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National Wood Flooring Association

SANDING AND FINISHING

OF HARDWOOD FLOORS

CONTENTS

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Introduction:

It's been said that there are enough wood floors already in existence to keep sanders and finishers busy for decades to come. The fact is, sanders and finishers are in great demand today — both to refinish those existing floors and to sand and finish much of the millions of square feet of new wood flooring being installed each year. (The exception, of course, is the factory-finished flooring being installed, but even that will need to be refinished or recoated someday.)

CUSTOMER EXPECTATIONS

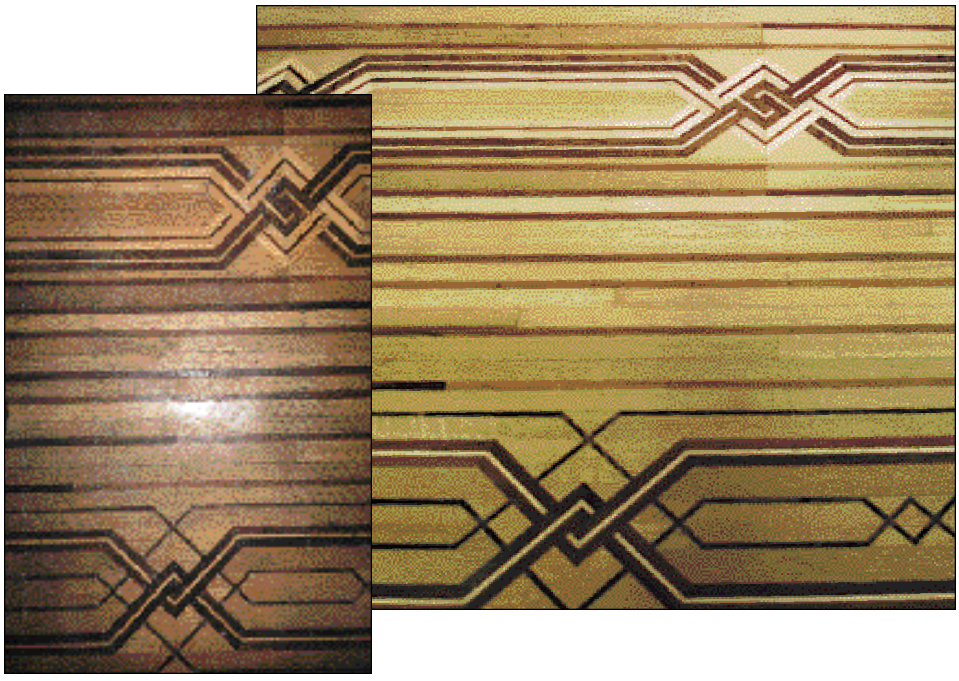
Whether you're working on a new home installation, at a commercial job site or on a home remodeling project, you will do yourself and your customers a favor if you properly prepare them for the sanding and finishing process.

As a flooring professional, you probably accept the sanding dust and the finish vapors as facts of life. And, in fact, it is easily dealt with. However, the home owner who is not properly prepared may see the dust and vapors as much larger issues than they are.

To address that, many contractors prepare "customer prep" fact sheets to give each customer before the job begins, outlining what the customer should expect in the way of disruptions. A typical fact sheet should detail several key factors:

- Tell how long the process will take.
- Indicate that dust is likely to accumulate in other parts of the house, even though those rooms are sealed off from the work area to reduce dust infiltration.
- Note that the finishing process will produce vapors. Depending on the finish being applied, this may require that pilot lights be shut off during the process.
- Stipulate that traffic in the work area should be restricted. That means that all other trades should have completed their work, and no other floor traffic should be allowed during the sanding and finishing process. Home owners should be especially watchful to keep children and pets away from the work area.
- Indicate that furniture, appliances and old floor coverings should be removed before the sanding and finishing process can begin.

A sample "Customer Prep Letter" is on page 28. For more on job site preparation, see Tech Manual Chapter A400: Jobsite Evaluation, Estimating and Preparation.



BEFORE AND AFTER: This turn-of-the-century wood floor features borders of walnut, mahogany, oak and maple, but decades of foot traffic and finish buildup have taken their toll. Never fear: A professional sand-and-refinish job returned the floor to its original beauty.

SECTION 1: SANDING

SAFETY

There are many safety issues to consider in the sanding process. One of the most important is spontaneous ignition, which can occur with sanding dust.

Combustion caused by wood dust is a potentially serious problem. There are several ways in which it can occur. The first and least common is the wood dust starting on fire in the dust-collection bag when a new floor is being sanded. The heat created from the friction of the machine and sandpaper on the floor can increase to the point that the sawdust begins to smolder inside the bag. Plain wood dust must reach a temperature of 400 degrees Fahrenheit for it to ignite.

Combustion happens much more frequently, however, when an old floor is being sanded. The old finishes that are on the floor become ground into a fine powder. Again, the heat created by the friction can cause spontaneous ignition.

Although it is not technically spontaneous combustion, a problem also occurs when small sparks fly into the dust-collection bag. These sparks, which are often caused by abrasives striking nails, can cause a fire to begin smoldering, not visible until minutes or hours later. For this reason, all nails should be set prior to sanding. This will also help prevent damage to the machine.

Sanding dust should be disposed of safely. Keep an eye on the dust-collection bags on all equipment. Empty the bags often in a proper container. Also, always empty dust collection bags before transporting the machine or leaving the job site — even if you're just leaving for a short time.

Always remove dust receptacles from the job site at the end of every day and dispose of them in the proper manner. For that matter, it's a good idea to remove dust receptacles any time you leave the job site for any length of time.

Refinishing old floors poses additional safety issues. See page 12 for a more thorough discussion of precautions you should take.

Another important safety issue involves the proper operation of the sanding machinery. The following safety guidelines should be adhered to:

* Proper electrical connections are essential. Refer to local electrical codes and to manufacturers' guidelines for each piece of equipment.
* Read the warnings and operational instructions that are provided by the manufacturer of each sanding machine.

***Spontaneous ignition:** The owner of this van learned the hard way what can happen if sanding dust is not disposed of properly. Dust-collection bags should be emptied into a proper container before transporting a sanding machine — and before leaving the job site, even for just a short time.*

* Eye, ear and respiratory protection devices as required by OSHA.
* Safe work shoes (with laces tied) are important.
* Make sure you are always in complete control of all equipment.
* Keep electrical cords away from machines' moving parts. Also keep cords out from underfoot and off your shoulders, since electrical cords can be the cause of injury. Use the manufacturer's recommended apparatus for proper cord control.
* Unplug all machines when you are repairing or adjusting them, or when changing abrasives.
* Smoking should be prohibited at the job site.

JOB-SITE ENVIRONMENT

Before sanding either a new wood floor or an existing one, make sure the interior environment is at "normal living conditions." Check the moisture content of the wood floor before you begin sanding to ensure that it is within the normal range for that environment. Record the moisture content. You can use that moisture content for comparison later, when you are checking moisture content between coats of water-based finish.

A more detailed discussion of proper moisture conditions can be found in the National Wood Flooring Association's Technical Publication No. A100: ***Water and Wood***. For information on obtaining a copy of that publication, contact NWFA at the address indicated on the back page of this publication.

Safety begins with your apparel and personal equipment. That means eye, ear and respiratory protection, safe work shoes and — for work that requires extensive time on your knees — knee pads.

PREPARATION AND INSPECTION

Walk the Floor/Make Necessary Repairs

Before sanding, the floor should be swept and inspected carefully. The floor should be properly fastened or adhered to the substrate before sanding begins. Also, protruding nails should be countersunk.

Dust Containment

While dust cannot be completely eliminated from the sanding process, the flooring professional should take steps to minimize the dust.

It is especially important in remodeling work, but also necessary on many new-construction jobs, to seal off the area with plastic. If possible, use a fan to exhaust dust from the working area. All doorways should be sealed off. On some jobs, you may also want to protect the wall coverings and ceilings. If light fixtures are covered, the bulbs should be removed to prevent a fire hazard should someone turn on the lights.

There are a variety of ways to hang plastic to seal off the area. Do not use fastening methods that will damage paint and wall coverings. Tape as much as possible to door jambs instead of wall paint, and never tape to wall coverings such as wallpaper. Always check in an out-of-sight place that the tape will not cause damage. Also, protect other floor coverings from wood dust. In the doorways you must pass through, overlap plastic for an extra barrier.

Be sure to protect HVAC (heating, ventilation and air-conditioning) openings. While you are sanding, you may want to shut off the HVAC system. However, some climates will necessitate that the HVAC system be run. In such cases, prefilter materials are available to cover HVAC returns. Check with a local HVAC contractor to determine which prefilter materials are appropriate. It is also essential to protect smoke and carbon-monoxide detectors, fire-alarm systems and elevator shafts, but remember to remove the dust protection before you leave the job site.

SANDING EQUIPMENT AND TOOLS

BASIC AND SPECIALTY EQUIPMENT AND SUPPLIES

The primary tools needed are a drum or belt floor sander, an edger sander, a buffer, a hand scraper, a sanding block and a variety of sandpaper and screen discs ranging in grit from coarse to fine, as well as a vacuum cleaner and broom.

Drum and belt sanders are similar, the difference lying in the way the sandpaper is mounted. On a drum sander, a sheet of sandpaper is wrapped around the drum and attached by insertion in a slot on the drum. A belt sander, as the name suggests, employs a continuous belt of sandpaper.

Edgers are hand-held rotary-disc floor-sanding machines used to sand around the perimeter of the room, as well as in closets, on stairs and in other small areas. Harder-to-reach places require the use of hand scrapers and sanding blocks.

The buffer, fitted with fine-grit screen or sandpaper discs, is used after the final cut — typically with the drum or belt sander — to blend the field and the edge.

A detailed discussion of sanding equipment can be found in the National Wood Flooring Association's Technical Publication No. A300: ***Tools of the Trade.*** For information on obtaining a copy of that publication, contact NWFA at the address indicated on the back page of this publication.

DRUM AND BELT SANDERS

The "big machines" — drum and belt floor sanders — are large, heavy, walk-behind (primarily electric) sanding machines designed for high production. They are usually available in widths of 8, 10 or 12 inches. All have integrated dust-collection systems. They are used for sanding wood over large, open areas, as well as removing old stain or finish.

BUFFERS, OSCILLATING MACHINES AND MULTI-DISC MACHINES

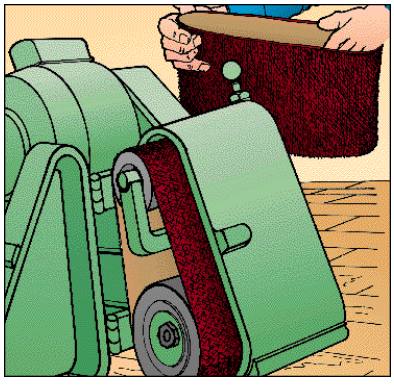
Buffers use circular sanding paper, screens, pads or polishing brushes — sizes vary from around 13 to more than 22 inches. They are walk-behind machines that abrade in a circular pattern.

There are also oscillating machines, which move in an elliptical pattern. Oscillating machines provide a less aggressive cut, but with more random abrasion patterns.

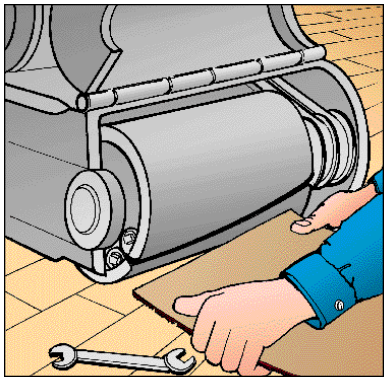
Another machine sometimes used in sanding hardwood floors is the three-disc sander. Also called a triplanetary sander, this machine is often used for fine finish sanding and for flattening floors. It has three perimeter discs that rotate in one direction around a main disc, which rotates in the opposite direction. Most three-disc sanders are also equipped with dust-containment systems.

Buffers for floor sanding run at low speeds, usually in the 175- to 375-rpm range, and are used for final sanding, screening, screening between finish coats, and low-speed buffing. Some models are designed for dedicated use as either sanders or polishers — be sure to match the machine with your main application. These machines are available with or without integrated dust-collection systems.

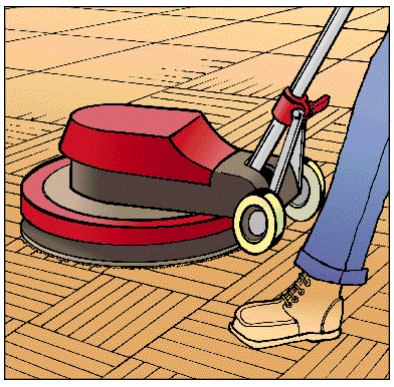
One of the primary uses of these machines is to blend drum or belt sander and edger marks to get rid of the "picture frame" effect around a room. Some finish manufacturers also recommend using buffer screens or pads after sealer or finish application to smooth imperfections and to lightly abrade the surface for better adhesion between coats. However, other finish suppliers recommend different methods. As always, rely on the recommendations made by the manufacturer of the finish you are applying.



