### APPENDIX

Appendix A				
Moisture Testing Procedures for				
Concrete Slabs	Page AA			
Moisture Testing for Wood	Page AB			
Crawl Space Moisture Barrier Diagram	Page AC			
Moisture by Area - United States	Page AD			
Moisture by Area - Canada	Page AE			
Subfloor Grade Levels	Page AF			
Appendix B				
Guide to Hardwood Flooring Grades	Page BA			
Appendix C				
Fastener Schedule	Page CA			
Appendix D				
Applicator Recommendations	Page DA			
Finish Chart	Page DB			
Abrasive Guide	Page DC			
Intercoat Abrasion	Page DD			
Appendix E				
Jobsite Checklist	Page EA			
Tools Checklist	Page EB			

### **APPENDIX AA**

### MOISTURE TESTING PROCEDURES FOR CONCRETE SLABS

Before moisture testing begins, the concrete slab must be a MINIMUM of 30 days old. Testing of slabs less than 30 days old can produce inaccurate, unreliable results. PH testing should be done on all slabs regardless of age.

Testing with Moisture Meter

NOTE: If the moisture meter used does not give a quantified number for moisture in the concrete slab, but indicates the presence of moisture, then the Calcium Chloride test needs to be run.

Test with an accepted moisture meter at each outside wall and 1-5 times in center area depending on size of room - residential.

Test with an accepted moisture meter at each outside wall and every 6' (1800mm) in center area - commercial

#### Testing Methods without Moisture Meter

Polyfilm:

One test per 200 s/f (minimum 2 tests per jobsite)

Completely tape down 2' X 2' (600mm X 600mm) polyfilm squares and leave them for 48 hours. Check for condensation under the plastic. Condensation indicates slab has moisture. Noticeable color changes indicates moisture.

Phenolphthalein

One test per 200 s/f (minimum 2 tests per jobsite)

Chip small section of concrete off floor and apply 3% Phenolphthalein in alcohol solution (available at most druggists) in the area. Red color indicates moisture. ALWAYS chip concrete as this protects against the possibility that a concrete sealer was applied.

<u>IMPORTANT</u>: Keep Phenolphthalein out of direct sunlight. Average shelf life of Phenolphthalein is six (6) months.

NOTE: IF ANY OF THESE TESTS INDICATE MOISTURE IS PRESENT IN THE SLAB, THE CALCIUM CHLORIDE TEST SHOULD BE RUN.

#### CALCIUM CHLORIDE TEST \*

One test per 1,000 s/f for 24 hours.

Instructions per Test Kit:

The surface where the test patch is to be placed must be brushed clean to remove any waxes, surface sealers, dust, dirt, oils or other surface contaminant's. At the time the test is conducted, the temperature of the floor and the surround-ing area should be at least 65 degrees Fahrenheit.

Leaving no gaps, apply the sealant tape completely around the perimeter of the plastic cover.

Remove the lid from the plastic dish containing the calcium chloride and, being careful not to spill any of the calcium chloride, place the dish on the floor (remember to save the tape to reseal the lid to the cylindrical dish after the test is concluded).

Immediately place the plastic cover over the calcium chloride dish and press the cover firmly to the floor making certain that the sealant gives an airtight seal around the plastic cover.

Leave the test undisturbed for the time prescribed in the test kit instructions. Note the date and exact time the test was started on the dish label.

At the end of the prescribed time, remove the cover and reseal the lid to the dish again being sure that none of the calcium chloride is spilled. Note the date and exact time the test was concluded on the label.

The test is then sent to a laboratory and documentation will be returned, (See manufacturers instructions on Calcium Chloride kits). Or you can purchase a scale and do the measurements in house.

#### <u>RESULTS</u> <u>INDICATES</u>

0-3 lbs dry\* over 3 lbs moisture barrier required over 7 lbs too wet

\*Calcium Chloride kits are generally available through your distributor or call NWFA at 800-422-4556 U.S. or 800-848-8824 Canada for the source nearest you.

ALWAYS FOLLOW MANUFACTURERS INSTRUCTIONS FOR ACCEPTABLE MOISTURE BARRIERS.

A MOISTURE BARRIER IS ALWAYS RECOMMENDED OVER CONCRETE WHEN INSTALLING SOLID WOOD FLOORING.

