



# Hallmark Healthy Home Indoor Climate Control

CARB II Formaldehyde Compliance

HVAC & Supporting Systems

Radiant Heat

Humidification

Air Exchange

Pre-Finished Engineered Hardwood

Solid Hardwood Flooring

Luxury Vinyl Plank & Tile



# Foreword

This guide is intended to educate and inform. A great deal of this information is very difficult to find. We decided to produce this publication as a helpful tool to those who wish to know more about indoor environment and its control. A special thanks to the National Wood Flooring Association and to April Air for the information they provide to our industry. All the facts mentioned in this book are validated by multiple sources.

Thank you,

Ron Oliver

*Vice President*

*Hallmark Floors*

Hallmark Healthy Homes  
CARB II Formaldehyde Compliance



# Formaldehyde: Fiction, Fear & Facts

Recently, the CBS 60 Minutes show did an investigative piece on a major U.S. floor covering retailer. The subject of the report was formaldehyde emission levels in both laminate flooring and engineered hardwood flooring. The controversy revolves around materials being labeled as compliant with CARB II (California Air Resources Board Phase 2 standards for formaldehyde emissions). 60 minutes sent investigators to factories in China where plant managers were asked if the product they were producing for this retail group were CARB II compliant. The managers answered that they were not, and when boxes from this retailer were filmed in the factory, these same materials were labeled as being CARB II compliant. The products purchased by investigators at the national retailer's stores were submitted for testing at independent, third party labs. These labs tested the materials purchased, adhering to ASTM (American Standard Testing Method), using test criteria recognized by the state of California, as the method for verification of compliance. The materials in question failed to meet CARB II standards, in many cases by having a significantly higher level than allowed by the state of California.

It is important to note that federal standards allow for formaldehyde emission higher than those of CARB II. However, the CARB II standard mimics the much more stringent indoor air quality standards found in Europe and Japan. Since California is such a large part of the U.S. market, reputable manufacturers simply adhered to the more stringent standards by using super low emitting adhesives to construct both fiber board and veneer core plywood/hardwood. CARB II became the gold standard and consumers wanted these products whether they lived in California or not. This issue is now being pressed against the retailer in question. Numerous class action lawsuits have been launched against the subject of the report and contend that the use of CARB II on boxes containing non-compliant product constitutes deceptive and misleading business practices.

In recent year's excessive exposure to formaldehyde has been discovered to be a human health hazard and potential cancer causing agent. These facts facilitated the need for more stringent standards such as CARB II. In fact, the federal government will make CARB II standards the basis of law for the entire United States in 2015.

What exactly is CARB II and what does it mean? The testing methods are designed to see how much formaldehyde is being released into the air and is measured by finding how many parts per million exist in a cubic meter (35.3146667 cubic feet) of air. The standard of measure is metric as the standards are international and make the playing field level and transparent. The CARB II maximum rate of emission of formaldehyde for engineered plywood/flooring is 0.05ppm (parts per million) and applies to the engineered wood flooring products that Hallmark manufactures. The CARB II standard for medium density fiber board / laminate flooring is 0.11ppm (a higher allowance due to the greater amount of glue required to manufacture that type of material). Hallmark Floors does not manufacture any laminate flooring.

Are Hallmark Floors engineered wood floors CARB II complaint? Third party testing has established CARB II compliance. In fact Hallmark has always used low emitting glues and by as early as the beginning of 2008 was producing products that met this standard. Four years before CARB II became law in 2012! Independent third party testing established the following:

- Silverado & Chaparral Collections / ppm rating 0.012 – Emissions well below CARB II standards.
- Heirloom, Hacienda, Ventura, Monterey & Moderno Collections / ppm rating 0.028 – Emissions well below CARB II.
- Alta Vista, Organic Engineered / ppm 0.042 – Emissions well below CARB II.

## FACT:

- Normal outdoor air ratings for formaldehyde are 0.03 to 0.06ppm.
- The majority of manufacturers, care for their customers and produce compliant product
- The use of non-compliant glues is a monetary issue. Large cost savings in the glue. Non complaint glues dry much faster thus increasing manufacturing efficiency (saving large amounts of money), and give those who sell them a cost advantage over reputable manufacturers who play by the rules.
- Formaldehyde is a naturally occurring substance in many plant fibers including many natural and healthy foods that we eat.
- The excessive concentration and molecular manipulation of this substance is what gets us in trouble.

## FEAR:

- Lack of a full understanding of the facts.
- Are my hardwood floors harming me?

KEEP CALM and BREATHE EASY --- Hallmark Floors, Simply Better

## FAQ About Hallmark Floors And CARB II

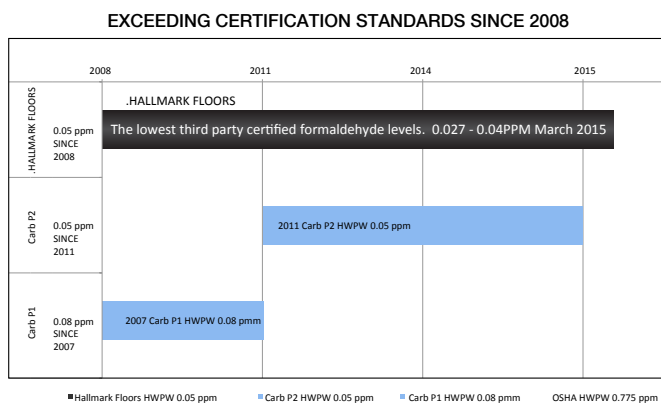
**Q.** Is Hallmark CARB II compliant for formaldehyde emissions?

**A.** Hallmark Floors takes pride in the fact that from our inception, indoor air quality has been a very high priority. Our manufacturing process is closely monitored and third party certified. We pride ourselves as being a cutting edge company when it comes to having obtained world class, low-formaldehyde emissions. In fact, Hallmark has been producing product that met the CARB II standards in 2008, a year prior to the CARB I standard and three years prior to the CARB II standards being developed and implemented.

OSHA – the US Occupational Safety and Health Administration guidelines allowed for more emissions than were permitted in Europe and Japan. Hallmark felt the most responsible thing to do for our customers was to emulate the more stringent international standards, E-0.

On January 1, 2009 the State of California (California Air Resource Board) implemented the CARB I standard of 0.08ppm (parts per million emission) for engineered hardwood flooring and hardwood plywood.

On January 1, 2011 CARB II was fully implemented at a maximum emission rate of 0.05ppm, which is lower than the International Standard E-0. CARB II is 15.5 times lower than the federal guidelines as determined by OSHA (0.775). CARB II is much closer to the rate of normal air quality ranging from 0.03ppm to 0.08ppm. Formaldehyde at these levels is naturally occurring, with higher levels typically in urban areas. To be completely Formaldehyde free is impossible given that plant matter naturally contains these trace amounts. The real point of CARB II is to ensure that engineered wood products are not pushing levels past the acceptable standards of nature.



**Q.** Specifically what is CARB II?

**A.** Carb II is the California Air Resource Board's newest emission standard for formaldehyde exposure in composite wood products. The first phase (CARB I) took effect on January 1, 2009. Shortly after the induction of CARB I, the California Air Resource Board decided to make emission standards more strict in the state. Beginning January 1, 2011, CARB II took effect. Hardwood plywood (HWPW) now has a 0.05-ppm maximum, particleboard (PB) has a 0.09-ppm maximum, and medium density fiberboard (MDF) now has a 0.11-ppm maximum.

As of today, only Japan, Europe, and California have their own emission laws, but the rest of the United States is expected to adopt the CARB II standards sometime in 2015.

**Q.** What is formaldehyde?

**A.** Formaldehyde is a colorless strong smelling gas. Formaldehyde occurs naturally in the environment and is emitted by processes such as combustion, decay and is emitted naturally by all timber species.

Formaldehyde is present in exhaust fumes, wood smoke, tobacco smoke and is produced by domestic appliances such as combustion heaters.

Formaldehyde is present in the air that we breathe at natural background levels of about 0.03 parts per million (ppm) with recent studies showing formaldehyde concentrations often up to 0.08ppm in outdoor urban air.

Formaldehyde is industrially significant with the downstream use of formaldehyde-based inputs contributing approximately 8% to US gross domestic product.

Formaldehyde is used as an ingredient in synthetic resins, industrial chemicals, preservatives, and in the production of paper, textiles, cosmetics, disinfectants, medicines, paints, varnishes and lubricants.

**Q.** How do I know my floor is safe?

**A.** You can check with your local supplier and find out what a companies policy is as to their compliance with the CARB II standards. All flooring sold in California is legally obligated to follow such standards. Though it is expected to become a nationwide standard in 2015, no other state in the United States is legally obligated to follow the CARB II standards.

There is also formaldehyde-testing kits that are available for purchase online through Amazon.com.

**Q.** Is there a national law in place to guard against using harmful chemicals?

**A.** As of today, there is no national law in place against these chemical emissions. In the United States, only California has the law of CARB II emission control laws. If someone bought flooring today from any other state, a company could sell that person a product with as much formaldehyde as they wanted. However, the United States is expected to adopt the laws made by California to make the rest of the nation CARB II compliant. This law is expected to become nationally recognized by 2015.

**Q.** What has the flooring industry done to reduce formaldehyde in plywood products?

**A.** Fortunately, acceptable formaldehyde emission levels from wood panel products are continuously dropping. Some reasons for these levels to be lowered are public awareness, which creates a greater demand for non-hazardous products, as well as things such as government regulations.

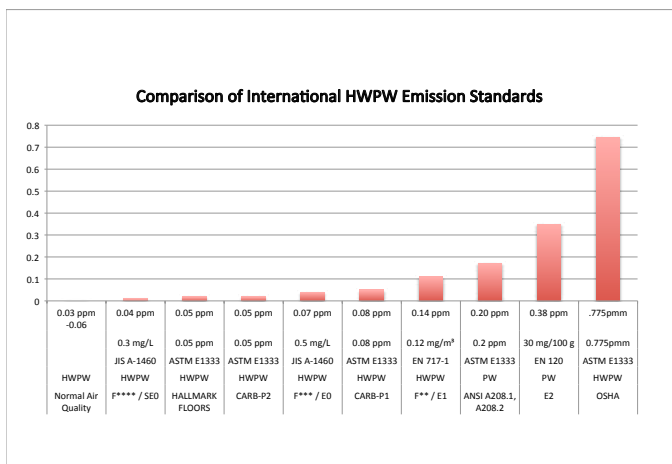
The International Agency for Research on Cancer, and the National Toxicology Program now recognize formaldehyde as a carcinogen. This has made the public more concerned on the topic, and has also gotten reactions by worker and consumer associations, environmental organizations, authorities, and the industry itself.

