cork underlayment to sub floor. CTIOA warns regarding concrete slabs on grade: “Organic adhesive should never be used to bond sheet type membranes onto a concrete slab on grade because of the potential for moisture problems.”

CLEAVAGE MEMBRANES:

1. Cleavage membranes are designed to separate the tile assembly’s mortar bed from the surface of the substrate.
2. The mortar bed is required to be reinforced and to be of a uniform thickness – 1-¼" minimum to 2" maximum (ANSI, TCA). Mortar beds (reinforced) in excess of 2-inches shall be detailed by the architect. For reference details, refer to TCA F111 -03, F114 -03 over concrete floors, TCA F141-03 over wood floors.
3. Membrane sheets approved as cleavage membranes should never be used, nor are they ever recommended by their manufacturers to be used, as a “load bearing, bonded, crack isolation or anti-fracture membrane.”

LOAD BEARING, BONDED, UNCOUPLING MEMBRANES:

1. Uncoupling membranes are used on problematic substrates to prevent any existing or potential cracks and stresses from transferring to the finished tile assembly. When there are height limitations, the uncoupling membrane is an alternative to using a reinforced mortar bed over a cleavage membrane. For quick reference details see TCA F147 and F148.
2. This membrane is a full coverage “load bearing, bonded, anti-fracture” membrane.
3. The material that forms this membrane is considerably thicker than any of the other membranes.

4. This single sheet membrane is available with a number of different patterns pressed into it. The intended use of the membrane will determine which pattern should be used. The patterns are designed to “keylock” the thin-set into the membrane’s top surface while providing mesh covered air cavities underneath to allow for some lateral movement without losing bond. *

* **NOTE:** There are other pressed patterns available in ‘uncoupling’ membranes for different uses. For this report, however, we are only reviewing “load bearing, bonded anti-fracture” membranes.

MOISTURE VAPOR EMISSION & MEMBRANES:

Not all membranes are suitable as vapor barriers and should be used only as per the manufacturer’s instructions. Floor membranes are usually classified as either a moisture barrier or as a vapor/moisture barrier. A **MOISTURE BARRIER** is designed to substantially reduce or eliminate moisture in a liquid state from passing through it; but it is breathable and does allow moisture in a vapor state to pass through it, to some degree. A **VAPOR/ MOISTURE BARRIER** does not allow moisture in a liquid or vapor state to pass through it; thus it is not breathable. In cases where the substrate’s moisture vapor transmission exceeds 3 lbs per 1,000 square feet in 24 hours, consult with the membrane manufacturer for suitability of use. The Marble Institute of America (MIA) recommends that all on-grade applications have a moisture barrier to protect the natural stone against potential moisture problems. Carefully consider all options, as improper use of a vapor/moisture barrier membrane may entrap moisture condensation.

SLIP-SHEETS:

“Slip-sheet” is an incorrect term used to describe all of the above membranes. In the past, the term “slip-sheet” was synonymous with cleavage membranes. Today “slip-sheet” is a term used by the Ceramic Tile Institute of America (CTIOA) to describe materials such as 15 lb. felt building paper, scribing felt, or Kraft paper. These products are misused as load bearing, bonded, membranes in order for contractors to reduce material costs. Slip-sheets are not recognized by the CTIOA or their manufacturers as an acceptable alternative or replacement for industry approved “load bearing, bonded, crack isolation or anti-fracture” membranes. This is due to their initial low tensile (shear bond) values and their rapid deterioration when exposed to moisture condensation with high alkalinity that are common with concrete slab on-grade tile applications.

CONCLUSION:

There have been many tragic failures when the wrong membranes have been used or where the membranes and/or the bonding mortars are not compatible, resulting in loss of bond. The reason for most failures where membranes are involved is that an inappropriate or unapproved membrane was used, or it was improperly installed for the kind of application for which it was being used. There are two requirements to consider when selecting the correct membrane to use:

1. Membranes must meet all current ANSI standards.
2. All manufacturers’ instructions must be followed and limitations considered when membranes are installed.

ADDITIONAL SOURCES OF INFORMATION

For additional information on membranes and related subjects, see the following CTIOA publications.

1. Field Report 82-1-3 ©-2002 – ‘Waterproof Membranes and Underlayments’ (ANSI A118.10)