

SECTION 07191

CONCRETE SLAB MOISTURE & pH TESTING (For areas to receive Resilient and other flooring)

PART 1 GENERAL

1.1 RELATED DOCUMENTS:

A. Related Sections:

1. Section 01450 – Quality Control
2. Section 03300 – Cast in Place Concrete
3. Section 03301 – Concrete Testing and Inspection Services
4. Section 03710 – Concrete Floor Preparation
5. Section 07110 – Vapor Barrier
6. Section 09650 – Resilient Flooring
7. Section 09655 – Sheet Vinyl Floor Covering
8. Section 09670 – Fluid Applied Flooring
9. Section 09680 – Carpet

1.2 SUMMARY:

- A. Provide concrete slab moisture vapor emission, *in-situ* relative humidity and pH (alkalinity) testing at existing and new substrates scheduled to receive Resilient and other flooring as specified in the project documents, and as needed for a complete installation.

1.3 QUALITY ASSURANCE:

- A. Testing: The Contractor shall provide access for and cooperate with the Testing/ Inspection Agency as described in Section 01450- Quality Control. Concrete slab Moisture and pH testing shall be performed by a qualified independent testing agency with verifiable experience utilizing ASTM F 1869-10, ASTM F 2170-09, ASTM F 710-08 and ASTM E 1907-06a testing Methods and Practices Referenced herein. All test results shall be forwarded to Owner's Construction Project Manager immediately following testing.
- B. Testing shall be performed by a qualified independent testing agency.
1. Approved North American Testing Agency, such as:
Independent Floor Testing & Inspection, Inc. (IFTI)
1850 Gateway Blvd., Suite 230
Concord, CA 94520
Attn: Lee Eliseian
(800) 490-3657 ifti@floortest.com

CONCRETE SLAB MOISTURE & pH TESTING

1.4 REFERENCES

- A. ASTM E 1907-06a – Standard Guide to Methods of Evaluating Moisture Conditions of Concrete Floors to Receive Resilient Floor Coverings
- B. ASTM F 710-08 – Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
- C. ASTM F 1869-10 – Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
- D. ASTM F 2170-09 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using *in situ* Probes

1.5 SUBMITTALS

- A. The Moisture Test Report will contain the following:
 - 1. Report the Test Deployment Parameters: The start and finish date and time of testing; the start and finish ambient temperature, ambient relative humidity and dew point temperature. The minimum and maximum ambient temperature and relative humidity reached during testing.
 - 2. Report the "Factor" used to calculate the actual test area of the Calcium Chloride test site.
 - 3. Report the Concrete Slab thickness (in inches).
 - 4. Report the Demolition Parameters for MVER testing: The start and finish date and time of removing any existing non-asbestos flooring, adhesive, etc prior to MVER testing.
 - 5. Report all test results in chart form listing:
 - i. Test locations (also mark test locations on floor plan)
 - ii. Type(s) of Existing Floor Coverings
 - iii. Visual Distress Level of existing Floor Coverings
 - iv. Surface Temperature of Concrete
 - v. pH Paper/ Pencil Reading (ASTM F 710)
 - vi. Visual Appearance of Concrete
 - vii. Concrete Slab Age
 - viii. Relative Humidity in Concrete, % (ASTM F 2170):
 - 1. Depth of hole from top of Slab, in.

2. RH in concrete, %
 3. Temp. in concrete, °F
 - ix. Surface Moisture Meter Test (ASTM E 1907):
 1. Electrical Impedance Test Values or
 2. Electrical Resistance Test Values
 - x. Moisture Vapor Emission - CaC₁₂ Test (ASTM F 1869):
 1. Weight Gain in grams
 2. Exposure Time/hrs
 3. MVER Lbs/1000 Sq. Ft./24 hours
6. Specifically indicate (NOTE) any unacceptable conditions observed during testing

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.1 SURFACE PREPARATION

- A. The Moisture Vapor Emission test area shall be free of sealers, coatings, finishes, dirt, film-forming curing compounds, or other substances which may affect the rate of moisture dissipation from the concrete. Non-chemical methods for removal, such as abrasive grinding or bead-blasting, including methods described in Practice D 4259 may be used on existing slabs with deleterious residues to achieve an appropriate state for testing. For example:

Concrete slabs covered by existing floor coverings must have such coverings and all three-dimensional adhesive removed for a minimum of 24 hours prior to testing. Expose a minimum area of 20" x 20".