Generally, all flooring manufactured in North America abides by the American National Standard for Particleboard (ANSI A208.1). This is the voluntary standard. In North America, the allowed formaldehyde emission levels are 0.20 ppm for particleboard. Flooring that is manufactured in Europe abides by the European E1 standard, which is 0.14 ppm. Flooring that is manufactured in Asia and imported to North America abide by the European E2 standard, which is 0.32 ppm. z across the rest of the United States. The rest of the country is expected to abide by the CARB II standards in 2015.

On April 26, 2007, the California Air Resources Board (CARB) approved an airborne toxic control measure. This control measure reduced acceptable formaldehyde emissions from hardwood plywood (HWPW), particleboard (PB), and medium density fiberboard (MDF). The CARB standard is for indoor products in the state of California, but will be the standard for the rest of North America, and is recognized around the world.

The CARB rule was put into place in two phases. CARB I was implemented January 1, 2009. These standards for the allowed formaldehyde emissions were 0.08 ppm for HWPW, 0.18 ppm for PB, and 0.21 ppm for MDF.

Two years after CARB I was introduced, CARB II was set and allowed emission levels were lowered. The new standards were set at 0.05 ppm for HWPW, 0.09 ppm for PB, and 0.11 ppm for MDF. CARB II is the law for formaldehyde emissions in California, but has yet to be implemented across the rest of the United States. The rest of the country is expected to abide by the CARB II standards in 2015.



**Q.** Is my Hallmark floor safe?

**A.** Yes! Hallmark has been CARB II compliant years before the CARB II standard was put into place in 2011. Hallmark Floors has been proactive in making a great product safe for its users.

**Q.** Why do companies use formaldehyde at all if it is a human carcinogen?

**A.** The properties in formaldehyde are exceptional and are not easily replaceable. Replacing formaldehyde also makes a product more expensive to produce, which will drive up costs not only for production, but also for a potential end user.

**Q.** Does my Hallmark floor have formaldehyde in it?

**A.** We are Carb II compliant. Formaldehyde exists naturally in many plant fibers. Formaldehyde has been found to be an excellent binding agent in the glues that hold the different layers of plywood, fiber type panels, strand board and engineered hardwood floors together. Low-emitting glue systems are formulated to encapsulate the formaldehyde to reduce the emissions they may give off. CARB II requires that formaldehyde emissions are reduced to a level more compatible with what would be found in natural outdoor air.

**Q.** Would Hallmark Floors affect my allergies?

**A.** When using Hallmark Floors, a person is no more susceptible to allergic reactions than any other floor. The levels of formaldehyde in Hallmark's products are so low that it is not possible to get a reaction from the formaldehyde content itself. It is easier to argue that someone's allergic responses would be lower if they had Hallmark Floors installed in their home. A hard surface is always better for someone's allergies than other floors such as carpet. Carpet soaks in dust particles, pollen, and other allergens that can become stuck into the fibers, while a hardwood or luxury vinyl keep these allergens on top of the floor, which are easily cleaned from the surface.

**Q.** How else does Hallmark Floors protect its customers?

**A.** Hallmark Floors has four collections of luxury vinyl that use Nano control technology in their finish. The anti-microbial characteristics of this finish make the finish kill viruses and bacteria as they come in contact with the floor's surface. The titanium dioxide additive in the finish reacts to light, which makes this possible without the use of harsh chemicals.

# Definitions:

## *Standards*

CARB-P1: California Air Resources Board Phase 1 emission standard (Allow sell-through date for PB & MDF is until Dec 31, 2011)

CARB-P2: California Air Resources Board Phase 2 emission standard (Enforcement date for PB & MDF is Jan 01, 2012)

ANSI A208.1 & 2: North America voluntary standards ANSI A208.1-2009 Particleboard & ANSI A208.2-2009 MDF (include most of industrial particle boards and MDF)

E2: European E2 emission standard (Most import products from Asia are E2 or worse)

E1: European E1 emission standard

E0: European E0 emission standard

SE0: European Super E0 emission standard

F\*\* : Japanese F-Star2 emission standard

F\*\*\* : Japanese F-Star3 emission standard

F\*\*\*\* : Japanese F-Star4 emission standard

JIS: Japanese Industrial Standard

## *Products*

HWPW: – Hardwood / Plywood

PW: – Industrial plywood

PB: – Particleboard

MDF: – Medium density fiberboard

ppm: – Parts per million





# Hallmark Healthy Homes Hardwood Flooring



# Hallmark Healthy Home & Wood

Home is where the heart is. Interior design should be fashionable, functional, practical, and provide a healthy environment for all.

These things are important to Hallmark Floors. In this publication we will talk about indoor environmental controls, that not only promote human health, but also protect our homes and their contents. We will discuss the nature of wood and how it will react to its environment positively, or negatively.

At Hallmark we believe there is very little information available in the marketplace regarding these issues. This publication will explain why indoor climate and humidity control is so important for human health. Also we will take a look at environmentally responsible manufacturing in relation to indoor air quality



## Environmental Responsibility

Hallmark Floors, uses FSC Certified materials for the construction of our TrueCore center ply.

Hallmark Floors procures its European Oak for face/wear layers and Organic Solid from sustainable forests under the guidelines of the PEFC (Pan European Forestry Council). In addition North American species (Maple, Walnut, and Hickory) are sourced from the Appalachian hardwood forest, which is deemed to be sustainable by the U.S. Department of Agriculture/Forestry.

The veneers in the plywood core are held together by state of the art glue from Japan. The panels are then placed in a hot press and heat cures the glue. The pressure compresses the veneer's making the resulting wood plank denser and harder than it was before processing.

The result of this process produces a product that is eight times more dimensionally stable than solid. In addition, Hallmark Floors' hardwood floors meet the stringent CARB II indoor air quality standards for Formaldehyde emissions as set by the State of California (the most stringent in the U.S.).

As well as an international ranking of E-0. Hallmark Floors' finishes are industry leaders in durability and emit no harmful emissions into the indoor environment.

From NuOil the revolutionary hybrid, two-stage oil system that is easy to maintain. To TrueMark GlazeTek, Poly System with hand rubbed furniture looks and three times the wear ratings of other industry finishes.

Hallmark Floors Simply Better – Discover Why  
[www.hallmarkfloors.com](http://www.hallmarkfloors.com)

## The History & Science Of Wood

Throughout history wood has played a vital role to humankind's comfort and very survival.

Since the earliest history of humans, wood has been vital as a fuel source for warmth and cooking of food. As well as for tools and weapons, for hunting and self protection.

As civilization continued to progress, wood was used to make wheels, barrels to store foodstuffs and liquids. Shelter in the form of dwellings and the advent of wood flooring.

With the rise of sea power nations who possessed significant forests of white oak and pine were able to build naval vessels to project power and build empires.

Today we are reconnecting with our history by looking for simpler more natural materials to enhance our day to day lives. Wood flooring has enjoyed a renaissance over the last 30 years as a result.

In the following discussion we will address the effects of indoor climate on the structure, its furnishings, cabinetry, wooden musical instruments and wood floors. We will answer some frequently asked or misunderstood issues regarding wood.

# Frequently Asked Questions

Q. What is the nature of wood why does it do what it does?

A. Wood is HYGROSCOPIC.

Wood can absorb and release water. Properties change depending on moisture content As we continue to explore this amazing substance called wood, many will learn things they never realized before. Once understood wood is no longer a mystery, and its physical behaviors become predictable.



Q. What does Hygroscopic mean?

A. Hygroscopic / Hygroscopy

Hygroscopy is the ability of a substance to attract and hold water molecules from the surrounding environment. This is achieved through by absorption or desorption with physical change being the result. This is due to an increase or decrease in volume of moisture in the wood cells.

All wood is a cellulose based and the cell walls expand to take in more moisture and shrink with the loss of moisture. Causing the wood to shrink or expand across the grain.

Q. What does Green or Wet Wood Mean?

A. Wood Processing: When hardwood trees are harvested They are considered to be green/wet or at or near their total capacity for holding moisture.

Moisture in the wood of a live tree can be 30% to 200% the weight of the wood substance itself! Wood must be dried to a stable moisture content and retain that moisture content in a controlled environment in order to retain consistent physical properties.

By carefully drying the wood the wood begins to shrink with moisture content loss. This process is very closely controlled to prevent splitting in the drying process. This process takes a great deal of time and patience.

Even "dry" wood contains some moisture.

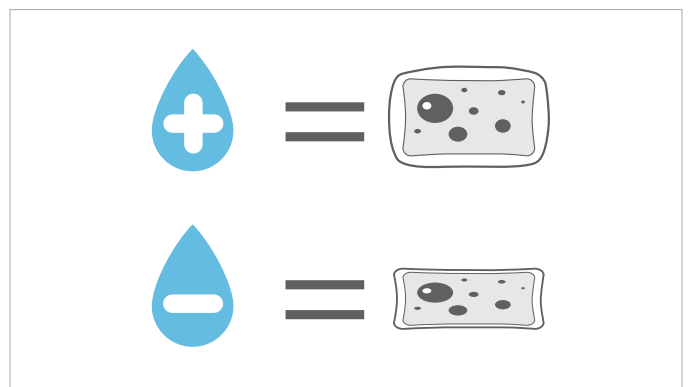


Q. What is expansion and contraction & how does it work?

A. Wood becomes wider or narrower. In a dwelling expansion / swelling, occurs with a rise in humidity and contraction / shrinking occurs with a drop in humidity.

Wood was once a living thing. At the microscopic level the cell linings are like the sponge described above, expanding and contracting with changes in moisture content.

Once dry, wood will still expand and contract, in reaction to the humidity levels found in the room or to the introduction of moisture from other sources, such as structural leaks.



Q. Due to woods properties is it a good choice for flooring in my home?

A. Absolutely. Wood can function well within the climate most comfortable and beneficial to humans (we have the same comfort level). Consider that most dwellings are made from wood, furnished with wood cabinets and furniture. Knowledge of wood can help preserve all the wood in a structure.

Q. Is wood that complicated?

A. No. It is relatively simple once you understand woods properties.

Q. What is necessary to maintain a relative humidity range of 30 to 55%?

A. This varies based on the outdoor climate area of the structure. In large areas of the southeast it is controlling high humidity in the summer. In large parts of the mid-west it is keeping humidity levels up during the winter. This is true of the mountain states as well. The south west's deserts are subject to low humidity in the summer. A great deal of information regarding humidity conditions and their seasonal swings can be provided by a qualified HVAC (heating, ventilation, air conditioning) contractor. Some geographic areas require little control others, require more.

