

A Guide to Flooring Moisture Problems

This document was prepared as a survey on what most flooring manufacturers, organizations, and experts say about the problem of flooring failures caused by high concrete moisture vapor emission.

Moisture vapor in concrete has always presented a problem for glue-down flooring systems and the delamination of flooring due to moisture has cost architects, contractors, flooring contractors, and building owners untold millions.

The chances of bond-failure can be greatly minimized by conducting a proper moisture test prior to flooring installation. The majority of the flooring industry recognizes a calcium chloride test for measuring concrete moisture vapor emissions prior to installation. Including this test in all flooring specifications will reduce your exposure to liability.

The following pages outline the **problem**, the **test procedure**, and cite the **limitations** on moisture emissions by a number of major flooring manufacturers, industry experts, and organizations responsible for specifications.

"Moisture has been causing floor covering installers problems since the beginning of time...Many new floor coverings stop or slow the transmission of moisture moving upward through the slab... Water vapor conditions...can exist for years without causing problems in places where the slab has never been covered with a floor that allowed moisture to pass through. If you install a new floor that traps moisture, there's trouble ahead!"

Mr. Joe Grady, National Market Development Manager, The W W. Henry Company

"Moisture related failures of resilient floor coverings installed over concrete have focused unfairly over the years on the premise that the product itself is at fault or the flooring contractor, perhaps, did not install the product correctly... Moisture and alkali can cause the following problems AFTER installation:

- 1. Adhesive deterioration.*
- 2. Bumps, ridges, or bubbles.*
- 3. Color changes.*
- 4. Mold, mildew, or bacteria growth.*
- 5. Efflorescence (alkali build-up at tile joints).*
- 6. Tile peaking or curling.*

Any of these conditions could occur at any time after installation if a moisture condition is present."

The Resilient Floor Covering Institute

"All concrete subfloors on and below grade should be tested for moisture...A dusty

concrete floor on or below grade can be a sign of alkali salts, and a moisture test should be run. The alkaline salts in solution with moisture, which exude from drying cement or which work their way up from the earth in concrete on and below grade, have, in addition to deteriorating effects, a tendency to prevent or destroy satisfactory bonding of adhesives by sheer physical displacement or to leave unsightly salt deposits at the seams of sheet materials and joints of tiles. Excessive amounts of ground moisture can, of course, create problems for on- and below grade areas of commercial and residential buildings over and beyond those relating to the installation and use of resilient flooring."

Armstrong World Industries

The Rubber Manufacturers Association

"...the moisture specification shall be that the emission of moisture vapor from the (concrete) floor shall not be more than **3.0 pounds per 1,000 square feet per 24 hours**...If a concrete underfloor, tested with this unit in accordance with directions, meets the stated conditions and specifications, rubber and solid vinyl flooring may be installed satisfactorily..."

The Resilient Floor Covering Institute

"The Resilient Floor Covering Institute subscribes to the use of the Rubber Manufacturers Association moisture test method. It has been widely used and accepted by the flooring industry since the early 1950's and quantitatively measures the rate of moisture transmission through a concrete slab."

Western Floor Covering Institute

"The Western Floor Covering Institute cites in their guidelines a number of testing methodologies and specifically cites the Rubber Manufacturers Association test and limitation for any flooring installation at **3.0 pounds per 1,000 square feet per 24 hours** using a calcium chloride test."

The Carpet and Rug Institute

"In order to prevent glue-down installation failures due to moisture and alkalinity, the owner or general contractor shall be responsible for providing written moisture and alkali test results pertaining to the concrete floor slab prior to installation. Concrete floors, even with adequate cure time, can demonstrate an unacceptable moisture condition by allowing excessive amounts of moisture to pass through. This can be a problem even for suspended concrete floors. Therefore, all concrete floors should be tested to determine the moisture emission rate by utilizing a calcium chloride moisture test kit...This is a very precise test...As a general guideline, an emission rate of **3 lbs. or less** is acceptable for most carpet. In the range from 3 to 5 lbs., carpet with backing of porous constructions can usually be installed successfully; however, the risk of failure increases. An emission rates above 5 lbs. is generally considered unacceptable."