Concrete slabs free of substances which may affect the rate of moisture dissipation must also be prepared as noted above. Such preparation may take place immediately prior to testing.

- B. To test for pH at the surface of a concrete slab, make sure the concrete surface is adequately cleaned of adhesives, curing compounds, etc. Any remaining residue can result in understated pH readings. Also use care not to over abrade the surface of the concrete (removing the thin layer of carbonation that is typically less than 1/16") this can result in overstated pH readings.
- C. To prepare the Relative Humidity *In Situ* probe test site, you will drill holes in the concrete and then insert test hole-liners, also called sleeves, in which you will take the relative humidity readings. To drill the holes, you will need

a rotary hammer drill with a carbide-tipped drill bit. Note that the drill bit diameter should not be more than 0.04 inches, or 1 millimeter, larger than the external diameter of the hole liner. Once you have the correct size drill bit in place, establish the proper hole depth by either marking on the drill bit with duct tape or by adjusting the attached limit rod. Start the measurement from the shoulder of the drill bit, not the tip. Hole shall be drilled dry. Do not use water for cooling or lubrication; do not wet-core test hole.

- D. **Warning**—Hydraulic cement used in concrete construction may contain trace amounts of free crystalline silica. Prolonged exposure to airborne free crystalline silica may be a health hazard. Avoid actions that cause dust to become airborne. Use local or general ventilation to control exposures below applicable exposure limits.

3.2 TESTING METHODS

A. Moisture Vapor Emission Test:

1. Anhydrous calcium chloride shall be in the form of prilled beads
2. Dish shall be made of a material that does not absorb moisture. Dish shall be supplied with a tight-fitting cover. The cover shall be secured to the dish with pressure-sensitive-adhesive backed vinyl tape
3. Pressure Sensitive Label to be used to identify the container of calcium chloride and to record the date, time and container weight when the test is started and completed
4. A transparent, hole-free plastic canopy square or circular in shape about 70-100 in² (450-650 cm²) in area and depth greater than the depth of the cylindrical container of anhydrous calcium chloride, and with 0.5 in (12 mm) flanges around the perimeter of the cover
5. Strip of sealant to secure the plastic cover to the floor in an airtight fashion
6. Brightly colored warning label to be placed on the plastic cover as a protective warning while the test is being conducted
7. Gram scale capable of measuring 0.1 gram, this scale will be used to weigh the calcium chloride container at the start and end of the test
8. Thermometer to measure ambient temperature of the test site and should be capable of recording highs and lows achieved during testing period

9. Hygrometer to measure ambient relative humidity of the test site and should be capable of recording highs and lows achieved during testing period
- B. Relative Humidity *In Situ* Probe Test:
1. Humidity Probe and Digital Meter with relative humidity and temperature sensors in cylindrical probe, with external diameter less than approximately 0.75 in. (20mm), and accuracy $\pm 2\text{-}3\%$ from 0 to 100% relative humidity
 2. Hole Liners plastic or non-corroding metal tubes, inside diameter not more than 0.04 in (1mm) greater than the probe's external diameter, of sufficient length to seal the hole to the desired depth
 3. Rotary Hammerdrill, carbide drill bits, vacuum cleaner, and brush for drilling holes in concrete and removing drilled dust from the holes
- C. pH Testing:
1. Wide range pH paper, its associated pH chart, and distilled or deionized water
 2. Other pH testing methods such as pH pencils or pH meters are available and may be used to measure pH levels
- D. Electrical Impedance Test:
1. An electrical impedance meter specifically developed and calibrated for concrete moisture measurement, or
- E. Electrical Resistance Test:
1. Suitable instrument to measure the conductivity between two electrodes which are placed in contact with the concrete floor surface or placed into two pre-drilled holes one inch (25 mm) deep into the concrete floor