Q. Can all of this be avoided by not installing hardwood flooring?

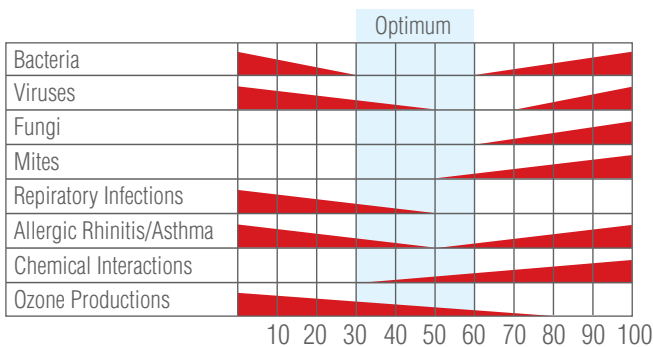
A. On the surface of things that might seem the way to deal with the issue. However, there remains the question of the wood in the structure of the home, furniture, cabinets, and any musical instruments in the dwelling. Human health issues remain regardless of the decision regarding type of floor covering.

Q. What are the human health issues relating to low or high humidity?

A. The healthiest environment for humans and their pets is the 30 – 55% relative humidity range. Viruses, fungus, dust mites, and multiple forms of dry or damp health issues are more common outside of this range.

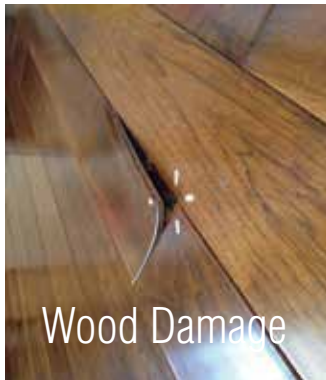
*Climate Control & You:* Indoor climate and humidity control are the key to proper wood performance, personal comfort and human health. Control of humidity levels in the atmosphere is vital to optimum health. If humidity levels are not maintained within the 30 to 55% humidity range, it can have adverse effects on human health. The Center for Disease Control and Prevention recommends humidity be set between 35%-50%. An ARIC report notes that areas with a relative humidity of lower than 50% had fewer rates of asthma.

Low humidity can lead to discomfort such as dry, itchy skin or throat irritation. Low atmospheric humidity pulls moisture out of humans and their pets. Lower moisture in the respiratory system can lead to upper respiratory distress. Low humidity and high humidity environments present multiple health challenges.



ASHRAE – American Society of Heating Refrigeration and Air Conditioning

# Dry Air Contitions The Effects Are Numerous



Later in this publication the different types of humidity control systems will be covered. Humidifiers should be used for dry conditions, to maintain humidity levels above 30%. Dehumidifiers should be used at the other end of the spectrum to keep indoor humidity levels below 55%. Again the optimum environmental conditions are between 30 and 55%.

## Humidity and Temperature Control

Room temperature of 60-80°F and a humidity range of 30% - 55% should be maintained a minimum of three days prior to installation, during installation, and at all times afterward to maintain normal environmental conditions.

## Normal Environmental Conditions

Ensure optimal performance, when heating and ventilating systems are designed and working to maintain an interior relative humidity level between 30% and 55%, and a temperature between 60 and 80° Fahrenheit year round.

## Outdoor Humidity

The amount of moisture in the air varies by season and geography.

*Information drawn from various health studies and industry information.*

## Structural Issues With Extreme Low Humidity

These photo shows the effects of extreme low humidity on structural wood and the resulting splits and cracking.



## Effect Of Extreme Low Humidity On Furniture And Cabinets

The following photos are of cabinet doors, a table top, and two guitars that have been exposed to extreme low humidity.



## Musical Instruments

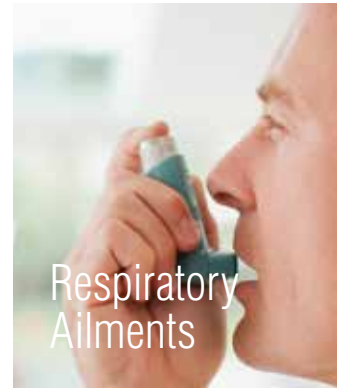


# Damp Air Contitions

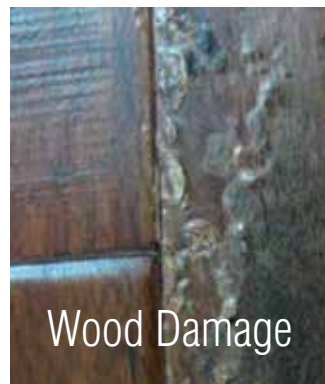
## The Effects Are Numerous



Mold



Respiratory Ailments



Wood Damage



Discomfort

## Structural Issues

### With Extreme High Humidity

These illustrations and photos shows the adverse effects of extreme high humidity. Mold Growth in HVAC system spreads and aerosolizes the mold spores. Dampness can cause these issues with fabrics and wood components of the home. Structural, furnishings & cabinets and wood floors.



# Effects Of Extreme High Humidity

Damage to structural wood, furniture, cabinets, such as warping, splitting, crowning, etc.

- Damage to structural wood, furniture, and cabinets such as warping, splitting, crowning, etc.
- Damage to HVAC system, drywall, and fabrics
- Can result in severe respiratory infection or pneumonia
- Asthma in Children
- Severe skin rash

Bear in mind we have been talking about extremes in indoor climate conditions. There is no cause for undue alarm. Knowledge regarding these issues empowers people to make informed decisions. As we continue, we will talk about how we control all of these issues.

## Stable Wood Equilibrium - EMC

Q. What is EMC?

A. EMC stands for equalized moisture content in the wood.

Q. Equalized to what?

A. As discussed earlier, the environmental conditions found in the structure into which it is placed.

Q. How does that work?

A. When Hallmark dries the material at time of manufacture we get the wood to a moisture content of between 7 and 9%. The climate in the factory is carefully controlled and the product is placed in a heavy plastic vacuum sealed bag before being placed in the box. This moderates the amount of moisture gain or loss that can occur after manufacturing and before installation.

Q. What purpose does drying the product to that moisture content serve?

A. The MOISTURE CONTENT OF WOOD chart to the right highlights controlled humidity and temperature. This generates an EMC / equalized moisture content best for to the optimum performance of the floor.

Q. Can wood still move from the 6% to 10% range of EMC?

A. Yes it can. This is most noticeable in solid flooring, where a tighter range should be established and maintained. Engineered will perform very well anywhere in the green zone of EMC.

### Relative Humidity, Humidity, & EMC Table

From the US Dept. of Agriculture Wood Handbook, Wood as an Engineering Material  
 Humidity recommendations range from 39% - 50% in a building.  
 Temperature recommendations range from 60°F - 80°F in a building  
 If you stay within the recommendations, the amount of expansion and contraction is limited

Temp	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
30	1.4	2.6	3.7	4.6	5.5	6.3	7.1	7.8	8.7	9.5	10.4	11.3	12.4	13.5	14.9	16.5	18.5	21	24.3	26.9
40	1.4	2.6	3.7	4.6	5.5	6.3	7.1	7.8	8.7	9.5	10.4	11.3	12.4	13.5	14.9	16.5	18.5	21	24.3	26.9
50	1.4	2.6	3.6	4.6	5.5	6.3	7.1	7.9	8.7	9.5	10.3	11.2	12.3	13.4	14.8	16.4	18.4	20.9	24.3	26.9
60	1.3	2.5	3.6	4.6	5.4	6.2	7	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	12	13.1	14.4	16	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	11.9	12.6	13.9	15.4	17.3	19.8	23.3	26
100	1.2	2.3	3.3	4.2	5	5.8	6.5	7.2	7.9	8.7	9.5	10.3	11.2	12.3	13.6	15.1	17	19.5	22.9	25.6

Example: (red) Conditions in a warehouse are 60% Relative Humidity at 50°F  
 Dry wood will pick up moisture until 11.2% MC has been reached, regardless of wood species and initial moisture content

# Relative Humidity/EMC Engineered & Solid

HUMIDITY GUIDELINES – ENGINEERED	RH	EMC
Danger Zone: Floor will experience buckling , edge peel, finish blistering, cupping , splits, cracks	5%	1%
	10%	2%
	15%	3%
	20%	4%
Caution Zone: May experience greater than normal movement in floor	25%	5%
Optimal Zone: Will experience normal seasonal movement (potentially small gaps)	30%	6%
	35%	7%
	40%	8%
	45%	9%
	50%	10%
55%		
Caution Zone: May experience greater than normal movement in floor	60%	11%
Danger Zone: Floor will experience buckling , edge peel, finish blistering, cupping , splits, cracks.	65%	12%
	70%	13%
	75%	14%
	80% +	15% +

HUMIDITY GUIDELINES – SOLID	RH	EMC
Danger Zone: Floor will experience buckling , edge peel, finish blistering, cupping , splits, cracks	5%	1%
	10%	2%
	15%	3%
	20%	4%
Caution Zone: May experience greater than normal movement in floor (See Q & A Humidity to the right *)	25%	5%*
	30%	6%*
Optimal Zone: Will experience normal seasonal movement (potentially small gaps)	35%	7%
	40%	8%
	45%	9%
	50%	
Caution Zone: May experience greater than normal movement in floor (See Q & A Humidity to the right *)	55%	10%*
	60%	11%*
Danger Zone: Floor will experience buckling , edge peel, finish blistering, cupping , splits, cracks.	65%	12%
	70%	13%
	75%	14%
	80% +	15% +

## Q&A Humidity/EMC

Q. Why are the charts slightly different for Engineered vs Solid?

- A. 1. Engineered is dried and manufactured to be placed within a specific range of humidity. Because it is engineered it's movement is limited, and therefore has higher tolerances to humidity swings.
2. Solid is dried to the same EMC at manufacturing. However, although, dried to the same EMC at manufacturing, solid can move more due to the fact that it is not engineered. Therefore it can be acclimated to higher or lower levels.

*NOTE: Once solid floors are acclimated, acclimated it is advisable to not have more than a 2% swing in EMC after installation.*

Q. Should Engineered be acclimated to structure?

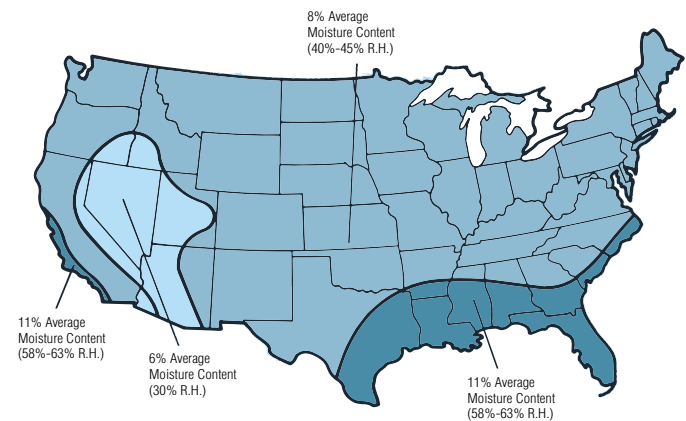
- A. With Engineered, the structure should be acclimated to the flooring (30 to 55% RH).