#### Acceptable Moisture Barriers

- Low end PVC vinyl applied over the slab following manufacturers recommended procedures.
- Polyfilm, 6 mil polyethylene film if glued, 8 mil polyethylene if loose lay, applied in accordance with manufacturers accepted recommendations.
- Double felt, two layers of 15# asphalt saturated felt paper that meets ASTM Standard D4869 with first layer adhered to the slab in a "skim" coat of appropriate adhesive, and second layer adhered to the first layer with appropriate adhesive.
- Epoxy sealer.
- Adhesive system recommended by the manufacturer.

NOTE: Test for curing sealers on concrete. If present, sand with (20 grit) #3 1/2 paper.

WHETHER YOU FIND THERE IS MOISTURE PRESENT OR NOT, AND ESPECIALLY ON COMMER-CIAL JOBS, IT IS SUGGESTED THAT YOU DO AN ALKALINITY TEST ON THE CONCRETE SLAB.

A PH range of 5-9 is satisfactory. A reading above 9 requires corrective measures.

#### TESTING FOR PH

There are several testing methods, but the most practical is with ph test papers.

Sweep the test area clean and apply a few drops of distilled water to the surface. Slightly scrape the wet area with a screwdriver or similar tool to break up any matrix that might have formed on the surface. Once the wet area is scraped, a strip of ph paper can be placed directly into the test area. Within five minutes, it will have turned to a color that can be compared to the color chart on the side of the box containing the ph test papers.

Orange ranges indicate neutral.

Light greens indicate acceptable but reaching borderline.

Dark green, blue or purple are danger signs.

#### Appendix AA, Moisture Testing Procedure for Concrete Slab

In the danger range the slab can be neutralized by washing the floor with a recommended acid solution.

**NOTE:** Check with Portland Cement Association for appropriate solution.

In less than severe situations, a slab can be neutralized with a 30 percent solution of vinegar and water. The washing and rinsing process are the same.

The slab should be checked again with a ph paper for the correct range and moisture content.

### **APPENDIX AB**

#### MOISTURE TESTING FOR WOOD

The determination of moisture content is an essential part of quality control within the flooring installation process. Flooring installers must know the dryness of not only the wood flooring but also its subfloor. Hand-held electrical tools, called moisture meters, should be part of the toolbox of every flooring contractor, for measuring moisture in sub-floors and floors.

Moisture meters have many purposes. They can determine if floorboards are dry enough for an installation to proceed. They can check subfloors and concrete for high moisture levels; they can decide when a second coat of finish can be applied; they can assess water damage.

There are two main types of meters - probe and pinless.

The probe type, measures electrical resistance across opposed sets of pins, which are pushed into the wood. The probe must be inserted parallel with the grain, along the face of the board at least 2" from the ends.

One advantage of probe type meters is that those with insulated pins can measure moisture content at varying depths - you can tell whether the moisture content near the bottom of a board is higher than near the top, for example.

The pinless, dielectric types are quite different.

Signal penetration for pinless meters is up to 1 inch for both hardwood and softwood. The meter can be moved across the surface to identify pockets of moisture in a wood block or plank. It is relatively unaffected by temperature. Rough surfaces have very little effect on the reading. Measurements can also be taken through coating; varnish or paint without damage to the surface.

It is important that the meter you choose offers the following:

- \*A wide moisture content range from at least 6 percent to 30 percent. (The accuracy of readings outside of these limits is generally considered questionable.)
- \*A clear analog or digital dial.
- \*The necessary adjustment tables for various species.

#### Appendix AB, Moisture Testing for Wood

Wood subfloors are actually easy to check for moisture content. Just test for moisture at several locations in the room and average the results. In most regions, a "dry" subfloor that is ready to work on has a moisture content of 12 percent or less. If excessively high readings are obtained, installation should not proceed until the origin of the moisture is identified and moisture problems are remedied. During the winter, an overly moist subfloor can be dried out by running the heat for a few weeks. Air conditioning during the summer will do the same thing.

Before flooring can be installed, the moisture content of the subfloor should be within 4 percentage points of the flooring that will be laid on it.

If the moisture content between the flooring and subflooring varies more than 4 percentage points, then the flooring should not be installed.

Equilibrium Moisture Content

The moisture content of wood below the fiber saturation point is a function of both relative humidity and temperature in the surrounding air. When wood is neither gaining nor losing moisture, an equilibrium moisture content (EMC) has been reached.