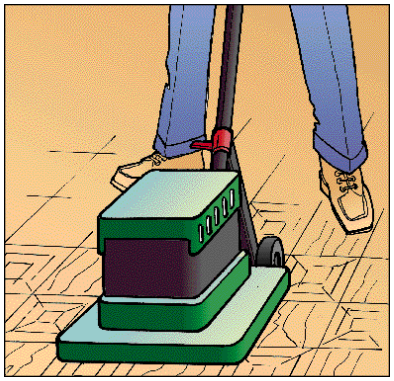
Belt sander



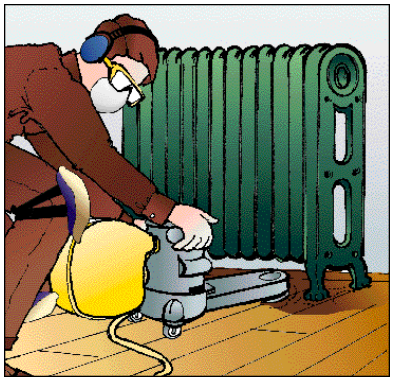
Drum sander



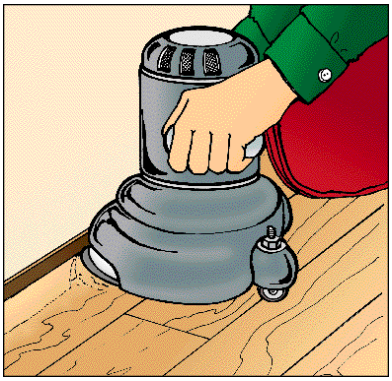
Buffer



Oscillating machine



Offset edger



Edger sander

Buffers can be difficult for beginners to operate. On start-up, they tend to "kick" to one side, usually the left. It's best to practice initially with a polishing pad in the middle of a large room. Start with the handle adjusted to waist height. You will notice that as you raise it, it will move to the right. And as you lower it, it moves to the left. An easy way to remember this is raise-right (R-R) and lower-left (L-L).

EDGERS

Edgers, or spinners, are small circular sanding machines designed to reach the areas where big machines can't. Several types of edgers are available, most consisting of a seven-inch shrouded disc connected to a motor. Two wheels on the housing hold most of the machine's weight; each is adjustable to vary the depth and angle of cut. The edger pad is set to hold the sandpaper disc at a slight angle to the floor.

The offset edger drives a disc offset from the motor, with a belt-and-pulley arrangement. This configuration allows reaching under difficult areas like cabinet toe kicks and radiators.

Some companies offer integrated dust collection for edgers, directly connecting a portable vacuum system to the edger to gather dust as it is produced.

Some edgers can be set to cut on the left, right or near center of the leading edge of the paper. Follow the manufacturer's recommendations for setting the edger.

DUST COLLECTION

Most standard sanding machines have dust-collection bags attached. This performs two functions: It collects large dust particles and also filters the air that passes through by catching the smaller particles on the inside of the bag. The key to keeping such machines performing optimally is permitting air flow through the system. That means that the bag should not only be emptied often, but cleaned, as well. Note: For best dust collection, the bag should be emptied by the time the dust reaches the line that says "full" — usually about halfway up the bag. If it isn't emptied by then, the dust-collection system will not function properly. Periodically, the bag should be turned inside-out and vacuumed to help remove the smaller particles that clog the bag's pores. Some manufacturers' bags can even be washed.

Several manufacturers have also introduced dust-containment systems. Some have vacuums mounted on top of the machines, others have hoses that attach to vacuums inside or outside the building, and still others can also attach to a vacuum strapped on the operator's back. There are dust-containment systems on the market for buffers, edgers and sanding machines, with some systems allowing the user to hook up two machines to a vacuum at once. For older machines, there are also retrofit options.

Regardless of how dust is collected, it must be disposed of safely. Contact local agencies for guidelines and directives on proper disposal.

MAINTENANCE OF EQUIPMENT

Proper maintenance will keep your equipment operating at peak efficiency and keep it operating longer. Perhaps just as important, it will prevent costly down-time when you can least afford it.

Keeping sanding machines properly tuned and adjusted also will help their vacuums perform optimally. Pulley belts that are loose will reduce air movement and inhibit dust collection, and can also cause chatter marks. Cleaning the machines out after every job by mechanically blowing out the motor and fan system with an air hose greatly reduces wear on the machines.

Maintenance practices vary among the different kinds of equipment, so follow manufacturers' guidelines.

Keep in mind that many repairs should be done by an authorized service center. Repairs performed by an unauthorized center may void your warranty.

Knowing the equipment and recommended service intervals will help keep your equipment running for years. There are nine primary areas to focus on: carbon brushes, dust bags, bearings, lubrication, sanding chambers, wheels, belts, pads and drum covers.

CARBON BRUSHES

Carbon brushes should be replaced after every 500 hours of use. The brushes are the pathways for electric current. Once the brushes are worn, the electric current will find the path of least resistance, causing a

short-circuit. Also check the brush spring — it keeps the pressure on the brushes, preventing arcing and premature wear of the armature. The big machines that have carbon brushes have a wear indicator. Inspect the motor brushes once a month and change all the motor brushes at the same time. Brushes must slide freely in the brush holder. Dust accumulated around the brush block must be cleaned out frequently. This prevents the brushes from sticking in an open position and keeps the motor from overheating.

MACHINE LUBRICATION

The machines come fully lubricated. Have the machine lubrication changed every year and inspected every six months. Remember that over-lubrication is as bad as under-lubrication. Ask your service center for the correct amount and the type of lubricants to use.

MACHINE BEARINGS

These are general guidelines for the maintenance of bearings. Follow the specific recommendations of the machine's manufacturer. With edgers, have the armature and pad driver bearings inspected after every 1,500 hours to ensure reliable service. Have the bearing replaced seasonally. Belt sanders need to be inspected according to the following schedule: Guide rollers every 650 hours; idler pulleys every 1,500 hours; dust fan shafts every 2,500 hours; arbor shafts every 5,000 hours; and motor shafts every 5,000 hours. Periodically check the guide rollers for wear. Drum sanders call for the following schedule: idler pulleys every 1,500 hours; fan shafts every 2,500 hours; arbor shafts every 5,000 hours; and motor shafts every 5,000 hours. A good rule is: Always keep an ear tuned to the sound of the machine. Any new or different sound is a sign of a bad bearing or wear in the bearing. If it remains unrepaired, a bad bearing can cause sanding irregularities. (See Troubleshooting Sanding Conditions on page 12.)

EDGER PADS

Inspect and clean edger pads before each job. An unbalanced or bent edger pad will cause gouging. Worn and improperly dressed edger pads also result in uneven sanding. A few edger troubleshooting tips:

Problem	Cause	Cure
Backup pad worn, uneven	Edger not adjusted properly	Replace pad
Backup pad gouged	Nails or staples hit while sanding	Replace pad
Bent edger pad	Edger damaged during transit	Replace pad
Center bolt won't hold paper tight	Grit and debris packed in hole	Drill out debris
Disc cutting only on outer edge	Improper wheel height adjustment	Follow manufacturer's setup instructions

SANDING DRUMS

Inspect and clean the sanding drum on split-drum or belt sanders before attaching sandpaper. Dust and debris on the drum will cause chatter marks. Gouged, grooved or badly damaged drum surfaces should be replaced. To prolong the life of a sanding drum, release the tension on the sandpaper or belt after every job, and leave sandpaper on the drum to protect it during transit.

SANDING CHAMBERS

Clean the sanding chamber once a week to prevent accumulation of debris, which can interfere with the performance of the dust-control system, the upper roller and contact wheel (drum). Cleaning the dust chamber also keeps the fan balanced, preventing vibrations that can cause chatter and imperfections in the floor.

WHEELS

Always inspect the wheels before you start any job. Debris on the wheels (grit, finish and stones, for example) can be left on the floor and also may cause chatter, wave and damage to the wood during sanding. When transporting the machine, lift it over stones and rough areas. After each grit or cut, clean the wheels, since grit can build up and cause the machine to cut unevenly. Keep the weight of the machine off of the wheels during storage and transportation. This prevents flat spots and prolongs the life of the wheels.

DRIVE BELTS

The best way to check drive belts is hands-on: If the belt feels rough, cupped, worn or grooved, it is bad. The most common problem with belts is letting the belts "take a set" — take the shape of the pulleys. During use, the belts become hot. If they are not loosened during a long shut-down (overnight or lunch), they can "take a set." This causes vibration and chatter. Tighten the belts before each use and always loosen the belts overnight or for any long-term idle period. Always use a high-speed belt per the manufacturer's recommendations. Most belts from a hardware store are for general use only, not high-speed. Belt tension is important. If it is too tight, the belt life will be short. If it is too loose, the machine can slip and vibrate. Check with your service center for correct belt tension.

Read the operator's manual. This is possibly the most important element in preventive maintenance. A poorly maintained machine can be costly.

DUST BAGS

Dust bags should be turned inside out, shaken vigorously, and machine-washed (if recommended by the manufacturer) in cold water to prevent pore blockage and loss of dust control. **Empty a dust bag when it is half full; never leave a dust bag unattended with sanding dust in it.** Sanding dust can ignite and cause injury or damage. Countersink all nails before sanding the floor — hitting a nail or staple while sanding can cause a spark, igniting a dust fire in the bag. Also, dust bags will eventually wear out and should be replaced periodically.

PROPER SANDING TECHNIQUES

THE BASICS

Floor sanding is something of an art and many veteran contractors have developed their own methods. Even though proper sanding procedures are somewhat subjective, the following are NWFA's recommendations:

When operating a sander, a mechanic should always keep the machine moving when the sandpaper is in contact with the floor, never allowing the sandpaper to come to rest in one spot with the drum or belt turning. The weight of the machine, combined with the speed of the drum or belt, will very quickly cut a drum mark in the floor that will be all but impossible to remove. Also, the operator must move the machine smoothly and evenly across the floor. For best results, the floor should be swept between all sanding cuts.

WHAT GRIT? HOW MANY CUTS?

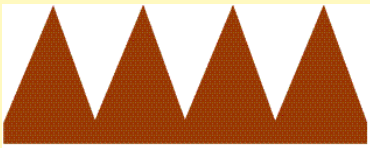
This is a critical area. Unfortunately, it is also one in which it is difficult to pinpoint specific recommendations, since there are a wide variety of circumstances

Diagram 1

CHOOSING THE PROPER SEQUENCE OF SANDPAPER GRITS

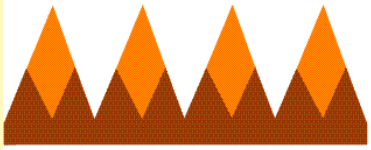
THE RIGHT WAY

When sanding a floor, use a coarse-grit sandpaper for the first cut, followed by a medium-grit paper and a fine-grit paper for succeeding cuts. Use only as coarse a paper as it takes to do the job — if you don't put a deep scratch in, you don't have to take it out. The drawing below shows what happens when the standard practice is followed.



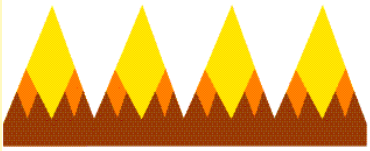
THE FIRST CUT

The initial sanding of the wood with a coarse-grit paper (grade 36, for oak, for example) creates deep scratches.



THE SECOND CUT

A medium-grit paper (such as grade 50) removes the deep scratches created by the grade-36 paper, leaving shallower scratches.

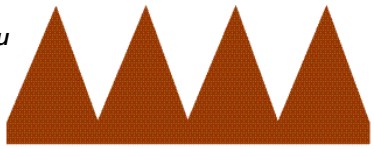


THE THIRD CUT

A fine-grit paper (grade 80, for example) then removes the shallower scratches left by the grade-50 paper. The resulting scratches, which are shallower still, should leave a surface that appears smooth.

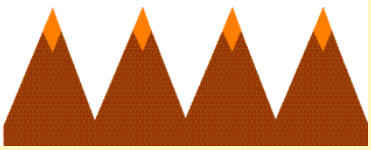
THE WRONG WAY

Do not skip more than one grade of sandpaper when you move from one sanding cut to the next. The drawing below shows what happens when you skip too many grades.



THE FIRST CUT

The initial sanding with a coarse-grit paper (such as grade 36) leaves deep scratches.



THE SECOND CUT

If you skip the medium-grit paper and jump all the way to fine grit, the paper will remove only the tops of the "peaks" left by the first cut. The deeper scratch marks will remain, resulting in a rough, unevenly sanded surface.

CHOOSE THE FINAL GRADE FIRST

In choosing a grit sequence, start with the finest grade you want to use (based on the finish manufacturer's recommendation) and work back to the coarser grades. For example, if the finish manufacturer recommends that you end with a grade-100 paper, the sequence you would use would be grades 40-60-100 (skipping only grades 50 and 80). If the manufacturer recommends that the final cut be made with a grade-80 paper, use a 36-50-80 sequence (skipping only grades 40 and 60).