The W.W. Henry Company

"Installations on concrete floors- above, on, or below grade....must be tested for moisture. It is the responsibility of the flooring contractor to conduct moisture tests to determine if

the concrete is suitable for the installation of a tile floor. DO NOT install where a moisture test shows more than **3.0 pounds per 1,000 square feet per 24 hours.**"

Altro Floors

"Moisture test must be taken to ensure the concrete substrate is sufficiently dry for installation of any Altro Safety Floor. Mat test - tape 3' x 3' pieces of polyethylene for a minimum of 72 hours approximately 50 feet apart. Remove the polyethylene after 72 hours and if there is any evidence of moisture, a quantitative test should be taken to determine the exact amount of moisture present. Rubber and Vinyl Manufacturers Test for Moisture Emission - Emissions should not exceed **3.0 pounds per 1,000 square feet per 24 hours**, per ASTM E 96-80."

Amtico-Congoleum

"Amtico does not guarantee against hydrostatic pressure under any circumstances..."Where excessive hydrostatic pressure or alkaline conditions exist, the installation of Congoleum sheet vinyl floors is not recommended. Installation or service failures due to excessive moisture, vapor or alkali through the concrete subfloors are not the responsibility of Congoleum Corporation and it does not assume liability for such failures."

Armstrong World Industries

"Using the flooring material specified, install 3' x 3' panels spaced approximately 50 feet apart throughout the subfloor area. If the panels are securely bonded after a period of 72 hours, it may be concluded that the subfloor surface is dry...Material can be considered 'securely bonded' if an unusual amount of force is required to lift it from the subfloor. Calcium chloride testing is acceptable to define amount of moisture vapor emission."

Azrock Industries

"The Azrock (RMA) Moisture Test Kit employs the use of anhydrous calcium chloride...The results should be lower than the upper threshold value of **3.0 pounds per 1,000 square feet per 24 hours.**"

Bruce Hardwood Floors

"Concrete subfloors must be dry...All concrete subfloors should be tested for moisture content."

Bruce lists three types of test methods:

1. *The Mat Test:* "Completely tape down 2' x 2' polyfilm squares in several areas and leave them for 24-48 hours. Check for condensation under the plastic."

2. *The Phenolphalen in Alcohol Test:* "Chip a small section of concrete off floor in several areas: Apply 3% phenolphalen in alcohol solution...If red color appears, further testing should be performed...If test proves positive, it is recommended to verify the results by performing a different test such as the polyfilm (Mat) test."

3. *Calcium Chloride Qualitative Test:* Described placing crystals directly on concrete, "If crystals dissolve within 12 hours, the slab is too wet."

Burke

"...no more than **3.0 pounds per 1,000 square feet per 24 hours...**

CONDITIONS OR AFFECTS NOT WARRANTED: Problems caused by excessive moisture, hydro-static pressure, or alkali."

Collins and Aikman

"Where excess moisture may be expected, i.e., on grade, below grade, or light weight aggregate floors with or without pan construction, a successful installation may be hampered due to moisture. While latent in appearance, it may become active when covered. The maximum allowable amount of moisture evacuation should not exceed **2.5 pounds per 1,000 square feet in 24 hours.**"

Endura

"Emission of moisture vapor from the floor should not exceed **3.0 pounds per 1,000 square feet per 24 hours** using the Moisture Test Unit developed by the Rubber Manufacturers Association."

Flexco

"All concrete slabs should be tested for moisture with calcium chloride prior to installation of resilient tile. A suitable moisture barrier is the best insurance against moisture problems for on or below-grade slab construction, but all slabs should be tested regardless of age. Moisture emission must not exceed **3.0 pounds per 1,000 square feet per 24 hours.** FLEXCO IS NOT RESPONSIBLE FOR FAILURE OF FINISHED FLOOR DUE TO MOISTURE."

Forbo Industries

"It is essential that moisture tests be taken on all concrete floors regardless of age or grade level. The test should be a calcium chloride test...One test should be conducted for every 1,000 square feet of flooring. The test should be conducted around the perimeter of the room, at columns, and where moisture may be evident. The moisture emission from the concrete shall not exceed **3.0 pounds per 1,000 square feet per 24 hours.** A diagram of the area showing the location and results of each test should be submitted to the Architect, General Contractor, or End-User. If the test results exceed the limitations the installation must not proceed until the problem has been corrected."

Fritztile

"FRITZTILE cites using a Delmhorst Moisture Detector and readings must indicate a dry subfloor. They also cite the Rubber Manufacturers Association Test both **Qualitatively**, that crystals placed on open concrete must not dissolve within time, and **Quantitatively**, as per the RMA specification."