Wood technologists have graphs that precisely tie EMC and relative humidity together, but as a rule of thumb at 70% Fahrenheit, a relative humidity of 25 percent gives an EMC of 5 percent, and a relative humidity of 75 percent gives an EMC of 14 percent. (See Section V, Appendix AB-3)

A 50 percent varience in relative humidity produces an EMC change of 10 percent. How that affects wood flooring depends on which species is being used. However, let's say the width variation is just !/16 inch for a 2 !/4 inch board. That's a full inch over 16 boards in a floor. Over the width of a 10-foot wide floor, that amounts to more than three inches of total expansion or contraction.

Protective coatings cannot prevent wood from gaining or losing moisture; they merely slow the process.

#### WOOD FLOORING HAS A COMFORT LEVEL, TOO

Wood flooring will perform best when the fluctuation in the environment is controlled to stay with-in a relative humidity range of 20 percent (ie 20-40 percent) and a temperature range of 20 degrees Fahrenheit. Fortunately, that's about the same comfort range most humans enjoy. The chart below indicates the moisture content wood will likely have at any given combination of temperature and humidity. Note that equilibrium moisture contents in the temperature/humidity range (shaded area) coincide with the 6-9 percent range within which most hardwood flooring is manufactured. Although some movement can be expected even between 6 and 9 percent, wood can expand and shrink dramatically when the relative humidity changes are greater than 20 percent. (See Section V, Appendix AB-3)

MOISTURE CONTENT OF WOOD AT VARIOUS TEMPERATURES AND RELATIVE HUMIDITY READINGS																				
Temperature (°Fahrenheit)																				
30	1.4	2.6	3.7	4.6	5.5	6.3	7.1	7.9	8.7	9.5	10.4	11.3	12.4	13.5	14.9	16.5	18.5	21.0	24.3	26.9
40	1.4	2.6	3.7	4.6	5.5	6.3	7.1	7.9	8.7	9.5	10.4	11.3	12.4	13.5	14.9	16.5	18.5	21.0	24.3	26.9
50	1.4	2.6	3.7	4.6	5.5	6.3	7.1	7.9	8.7	9.5	10.4	11.3	12.4	13.5	14.9	16.5	18.5	21.0	24.3	26.9
60	1.3	2.5	3.6	4.6	5.4	6.2	7.0	7.8	8.6	9.4	10.2	11.1	12.1	13.3	14.6	16.2	18.2	20.7	24.1	26.8
70	1.3	2.5	3.5	4.5	5.4	6.2	6.9	7.7	8.5	9.2	10.1	11.0	12.0	13.1	14.4	16.0	17.9	20.5	23.9	26.6
80	1.3	2.4	3.5	4.4	5.3	6.1	6.8	7.6	8.3	9.1	9.9	10.8	11.7	12.9	14.2	15.7	17.7	20.2	23.6	26.3
90	1.2	2.3	3.4	4.3	5.1	5.9	6.7	7.4	8.1	8.9	9.7	10.5	11.5	12.6	13.9	15.4	17.3	19.8	23.3	26.0
100	<b>)</b> 1.2	2.3	3.3	4.2	5.0	5.8	6.5	7.2	7.9	8.7	9.5	10.3	11.2	12.3	13.6	15.1	17.0	19.5	22.9	25.6
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	98
Relative Humidity (percent)																				

Chart taken from Wood Handbook; Wood as an Engineering Material,(Agriculture Handbook 72), Forest Products Laboratory, U.S. Department of Agriculture.

### **APPENDIX AC**

### **CRAWL SPACE MOISTURE BARRIER DIAGRAM**



In crawl space construction,6- or 8-mil plastic,(preferably black) should cover the entire ground area.

Crawl space should have 1.5% of open venting per 1,000 s/f (92.90 sq. meters) of floor area properly located to foster cross ventilation.





NOTE: Relative humidity in the building should be maintained between 30-50% year round. The key to wood floor performance is consistent environment.

Revised June 2002

### **APPENDIX AE**

**MOISTURE BY AREA - CANADA** 



NOTE: Relative humidity in the building should be maintained between 30-50% year round. The key to wood floor performance is consistent environment.





If any part of the soil surrounding a structure is above the floor of any level, consider that level belowgrade. This includes walk-out basements. In addition, the surrounding soil should be sloped away from the structure with at least 6 inches of fall over the first 10 feet.