SUGGESTED SANDING AND FINISHING SEQUENCE

	Floor in good condition	**Floor in rough condition**
Step 1:	Inspect, repair and clean	Inspect, repair and clean
Step 2: Belt/drum sander	Coarse-cut, 36- or 40-grit (Use only as coarse a grit as necessary to do the job.) Spot- or trowel-fill if necessary.	Diagonal coarse-cut 36-or 40-grit (If 36- or 40-grit loads up with old coatings, remove coatings with open-coat 12-, 16- or 20-grit, then sand with 36- or 40-grit)
Step 2a: Belt/drum sander		Straight coarse-cut 36- or 40-grit Spot- or trowel-fill if necessary
Step 3: Edger	Medium-cut 50- or 60-grit	Coarse-cut 36- or 40-grit
Step 4	Clean and sweep	Clean and sweep
Step 5: Belt/drum sander	Medium-cut 50- or 60-grit	Medium-cut 50- or 60-grit
Step 6: Edger		Medium-cut 50- or 60-grit
Step 7:	Clean and sweep	Clean and sweep
Step 8:	Spot- or trowel-fill if necessary	Spot- or trowel-fill if necessary
Step 9: Edger	Fine-cut 80- or 100-grit	Fine-cut 80- or 100-grit
Step 10: Belt/drum sander	Fine-cut 80- or 100-grit	Fine-cut 80- or 100-grit
	• Note: Some wood species (maple, for example) might require a 120-grit paper on the edger or belt/drum sander for the final sanding.	
Step 11:	Clean and sweep	Clean and sweep
Step 12:	Hand-scrape corners and inaccessible places	Hand-scrape corners and inaccessible places
Step 13:	Hand-sand perimeter and scraped areas, and/or use oscillating sander if stain is to be applied	Hand-sand perimeter and use scraped areas, and/or use oscillating sander if stain is to be applied
Step 14: (can be optional) Buffer	Fine-screen 100- or 120-grit (Check with finish manufacturer for screen-cut recommendation.)	Fine-screen 100- or 120-grit (Check with finish manufacturer for screen-cut recommendation.)

SUGGESTED SANDING AND FINISHING SEQUENCE (continued)

Step 15:	Clean and vacuum	Clean and vacuum
Step 16:	Apply sealer or stain-and-sealer	Apply sealer or stain-and-sealer
Step 17:	Use screen, fiber pad or steel wool, depending on the finish manufacturer's recommendations.	Use screen, fiber pad or steel wool, depending on the finish manufacturer's recommendations.
FOR SURFACE FINISHES:		
Step 18	Apply finish coat	Apply finish coat
Step 19	Use screen, fiber pad or steel wool, depending on the finish manufacturer's recommendations	Use screen, fiber pad or steel wool, depending on the finish manufacturer's recommendations
Step 20	Sweep, vacuum and tack	Sweep, vacuum and tack
Step 21	Repeat Steps 18, 19 and 20 as necessary	
FOR SEAL-AND-WAX FINISHES:		
Step 18	Apply second coat of sealer	
Step 19	Apply wax	
Step 20	Polish	

ABRASIVES GUIDE

TYPE	Abrasive Grades (GRIT) Grade No.	Symbol	USE
Open Coat	12	4½	Remove old coatings
	16	4	
	20	3½	
	24	3	
Coarse	30	2½	Fast cutting of uneven floors
	36	2	
	40	1½	
Medium	50	1	1st sanding — new
	60	1/2	2nd sanding — old
Fine	80	1/0	Final sanding
	100	2/0	New or old
Extra Fine	120	3/0	Very fine finish
	150	4/0	

PROPER SANDING TECHNIQUE FOR PLANK AND STRIP FLOORING

- *Sand in the direction of the flooring. If the machine is set up to cut aggressively on the right side of the drum, begin sanding on the left wall and move right. If the machine is set up to cut aggressively on the left side of the drum, begin sanding on the right wall and move left.*
- *Start the machine with the sanding drum raised off the floor. As you start forward, gradually lower the drum to the floor and continue moving forward. Before reaching the opposite wall, raise the sanding drum from the floor, then move backward over the same path, again lowering the drum and raising it when the pass is complete.*
- *On each sanding pass, move the machine no more than half the width of the drum or belt (4 to 6 inches), then repeat the forward and backward passes.*
- *When you have sanded two-thirds of the room, turn the machine in the opposite direction and sand the remaining third in the same manner, overlapping the two areas by 2 to 3 feet.*
- *The overlap area should be staggered every two or three passes.(See diagram below.)*
- *Sanding strip or plank floors is normally done either parallel or at a slight angle (7 to 15 degrees) to the direction of the boards, but never directly across the boards.*

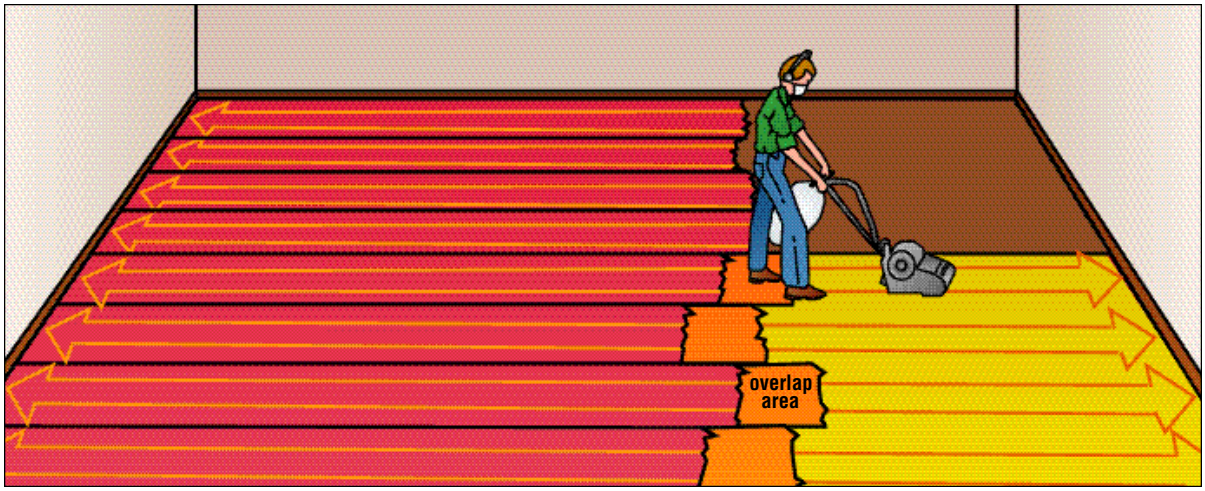


Diagram 2

and each may require a slightly different approach. The number of cuts and the grit sequence of sandpaper required to adequately sand a floor may depend on the species of the wood, the condition of the floor and the type of finish to be applied.

A properly sanded floor results from employing a sequence of cuts, using progressively finer grits of sandpaper. The purpose of the first cut is to flatten the floor as much as possible and — in the case of a previously finished floor — to remove old finish and stain. The purpose of succeeding cuts is to remove the scratches left by preceding cuts.

Recommendations tend to favor at least three cuts, followed by a final surface preparation with the buffer, especially if the floor is to be stained. The final surface preparation will use a fine-grit screen or sandpaper disc.

Standard practice dictates using a coarse-grit paper for the first cut, followed by medium-grit and fine-grit papers for succeeding cuts. (See Diagram 1.) In choosing the paper sequence, select the grade you want to use for the final cut (based on the finish manufacturer's recommendations), then work back to the coarser grade, skipping no more than one grade per cut. Don't make the mistake of skipping more than one grade in the sanding sequence. When that happens, the finer-grit paper is often unable to remove the scratch marks left by the previous cut.

One further variation: When resanding an old floor, the number of cuts and the grit of paper used may be affected by the condition of the floor, the type of finish to be removed and the thickness of the boards. (See page 12 for specifics on resanding old floors.)

SANDING TECHNIQUE

Before beginning, you should know whether the sanding surface (drum) of the machine is set up to cut from the the right or the left. (See Diagram 2.) If the machine is set up to cut aggressively on the right side of the drum, begin sanding on the left wall and move right. If the machine is set up to cut aggressively on the left side of the drum, begin sanding on the right wall and move left.

Sand in the direction of the flooring. Start the machine with the sanding drum raised off the floor. As you start forward, gradually lower the drum to the floor and continue moving forward. Before reaching the opposite wall, raise the sanding drum from the floor, then move backward over the same path, again lowering the drum and raising it when the pass is complete. On each sanding pass, move the machine at least 2 inches, but no more than half the width of the drum or belt (4 to 6 inches), then repeat the forward and backward passes.

When you have sanded two-thirds of the room, turn the machine in the opposite direction and sand the

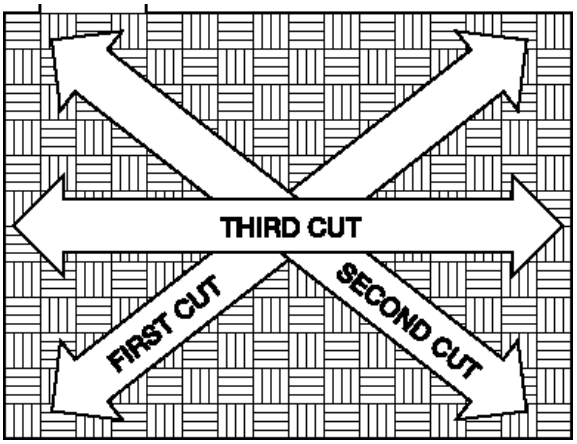


Diagram 3

When sanding a surface where grain patterns differ (a parquet pattern, border or inlay, for example), cut at a 45-degree angle to the floor in two directions. You must also make a third cut along the room's longest dimension, and you may also make a fourth pass, using a floor polisher and hard plate. Remember to use a progressively finer grit for each cut. (See Diagram 1.) Extra hand-sanding work may also be required.

remaining third in the same manner, overlapping the two areas by 2 to 3 feet. The overlap area should be staggered every two or three passes. (See Diagram 2.)

Sanding strip or plank floors is normally done either parallel or at a slight angle (7 to 15 degrees) to the direction of the boards, but never directly across the boards. A diagonal cut is especially effective if the floor is uneven. If the first cut is diagonal, the second cut should be parallel to the boards, with the same grit paper used on the first cut.

SANDING PARQUET

For parquet floors, the first cut should be on a diagonal to the majority of the grain, and the second cut should be on the opposite diagonal. A third cut, if needed, should be parallel to the majority of the grain. (See Diagram 3.) The next surface preparation should be hard plating with a buffer, using a fine-grit paper to remove cross-grain abrasion patterns. The final surface preparation will be screening. (For more on sanding patterned floors, see "Specialty Floors" on page 13.)

TROUBLESHOOTING SANDING CONDITIONS

Floor sanders may sometimes encounter sanding imperfections known as chatter marks. Chatter marks are defined as consistent sanding imperfections across the grain of the wood, varying from ¼ inch to 1 inch apart. Most chatter marks result from the drum being damaged or out of balance. Other causes include worn belts or bearings; out-of-balance dust fans; damaged wheels or wheels with dirt or other debris embedded; improper paper installation; improperly stored abrasives; and inadequate power-supply connections.

Heavy chatter marks can be removed by cutting on a diagonal with a repaired and/or properly functioning machine. Minor chatter marks can be removed by using a hard plate with a finer-grit sandpaper disc.

Other sanding imperfections are called waves — which are best described as two or more "upsets" in a wood floor, occurring along the direction of travel of a big machine. Waves in wood floors are generally 1 to 6 inches from peak to peak, and should not be confused with chatter marks, which we have noted are generally less than 1 inch apart. Waves have a defined, but smooth peak and valley, and they tend to become worse and increase in number as more passes are made over them with a sander. Waves are most obvious after a finish is applied and a low angle of light is cast on the floor. Waves can be eliminated by slowing down, and by cutting in the direction recommended by the sanding machine manufacturer (left to right or right to left), and by cutting at a 7- to 15-degree angle on strip and plank flooring. Some floor sanders will also hard plate the floor to remove waves. (See "Hard Plating," p. 12.)

EDGING

On all floors, after each of the first two cuts with a big machine, the edger sander should be used to sand along the baseboards and in closets, corners and other areas where the drum or belt sander could not reach, using a similar progression of grits. (See Diagram 4.) The edger

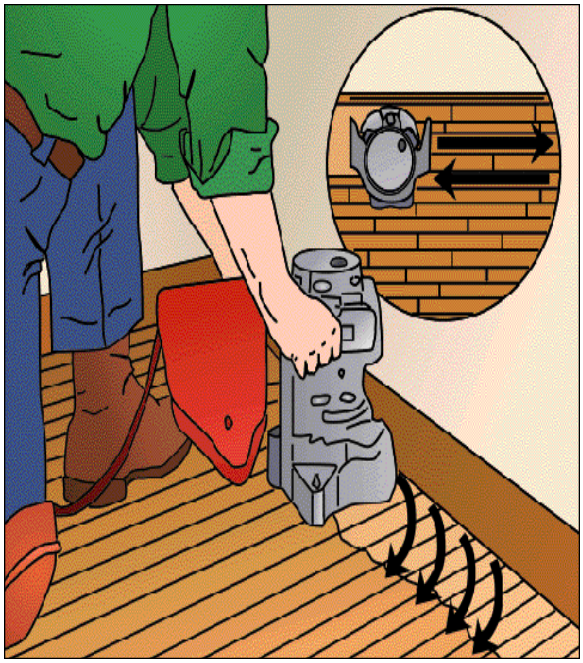


Diagram 4

The most effective way to use the edger is to cut cross-grain first to flatten the floor, then move it in a circular or orbital fashion along the wall, as much as possible in the direction of the grain, edging from the wall to the field.

should also overlap into the drum- or belt-sanded area. The most effective way to use the edger is to cut cross-grain first to flatten the floor, then move it in a circular or orbital fashion along the wall, as much as possible in the direction of the grain, edging from the wall to the field. As with the drum or belt sander, care should be taken to keep the machine moving to prevent gouges. Some professionals also recommend using a backup pad as an edger cushion to minimize marks. Even when done with care, however, the edger may leave swirl marks and these can be eliminated by hand sanding or scraping.