Q. How long should Solid (Organic) be acclimated to the structure?

- A. It is not a matter of time but of percentages. The flooring should ideally be acclimated out of the box in the condition expected. After installation, if the wood is at the correct EMC for the structure and that climate exists at time of installation the floor can be installed right away. If the living conditions are going to have a lower or higher humidity average then the floor should be acclimated to match that environment, and within those conditions.

Q. How does one determine what the humidity conditions will be?

- A. The map below gives a general idea of the EMC ranges found in wood flooring seasonally. However, consulting an HVAC specialist is advisable. As we will discuss later houses are being made almost airtight and that specialist will help address all the variables.



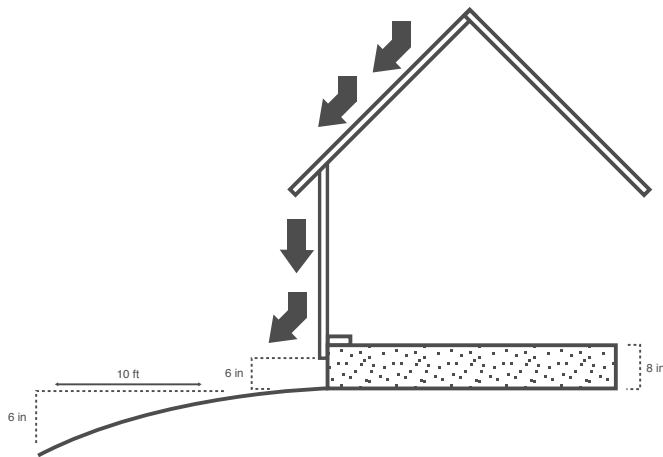


The amount of moisture in the air is generally:

- High in warm seasons. Low in cool seasons.
- Desert environments are generally the reverse. To minimize distortion and maintain consistent size and shape.
- CONTROL HUMIDITY!

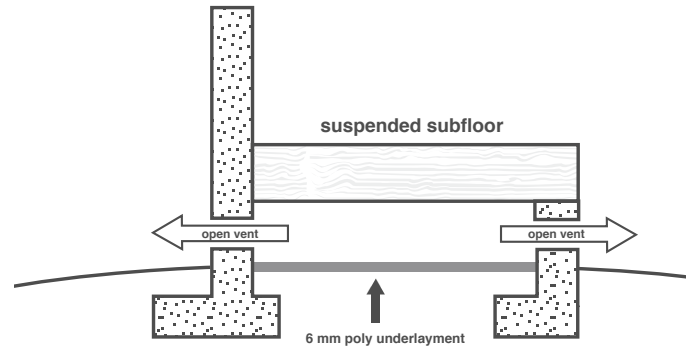
## Moisture Drainage Away From Structure

Is exterior soil elevation 6" below edge of flashing? Does exterior slope away from foundation at a rate of 6" drop in 10' for soft-landscaped areas and 3" drop in 10' for hard-paved areas? Proper drainage away from the structure is absolutely critical to ensure weather tight conditions and crucial to proper hardwood flooring performance. If structure is near a hill, the lot should be graded with a swale to move moisture off the lot and prevent it from coming in contact with the foundation. Water must drain away from foundation to prevent moisture intrusion into the structure.



## Crawl Space Ventilation

Crawl space earth (or thin concrete slab) should be covered 100 percent by a vapor retarder of black polyethylene (minimum 6 mill) or any recommended puncture-resistant membrane, such as Class C meeting ASTM D1745. Check local codes for any additional requirements. Size of available vents should equal 1.5% of the square footage within the crawl space. Relative humidity should be consistent with interior of home. Moisture content of sub-floor should not vary more than a 2% MC from the top of the subfloor to the bottom.



It may be necessary to install temperature/humidity activated exhaust fans to create more movement in the crawl space. Uncontrolled humidity and moisture in crawl space will lead to mold and damage to the structure as well as the hardwood floor. In these events a contractor specializing in dehumidifying systems will need to be contracted to keep crawlspace humidity within proper norms. This is more likely in high humidity areas.

Ensure that clothes driers are properly vented to the outside of the foundation.

Check for signs of plumbing, both pressurized and non-pressurized/drain leaks.

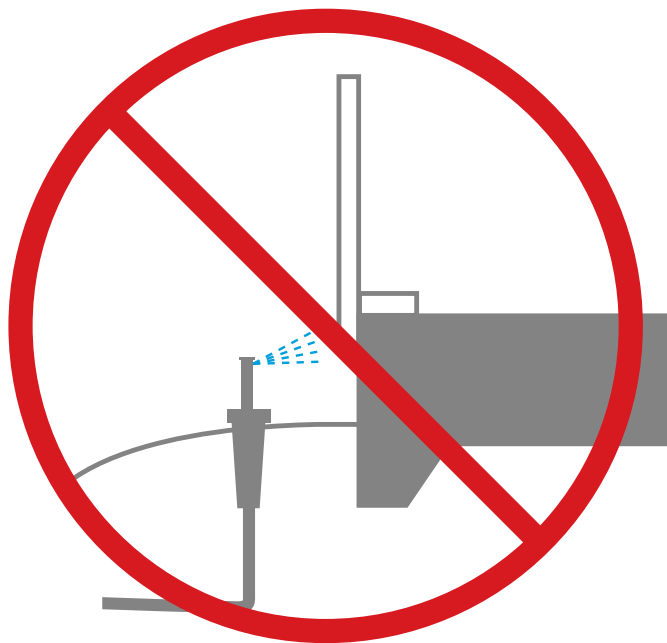


For crawl spaces without ventilation openings, vapor retarder joints must overlap a minimum of 6 inches and be sealed or taped. The vapor retarder should also extend at least 6 inches up the stem wall and be attached and sealed to the stem wall. Continuously operated humidity control and perimeter wall insulation or conditioned air supply and insulation must be provided.

## Basement Moisture & Humidity Control

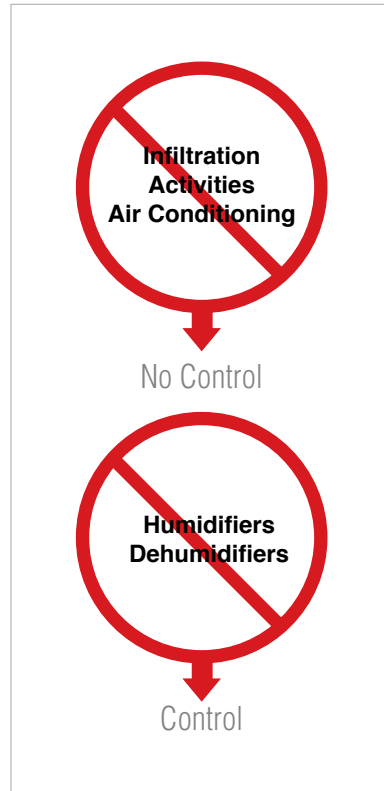
Basements should be completely weather tight and proper drainage away from the foundations walls in place to insure that basement remains dry.

1. Rain gutters must be in place to carry moisture away from the house. French drains are recommended, and basement walls should be properly sealed.
2. Relative humidity of basements should not be more than 10% higher than the upper floors.
3. Humidity control of the basement is vital to help control mold and prevent damage to the structure and hardwood flooring.
4. Basement walls should be inspected for cracks and excessive moisture content.
5. Drains must be placed at basement windows.
6. Direct sprinklers and irrigation systems away from the foundation. Sprinklers spraying the foundation edge can lead to moisture intrusion into structure. Drip irrigation systems for plant beds is recommended.



## Climate Control Systems

A large number of options exist for the heating and cooling of structures. This publication will attempt to discuss the basics and is for the purpose of general information. Consult HVAC specialist to assist in selecting the correct options for any residence.



Consult with HVAC professional to establish dew point in the structure. Many things like R-Value of windows has a big impact on dew collecting on windows or promoting mold growth in draperies or around windows. Air is a gas. Water in the air is a vapor. The warmer the air is the more moisture it can contain. Conversely, the colder the air the less moisture it can contain.



DEW POINT is the temperature at which vapor in the air condenses out and changes to a liquid. Moisture condenses on surfaces that are colder than the dew point.

Another, newer option is to maximize comfort and health benefits of HVAC systems. Occupants run systems on constant fan. The low energy blower runs all the time...not just when furnace or air conditioner are operating.

1. Good for air cleaning (with proper filtration).
2. Good for minimizing temperature swings.
3. Good for minimizing temperature stratification.
4. Good for some types of humidifiers. Based on 75°F & 30% RH indoor and 0°F & 80% RH Outdoor conditions.

HUMIDIFICATION LOAD						
Type of Construction	Gallons per day					
	Size of House (Square Feet)					
	1250	1500	2000	2500	3000	4000
Tight	5.3	6.4	8.5	10.6	12.7	17.0
Average	10.6	12.8	17.0	21.3	25.4	34.0
Loose	15.9	19.1	25.5	31.8	38.1	51.0

## Different Humidification Technologies

- Atomizing/Misters
- Evaporative
- Fan Powered
- Bypass
- Steam
- Resistive
- Electrode

*REMINDER: Not all homes require this degree of intervention or possible any of it. These additional items help in climates where humidity levels are below or above the comfort zone for wood.*

*NOTE: The above systems could improve human and pet health in many circumstances.*

## Humidity Q & A

- Q.** Is there any benefit to having a counter top humidifier?
- A.** Generally they do not help very much and they require constant refilling. They also tend to make noise. Not to mention generally unattractive. Portable humidifiers generally deliver 1-2 gallons per day, vs. a unit in the HVAC unit which generally deliver from 12 to 35 GPD depending on type.
- Q.** From which of the above list of humidification types is the best choice.
- A.** No one system is the best at every climate. Some systems are best suited for cold dry environments and others for hot dry climates.
- Q.** Does Hallmark Floor recommend types of systems or manufacturers.
- A.** Hallmark does not endorse a type of humidification or dehumidification system. Nor do we endorse a manufacturer of this equipment. Many options exist and the best source of information about which type is best would be an HVAC professional.