3.3 MEASURING MOISTURE VAPOR EMISSION RATE USING ANHYDROUS CALCIUM CHLORIDE

- A. Testing should be performed in accordance with ASTM F 1869-10 – Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride and manufacturer's instructions
- B. The number of tests required is determined by the square-footage of the project:
1. Three (3) kits are required for the first 1,000 square feet, and
 2. One (1) additional test kit for each 1,000 square feet thereafter

- C. The test site should be at the same temperature and humidity expected during normal use. If this is not possible, then the test conditions should be 75°F ± 10°F and 50% ± 10% relative humidity. Maintain these conditions 48 hours prior to and during testing
- D. Prior to test placement, the actual test area shall be clean and free of all foreign substances. All residual adhesives, curing compounds, sealers, paints, floor coverings, etc. shall be removed.
- E. Tests shall not be placed within five (5) feet of the nearest external wall
- F. Weigh test dish on site prior to start of test. Scale must report weight to 0.1 grams. Record weight and start time
- G. Expose Calcium Chloride and set dish on concrete surface
- H. Install test containment dome, (lightly press on the top of the containment dome to assure seal) and allow test to proceed for 60 – 72 hours
- I. Retrieve test dish, (lightly press on the top of the containment dome to confirm seal) carefully cutting through containment dome. Close and reseal test dish
- J. Weigh test dish on site recording weight and stop time
- K. Calculate and report results as “pounds of emission per 1,000 square feet per 24 hours”

3.4 DETERMINING RELATIVE HUMIDITY IN CONCRETE FLOOR SLABS USING *IN SITU* PROBES

- A. Testing should be performed in accordance with ASTM F 2170-09 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using *In Situ* Probes
- B. The number of tests required is determined by the square-footage of the project:
 - 1. Three (3) tests are required for the first 1,000 square feet, and
 - 2. One (1) additional test for each 1,000 square feet thereafter
- C. The test site should be at the same temperature and humidity expected during normal use. If this is not possible, then the test conditions should be 75°F ± 10°F and 50% ± 10% relative humidity. Maintain these conditions 48 hours prior to and during testing

- D. Determine the thickness of the concrete slab, typically from construction documents
- E. Utilizing a rotary hammerdrill with a carbide-tipped drill bit to drill holes to required depth (for slabs on-grade, depth equal to 40% of the concrete thickness*. *i.e.* 2.0" deep for a 5" thick slab, or 1.6" deep for a 4" thick slab).
- F. Remove dust from the hole using a vacuum cleaner.
- G. Insert hole liner to bottom of hole. Place rubber stopper into upper end of liner and seal around liner to concrete at concrete surface with gasketed cover
- H. Allow 72 hours to achieve moisture equilibrium within the hole before making relative humidity measurements
- I. Remove the sleeve plug and place probe into the sleeve assuring that it reaches the bottom of the test hole
- J. Allow ample time for the probe to sit in the test sleeve to achieve moisture equilibrium before taking relative humidity readings
- K. Record the relative humidity and temperature. Also record the location of the hole within the structure and depth of the probe tip below the concrete surface
- L. Use the relative humidity probe to measure the ambient air temperature and relative humidity above the slab in the vicinity of the test location
- M. Remove the hole liner and fill the hole with a cementitious patching compound
- N. Report any observations that might affect the interpretation of individual measurements such as standing water on the slab, wet coring operations, weather, or ventilating system operations

3.5 Determining pH Levels

- A. Testing should be performed in accordance with ASTM F 710-08 – Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
- B. Conduct at same time as vapor emission and relative humidity testing:
 - 1. Place several drops of water onto the concrete surface to form a puddle approximately 1" in diameter
 - 2. Allow the water to set for 60 +/- 5 seconds
 - 3. Dip the pH paper into the water and remove immediately, compare color to chart provided by paper supplier to determine pH reading

4. Record and report results
 5. pH Pencil and pH Meters – Follow instrument manufacturer’s instructions
- 3.6 Determining Electrical Impedance Levels
- A. Follow instrument manufacturer’s instructions, or
- 3.5 Determining Electrical Resistance Levels
- A. Follow instrument manufacturer’s instructions

END OF SECTION