Never apply pressure or "bear down" on the edger to produce extra cutting power. This is not only hard on the machine, it also results in unsightly "dish" markings in the floor.

SCRAPING

Hand scraping and hand sanding of areas not reached by the edger should also be done before final surface preparation. Scrape in the direction of the grain whenever possible. Follow this by hand sanding with a sanding block to help blend the scraping marks in with the rest of the floor.

Perhaps the most difficult aspect of sanding is achieving a consistent sanded surface throughout the entire floor. The most obvious error is called "picture framing," which occurs when the edger-sanded areas around the perimeter are inconsistent with the drum- or belt-sanded areas in the center. Often, this will not show up until after the stain and/or finish are applied, but the effect is, as the name implies, that the room has been "framed" with a different color.

There are a variety of ways to avoid this problem. To begin with, hand sanding along the overlap can help blend the two areas together. Also, the buffer, fitted with a screen or sandpaper disc, can help smooth out any inconsistencies across the floor.

REFINISHING OLD FLOORS

Procedures for resanding an existing floor are much the same as those described above, but there are some variations. In most cases, you will want to remove the base shoe moldings in order to sand as close as possible to the baseboards. Also, you need to remove staples and tacks protruding from the floor and you may need to repair or replace damaged boards.

Before sanding old floor finishes, paints or adhesives, check to be sure they are not lead- or asbestos-based. If the finish, paint or adhesive contains lead or asbestos — or if you are not sure — do not sand the floor unless you first contact local authorities for proper abatement procedures.

Other differences have to do with the type of flooring to be refinished. Solid ¾-inch flooring, for example, can be sanded and refinished a number of times without problems. However, caution should be exercised with thinner flooring and with engineered flooring. In any case, remove as little of the wood as necessary to provide a satisfactory surface for refinishing. Always start with the least aggressive sandpaper that will do the job. If unsure of the thickness of the flooring, remove a heat vent or find another area where the thickness can be measured.

If the finish coat to be removed is very thick or the floor has been painted, sandpaper may load up. In these cases, a very coarse "open coat" paper may be necessary for the first cut. Once bare wood is reached, the usual grits of sandpaper can be used for the final cut or cuts. The number of cuts needed will depend on the condition of the floor.

In general, factory-finished floors can be resanded and refinished the same as floors that were originally sanded and finished on-site.

Any floor that has ever been waxed will be difficult to convert to a non-wax finish, since most finishes will not bond properly to a waxed surface. Sanding may not be sufficient, since it's possible that wax may have penetrated into side and end joints, and may contaminate the finish. In many cases, the best solution is to maintain the floor as a waxed surface.

FILLING

Small cracks and nail holes should be filled, except perhaps in floors that are likely to move a lot with foot traffic. Some fillers should only be applied before the final cut. Others may be used at any time in the process, even before sanding begins. As always, follow the filler manufacturer's recommendations. Some contractors use a commercial wood filler that is compatible with the stain and finish to be applied, while others prefer to mix their own filler, using wood dust from the sanding process to create a paste that can be troweled into the cracks and holes.

Remember to vacuum after each step on the job. After the final surface preparation is completed and before any stain or finish is applied, the room should be cleaned, swept and vacuumed, removing dust from all surfaces.

HARD PLATING

Hard plating is a process often used to flatten a floor. The process employs a buffer, fitted with a hard plate and a sanding disc — but without a driving or backing pad. Hard plating is also sometimes used to sand areas where grain changes direction, or where wood species of different density are adjacent to one another. Hard plating can help prevent "dishing out" in these instances.

SCREENING

Screening is somewhat similar to hard plating, but its purpose is to remove abrasion patterns left by previous sanding cuts. Part of the final sanding process, screening employs a buffer, fitted with a hard plate or a pad driver, along with a driving or backing pad and abrasive screen.

SPECIALTY FLOORS

Sanding and finishing ornamental wood floors requires the consideration of several additional factors that do not apply to the finishing of strip or plank flooring. Ornamental floors tend to have intricate patterns and different species of wood, stone and even metal. Some considerations are:

- Frequently, the wood grain does not run in the same direction.
- The use of different media (wood, stone and metal, for example) will place materials of varying hardness and density next to each other. (For more information on how various species differ in hardness, see NWFA Technical Publication A200: ***Wood Species Used in Wood Flooring***. For information on obtaining a copy of that publication, contact NWFA at the address indicated on the back page of this publication.)
- Different species and non-wood materials may react differently to sanding, stains and finishes.

Therefore, specialized sanding procedures and additional labor will be required when sanding and finishing floors that include multiple species of wood and those that include mixed media.

VARYING GRAIN DIRECTION, HARDNESS AND DENSITY

Where wood grain does not run in the same direction, different sanding procedures must be employed to ensure that the action of the abrasive does not make the surface uneven.

A large drum or belt sander cuts in only one direction. When sanding with the grain of the wood, a drum or belt machine does not cut as aggressively as it does when it is sanding across the grain.

When sanding a surface where grain directions differ or where species of different density are next to one another, a drum or belt machine will dig into ("dish out") the cross-grain or softer wood areas and leave the harder woods or areas cut with the grain smoother and higher.

To overcome this, cut at a 45-degree angle to the floor in two directions — the same as you would with a parquet floor. A third cut along the long dimension of the room must also be made, and you may also make a fourth pass, using a buffer and hard plate. Extra scraping and hand-sanding work may also be required.

In choosing the grits of sandpaper to use, consider that softer woods should be sanded with a finer-grit paper. Therefore, choose the paper you need for the least-hard material in the floor.

SANDING METALS

When sanding brass or other metals with a drum or belt sander, be aware that the metals will dull the abrasive, causing streaks in the sandpaper, which will show up in the wood.

Caution must be taken when using an edger not to overheat the metal, which can burn the adjacent wood. If metal is protruding above the surface of adjacent wood, sand it flush with an edger using 50- or 60-grit paper.

Sand at short intervals and move to different areas, allowing the metal to cool. Otherwise, the metal will expand and break the bond between the mastic and wood. Even splined joints between wood and metal may fracture if the heat becomes great enough.

STONE INSETS

Stone and marble insets may or may not be sanded with the wood flooring. Often a plywood blank will be inserted in place of the marble or stone during the sanding phase. Once the sanding is completed, the blank will be removed and the marble or stone inset put in place.

Certain marbles can be sanded and finished at the same time the wood flooring is sanded and finished. The sanding process will remove the look of the prepolished marble, so samples should be submitted to and approved by the customer.

REFINISHING

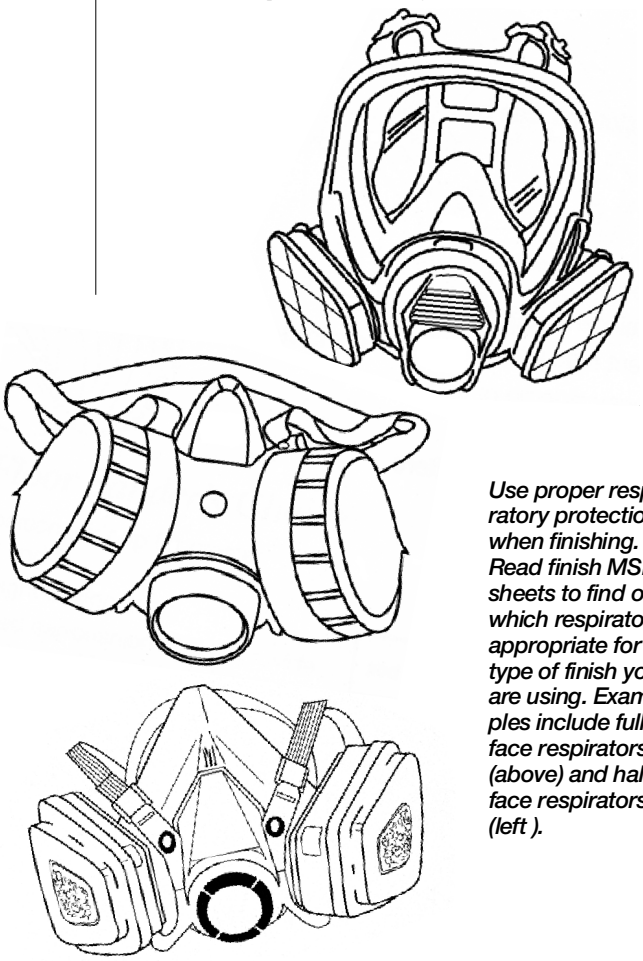
Refinishing wood floors that include multiple species, varying grain direction or mixed media usually requires a lot of detail work, including scraping and hand-sanding. It should only be tackled by those with a good deal of experience with such projects, or with the supervision of someone who has such experience.

SECTION 2: FINISHING

SAFETY

Before contractors even consider going out to stain, seal or finish a wood floor, it is imperative that they be aware of the safety issues involved. Besides being a vital health issue, following safety regulations is also required by law. Failure to comply can cost a contractor thousands of dollars in fines.

The **Occupational Safety and Health Administration (OSHA)** has rules and regulations that aim to protect the safety of workers on the job site. The rules may vary according to whether the job is residential or commercial, and requirements are also different for home owners and professionals. Check the OSHA requirements in your area.



Use proper respiratory protection when finishing. Read finish MSDS sheets to find out which respirator is appropriate for the type of finish you are using. Examples include full-face respirators (above) and half-face respirators (left).

It is mandatory that there be **Material Safety Data Sheets (MSDS)** present wherever hazardous materials are used or transported. These sheets are issued by manufacturers and provide the contractor with a list of hazardous characteristics of each material. They also detail emergency procedures should an accident occur. Read them thoroughly — although MSDS sheets must contain certain information, they do not have a standard format and can be confusing.

Part of the mandatory information in an MSDS sheet is required safety gear when using the material. For most finishes, eye protection, rubber gloves and respirators are recommended. Be sure to check the regulations for the specific product you are using. In general, you should avoid contact of finish with any exposed skin, and always avoid breathing finish vapors.

VOLATILE ORGANIC COMPOUNDS (VOCs)

Among many other consumer products, hardwood floor finishes contain Volatile Organic Compounds. VOCs that are released into the air react with oxides of nitrogen and sunlight to form ground-level ozone.

In August 1998, the U.S. Environmental Protection Agency approved a national standard for VOC emissions in architectural coatings, including floor finishes, to take effect in September 1999. The standard calls for a VOC limit of 450 grams per liter for most wood flooring finishes. (Traditional oil-modified finishes have about 550 grams per liter; water-based finishes contain about 250 grams per liter.) However, conversion varnishes have a VOC limit of 725 grams per liter (most are already within that limit).

In addition, the rule contains several clauses that will allow the sale of finishes that exceed those limits. There is a grandfather clause that allows manufacturers to sell non-compliant finishes that they have in stock before the standard takes effect, and there is also a “quart exemption” that allows manufacturers to sell non-compliant finishes in containers of one liter or less.

APPLICATORS

Although there are many types of applicators, not all types can be used with all types of finishes. Consult manufacturers' directions to be sure of which type to use and how exactly to use them. For general guidelines, consult the chart below.

Cut-in pads and small brushes are used for tight areas and edges.

Applicator bars or "T-bars" are long (12, 18, and 24 inches), thin cylinders with a removable sleeve or cover. They may be weighted or non-weighted. They have swivel handles with extension handles attached, and are used primarily with water-based finishes.

Lambswool applicators are natural or synthetic materials that are wrapped around wooden blocks with extension handles, predominantly used for applying solvent-based finishes.

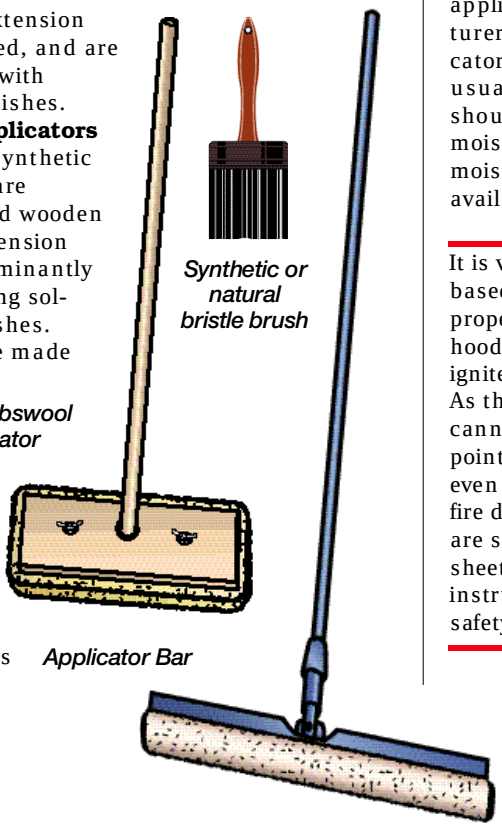
Brushes can be made from natural bristle, nylon bristle, foam or other synthetic products. Always check to see which specific types of brushes are appropriate for the finish you are using.