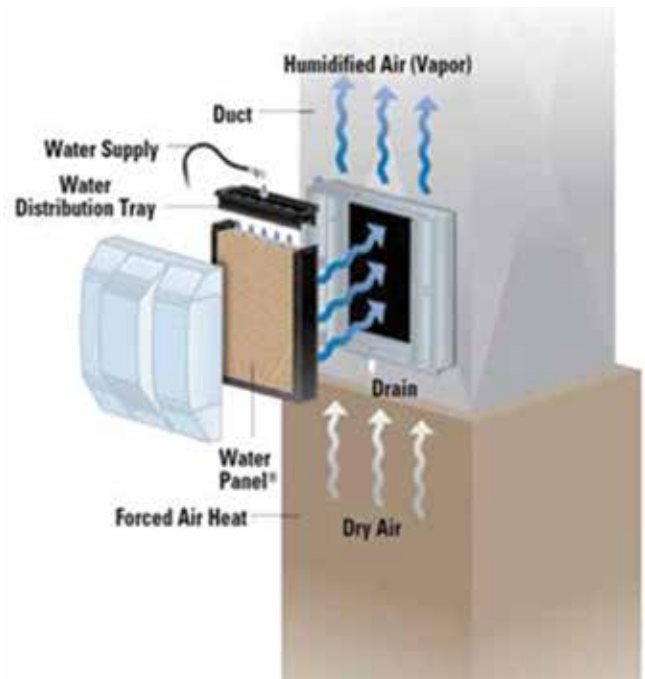
## Humidification Systems

### Fan Powered Humidifier

Water vapor is delivered naturally. Water is delivered to the humidifier, the air temperature and air flow evaporate the water into the air, increasing humidity

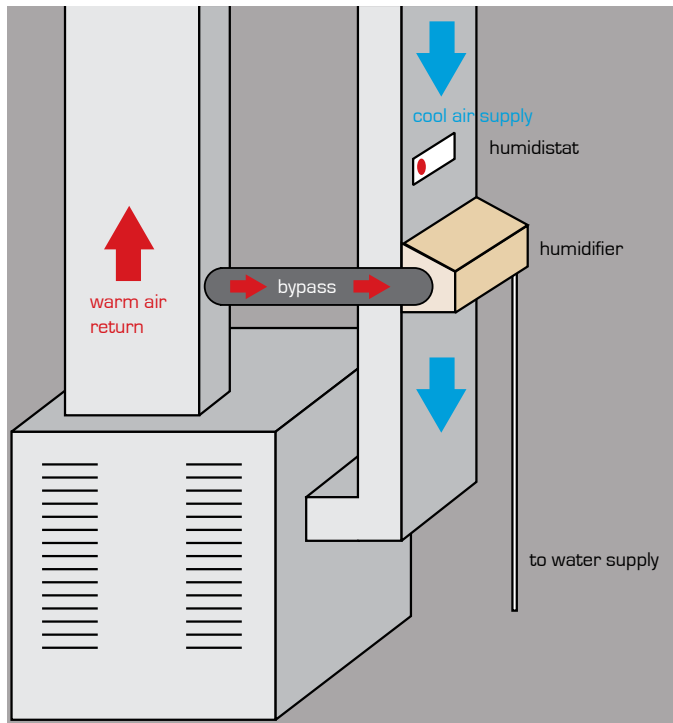
#### THREE PROPERTIES

- Heat
- Airflow
- Water



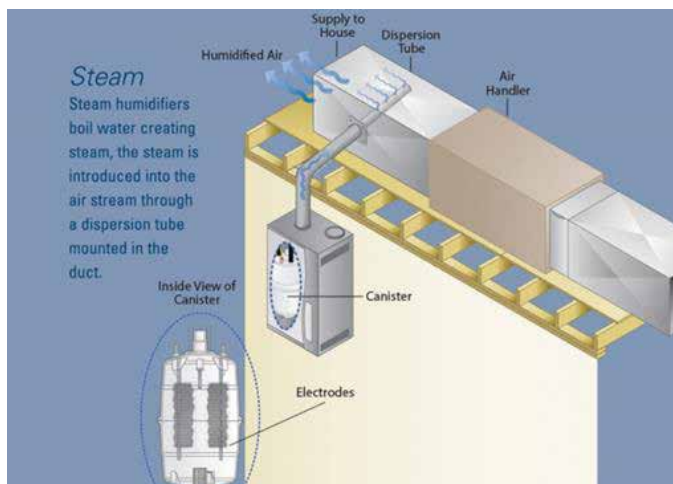
## Bypass Humidifier

Water vapor is delivered naturally. Water is delivered to the humidifier, the air temperature and air flow evaporate the water into the air, increasing humidity.



## Steam Technology

- Water is heated to a boil and the steam is delivered into the home.
- The steam disperses into the air through a dispersion tube.



Humidifiers require maintenance to ensure trouble-free operation at rated capacity. Many systems require maintenance just once per year, but if water has exceptionally high mineral content or if run time is excessive, more frequent attention may be required.

*NOTE: It is important that the dehumidifier be serviced annually, more often if water contains high level of minerals. Follow all manufacturers instructions for proper use. Failure to service your unit can result in damage to the unit and not maintaining proper humidity levels.*

## Evaporative Coolers/Swampcoolers

Swamp coolers use dry warm air passed over water to cool structures. However, generally they do not have the feature of maintaining humidity levels within the designated safe zone. Unless the system has this capability they should not be used in conjunction with hardwood flooring.

In some areas swamp coolers are used in the summer and passive radiant heat (a system without humidification or air movement capability). The dramatic swing from excessively humid in the summer and excessively dry in the winter is very likely to damage a hardwood floor.

## Dehumidification Technology

### Excessive Humidity:

- Homes gain moisture from floor drains, cracks in the basement walls/floors, sump pumps crocks, crawlspaces, washing clothes, cooking, showering, plants, fish tanks, breathing, exercising, etc.
- Natural infiltration from ground water, particularly in the northern and eastern parts of the U.S., adds SIGNIFICANT moisture
- Ventilation only often introduces moist outside air into the living space
- New homes have an excessive amount of moisture in building materials.

### Moisture Removal Methods:

- Exhaust: Bathroom fans and range hoods are good but can leave the house under negative pressure.
- Ventilation can add moisture.
- Air conditioning (HVAC System) they remove moisture until the temperature set point is reached but typically won't reach the desired humidity level (overcooling)
- Portable dehumidifiers: Struggle to remove enough moisture below AHAM conditions (80 degrees and 60% RH) and are typically used as room dehumidifiers.
- Desiccant Wheel: This process uses a special humidity-absorbing material called a desiccant and a fan to blow air across it. Not extremely efficient and requires a lot of maintenance.
- Whole Home dehumidification systems
  1. Designed to dehumidify the whole home
  2. Can be connected to the homes HVAC system
  3. Designed to work at low load conditions.
  4. Higher capacity

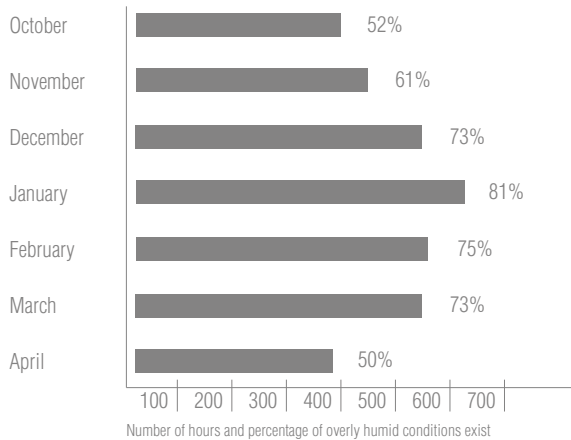
AHAM – Association of Home Appliance Manufacturers.

# Dehumidification Systems

## HVAC

There are months between summer and winter when outside temperature is below 76 degrees and the RH is above 60%. Air conditioner load is low and run time is not adequate to remove excess humidity.

AIR CONDITIONING - ITSELF IS NOT THE ANSWER Example: 68% of the time homes in Tampa/St Petersburg need a dehumidifier between Oct –April Temperature below 76° F and relative humidity above 60%. See NOAA National Climate Data Center.



These types of conditions exist in many areas and the high degree of humidity is a prime cause of mold and wood damage in a home.

Often, homes must be overcooled to remove humidity, making them chilly even in summer. To achieve desired RH levels, the thermostat drives temperature under its set point. It's nicer outside than in because the HVAC is overworking to eliminate the humidity. Sometimes, it's nicer outside than in because the HVAC is overworking to eliminate the humidity.

## Dehumidifiers

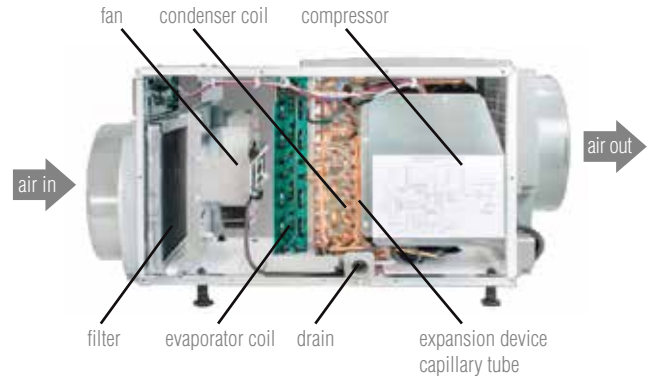
The function of a dehumidifier is to remove excess moisture from the air and through drainage get the moisture out of the units.

Portable dehumidifiers just like humidifiers have very low capacity and in the case of a dehumidifier pans or buckets must be regularly emptied. Portables are highly visible and noisy.

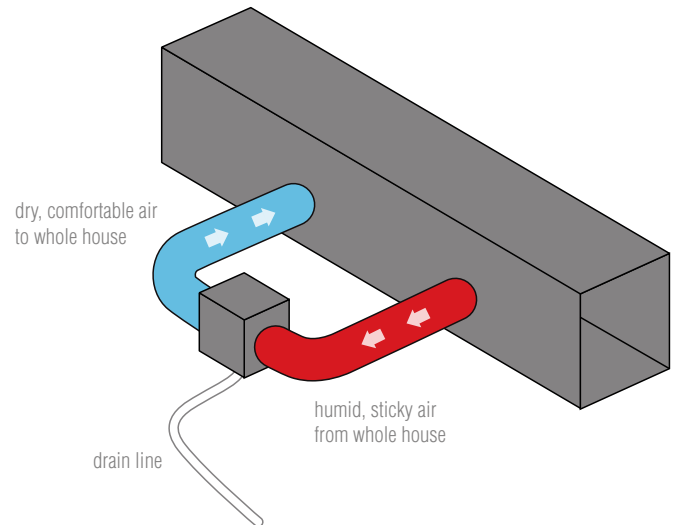
Indoor humidity can come from a number of sources. Homes with basements or crawl spaces can be adding huge amounts of moisture to the residence and as a result rot, mold, and insect attack become more likely.

Sometimes, with basements or crawlspaces, a stand alone unit is needed to address the microclimate found there and a separate dehumidifier be included in the HVAC. Crawl spaces especially which have no direct air exchange from the living areas can be very beneficial.

## Typical Dehumidifier Design



## Dehumidifiers Incorporated Into HVAC Or Blower Systems (Radiant Heat).



For homes without HVAC wall unit dehumidifiers in conjunction with fans for air movement can be used. Consult with HVAC professional for the right application for the structure and conditions found therein.

