

APPENDIX A: TESTING FOR MOISTURE VAPOR EMISSION FROM CONCRETE

Excess moisture in concrete can produce harmful effects of discoloration, interruption of the polymerization of products, and delaminating of non-permeable resinous systems. Sources of moisture fall into three distinct categories. Moisture present at the surface prior to or during application, moisture within the concrete that attempts to escape during and after application and a distinct source of moisture in intimate contact with the concrete that provides a continuous supply of moisture. Avoiding moisture related problems and understanding the options available for remediation once they occur is important. Detecting moisture in concrete may be accomplished by employing a number of methods briefly described below:

Relative Humidity Method BS 8201 and BS 5325 - These are British Standards that result in pass/fail of whether or not moisture is being emitted, but does not quantify the results. This is not a useful test.

Gel-B Bridge Test - This test measures electrical resistance of the concrete, but is dependent not only on the moisture content of the concrete, but also on the other constituents of the concrete. Calibration of the results obtained with this method, depend on knowing the mix design of the concrete and the raw material used. At best it is a difficult interpretation.

Radio Frequency (capacitance-impedance) Method- This method relies on portable electronic moisture meters that transmit strong radio waves that are absorbed by water. Calibration of the results obtained with this method depends on knowing the mix design of the concrete and the raw material used.

Carbide-Acetylene Test - This destructive test tells us nothing about the relative movement of moisture out of the concrete. It only quantifies that the portions of concrete removed and tested contain a measured content of moisture.

ASTM F 2170-02– Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using *in situ* Probes - The test method, modeled after the process uses in Europe for several years, requires drilling holes at a diameter of 5/8" to a depth equal to 40% of the slab's thickness. The hole is then lined with a plastic sleeve, capped and allowed to acclimate for 72 hours. The probe is placed in the sleeve, allowed to equilibrate for 30 minutes, and then readings are recorded. Acceptable relative humidity readings for substrates receiving non-permeable flooring are 75% or lower. Testing should take place in an acclimated building and is required to equal 3 tests in the first 1,000 square feet, with one additional test per each additional 1,000 square feet of concrete slab surface. This test method is less subject to conditions occurring at the concrete surface that may influence calcium chloride test results. This method only defines existing moisture content of the sample and cannot address moisture vapor transmission.

ASTM D 4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method - This qualitative method will indicate the presence of moisture movement, but it will not quantify the amount of moisture movement, and is only useful in determining that additional testing is required.

ASTM F 1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride Moisture Emissions Test - Originally developed by the Rubber Manufacturers Association, General Polymers Moisture Vapor Test Kits use anhydrous calcium chloride to make a quantitative evaluation of vapor emissions from the concrete. To determine the amount of moisture movement, the floor and surrounding environment must be in the anticipated service condition. The test must be conducted over raw exposed concrete, which has been exposed to the environment for at least 24 hours. A quantitative evaluation is conducted wherein the anhydrous calcium chloride container & contents are pre-weighed on a gram scale, allowed to remain in it's container with the lid removed, and the container placed under a sealed dome to prevent loss of moisture for a period of 60 to 72 hours.

Three tests are required for the first 1000 S.F., with one additional test for every 1000 S.F., or fraction thereafter. The container is removed and again weighed on a gram scale to determine the weight gain of the anhydrous calcium chloride. A calculation is performed to determine the amount of moisture adsorbed. These results are quantified as the rate of moisture vapor transmission expressed as pounds per 1000 square feet of surface area per 24 hours. General Polymers has adopted a commonly accepted value for application of polymer coatings or toppings to be not more than 3 pounds of moisture per 1,000 square feet per 24 hrs.

Moisture content and moisture movement, are merely snapshots in time of dynamic conditions within the concrete. Moisture vapor movement is dependent upon the relationship between temperature and humidity of the two adjacent environments. In this case, the internal environment of concrete and the external environment of the air surrounding the concrete. Any change in temperature and/or moisture content of either will result in a change in vapor pressure and the attempted movement of moisture vapor into or out of the concrete as referenced below:

It is the combination of temperature and humidity (called vapor pressure) that determines the direction of moisture movement. Moisture will move from a higher vapor pressure to a lower vapor pressure. When there is air movement over the surface of the concrete, moisture will attempt to move out of the concrete toward the area of air movement.

For these reasons, it is important to measure the temperature and relative humidity during the test period. The Moisture Vapor Test Kit values will not be useful in predicting possible problem areas unless the tests are conducted in the environment in which the structure will be used. The air temperature and humidity around the concrete during the test should be the same air temperature and humidity that will be in place during the useful life of the structure. Contact the Technical Service Department immediately if there are any questions concerning the use of the test kits or interpretation of the results.

To successfully and predictably reduce moisture vapor emission rates apply one of the following remediation systems:

- General Polymers P-105 Penetrator with General Polymers Epoxy Water Emulsion Primer/Sealer (3477);
- General Polymers P-105 Penetrator in combination with General Polymers Recover #9000 System;
- FasTop MVT; or
- AquArmor MVT.

Consultation with the Technical Service Department for specific recommendations and utilized in accordance with application instructions. For slabs with potential moisture issues, utilizing systems that are designed to accommodate moisture movement from the slab such as FasTop and AquArmor Systems may be the most cost effective alternative. Whenever, moisture issues present themselves on a project document the conditions, inform the owner representative and consult with General Polymers technical service personnel.

Consult the technical paper, "Prevention of Moisture Related Disbondment of Non-Permeable Flooring Systems", for more details and potential solutions if a problem is detected. For copies of this and other technical articles, please visit our web site at www.generalpolymers.com or contact your local sales representative.

Note: The industry standard for curing concrete is 28 days. This is usually sufficient to allow excess moisture to leave a concrete slab. To minimize moisture related disbondment, new concrete should be allowed to cure 28 days before installation of General Polymers non-permeable resinous flooring systems. If any doubts exist concerning moisture in the slab, Calcium Chloride and/or Humidity tests should be run to document the presence of moisture.

DEW POINT CALCULATION CHART (FAHRENHEIT)

% Relative Humidity	AMBIENT AIR TEMPERATURE °F										
	20	30	40	50	60	70	80	90	100	110	120
90	18	28	37	47	57	67	77	87	97	107	117
85	17	26	36	45	55	65	75	84	95	104	113
80	16	25	34	44	54	63	73	82	93	102	110
75	15	24	33	42	52	62	71	80	91	100	108
70	13	22	31	40	50	60	68	78	88	96	105
65	12	20	29	38	47	57	66	76	85	93	103
60	11	19	27	36	45	55	64	73	83	92	101
55	9	17	25	34	43	53	61	70	80	89	98
50	6	15	23	31	40	50	59	67	77	86	94
45	4	13	21	29	37	47	56	64	73	82	91
40	1	11	18	26	35	43	52	61	69	78	87
35	-2	8	16	23	31	40	48	57	65	74	83
30	-6	4	13	20	28	36	44	52	61	69	77



Cincinnati, OH
(800) 543-7694

www.generalpolymers.com
© The Sherwin-Williams Company All Rights Reserved September 2005