Rollers are made of synthetic materials or natural fibers, such as mohair.

Rags are used to apply stains. Clean, cotton, lint-free rags should be used.

Trowels/Joint Knives/Putty Knives without notches are used to spread some types of fillers, and some people use them to apply finish.

Squeegees are used to apply some fillers and finishes.



Applicator Maintenance

Finishers can save a lot of money over the long run if they take the time to clean and maintain their applicators. For oil-based products, most manufacturers recommend using mineral spirits for applicator clean-up. For water-based products, water is usually the recommended cleaner. Lacquer thinner should be used for conversion-varnish products; moisture-cure thinner or xylol should be used for moisture-cure finishes. Storage containers are available for some types of applicators.

It is vital that rags and steel wool soaked with oil-based products (especially stains) be disposed of properly. Wood floor finishers have lost their livelihood when their stain-soaked rags spontaneously ignited. Such rags need no ignition source to burn: As they dry, the oxidation gives off heat. If that heat cannot escape, the rags can reach their ignition point and burn. Rags tossed into a garbage can or even left in a pile may ignite. Check with your local fire department to find out what disposal methods are safe and legal in your area. Also check MSDS sheets and product labels for instructions. Common instructions say to place the rags in an approved safety container sold for this purpose.

APPLICATOR RECOMMENDATIONS

APPLICATOR TO USE	Oil-Modified Urethane	Lacquer Sealer	Varnish Sealer	Moisture-Cure Polyurethane	Shellac	Varnish	Wax	Stains	Water-Based Urethane	Bleach	Conversion Varnish
100 % LAMBSWOOL	X	X	X	X	X	X	X	X	X		X
SYNTHETIC LAMBSWOOL	X		X			X	X	X	X		
SYNTHETIC PAD/SLEEVE	X							X	X	X	X
RAG							X	X		X	
BRUSH	X	X	X	X	X		X	X	X (Synthetic)		X

STAINS

Stains are made of either pigments, dyes, or a combination of both. They change the color of the wood and also may seal it. Colors range from neutral to light browns, dark browns and pastels. Stains may be oil-based, water-based, or anilines.

OIL-BASED

Oil-based stains are the most widely used today. Contractors use them because they take a relatively long time to dry, which helps prevent lap marks.

Fast-dry oil-based stains contain some solvent other than mineral spirits, such as alcohol. Such solvents have a faster evaporation time and thus dry more quickly.

Some oil-based stains on the market are referred to as "penetrating" stains. In the wood flooring market, this means a high-viscosity (thicker) formula stain that also seals the floor. Such stains tend to give floors the appearance of more depth.

Application

To apply oil-based stains, use a recommended applicator (typically 100 percent cotton rags, lambswool applicators, or natural-bristle brushes). Apply the stain and allow it to penetrate for the recommended amount of time. Remove the excess by hand wiping with rags. Some manufacturers recommend burnishing the floor with fine steel wool, a white pad, 100 percent cotton rags or towels. This can help in the drying process and may reduce bleed back. Typical dry time is eight to 24 hours, *depending on job site conditions*, and possibly longer for darker pigmented and pastel stains.

WATERBORNE

Waterborne stains also dry through evaporation of a solvent — in this case, water. These stains are fast-drying. Because they are fast-drying, you may be able to coat over water-based stains in a few hours, depending on job-site conditions and the finish to be used.

Application

Waterborne stains should be wiped on and off with clean cotton rags, working with the grain. Apply small areas at a time, taking care to wipe the stain off thoroughly and quickly. Areas with too much stain may show lap marks. Lapping may occur due to rapid dry time, and the stains may raise the grain. Typical dry time for water-based stains is 1 to 3 hours, depending on job site conditions.

ANILINE DYE

These colors are made from aniline oils or coal tar derivatives. Aniline dyes are made in different grades to be soluble in water, alcohol or oil-based solvents, and are called water colors, spirit colors and oil colors, respectively. They provide intense color but tend to fade quickly, and are difficult to apply because of their extremely fast dry times.

GENERAL STAINING TIPS

- Make sure the floor is clean before applying any stain.
- A stain is only as good as the sanding job underneath it — stain will emphasize irregularities such as edger marks, chatter marks, picture framing, scraping marks and abrasion patterns. It will also highlight problems from skipping too many sandpaper grits.
- "Popping the grain" by lightly moistening the wood and letting it dry (confirm dryness with a moisture meter) before the stain is applied allows the stain to penetrate more, making the stain appear more intense.
- A finer grit of sandpaper used before staining will leave the wood surface smoother, making the stain color appear lighter than if a coarser sandpaper grit is used.
- Stains must by completely dry before a coat of sealer or finish is applied.
- Stains take differently with different species of wood — make samples to ensure the desired color and, if possible, make samples on the actual job site.
- Highly pigmented stains, e.g., white, pastel, mahogany or ebony, can take substantially longer to dry than other stains.
- Some wood species such as maple and pine are difficult to stain because they do not accept stain uniformly.
- Some stain colors are not compatible with water-based finishes.

BLEACHING

Bleaching will not turn a wood floor white. Rather, it reduces variations in color without obscuring the grain pattern. The process damages the fiber of the wood and changes the existing color of the wood — red oak will lighten to a pink cast, while white oak will take on a greenish cast. Many water-based finishes are not compatible with a previously bleached wood floor.

Use only bleach specifically formulated for wood flooring. Because bleaching raises the grain of the wood, sanding with fine paper or buffing may be necessary to restore a smooth surface. Use a system of compatible bleach, stain and finish. Before using different products, check with the manufacturers for compatibility, and do a test area in an inconspicuous place. Always use nonambering products, and be aware that most wood fillers cannot be bleached.

The bleach must dry completely and the wood must return to its original moisture content before a white stain or other finish is applied.

SEALERS

Sealers are finishing materials applied with the primary purpose of reducing the absorption of succeeding coats, allowing the succeeding coats to build up.

OIL-MODIFIED SEALERS

Oil-modified sealers are similar to a regular topcoat finish with a much lower solids level. This lower-solids formula has more mineral spirits, allowing it to penetrate the wood more. Most oil-modified sealers have a solids content between 30 and 35 percent (a typical oil-modified topcoat has a solids content between 40 and 50 percent.)

Some "fast-dry" oil-modified sealers are available. Instead of containing mineral spirits (which dry relatively slowly) as their solvent, these sealers typically contain a faster-drying solvent. In addition, some additives that quicken the drying process are available. (Always check with the manufacturer before using such a product.)

Application

Always follow the finish manufacturers' recommendations and consult MSDS sheets for appropriate respiratory protection.

Turn off open flames (including pilot lights and electonic ignition systems) and shut off HVAC systems, if recommended. Make sure the room is within the recommended temperature and humidity ranges. Sweep, vacuum and tack the floor thoroughly and block off any direct sources of sunlight hitting the floor.

Stir the finish well, but not so much as to create bubbles. Pour the sealer into a tray or bucket and use a recommended applicator to apply the sealer. Lambswool applicators, brushes, rollers and T-bars are among the most common applicators used for oil-modified sealers.

Begin the application along one edge of the room in the direction of the flooring. Cut in at the wall. Remove the excess sealer from the brush and apply liberally with smooth, even strokes along the grain. Overworking can both produce bubbles and splatter. Work in a path narrow enough to keep a wet edge, and lap strokes back into the area just covered. If using a lambswool applicator, remove the excess finish and then apply across the strip direction or pattern direction in short strokes. Straighten the cross strokes with a single sliding stroke along the strip direction, feathering into the previously applied wet area. Again, always maintain a wet edge. Follow the recommended coverage rates. Sealers that are too thick or too thin can negatively affect the finish's appearance and performance.

BEFORE YOU BEGIN SEALING OR FINISHING THAT FLOOR...

- ❑ Did you check the moisture content of the floor and record it in your job site notes?
- ❑ Did you block off all direct sources of sunlight hitting the floor?
- ❑ Is the HVAC system turned off? If not, are the HVAC openings blocked with filters to prevent debris from blowing into the room and onto the wet finish?
- ❑ Did you block off all access to the area in which you're working so that home owners or other workers will not walk onto the wet finish?
- ❑ Are all children and pets contained?
- ❑ Is the floor sanded as perfectly flat as possible?
- ❑ Did you sweep, vacuum and tack the floor so that remaining grit will not be trapped forever in the finish? (Tack the floor by wrapping a clean, lint-free rag around the head of a broom or applicator and running it over the floor.)
- ❑ Are the bottoms of your shoes as clean as possible?
- ❑ Did you read the finish manufacturer's directions?
- ❑ Do you know what the recommended coverage rate is for the finish you're using?
- ❑ Are you using a recommended applicator for the type of finish you have?
- ❑ Is the applicator lint-free and clean?
- ❑ Are you wearing the appropriate respirator?
- ❑ Do you have a plan for how to get out of the room without walking across your wet finish?

Missed spots or skips can be retouched if the sealer has not begun to skin over. Follow manufacturers' recommendations for drying times. The entire floor must be dry before it can be abraded. The finish is not dry if it doesn't powder upon abrasion.

After abrading, vacuum thoroughly and tack the floor with a cloth lightly dampened with mineral spirits or water, depending on the finish used. Let the floor dry completely and apply the next coat. Always abrade between subsequent coats.

WATER-BASED SEALERS

Chemically speaking, most waterborne sealers break down into three categories: acrylic, urethane and acrylic/urethane blends. Both are available as single- or two-component products. Some waterborne sealers (both acrylic and acrylic/urethane blends)

are two-component sealers, meaning that a catalyst, or a "cross linker" is mixed into them on the job site. **Cross linkers should be for professional use only.**

Most waterbased finish manufacturers recommend using the "system" approach, that is, using their recommended sequence of "matched component" products for each step in the finishing process to ensure compatibility.

Application

Always follow the finish manufacturers' recommendations and consult MSDS sheets for appropriate respiratory protection.

Shut off HVAC systems, if recommended. Make sure the room is within the recommended temperature and humidity ranges. Sweep, vacuum and tack the floor thoroughly and block off any direct sources of sunlight hitting the floor. Take moisture-content readings at various points around the room.

Carefully mix the sealer before using, and follow directions for adding a catalyst/crosslinker if necessary. If pouring the sealer into a different container, use a non-metal tray or bucket. Use a recommended applicator to apply the sealer. The most commonly used applicators for water-based sealers are nylon brushes, paint pads, and weighted or non-weighted bars.

If using an applicator bar to apply the sealer, use the "snowplow" method for application. Pour a small stream of sealer along the starting wall. Using a clean applicator predampened with water, draw the applicator forward, with the grain of the wood, moving the sealer toward the opposite wall. Do not put pressure on the applicator; merely pull it across the floor. Keep the head of the applicator at a "snowplow" angle, directing excess sealer toward an unfinished area. At the end of each stroke, turn the applicator toward you and pad out the applicator parallel to the wet edge. Remember to feather out all turns, taking care to avoid drips. As the sealer is used, repour a line of sealer and continue.

If using a pad or nylon brush to apply the sealer, begin the application along one edge of the room in the direction of the flooring. Cut in at the wall. Remove the excess sealer from the pad or brush and apply liberally with smooth, even strokes along the grain. Overworking can both produce bubbles and splatter. Work in a path narrow enough to keep a wet edge, and lap strokes back into the area just covered. If using a lambswool applicator, remove the excess finish and then apply across the strip direction or pattern direction in short strokes. Straighten the cross strokes with a single sliding stroke along the strip direction, feathering into the previously applied wet area. Again, always maintain a wet edge.

Follow the recommended coverage rates. Sealers spread too thick or too thin can negatively affect the finish's appearance and performance.Check the floor for dryness with a moisture meter (use readings taken prior to sealing as a reference). The entire floor must be dry before it can be abraded or a subsequent finish coat can be applied. Take caution when abrading the sealer coat. Sealers that are not dry may cause screens or pads to load up.

OTHER SEALERS

Linseed and Tung Oil These products form the basis for most oil-based stains, but are rarely used alone today as sealers.

Lacquer and Shellac Although not recommended as a floor finish, lacquer and shellac are still commonly used as sealers in some regions because of their fast dry times — typically 15 minutes for lacquer and about 1 hour for shellac. Both products are extremely flammable.

The snowplow method of applying water-based finish

FINISHES

OIL-MODIFIED URETHANE

Oil-modified finishes are a petroleum base with a blend of synthetic resins, plasticizers and other film-forming ingredients that produce a durable, moisture-resistant surface coating. These finishes are available in different sheen levels.

