BEHAVIOR OF FLOORING

If it's not marked NOFMA, it's not certified.

Cupping and Crowning

Cupped Floor
STEP 1. Flooring absorbing excessive moisture on the underside causes expansion and cupping with the edges raised.

Flooring Sanded Flat
STEP 2. Floor is sanded flat while at the higher moisture content, resulting in strips with thinner edges.

Crowned Flooring
STEP 3. Flooring loses some excess moisture, shrinks on the underside and flattens, leaving the edges of strips lower than the centers.

CUPPING OF WOOD FLOORS--CAUSES

Kiln-dried wood boards which are subjected to moisture only on one side will expand on that side, and will warp by bending away from the moist side. This can be easily demonstrated with a narrow piece of paper; simply moisten one side. the paper will immediately “cup” away from the wet side, creating a convex surface on the wet side and a concave surface on the other side. Similarly, hardwood flooring will cup for one reason and one only -- from gaining or losing moisture on one side faster than on the other.

(In basement construction, the soil drainage solution applies, but it may be necessary to dig out and waterproof the exterior of basement walls, and install drainage near the bottom of footings as well as intermittently up the side of the basement walls. Because of the expense involved this should be considered only as a last resort. Mechanical dehumidifiers in the basement plus summertime ventilation may ease the problem enough to allow the subfloor and surface hardwood to dry.

The next step is to allow the floor and all underfloor construction to dry thoroughly. The process by which hardwood floors take on moisture and expand takes many weeks, unless water in liquid form has been in the picture. By the same token, its removal may also take several weeks, or even months. Once a program of drying has been set up, evidence that it is working can be seen within a short time. Its progress should be monitored by taking moisture readings on a bi-weekly or monthly basis, and no repairs should be attempted until the readings have remained balanced between face and back for 30 days to be sure that cupped floors have flattened as far as they are going to. (Floors with a surface finish react much more slowly to moisture changes.)

Normally when cupping is noticed, the surface of boards will be concave -- edges higher than the center of the boards. This will mean that the backs of the boards are absorbing water vapor - to an extent expansion has begun. If unchecked, heavy expansion may ensue, followed by buckling of the floor. Often, however, only enough moisture is present to cause the cupping, and this will be the extent of damage. Rapid cupping may occur when an impervious surface finish is applied, cutting off evaporation through the surface. The cause will still be moisture accumulating in the back sides of boards.

Extent of moisture changes can be illustrated by the following example when checking the moisture content of the flooring with a moisture meter having insulated needles:

Surface of flooring -- 9% - 10% : Subfloor -- 13% - 15%
Back of flooring -- 11%- 12% : Joists -- 14% - 16%

These are approximations, intended to illustrate that higher readings occur as the insulated moisture meter probes are driven deeper into the construction. Actual readings may be lower or higher, depending on how far the moisture condition has progressed.

Usually when readings like the above are found some evidence of the moisture source will be obvious, especially in a crawl space, when the full inspection procedure is followed. In a basement the moisture source may not be quite as obvious. A sling psychrometer or digital thermometer hygrometer may be needed to establish humidity levels beyond question. An observant inspector will usually notice high humidity, however, because the air in the basement will feel cooler than its dryer counterpart in the rooms above. Lack of visual evidence of evaporation below the floor does not disprove its presence by any means. Concrete basement walls and floors are ready evaporators, as can be demonstrated with a moisture meter.

If cupped boards are dried soon enough, they usually return to a flat position. However, if they remain cupped long, the stresses within boards may change to the extent drying will not remove the cupping. (This is more common in wider boards.) In that event, moisture readings taken during the inspection can be at or near normal.

CONVEX CUPPING ("crowning") of the floor surface may also occur for all the reasons previously described, but most often the reason is a different one. It usually follows cupping of the concave type, which often occurs before the house is ready for floors to be sanded and finished. If the flooring is sanded with boards cupped and edges high, the high edges of boards are cut flat by the sanding machine if the operator does his job correctly. In profile, after sanding, the boards will then have abnormally thin edges -- flat on top, with edges of the reverse side of boards still curved upward, or cupped. If these boards later dry and flatten to their original position, the thin edges recede, leaving the top of boards convex (edges lower than the centers) and the back again flat against the subfloor (Fig. I)

NORMAL CUPPING: Some cupping should be considered normal, especially in wide planks -- 5", 6", 7" and wider -- and particularly in plain-sawn boards. In such boards (as opposed to quarter-sawn; see Fig. 2) the growth rings of the tree travel in a slightly curved pattern from one side of the board to the other. This curved pattern produces, with normal moisture content changes, a slight convex or concave cup, depending on how the rings curve within individual boards.