## Additional System Changes Due To Cost Of Energy

- Furnaces became more efficient.
- This significantly reduced run time and reduced the temperature of air delivered.

## What Impact Does That Have On Humidity And Wood?

- Prior to 1975 furnaces delivered hot air and because houses were loose they ran for long periods of time. Great for evaporative humidifier operation! (more information coming shortly).
- However, newer furnaces in tighter houses do not need to run as long to maintain temperature. Not good for evaporative humidifier operation!
- Recently a newer type of system has been developed to minimize temperature swings, furnaces deliver cooler air but run longer. Great for evaporative humidifier operation!

## Indoor Air Quality

According to AHRI... (Air Conditioning, Heating and Refrigeration Institute).

CONSTRUCTION QUALITY	AIR CHANGES/HOUR
Tight	1/2
Average	1
Loose	1 1/2

Prior to 1975, Houses were loose, which meant that while a good exchange of air took place it was not very energy efficient.

The Energy Crisis of mid 1970s changed everything In the 1980s houses became tighter

- Higher quality windows
- More efficient furnaces
- More attention to passive solar practices
- Far less air exchange

Resulting changes in construction practices...

- Houses became sealed too tight.
- As outdoor air became cleaner indoor air became more polluted.
- Gases, moisture, odors were trapped inside
- Houses were more energy-efficient, but comfort, health & preservation of furnishings and structure suffered.

## Fresh Air Exchange

*A shift towards healthy indoor living.*

*The solution to pollution is dilution = Ventilation/Air Exchange.*

Controlled ventilation was required to improve indoor air quality due to tight energy efficient buildings.

- The industry realized the need to bring in fresh air to maintain acceptable indoor air quality levels.
- Fresh air is necessary for comfort, health and preservation of structure, furniture, cabinets.

Introducing fresh air via outdoor air infiltration creates an unacceptable spike energy use and will lead to poor control of humidity

### NOT A CONTROLLED ENVIRONMENT

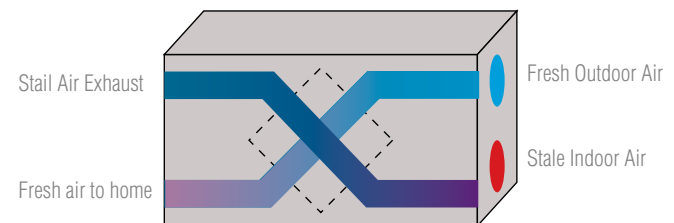
Introducing fresh air via venting, fresh air exchangers, and powered ventilators is good.

### CONTROLLED ENVIRONMENT

The object of ventilation is to return to the benefits of loose construction, without the corresponding energy loss. *This is accomplished by the use of Energy Recovery Ventilation (ERV).* ERV does not replace climate and humidity control. It is designed to replace stale air with fresh air.

The goal is to increase total air replacement to more turns per hour. An ERV reduces indoor pollution while retaining indoor temperature and humidity levels.

ERV units allow the recovery of energy without losing indoor humidity to the outdoor environment. As fresh air is cycled into building outdoor humidity conditions are prevented from influencing indoor humidity levels.



*CAUTION: HRV (heat recovery ventilation) also provides fresh air exchange in a way that is similar to an ERV. However HRV, does not control humidity exchange. Therefore the humidity levels outdoors whether high or low can negatively affect indoor humidity control.*

# Radiant Heat

Hallmark Hardwoods has been manufacturing hardwood floors for over 10 years. Our commitment to quality is unsurpassed. Hallmark Hardwoods collection of hardwood flooring is an exceptional choice for installation over hydronic (warm water) radiant heat systems.

*NOTE: Hallmark does not warrant product installed using electric radiant heat nor does it warrant hydronic systems that are passive (without mechanical systems to move air) or hydronic systems lacking failsafe sensors to prevent heat from exceeding maximum temperature at surface of floor.*

Our high-quality engineered flooring systems are very dimensionally stable as opposed to solid hardwood, and is thus ideal in radiant heat applications. Our internal glue systems are manufactured in Japan and are the lowest emitting plywood glue in the world and E-0/CARB II compliant.

## Recommended Installation Methods

### FLOATING

Hallmark recommends Eternity or comparable pad. The tongue and groove must be glued together using Hallmark TrueBond Tongue and Groove adhesive.

### GLUE DOWN TO CONCRETE THERMAL MASS

Adhesive must be approved by adhesive manufacturer for use with radiant heat. Adhesive system must employ a vapor control component designed to be used in conjunction with the adhesive by the adhesive manufacturer. Thermal mass must be Portland based concrete product and rated at a tensile strength of 3000 psi or greater. Thermal mass with less than 3000 psi tensile strength must use floating installation method (unless otherwise specified by adhesive manufacturer). Follow all adhesive manufacturer's installation specifications.

### NAIL DOWN

This installation method is not recommended under any circumstances for installation over radiant heat systems.

## Products Suitable for Installation over Radiant Heat

Alta Vista - All  
Heirloom – All (excluding Hickory)  
Hacienda - All (excluding Hickory)  
Moderno - All (excluding Hickory)  
Monterey - All (excluding Hickory)  
Ventura – All  
Silverado – All  
Chaparral - All (excluding Hickory)  
Organic Engineered - All (excluding Hickory)  
Organic Solid - None/Not approved for over radiant heat installation

## Radiant Heat Q&A

In-floor heating systems must be water based, and designed to prevent the surface temperature of the hardwood floor from exceeding 85° F.

- Q.** At what point should a Hallmark Hardwoods floor be installed?
- A.** Hardwood flooring should be the last item installed on the project. All windows and doors must be in place and the structure completely weather tight. If the tubing is encased in lightweight concrete, the concrete must be completely dry. Kitchen cabinets must be in place prior to installation of the floor. The relative humidity conditions must be between 30 and 55%, and the temperature between 60 and 80° F.
- Q.** How long before installation of the floor should the radiant heat system be powered on?
- A.** Two to three weeks prior to installation of the hardwood flooring with the thermostat set at 70° F and then at 85°. The home should be aired out briefly everyday to allow excess humidity from the thermal mass to exhaust moisture out of the structure.
- Q.** Should the floor be acclimated?
- A.** Since the floor is engineered long acclimation times are not required. Prior to bringing material on the site for acclimation the thermal mass must be dried to specification listed above. The key to proper performance is to establish the correct environment in preparation of installing the floor.
- Q.** What should the moisture content of the lightweight concrete be before installation?
- A.** The lightweight concrete moisture content must not exceed 1.5% as measured with a Tramax Moisture Encounter meter.

Q. Do the floors move when walked on?

A. A floating floor will have a degree of resilience or give that a nail-or-glue-down floor does not have

Q. Do the floors gap or expand and contract?

A. Hardwood flooring is a natural product and will change size with variations in temperature and moisture content. However, engineered hardwood floors are far more dimensionally stable than solid hardwood floors. Good humidity control can minimize these changes even more..

Q. What constitutes a low humidity environment?

A. This varies by geography but is usually defined by areas that experience long periods of freezing weather or have naturally low humidity like the deserts or higher elevations present in the mountains (below 30% humidity).

Q. Should radiant heat be turned on before weather becomes cold?

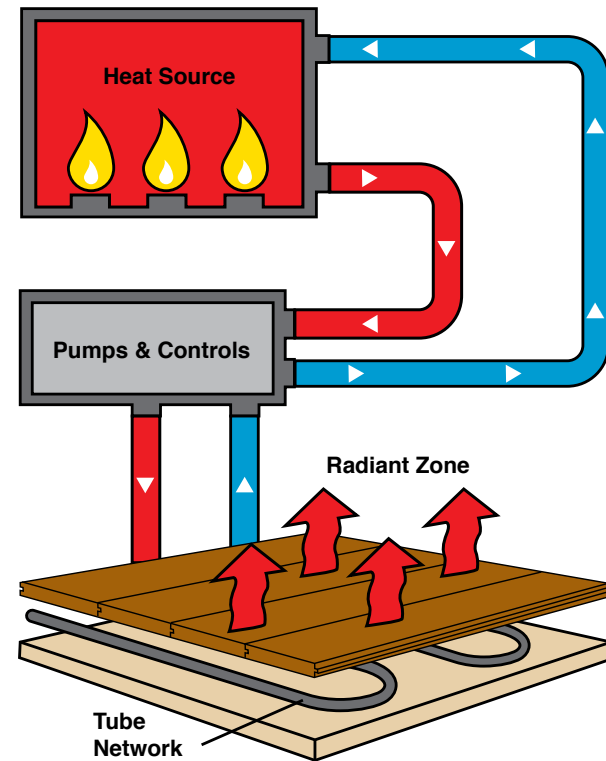
A. Radiant heat should be turned on at low power in the fall and the heat increased gradually. This allows the temperature to be increased slowly with less shock to the floor. An exterior thermostat should be used to allow the system to gradually power up.

Q. What are the benefits of the floating method of installation?

A. The benefits floating floor over hydronic radiant heat systems include:

1. No nailing required, eliminating the risk of puncturing the in-floor tubing that exists with nail-down applications.
2. The floor is not glued directly to the thermal mass, eliminating potential loss-of-bond issues.
3. Eternity or equivalent pads do not add substantial R Value resistance to the installation and keep the system energy efficient. This, combined with the thinner overall thickness, our engineered floors have lower R Values than traditional, solid wood floors. .

Q. What is Hydronic Radiant Heat?



A. Hydronic radiant heat is a system that uses warm water driven through a tube network. Energy is released to warm the room and cool water returned to the boiler to be reheated.

Q. Can Hallmark be glued down to wood subfloor with tubing underneath?

A. Hallmark Engineered products (excluding Hickory and Exotics) can be glued directly to the wood substrate/ deck. However, should a plank require replacement at a later date that process could damage the substrate/wood deck.

Q. Does radiant heat eliminate the need for HVAC?

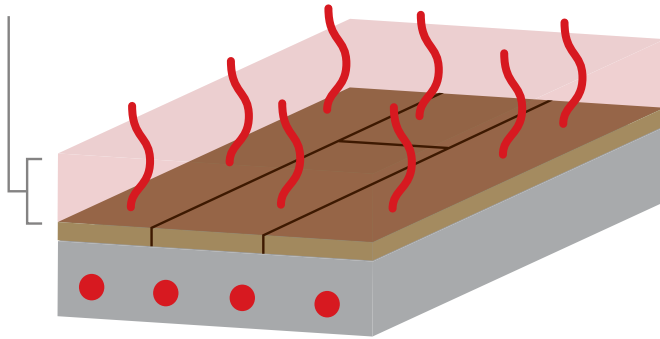
A. In some areas the summer temperatures do not require air conditioning. However, HVAC provides a vital function in radiant heat. The blower motor on the HVAC can be set to move air and deliver the correct amount of air movement, and humidity control, preventing an excessive dry zone at floor level.