Some oil-modified finish manufacturers have developed products and packaging methods to be compliant with current Volatile Organic Compounds (VOC) laws. Oil-modified VOC-compliant finish formulations may take longer to dry.

Application

Always follow the finish manufacturers' recommendations and consult MSDS sheets for appropriate respiratory protection.

Turn off open flames (including pilot lights and electronic ignition switches) and shut off HVAC systems, if recommended. Make sure the room is within the recommended temperature and humidity ranges. Sweep, vacuum and tack the floor thoroughly and block off any direct sources of sunlight hitting the floor.

Stir the finish well, but not so much as to create bubbles. Pour the finish into a non-metal tray or bucket and use a natural-bristle brush, lambswool applicator, applicator bar or roller to apply the finish.

Begin the application along one edge of the room in the direction of the flooring. Cut in at the wall. Remove excess finish from the brush and apply liberally with smooth, even strokes along the grain. Overworking can both produce bubbles and splatter. Work in a path narrow enough to keep a wet edge, and lap strokes back into the area just covered. If using a lambswool applicator, remove excess finish from the applicator and then apply across the strip direction or pattern direction in short strokes. Straighten the cross strokes with a single sliding stroke along the strip direction, feathering into the previously applied wet area. Again, always maintain a wet edge. Follow the recommended coverage rates. Finish that is too thick or too thin can negatively affect the finish's appearance and performance.

Missed spots or skips can be retouched if the finish has not begun to skin over. Follow manufacturers' recommendations for drying times. The entire floor must be dry before it can be abraded. The finish is not dry if it doesn't powder upon abrasion.

After abrading, sweep, vacuum thoroughly and tack the floor with a cloth lightly dampened with mineral spirits or water. Let the floor dry completely and apply a second coat. Always abrade, vacuum and tack between subsequent coats.

It takes meticulous preparation and application to complete a beautiful wood finish job.

WATERBORNE URETHANE

These finishes are a blend of synthetic resins, plasticizers and other film-forming ingredients that produce a durable surface that is moisture-resistant. These finishes are available in different gloss levels.

There are both one- and two-component waterborne finishes. While single-component finishes are ready to use right out of the container, two-component waterborne finishes need to have a catalyst, or a "cross linker" mixed into them on the job site. **Cross linkers should be for professional use only.**

Application

Always follow the finish manufacturers' recommendations and consult MSDS sheets for appropriate respiratory protection.

Shut off HVAC systems, if recommended. Make sure the room is within the recommended temperature and humidity ranges. Sweep, vacuum and tack the floor thoroughly and block off any direct sources of sunlight hitting the floor. Take moisture-content readings at various points around the room.

Carefully mix the sealer before using, and follow directions for adding a catalyst/crosslinker if necessary. If pouring the finish into a different container, use a non-metal tray or bucket. Use a recommended applicator to apply the finish. The most commonly used applicators for water-based finishes are nylon brushes, paint pads, and weighted or non-weighted bars.

If using an applicator bar to apply the finish, use the "snowplow" method for application. [See page 20] Pour a small stream of finish along the starting wall. Using a clean, predampened applicator, draw the applicator forward, with the grain of the wood, moving the finish toward the opposite wall. Do not put pressure on the applicator; merely pull it across the floor. Keep the head of the applicator at a "snowplow" angle, directing excess finish toward an unfinished area. At the end of each stroke, turn the applicator toward you and pad out the applicator parallel to the wet edge. Remember to feather out all turns, taking care to avoid drips. As the finish is used, repour a line of finish and continue.

If using a pad or nylon brush to apply the finish, begin the application along one edge of the room in the direction of the flooring. Cut in at the wall. Remove the excess finish from the applicator and apply liberally with smooth, even strokes along the grain. Overworking can both produce bubbles and splatter. Work in a path narrow enough to keep a wet edge, and lap strokes back into the area just covered. If using a lambswool applicator, remove the excess finish and then apply across the strip direction or pattern direction in short strokes. Straighten the cross strokes with a single sliding stroke along the strip direction, feathering into the previously applied wet area. Again, always maintain a wet edge.

Check the floor for dryness with a moisture meter. (Compare the readings to the moisture content before the finish was applied.) The entire floor must be dry before it can be abraded or a subsequent coat can be applied. Manufacturers' recommendations vary on whether the floor should be abraded after the first coat. Some recommend abrading after the first coat to cut down grain raise, while others recommend applying a second coat without abrading. When abrading a water-based finish, always use fiber pads or screens per manufacturer's recommendations (never steel wool).

After abrading, vacuum thoroughly and tack the floor with a cloth lightly dampened with water (do not use mineral spirits). Let the floor dry completely before applying another coat.

MOISTURE-CURE URETHANE

Moisture-cure urethanes cure by absorbing minute quantities of moisture from the air, which causes them to dry and harden. Relative humidity is critical to the curing process. These finishes are moisture-resistant and durable. **These finishes may be difficult to apply properly, and are best left to wood flooring professionals.**

Application

Always follow the finish manufacturers' recommendations and consult MSDS sheets for appropriate respiratory protection.

Turn off open flames (including pilot lights and electronic ignition switches). Turn off HVAC systems, if recommended. Sweep, vacuum and tack the floor thoroughly and block off any direct sources of sunlight hitting the floor. Use a moisture meter on the floor in several areas to ensure that the wood is within an acceptable moisture content. The finish should only be applied in areas with adequate ventilation. Make sure the room is within the recommended temperature and humidity ranges. Best results are obtained if the material, room temperature and floor are above 65 degrees Fahrenheit and the relative humity is over 50 percent. The finish may be difficult to apply if the humidity is over 75 percent.

Do not stir or shake the finish container. A clean, fine brush or lambswool applicator should be used to apply the finish. It is important that the recommended coverage rates be followed. Dry time for the finish is usually six to eight hours (depending on jobsite conditions).

CONVERSION VARNISH

Because of their national origin, conversion varnish finishes are often referred to as Swedish finishes, (Some water-based urethane manufacturers also call their products "Swedish" because of their origin.) Conversion varnish finishes (until recently, referred to as "acid cure" finishes) are durable and moisture-resistant. **Conversion varnish finishes may be difficult to apply properly and should be applied only by a wood flooring professional.**

Application

Always follow the finish manufacturers' recommendations and consult MSDS sheets for appropriate respiratory protection.

Turn off open flames (including pilot lights and electronic ignition switches) and shut off HVAC systems, if recommended. Make sure the room is within the recommended temperature and humidity ranges. All air flow sources, including windows, door and refrigerators, should be blocked off. Make sure the area is within the recommended temperature range. Sweep and vacuum the floor thoroughly and block off any direct sources of sunlight hitting the floor. Tack the floor with water or denatured alcohol.

Stir the finish well and pour it into a clean plastic container. Using a natural brush, lambswool applicator, or applicator-bar, follow the grain of the wood from wall to wall, being sure not to overwork or apply too thinly, which will cause the finish to set up too quickly and not allow full flow. Some manufacturers offer a product to add to the finish that can extend its open time and aid flow.

OTHER FINISHES

Wax Wax is one of the oldest floor finishes. It is applied in thin coats, typically following the application of a sealer and/or stain, and then buffed. Periodic rewaxing is necessary when buffing doesn't restore shine. Because liquids leave spots on wax finishes, wax is not ideal for applications such as kitchens. Wax is, however, one of the easiest finishes to topically mend. One of the most common problems with wax is people's tendency to recoat the entire floor without treating damaged areas separately. This leads to unnecessary wax build-up, while leaving the damaged area still looking worn.

Shellac Shellac is not recommended for use as a floor finish but is used occasionally to match old finish. Shellac may be coated with wax.

Varnish Varnish was commonly used before the introduction of urethane finishes, but it is rarely used today.

Lacquer Lacquer enjoyed only a short run as a popular floor finish. It is not recommended as a floor finish, but it is occasionally used as a sealer. It has an extremely low flash-point (the temperature at which a material will ignite if a spark or flame is introduced) of about 45 degrees Fahrenheit.

GENERAL FINISH TIPS

- Finishes must be completely dry before the floor is abraded and/or the next coat of finish is applied.
- High humidity, low temperature, lack of air movement or too much finish may all cause dry times to lengthen, depending on the finish. (High humidity will shorten the dry time for moisture-cure finishes.)
- Do not use the same applicator for applying sealers and topcoat finishes, even if they are from the same manufacturer.

FINISH PROPERTIES

PRODUCT	Respiratory Protection	Number of Coats	Drying Time	Color	Sheen	Odor	Flammability
Oil-Modified Urethane	Required	2–3	Slow	Amber	Satin to Gloss	Moderate	Combustible
Water-Based Urethane	Required	2–4	Fast	Clear to Amber	Satin to Gloss	Mild	Non-combustible
Moisture-Cured Urethane	Required	2–3	Slow to Fast	Clear to Dark	Satin to Gloss	Strong	Combustible to Flammable
Conversion Varnish	Required	2–3	Fast	Clear to Slight Amber	Satin to Gloss	Very Strong	Combustible
Wax	Optional	1-3	Fast	Slight Amber	Wax Luster	Mild	Combustible

FILLERS

Fillers are substances used to fill the holes and irregularities in wood surfaces, decreasing the porosity of the surface before finish coatings are applied. For many years, contractors made their own filler by combining wood dust with a solvent, such as lacquer, or by mixing wood dust with stain and buffing it into the floor. Today, most contractors use premixed fillers that come out of the container ready to use. There are several types of fillers; all are typically applied with a trowel or putty knife.

Grain filler has been used for many years to fill in the open pores of the wood. It is typically the last process before a light sanding with a screen or abrasive pad. Sanding grain fillers with sandpaper (by hand or with a machine) will reopen the pores of the wood, eliminating most of the effects of grain filling. Grain filler can also be used between finish coats to fill tiny cracks or fill open wood grain. Excess grain filler can be removed by lightly screening or abrading with a pad or with a rag/towel dampened with a compatible solvent.

Spot filler (also called "wood patch") is used for larger cracks or holes and for spot-filling during sanding. It may fill cracks, nail holes, gouges and broken edges. It usually dries hard, can be sanded and stained, and comes in a variety of colors. Spot filler may be water- or solvent-based.

Trowel filler is a thinner version of spot filler that is designed to spread across the entire surface of the wood floor before or during the sanding process. It may also fill cracks, small holes and pores of grain in the wood.

Latex filler is commonly used for filling small gaps and chips after floors have been finished. It is generally color-blended to match stains.

Colored Wax Pens are used for minor filling of finished floors. They are available in a variety of colors to blend with the stain. A topcoat finish cannot be used over wax.

Touch-Up Putty (painter's putty or oil putty) is typically used between coats of finish or after all finish is applied, depending on the manufacturer. It comes in a variety of colors and fills small areas, such as nail holes, that have been missed. It is often used with prefinished floors.

GENERAL FILLER TIPS

- Completely fill the hole or crack — otherwise the filler may pop out during or after sanding.
- Most water-based wood fillers cannot be bleached — check with the filler manufacturer.
- Loose floors will not hold floor filling compounds.

CUSTOM PAINTING

As consumers demand more creative options for their floors, painted floors have become increasingly popular. Nearly any effect can be achieved with paints, glazes, stencils or a combination of them all.

The most important step in creating a painted floor is the preparation of the floor for an incredibly smooth surface. The floor needs to be filled well and be sanded using a sequence of sandpapers from coarse to fine, not missing a grit and ending with a 120- or 150-grit paper. If the floor is to be painted, it should be sealed or stained and the first coat of finish should be applied. A floor that will have a custom stain detail should be sealed before it is stained. If acrylic glazes are to be used, use an oil-modified urethane. It is vital that a test sample be made with the actual wood of the floor to ensure that all finishes and paints will be compatible. Make sure in making a sample that the final finish is applied to the sample, as many finishes will amber and change the color scheme of the finishes and textures you are using. Also check with manufacturers for compatibility. When the desired effect is completed, it should be allowed to dry fully and should be coated with the desired number of topcoats (typically three or four coats). Have the painted floor inspected by a wood floor contractor every 12-18 months to check for finish wear, as it is very difficult to make repairs to the painted finishes if worn through.

Custom painting can be used to produce many special effects.

Game Lines For directions and specifications on painting game lines on athletic floors, contact the Maple Flooring Manufacturers Association (60 Revere Drive, Suite 500, Northbrook, IL 60062, phone: 847/480-9138, fax: 847/480-9282), and refer to finish manufacturers for proper paints and finish compatibility.

MAINTENANCE

Preventive maintenance for wood floors today involves protecting the finish from scratches, spills and moisture.

Customers who realize that their floors aren't impervious to an onslaught of spills, grit and water will be less likely to call back with complaints in the future. That means explaining proper maintenance. (The NWFA has a floor-care brochure available to members.) The key points to tell customers about maintenance include:

MAINTENANCE FOR ALL FLOORS:

• Follow manufacturer's recommendations if known.
• Install floor protector pads on the bottom of all furniture.
• Place protective rugs or mats at all entrances to the area. These rugs help trap grit and also absorb moisture before either one has a chance to damage the floor. These should be placed after the finish is fully cured.
• High heels should be kept in good repair — if they lose their protective cap, they will dent the surface of any floor.
• The floor should be swept, vacuumed and/or dust-mopped with a recommended hardwood floor cleaner regularly to remove dirt and grit, and rugs should be shaken out frequently. (Use only vacuums that have a special hard-surface setting).