This type of cupping is usually not noticeable unless the floor is viewed across the boards and against a strong, low light source, such as a patio door or window wall. It is often noticed while the house is still unoccupied but furnishings usually make the cupping seem more normal as the strong light reflection is softened and angles of view are changed.

SOLUTIONS -- CUPPED FLOORS. Cupped floors have gone through a site-related moisture escalation. Re-dried and repaired, the floor already in place is, in most cases, the best choice for a trouble-free floor in the newly-established environment. Replacing a cupped floor is usually the worst choice, especially if replacement is made before the moisture condition causing the problem has been corrected. The replacement is almost certain to react to the moisture situation by cupping, like the first floor, and the whole process must be repeated.

There are, of course, exceptions, when the only solution is to replace the flooring. But the problem has usually reached a far more serious level before replacement is needed.

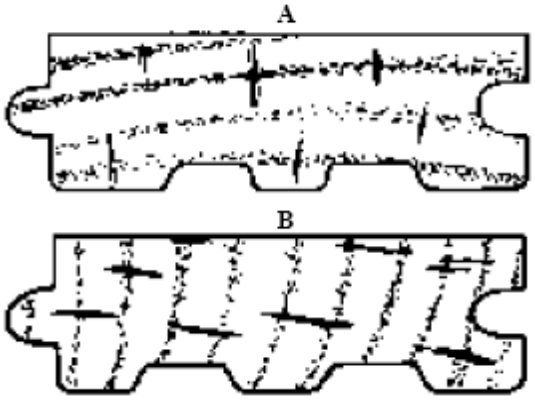

Figure 2. (A) Plain-sawed boards have grain (the tree's growth rings) flat with the board. Slight curves make wide boards cup slightly.
(B) Quartersawed boards have grain vertical to the board's wide dimension. Expansion follows the grain direction about 4-1, making quartered boards more stable.

The first step in repairing a cupped floor is to remove the source of moisture. To cure it the source must first be found.

In crawl-space or concrete slab subfloors, be sure all outside drainage moves rainwater away from the house. Water flows through many types of soil almost as rapidly as on the surface of the ground. If the building sits on a hillside the natural flow of water may take it under the foundation in large volume, where some will evaporate. Close this source by installing soil tile on the high side of the building to drain subterranean water around the house. Generally regrade if necessary to move water away from the house. In crawl-space construction lay 6-mil polyethylene film over the entire area of earth (or concrete or whatever surface exists), weighted down with bricks to prevent its shifting in a breeze. Be sure the entire area is ventilated on all walls and that vents are open. If there are dead ventilation areas provide mechanical means, either temporary or permanent, to circulate air. A humidistat-switched automatic fan, with a tunnel to an outside vent, is one such arrangement; coupling the fan to the air conditioning/furnace fan is also a good arrangement.

WHEN THE FLOOR RE-FLATTENS: If cupped floors flatten when they have dried, new considerations of a complete repair may arise:

Fastenings -- nail installation: The cupping action may have loosened nails to some extent. If so, this will express itself by squeaks or looseness when the floor is walked on. Face nailing or fastening from underneath with wood screws will correct the problem.

Adhesion -- mastic installation: Some types of wood floor mastic have re-tack properties which will allow the mastic to re-adhere even after the floor has been pulled loose and reset. If walking on the floor produces popping sounds, or the floor sounds "hollow" when tapped, adhesion has probably been lost. In this event the affected parts of the floor must be removed and replaced to accomplish an effective repair.

If an asphalt cut-back mastic was used originally, the dried-out floor can be removed and replaced (a few pieces at a time), as the mastic can be reactivated with a light spray of kerosene. Headless pins of hardened steel can be used also where mastic adhesion has beenlost. These pins can be driven into either wood or concrete subfloors.

Once fastenings are secure, the floor can be filled where cracks exist, and either given a new coat of finish, after screening, or buffed with No. 00 steel wool, cleaned, and re-waxed. If the original finish was a surface type (i.e., Polyurethane), it can be re-coated only if it has not been waxed.

WHEN THE FLOOR REMAINS CUPPED after thoroughly drying it has most likely set new stresses and most boards will remain cupped indefinitely. In this case the only practical repair is a complete resanding and finishing job. Cracks should be filled as a normal part of the finishing process and fastenings checked and repaired before sanding.