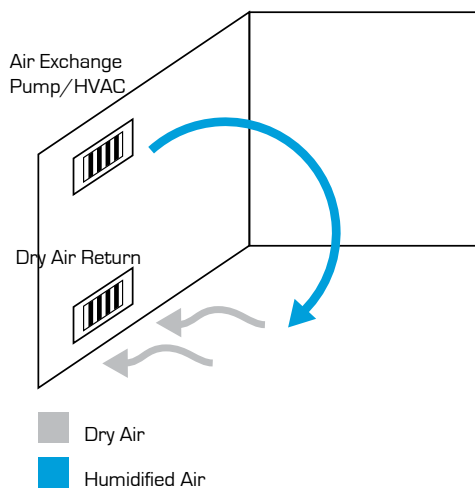
Q. Why is humidity control and air movement so important with radiant heat?

A. As discussed earlier, wood is hydroscopic. Without air movement, the heat rises from radiant heated floors and creates a excessively low humidity zone directly over the floor.

8-12"  
Low Relative Humidity Zone



Air movement helps break up the low humidity zone at floor level.



Q. Is radiant heat better than forced air heating?

A. Each systems manufacturer makes compelling points for why their system is better than another.

1. Radiant Heat: The system warms the floor and the heat rises making the floor warmer to walk on. However, If the radiant heat system is completely passive and has no ability to humidify or move air or humidify the air problems can occur, such as a low humidity zone at floor level or overall extreme low humidity at floor level.
2. Forced Air Heating: Has the ability to easily support air conditioning, whole house humidifier or dehumidifier as well as creating adequate air movement to disperse dry or damp air. This option also makes it possible to use filtration to r remove air particulates.

Q. Can Radiant heat work in a structure with no HVAC?

A. Yes, wall mounted humidification units can generate enough humidity to keep levels at acceptable levels. However, the unit needs to be plumbed to a water source and given proper drainage. If the home is in the planning stages the duct work can be put in place and then a steam humidifier placed into that system to distribute proper humidity to the environment.. Air must be moved mechanically to ensure even distribution of humid air.

Q. Can Hallmark Hardwood Floors be nailed down to a sleeper system set in concrete?

A. Hallmark does not authorize this method of installation under any conditions. Sleepers can absorb moisture from thermal mass, nails can puncture tubing, cleat/staple can transfer intensified heat to plank.



Q. Can Hallmark be glued directly to lightweight concrete?

A. There are several adhesive manufacturers who have primer systems that they recommend prior to the application of adhesive. Follow all adhesive manufacturers guidelines.

Q. Is nail down allowed with radiant heat under any circumstances?

A. Hallmark Hardwoods cannot be nailed down under any circumstances on a radiant heated floor.

Q. Are there any design limitations you need to be aware of?

A. Radiant heat is very efficient but does have some limitations. When ceilings exceed 10' high, the amount of cubic air that needs to be heated can create problems for a hardwood floor. Rooms with high ceilings can create a situation where the floors can become too warm due to the high volume of space to be heated. Rooms with high ceilings may require radiant heat to be installed in the ceilings and ceiling fans mounted to circulate the air. NOTE: All systems should have a fail-safe to ensure that the surface of the floor never exceeds the recommended surface temperature of 80° F.

Q. Are all hydronic systems OK for use with Hallmark Hardwoods?

A. Only the systems that ensure a very even distribution of heat. Hydronic systems that do not include thermal mass, or aluminum transfer sheets, will not provide even distribution of heat. Good systems will not have temperature variations exceeding 3° F within a 2' radius. *Electric radiant heat systems are not acceptable.*

*Passive Hydronic Systems* that have no allowances for humidification/dehumidification or air movement create hot zones at floor level. Usually the issue is low humidity damage to the floors containing a Passive Hydronic System.

Q. Are electric radiant heat systems OK for Hallmark Hardwoods?

A. Electric radiant heat systems are not accepted by Hallmark Hardwoods. Electric systems are high temperature systems with the heat highly concentrated on the electrical filament.

Q. Can area rugs increase thermal resistance and overheat the floor?

A. Depending on the thickness of the area rug, a situation can develop where the floor could be overheated. However, a well designed radiant system is usually operating well below the maximum of 85° F. After rugs are in place, ask your radiant heat contractor to turn back the rugs and measure the surface temperature of the floor with an infrared surface thermometer to determine if the rug is making the floor too hot. Make adjustments to turn down the heat down as necessary.

Q. Can book cases and entertainment units increase thermal resistance and overheat the floor?

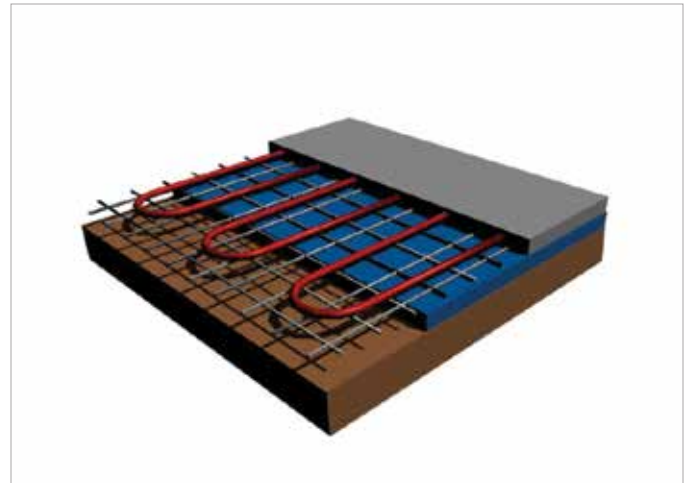
A. Just like area rugs, anything that sits on top of the floor can trap heat. This should not be any more cause for alarm than an area rug.

## What types of hydronic systems are suitable for a Hallmark Hardwoods Installation?

### 1. Concrete Thermal Mass:

The heating tubes are installed and lightweight concrete poured over the tubing. Concrete acts as a radiator to provide even distribution of heat. (This is the method is described in previous section.) Although this is the most traditional method, additional systems have been developed.

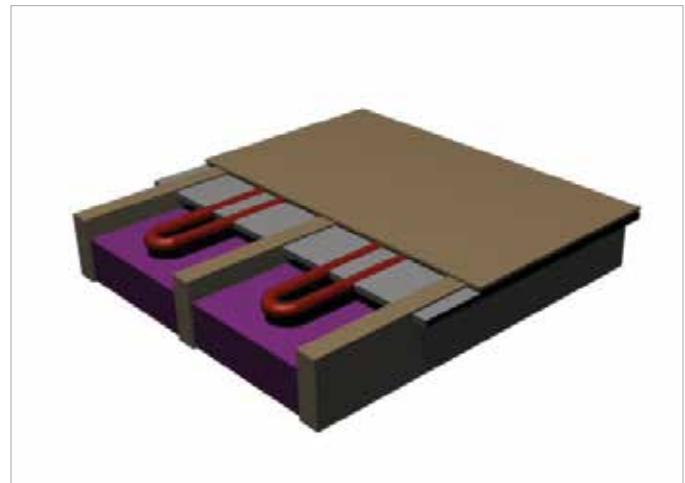
Installation method: Floating or Glue-Down



### 2. Aluminum Hangers:

The tubing is suspended in aluminum hangers with channels to accommodate the tubing. An efficient conductor of heat, these aluminum hangers radiate heat evenly and effectively upwards. This system removes the need for a concrete thermo mass and eliminates the corresponding weight and elevation gain it produces.

Installation method: Floating or Glue-Down

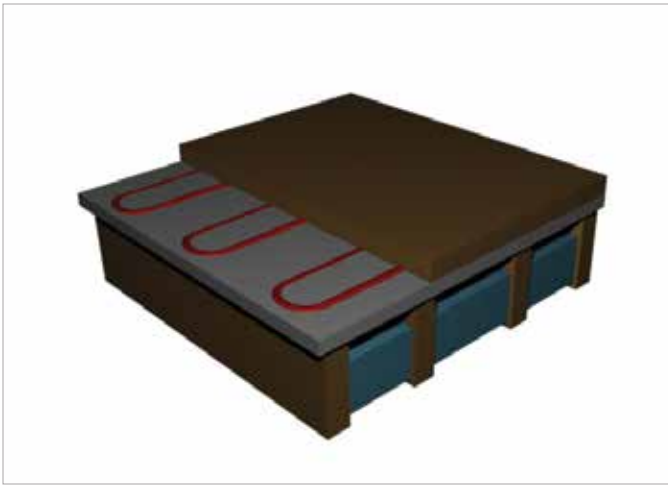


### 3. Channeled Aluminum Board:

Wood subfloor panels are channeled and an aluminum transfer sheet vacuum pressed to the surface. The water tubes are then pressed into the channels. The tubing in the channels transfers heat to the aluminum and generates very even results. Since there is less loss of thermal energy, this system is more efficient than others.

Installation method: Floating or glue down is allowed by some radiant system manufacturers. The downside is the risk of damaging the radiant system if a board is damaged and requires replacement.

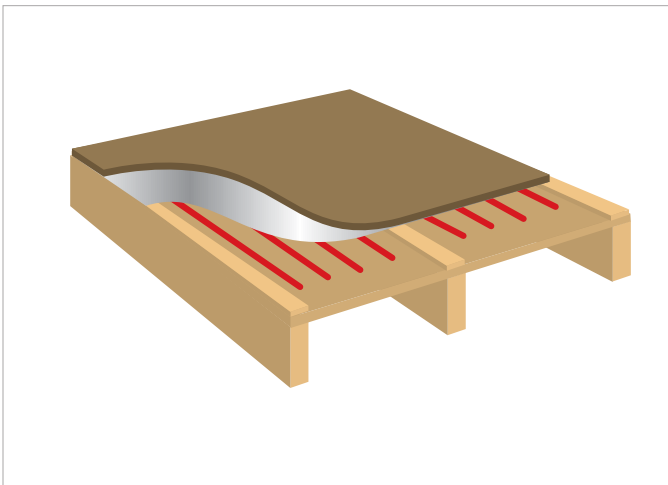
*Some radiant manufactures allow nail-down, which Hallmark does not recognize, and results in making the Hallmark warranty VOID.*



#### 4. Sleeper System:

Confirm with radiant heat manufacturer that the thickness of the aluminum transfer sheet will meet Hallmark specifications for no more than a 2° F temperature variation anywhere in the floor.