URETHANE FLOORS:

• Most finish manufacturers do not recommend wet mopping.
• Never use a household dust treatment.
• Always use manufacturers' recommended cleaning products. If the manufacturer is not known, use a recommended hardwood floor cleaner available at local retail wood flooring stores.
• Never use wax on top of a non-wax surface finish.
• Wipe up spills immediately with a lightly dampened cloth, then follow up with a recommended cleaning product.
• For stubborn stains, lightly dampen a soft cloth with a manufacturer's recommended cleaner or a hardwood floor cleaner. Apply directly to the stain and repeat as necessary.
• Never use petroleum-based cleaners on waterbased finishes.
• When the floor loses its luster, it's time for a recoat.

ACRYLIC IMPREGNATED FLOORS:

These floors come in two types: those coated with urethane, and those that are not.
• Urethane-coated acrylic impregnated floors require routine sweeping, vacuuming or dust-mopping, as well as damp-mopping with a recommended cleaner.
• Non-urethane-coated acrylic-impregnated floors, typically used for commercial applications, should be swept, vacuumed or dust-mopped. In addition, however, they should routinely be buffed with a low-speed buffing machine and the appropriate cleaner. When the floor becomes dull, some manufacturers recommend that the floor be lightly screened, and a conditioning product and cleaner should be used.

WAX FLOORS:

• Never use a water-based cleaner on wax floors.
• Wipe up spills immediately with a dry cloth. This may dull the area, so buffing may be required.
• To remove white spots caused by water spills, use a fine steel wool and a small amount of mineral spirits. Rub gently in a circular motion until the spot is gone, then rewax the area and rebuff.
• When the floor loses its luster in heavy traffic areas, buff to a satin shine. When the buffing does not produce a shine, rewax only the dull areas. Note that too much wax causes the floor to scuff easily.

FACTORY-FINISHED FLOORS:

• Impress on your customers that they should use the cleaning products recommended by the flooring manufacturer — not doing so can void the floor's warranty.

One way to encourage customers to use the correct cleaner on their wood floors is to include the cost of the cleaner into the job with the initial bid, or at least offer it at the time you're finishing the job.

Another area where you need to be up front with customers is the recoat schedule. They'll be disappointed if they've been lead to believe that their floors will look brand-new forever. Take a proactive stance in this regard: Leave behind a recoating schedule. If the floor performs as you've said it will, the customer will feel confident calling you when it's time for a recoat. A simple postcard can be all the reminder a customer needs.

TROUBLESHOOTING FINISHES

Although many problems can result with the finish, the source is not necessarily the finish itself. Consult the following list for some of the most common problems and solutions. (If you have questions not covered here, members can call NWFA's technical hotline at 800/422-4556 in the United States, 800/848-8824 in Canada, 636/391-5161 local and international.)

Problem: Excessive and early wear

Often, the cause is improper maintenance procedures that have either failed to fully remove grit from the floor's surface, or the introduction of water or strong cleaners. Pet nails and chair legs also contribute to the problem. Institute proper maintenance procedures, including regular dust-mopping with an approved wood-floor cleaner. If recoating is necessary, the owner should pay for it.

Problem: Discoloration

Oil-modified finishes will amber in appearance and will yellow even further over time. Wood lying in direct sunlight will change color and lighten over time — a natural change. Ambering of oil-modified finishes cannot be prevented, despite the pervasive myth that an oil-modified finish recoated with waterbased finish will stop ambering. Shading the floor can minimize lightening. Wood also changes color through oxidation, a change that cannot be prevented.

Problem: Stains

Spilled water and other liquids, including the residue from improper cleaners, can stain finish. Cloudy surface finish can be fixed by lightly rubbing with a proper cleaner and buffing, although some stains require screening and recoating.

Problem: Alligatoring

This is a condition in which the finish pulls away from itself, causing ridges in the finish, similar to an alligator's skin. This condition can occur in both water-based and oil-modified finishes. There are many possible causes, including poor wetting of the finish, contamination of the finish, application under cold temperatures, application of a new coat before the previous coat has dried, application of a heavier coat than is recommended, or the use of thinners that cause the finish to dry too quickly. The solution is to screen and recoat after the finish has dried sufficiently.

Problem: Roughness

The cause is often contamination of the finish during dry time, although moisture can also cause the wood grain to rise. If a moisture problem is evident, this must be corrected before rescreening and recoating.

Problem: Uneven gloss levels

Insufficient mixing of finish prior to application, a contaminated finish applicator and uneven sanding or finish thickness are typical culprits. All require rescreening and recoating.

Problem: Sticky board syndrome

This occurs when excessive tannic acid or pH imbalance in the wood prevents the finish from adhering to the wood or curing properly. This is most common with oil-modified finishes and with white oak. When one board or several boards scattered throughout the floor will not take stain or finish, the most common solution is to repair the floor by replacing the boards.

Problem: Peeling/Bubbles

Bubbles and blisters in the finish usually mean that the floor was not screened or sufficiently cleaned between coats of finish, or that soap or some other contaminant was not removed before coating. Problems in the topmost finish coat can be screened and recoated, while cases of delamination require complete sanding and refinishing.

Peeling

Orange peel

Problem: Orange peel

If the surface of the finish has a texture that resembles an orange peel, the problem may have been caused by rolling a finish that is not designed to be rolled on, which then dries too quickly. When that happens, the texture is "frozen" into place before the finish has a chance to flow out and level. The solution is to screen and recoat.

Problem: Fisheyes

Called by many others names (crawling, cratering, holes, spots, flow marks), this condition is caused by one of two reasons. The first is contamination in the surface — the new coat "crawls" away from the wet or contaminated areas, giving the appearance of fisheyes when the finish sets. The second reason can be finish. If the can has sat undisturbed for some time and has not been properly agitated, a disproportionate amount of flow and leveling agents may be put on the floor, causing a fisheyed appearance. The solution is to screen and recoat.

Problem: Bleed back

This condition, associated with stain application, occurs when excess stain seeps from the grain or from the spaces between boards. The most obvious cause is excessive stain application, but high-viscosity or highly pigmented stain may also be the culprit. The solution is to wipe off the excess stain and let it dry thoroughly before applying another coat. If finish has already been applied over bleed-back, a complete resand is required. Trowel filling a floor can help prevent bleed back.

Problem: Application streaks

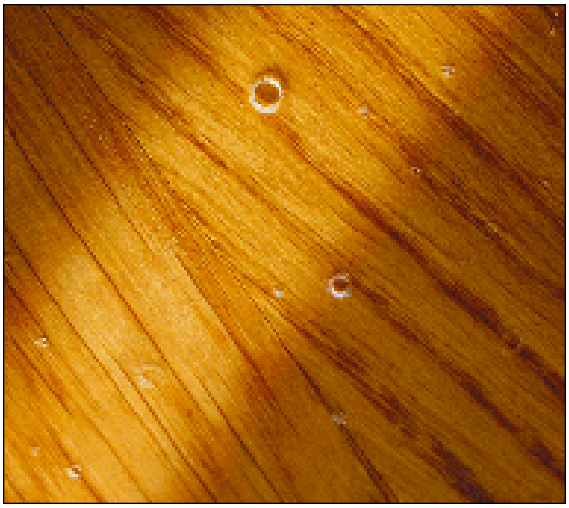
This condition is usually associated more with water-based finishes than other types of finishes, although it may affect them, as well. It often occurs when an improper spread rate is used — too much or too little finish is applied — or if the finish is not applied evenly. Excessive air movement and abnormally high temperatures can also be responsible for causing the finish to dry too quickly, so that a wet edge of finish is pulled over one that has already dried. The problem can also be caused by applying a satin or semi-gloss finish that has not been stirred properly. The solution is to screen and recoat after the finish has dried sufficiently.

Problem: Poly beads

Poly beads are droplets ("BB's") of finish that form along strip edges. They can be soft and sticky when first formed, but will become quite hard if left undisturbed. They are generally associated with a slow drying condition and excessive amount of sealer, stain and/or finish that seep into cracks. When soft, the beads can be smeared, leaving an unsightly appearance that may require screening and recoating. For hardened beads, the solution is to mechanically remove them with a sharp edge (i.e. razor blade) and if necessary, screen and recoat. Do not attempt to screen the hardened beads — it will cause circular scratches within the finish.

Problem: Cratering

Often mistaken for bubbles, this problem resembles craters on the moon. It is generally caused by contamination. The solution is to sand the crater out by handsanding and screen, pad and recoat. If the problem is severe enough, the floor may need to be resanded.



Cratering

SAMPLE CUSTOMER PREP LETTER

The following sample letter can be used as a guideline to develop your own Customer Preparation Letter. While you may want to use some of the information contained here, you will want to tailor your letter to fit your own needs, based on your local climate and working conditions, and on the finish products you are planning to apply.

WHAT YOU CAN EXPECT FROM US

Sanding and refinishing your wood floors will add value and beauty to your home, but with any home improvement you should expect some disruption and inconvenience. We will employ our experience, the latest equipment and the most environmentally safe materials to complete the work with the least possible disruption. However, you should be aware of the following factors:

Pre-sanding requirements

- The building should be completely closed in, with outside windows, and doors in place.
- All other trades should have completed their work, and no other floor traffic should be allowed during the sanding and finishing process.
- Air conditioning, heating and ventilation systems should be operating.
- The temperature and relative humidity should be at "normal living conditions."
- Furniture, appliances and old floor coverings should be removed.

Sanding and finishing expectations

- There will be noise, dust and some vapors during the sanding and finishing process.
- Even though we will seal off the work area from other rooms, dust from the sanding process could infiltrate to other areas of the house.
- Because of the vapors that will be released during finish application, pilots lights may need to be turned off.
- Please keep pets and children away from work areas.
- A typical finish job (approximately 1,000 square feet) takes ___ days of sanding, with stain (if any) applied on the ____ or ____ day. Finish is applied on the _____ and _____ days. You may not walk on the floors while stain and finish are wet. Allow _____ hours for these finishes to dry.
- Our work hours are 7 a.m. to 4 p.m.
- When the work is completed, you may need to replace or repaint your base and shoe moldings, as well as your walls. Also, be prepared to remove the fine dust that may have accumulated, despite our best efforts to contain it.
- Also, although finishes may appear dry, they are not completely cured and will not support heavy foot traffic or the replacement of area rugs and furniture for _____ days after the job is completed.

After the job is completed, your estimator will go over the job with you on-site. Maintenance procedures will be reviewed.

GLOSSARY

Abrasion Resistance That property of a surface that resists being worn away by a rubbing or friction process. Abrasion resistance isn't necessarily related to hardness, as believed by some, but is more closely comparable to, or can be correlated with, toughness.

Acrylic Resin A synthetic resin, white in color, very transparent, and resistant to discoloration, moisture, alcohol acids, alkalies and mineral oils. It is usually made by polymerization of acrylic acid and methacrylic acid.

Adhesion The property that causes one material to stick to another. Adhesion is affected by the condition of the surface to be coated and by the closeness of contact, as well as by the molecular forces of the unlike substances. Thus, the surface should allow a certain amount of penetration, should be chemically clean and not too smooth, hard or nonporous for good adhesion.

Adsorption A type of adhesion that occurs at the surface of a solid or liquid in contact with another medium, thus allowing an increased number of molecules of the gas or liquid to become attached to the surface of the solid at the point of contact.

Alligatoring The appearance of paint, varnish or lacquer film that is cracked into large segments, resembling the hide of an alligator. It is caused by heavy coats, recoating before the bottom coat is completely dry, the use of thinners that evaporate too quickly, or by a less elastic material applied over a more elastic one.

Amber A yellowish translucent resin formerly used in the manufacture of varnish, but now very scarce and expensive. The term also is used to refer to the color of a resin or varnish.

Aniline Colors Colors made from aniline oils or coal tar derivatives, and used in the manufacture of wood stains. Aniline dyes are made in different grades to be soluble in water, alcohol or hydrocarbons, and accordingly are called water colors, spirit colors and oil colors, respectively.

Bleeding When the color of a stain or other coating material works up into succeeding coats, imparting to them a certain amount of color, it is said to bleed. A non-bleeding color is one that isn't soluble in materials used over it.

Blistering The formation of bubbles or pimples on the surface of finished work. It is caused by exposure to excessive heat, grease or other volatile material under the finish, by moisture in the wood or by the too-frequent application of coats. Anything that causes a gas or vapor to form under the film may cause blistering.

Blushing The formation of a white or grayish cast in a spirit varnish, shellac or lacquer film during the drying period. It is caused by the partial or total precipitation of the solid ingredient as a result of condensed moisture in the film. This may be caused by excessive humidity or by use of an improper solvent.

Body Often used to describe the consistency of viscosity of a finishing material. It's also used to describe the fullness or thickness of film on the work.

Bond The adhesion between two dissimilar materials.

Brushability The ease with which a material can be applied with a brush under practical conditions.