Ipocork

"The surest test is the Rubber Manufacturers Association Method using a moisture test unit. This test stipulates that a concrete slab has a vapor moisture emission of less than **3.0 pounds per 1,000 square feet per 24 hours** for a safe condition...Do not install vinyl cork tiles if an excess moisture condition exists or could exist."

Kentile

"Several moisture tests are available. However, Kentile recommends the following tests:

- (a) The Protimeter...instrument.
- (b) The RMA anhydrous calcium chloride quantitative test unit method."

Lonseal

"The flooring contractor should test all slabs with an industry approved moisture meter before proceeding with the installation of the sheeting. Lonseal, Inc. does not guarantee its products against hydrostatic pressure under any circumstances. It is the responsibility of the flooring contractor to determine whether or not the condition of the slab permits a satisfactory installation."

Mannington

"Where excessive hydrostatic pressure may exist, the installation of any Mannington sheet floor covering is not recommended. Mannington will not assume responsibility for floor covering failure due to this condition. Mannington also accepts the RMA calcium chloride test but cites a mat test primarily, yet says regarding a mat test, "The absence of moisture beads (under the polyethylene sheet) can be misleading if the test was made during a dry season. This test is most accurate if conducted after a rainy period. Never install floor covering on a wet underfloor."

Mipolam

"Moisture levels found in the concrete should be made available to all parties involved, in writing. Maximum moisture content in subfloors on which impermeable covering such as PVC floor covering is installed is as follows: Concrete or cement-like floors: less than 3% by weight using CM unit or similar apparatus. Mipolam also recognizes the RMA test using calcium chloride and limitations."

Nora Rubber Flooring

"The following conditions must also be present in an acceptable concrete subfloor: (1) A moisture condition of **3.0 pounds per 1,000 square feet per 24 hours**...is maximum."

Tarkett

"The TARKETT LIMITED WARRANTIES DO NOT COVER: (#5) Problems due to moisture, mildew, alkaline substances, or hydrostatic pressure in underfloor which exceeds **3.0 pounds per 1,000 square feet per 24 hours** when tested by Rubber Manufacturer's Association Test."

VPI

"VPI's warranty will not apply if rate of moisture emission from subfloor exceeds **3.0 pounds per 1,000 square feet per 24 hours** at any time of laying of Conductile or at any future time."

IN SUMMARY

The flooring material manufacturers did not create the problem of moisture vapor emission. It is a natural constituent of all hardened concrete. However, by setting limitations as to HOW MUCH vapor emission is tolerable, they are helping to reduce the potential for failure which has proven to be extremely costly to everyone.

The majority of flooring material manufacturers, in order to help architects, contractors, flooring contractors, and building owners understand the problem of moisture, have adopted the **calcium chloride test** as the primary measurement of moisture vapor emissions since it is simple to conduct, inexpensive, and provides useful information for making decisions.

Flooring material manufacturers simply do not warrant against bond failures due to moisture. The limit of 3.0 pounds is not necessarily their limit of liability, but a limit as to whether or not flooring should ever be installed.

The bottom line is, that by specifying quantitative limits for moisture, everyone involved with the flooring specification and installation has the opportunity to avoid a costly moisture related failure. By NOT setting quantitative limits, it becomes a subjective gamble as to whether or not the substrate is safe for installation.

The responsibility, therefore, to determine moisture levels for any flooring installation lies with the architect, contractor, flooring contractor, and building owner, as well as the liability involved if the flooring bond fails.

Facts Everyone Should Know About Flooring Installations Over Concrete

- 1) All concrete regardless of age or grade-level emits some degree of moisture and must be tested prior to installation.
- 2) The majority of flooring material manufacturers, organizations, and experts recognize the Rubber Manufacturer's Association Test (calcium chloride) as their primary criterion for determining moisture vapor emission limitations since it is the only quantitative measurement of moisture.
- 3) Mat and bond tests do not model vapor emissions and are only subjective, at best, in their interpretation.
- 4) The calcium chloride test is used by the vast majority of flooring contractors.
- 5) Flooring manufacturers do not warrant against substrate moisture, and most recognize a limit of 3.0 pounds as the maximum allowable amount of moisture vapor emission. Pounds refers to the actual weight of the water passing through a 1,000 square foot surface area, every 24 hours. Over 3.0 pounds and floors will eventually fail.

6) Calcium chloride crystal tests produce their results by changes in weight. The dish must be weighed within 1 hour after upon termination of the test to be valid. Mailing off the dish to be weighed invalidates the results.

7) Flooring contractors who do not test for moisture prior to flooring installations run the risk of total liability for a moisture failure.