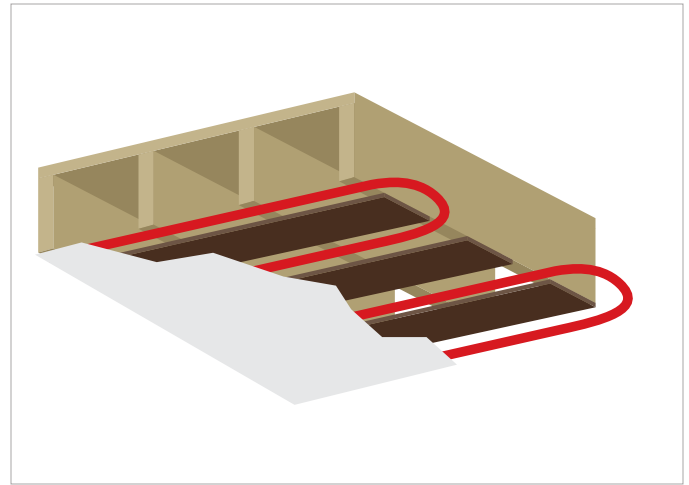
Installation method: Floating or Glue-Down



#### 5. Ceiling Radiant Heat:

When ceiling heights reach more than 10' the draw from the in-floor radiant heat may overheat the floor. To heat the greater cubic feet of air to be heated. Use of air exchange pumps or traditional HVAC set on fan to move the air will make heating of room more efficient.

*Note: For use in rooms with ceilings greater than 10'*



## Radiant Heat Technical Information

Thermal Resistance/Insulation R-Value of Flooring Materials 9/16" & 1/2" products = 0.45 – 0.50 5/8" products = 0.50 – 0.55

## Radiant Heat Terminology

Subfloor Tolerance:

Degree of flatness; 3/16" in 10' radius or 1/8" in 6' radius (see installation instructions).

Flow Temperature (F):

Water temperature flowing from the boiler to the tubing under the floor. Most hydronic systems operate at about 95° – 113° F. The temperature depends on the type of system and how efficient it is in radiating heat. Maximum surface temperature of wood floor: 80°F.

Mechanical Humidity Control:

The heating/ventilation/ air conditioning system should have mechanical humidity control. Control of relative humidity in room will ensure the woods moisture equilibrium will remain a proper levels.

Exterior Thermostat:

An exterior thermostat is recommended to protect the system from condensation absorption during spring and fall when rapid changes in temperature and relative humidity may occur.

Heat Transfer Point Control:

Acts as a fail-safe to prevent wood flooring surface from exceeding 85° F. A well designed system should have a set point control that will monitor the temperature of the wood floor. The set point control should either reduce the system water temperature or temporarily cycle the system off to prevent overheating the floor in case of equipment malfunction.

## Advances in Radiant Heat Systems

Radiant heat is enjoying a surge in popularity. Some builders remain reluctant to work with these systems because of misgivings that exist in the builder community. Forty years ago, radiant heat systems operated at much higher temperatures to compensate for the lack of insulation. However, modern systems now make it possible to install these systems without damaging the hardwood floors or making the floor covering too warm to walk on in bare feet.

# Hallmark Healthy Homes Luxury Vinyl Flooring





# Hallmark Healthy Home & Luxury Vinyl

Luxury Vinyl is the fastest growing segment for many reasons. Printing technology, texture, and surface finishes make a very good substitute for wood, stone, and marble. Resilient and soft on feet, are two features that make this segment a good choice. These new options mean luxury vinyl planks and tiles are not your grandmother's old fashioned sheet vinyl.



With luxury vinyl the same indoor air quality standards we discussed in wood are a good idea.

Indoor air quality is a top priority with Hallmark Floors. In this section we will discuss the different finishes hallmark places on its luxury vinyl.



Surface Guardian Basic® is the perfect floor for light commercial and apartment installations. Containing ceramic bead additives in the UV surface finish makes for reliable performance and durability. Basic is found on Hallmark's Town & Country and Castle & Cottage collections.



Surface Guardian Pro® takes performance to another and higher level. Pro contains Hallmark's Nanocontrol technology. The secret is a titanium dioxide additive in the finish itself. As air circulates viruses, and bacteria, move through the air. When these organisms come into contact with the surface finish the cell wall is destroyed killing the organism.

This is achieved by the titanium dioxides reaction to light. In effect killing the micro organisms without the use of harsh chemicals. Another byproduct of this process is cleaner indoor air, as only water vapor remains from the destroyed organisms.

Surface Guardian Pro® is found on the following Hallmark Products:

- El Dorado
- Sierra Madre
- Hermosa Stone
- San Simeon



Purcore Eco®:

Contains 25% recycled content. This is post industrial content single source. The makeup of this material matches the same formula we use. This is critically important as post consumer content many times contains a huge mix of different chemistry's which can produce product that is not stable and contain undetected and undesirable additives.



Purcore Ultra®:

Contains 100% pure virgin PVC. This formula is used to ensure the highest dimensional stability and due to the limited amount of industrial single source material suitable for the production of Hallmark Floors products.



Indoor air quality is vital to a healthy life for everyone. This is why Hallmark's luxury vinyl products are third party certified to comply with regulations regarding emissions off-venting from the floor itself.

## Materials

Luxury Vinyl Floors are made from the following items:

- PVC Plastic
- Aggregate – finely ground stone for use in the core. This additive give luxury vinyl its strength and ability to bear a load and provides stability.
- Binding Agents – Attach the PVC to itself as well as to the aggregate. This is where the use of phthalate binding agents can be a problem. Phthalates emissions have been identified as a hazard to human health. In some cases low cost producers actually use heavy metal industrial waste as a binding agent allowing them to use more aggregate than PVC. Make sure to look for the Floor Score Certified Label.
- PVC encapsulated fiberglass. Hallmark uses this only in its San Simeon EZ Lock products. Encapsulation can only be achieved in hot press manufacturing.

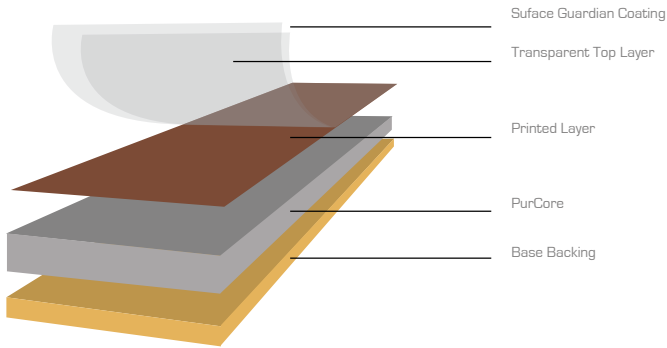


Encapsuloc:

Is used in our San Simeon product to provide additional stiffness to the plank to aid in the installation as a floating floor. The extra sheet is encapsulated while the product is being hot pressed. This is possible because all the layers are being physically intergated together by thermal fusion.

# Manufacturing

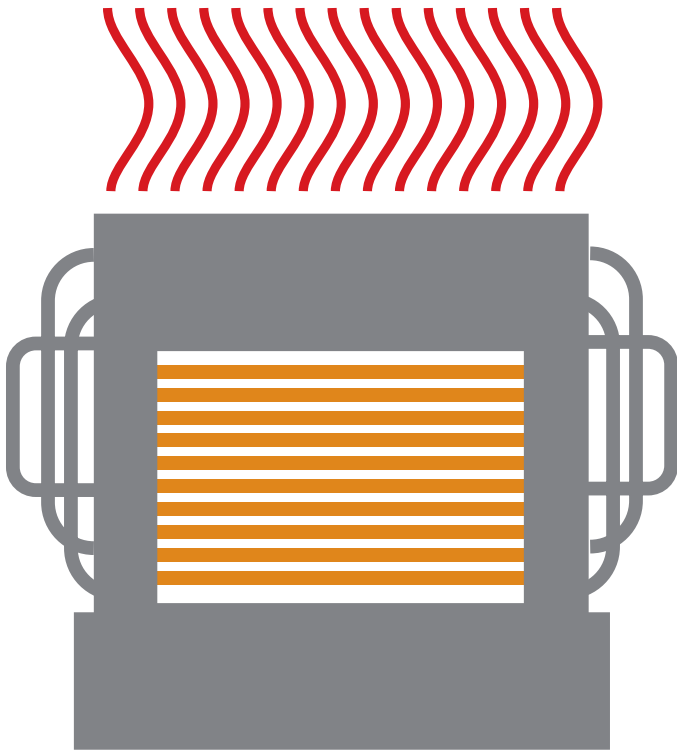
Luxury Vinyl Planks and Tiles are comprised of various levels. In common practice there is a bottom layer, core, printed layer, a top layer and in most cases a UV protective coating. In the case of Hallmark ceramic beads are added to the UV coating for added durability.



Methods of manufacture vary from product to product. Two basic techniques are used.

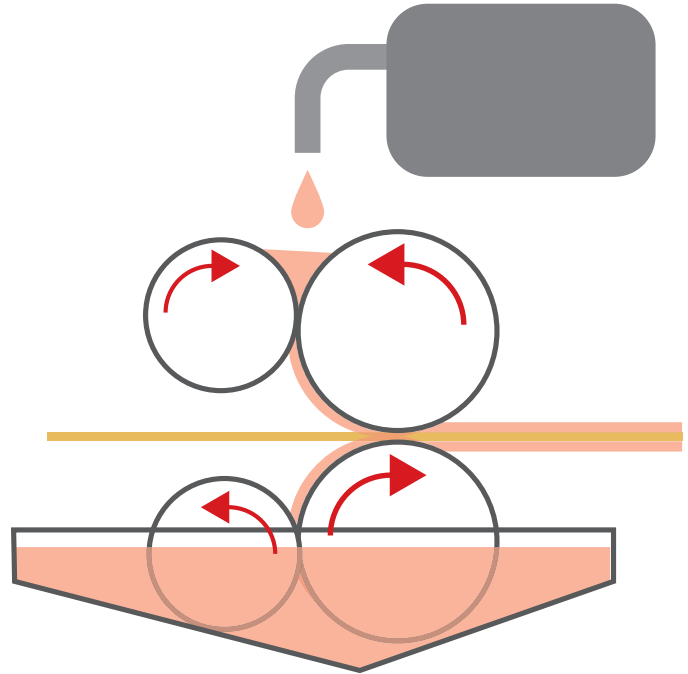
## Hot Press / Thermally Fused

The individual layers are stacked and fed into a hot press. In a process that takes several minutes the layers are literally melted into one another. Therefore, no glues are added. Surface grain texture from very light all the way to had scraped can be placed into the surface of the floor by the press plates.



## Extruded:

In this process the individual layers receive a layer of glue and then quickly run through hot rollers in a matter of seconds. This production method is much faster than hot press and is generally reflected in a lower cost. Also many of these products do not receive a UV coating or if they have one do not contain ceramic or other protective additives.









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