Brush Marks Marks of the brush that remain in the dried film of a finishing material. They are caused by working the material after its solvents have evaporated to the point that the flowing power has been lost or by defects in formulation that prevent the material from leveling out after it has been brushed.

Bubbling The appearance of bubbles in the film of finish while a finishing material is being applied. It is caused by any condition that causes air, vapors or gases to be trapped in the film while it's soft, but after it has hardened sufficiently to prevent the gas from escaping.

Build Coat A finishing material, usually of a transparent nature, used over the sealer or color coats and under the finishing coats to increase the fullness of the finished work.

Chatter marks Chatter marks are consistent imperfections across the grain of the wood, varying from ¼ inch to 1 inch apart.

Checking Similar to alligatoring, except that the finish is broken into smaller segments. Crowfoot

checking is the name given to the defect when the breaks in the film form a definite three-prong pattern with the breaks running outward from a central point of intersection. When the checks are generally arranged in parallel lines, the defect is known as line checking. Irregular checks without a definite pattern are known as irregular checking.

Chipping The condition that occurs when a dried film of finishing material separates from the underneath surface in the form of flakes or chips. It is usually caused by insufficient elasticity or improper adhesion to the base material.

Conversion Varnish See **Swedish Finish**.

Crazing The appearance of minute, interlacing cracks or checks on the surface of a dried film of finishing material.

Crowfooting A species of crystallization (See **Checking**) wherein the lines come together at a central point.

Cure To change the properties of an adhesive by chemical reaction (which may be condensation, polymerization or vulcanization) and thereby develop maximum strength. It is generally accomplished by the action of heat or a catalyst, with or without pressure.

Cuts A pass over the floor with a big machine — a belt or drum sander.

Drier A catalytic material that improves the drying or hardening properties of oils or varnishes when added in small amounts. They are usually organic salts of lead, cobalt, manganese, zinc and iron, such as naphthenates, resinates and linoleates.

Drying The act of changing from a liquid film to a solid film by the evaporation of solvents, oxidation, polymerization or by a combination of these phenomena.

Dry Tack-Free The stage of solidification of a film of finishing material when it doesn't feel sticky or tacky when a finger is drawn lightly across it in a quick continuous motion.

Dry to Sand That stage of solidification of an applied film of finishing material when it can be sanded without undue softening, sticking or clogging of the sandpaper.

Dry to Touch That stage of drying of a film of finishing material when it has solidified sufficiently that it can be touched lightly without any of the finishing material adhering to the fingers.

Durability The ability of a finishing material to withstand the conditions or destructive agents with which it comes in contact in actual usage, without an appreciable change in appearance or other important properties.

Dust-Free That stage of solidification of an applied film of finishing material when dust that settles on the coated surface won't penetrate or stick to the film.

Fading The loss of color due to exposure to light, heat or other destructive agents.

Feather Edge The tapering of the edge of a film of dried material either by the method of application, sanding or rubbing the dried film, resulting in a gradual progression of the film thickness from little or no material at the edge to a normal coating at the center.

Filler In woodworking, any substance used to fill the holes and irregularities in planed or sanded surfaces to even irregularities and create a smoother surface. Wood filler used for cracks, knotholes, worm holes, etc., is often a commercial putty, plastic wood or other material mixed to the consistency of putty. A wood filler also may be mixed on the job using sander dust from the final sanding, or other suitable material, mixed with sealer or finish.

Flatting Agent A material added to a normally glossy coating to reduce luster and produce a flat appearance.

Flow The characteristic of a coating that allows it to level or spread into a smooth film of uniform thickness before hardening.

Gloss The luster, shininess or reflecting ability of a surface.

Glossing Up The increase of luster in a rubbed film through friction in use or the increase in luster of a flat varnish in the package through a decrease in the effect of a flattening agent.

Gloss Meter An instrument for measuring the luster or gloss of a finished surface.

Graininess The objectionable appearance of small, grain-like particles in a finishing material or in the dried film thereof.

Hard plate — Drive plate for a low-speed buffer used to flatten a wood floor, especially parquet, mixed species and specialty patterns.

Hardness That property of a dried film of finishing material that causes it to withstand denting or being marked when pressure is exerted on its surface by an outside object or force.

High Solids A general term used to denote the presence of a higher than average percentage of solid ingredients and thus a lower percentage of solvents.

HVAC — Heating, ventilating and air conditioning.

Impact Test A test for determining the resistance to shattering of a dried film by dropping a weight onto the finish.

Incompatible Not capable of being mixed together without impairing the original properties of the materials being mixed. Mixing incompatible materials usually results in a separation of solid particles, cloudiness or turbidity.

Intensity The intensity of a color is its purity or degree of hue as seen by the eye.

Lacquer The term applied to mixtures of solutions of nitrocellulose, ethyl cellulose, and natural and synthetic resins that dry by evaporation alone.

Lap Used as a verb, lap means to lay or place one coat so its edge extends over and covers the edge of a previous coat, causing an increased thickness where the two coats are present, as compared to the single thickness on either side of the lap. As a noun, lap is that portion of a coat of finishing material that extends over the edge of and onto a previous coat.

Leveling The ability of a film to flow out free of ripples, pock marks, brush marks or other surface defects.

Milky Having the appearance of milk or showing some whiteness, as when water is mixed with varnish or when a dried transparent film starts to turn white from moisture.

Mineral Spirits A medium-boiling fraction of petroleum naphtha having a boiling range between 300° F and 400° F. The flash point is usually slightly above 100° F and the weight is about 6 1/2 pounds per gallon.

Moisture-Cure Urethane A solvent-base polyurethane that dries by solvent evaporation and cures by a reaction of the polyurethane with atmospheric moisture.

Odor That property of a substance which is perceptible by the sense of smell; the smell, scent or fragrance of a material.

Oil-Modified Urethane A solvent-base polyurethane that dries by solvent evaporation and cures by a reaction of the polyurethane with driers and air.

Opaque Having the property to hide or obliterate an underlying material.

Peeling A defect in a dried film manifested by large pieces becoming detached from the under surface and coming loose in sheets or large flakes.

Penetrating Stains Stains that penetrate into the surface of the wood. They are usually made of dyes dissolved into liquids that easily penetrate the wood.

Petroleum Spirits Another name for mineral spirits.

Picture framing Picture framing occurs when the edger-sanded areas around the perimeter are inconsistent with the drum- or belt-sanded areas in the center.

Pigment The fine, solid particles used for color or other properties in the manufacture of paint and enamel.

Pigment Stains Stains that get their color primarily from pigments mixed with binder and volatile thinners.

Poly Beads Droplets of urethane resins that form along edges of strips after finishing. They may be quite hard after curing. When separated from the floor, they are hard enough to scratch finish.

Puckering The crinkling, shriveling or wrinkling of a coat of finishing material upon drying.

Raised Grain A roughened or fuzzy condition on the face of the flooring in which the dense summerwood is raised above the softer springwood.

Reduce To lower the viscosity of a material or to thin it by the addition of a solvent, thinner, varnish, oil, etc.

Retarder A slowly evaporating solvent that decreases the evaporation rate or slows up the drying of lacquers and similar materials.

Scratches Slight incisions, breaks, tears or indentations on the surface caused by abrasive friction.

Sealer Any finishing material that is applied with the primary purpose of stopping the absorption of succeeding coats.

Separation The breaking up or segregation of two or more integral parts of a mixture into its component parts. In a varnish, this may take the form of the resin becoming insoluble in the other ingredients. In a paint or enamel, it may mean that a clear liquid portion forms above the pigmented portion. In liquid, there may be a segregation of layers of component liquids.

Settling The separation of a pigment or other solid ingredient from a coating material upon standing.

Set to Touch See **Dry to Touch.**

Shade The degree of a color, as a dark green. Also, the act of changing the tone or degree of a color by adding small quantities of other colors to it.

Sheen The degree of luster of the dried film of a finishing material. It is usually used to describe the luster of rubbed surfaces or of flat-drying materials.

Shellac The resinous material secreted by an insect that feeds upon the twigs of certain trees in India. It is soluble in alcohol to form liquid shellac, which was once widely used as a sealer and finishing material for wood. It is rarely used for that purpose today.

Skin The film of oxidized or polymerized finishing material that forms on the surface while in a container or a tank.

Solvent A liquid that can dissolve another substance.

Spontaneous combustion The ignition of combustible material through chemical action of the material's constituents, without the action of an exterior source such as a flame or spark. Can occur with sanding dust or stain-soaked rags.

Staining The act of changing the color of wood without disturbing the texture or markings, through the application of transparent or semitransparent liquids made from dyes, finely divided pigments or chemicals.

Swedish Finish A term sometimes used to describe two different types of finishes. One is also called a conversion varnish, though it's not a varnish, but rather a two-component system consisting of a base coat and an acid-curing top coat. The term is also sometimes used to refer to water-base finishes, which — like conversion varnishes — originated in Sweden.

Tack-Free That condition when a film of finishing material has reached the point that the surface can be touched lightly without a sensation of stickiness.

Tensile Strength The ability of a film to withstand pulling stresses.

Thermoplastic The property of softening when heated and hardening upon cooling.

Thickness of Film The body on the work after the film of finishing material has thoroughly dried.

Thin Coat A coat of finishing material that's less heavy than usual.

Thinner A volatile material used to thin or reduce finishing materials.

Tint A color produced by the addition of another color to white paint or enamel. The act of adding the color to the white material is known as tinting.

Undercoats Coats that are applied prior to the finishing or final coats.

Urethane A synthetic chemical structure formed by one of three specific chemical reactions.

UV-Cured Polyurethane A special type of polyurethane that is cured by subjecting it to a specific dosage of radiation in the form of ultraviolet light.

Varnish Any homogeneous transparent or translucent liquid that, when applied as a thin film, hardens upon exposure to air or heat by evaporation, oxidation, polymerization or a combination of these to form a continuous film that imparts protective or decorative properties.

Viscosity A property of fluids, either liquid or gaseous, that can briefly be described as causing resistance to flow. Viscosity is the measure of the combined effects of cohesion and adhesion. It is one of the most important physical properties of an oil, varnish or lacquer. Viscosity is usually measured with the Gardner-Holdt Bubble Viscometer.

Water-Base Urethane A waterborne urethane that is fully cured and dries by water evaporation.

Waves Waves are two or more "upsets" in a wood floor, occurring along the direction of travel of a belt sander. Waves in wood floors are generally 1 to 3 inches from peak to peak, and should not be confused with chatter marks.

Wax Any of a number of resinous, pliable substances of plant or animal origin that are insoluble in water, partially soluble in alcohol, ether, etc. and miscible in all proportions with oils. It is used for making polishes and other products.

Wiping Stains Those stains, usually pigmented, that are applied and then wiped with a cloth to remove excess.

Wood Filler See **Filler.**

Yellowing The tendency of a dried film to take on a yellowish cast with age.

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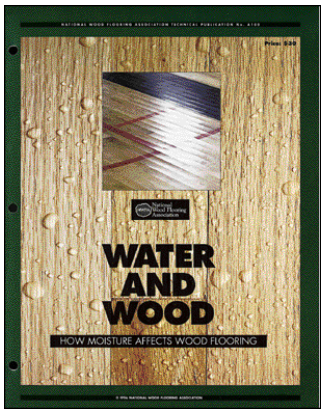

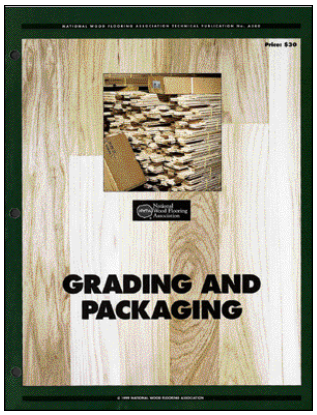

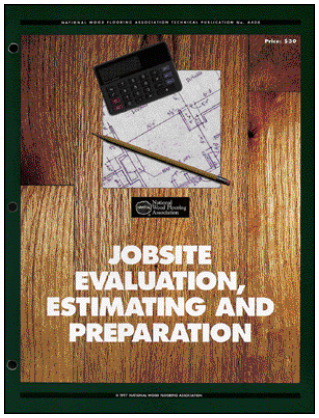

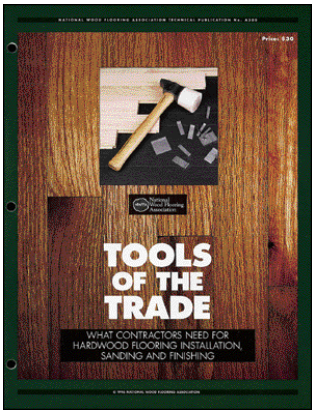

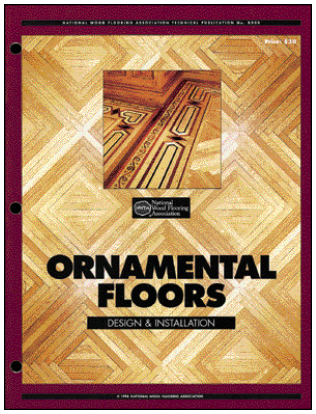

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Methods of Installation
Maintenance
Troubleshooting
Repairs/Refinishing

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Ellisville, MO 63021
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