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# **WOOD FLOORING SAND AND FINISH GUIDELINES**

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**nwfa**  
National Wood  
Flooring Association



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# WOOD FLOORING SAND AND FINISH GUIDELINES

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## NOTICE

The National Wood Flooring Association assumes no responsibility and accepts no liability for the application of the principles or techniques contained in these guidelines/standards.

These guidelines/standards for the sanding and finishing of hardwood flooring were developed by subject matter experts serving on the NWFA Technical Standards and Publications Committee and the Sand and Finish Guidelines Taskforce, using reliable principles, with research of all available wood flooring data and in consultation with leading industry authorities. The standards are not intended to apply to unrelated wood floor issues absent a causal connection.

While every effort has been made to produce accurate and generally accepted guidelines, the principles and practices described in this publication are not universal requirements. The recommendations in this publication are directed at the North American market in general, and therefore may not necessarily reflect the most accepted industry practices in all geographic areas. Some methods and materials may not be suitable in some geographic areas because of local trade practices, climatic conditions, regulations or construction methods. All wood flooring projects must conform to local building codes, ordinances, trade practices and climatic conditions.

In addition, manufacturers' recommendations for use of specific products should always supersede the recommendations contained in this publication.

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### **NO GUARANTEE OR WARRANTY**

The information contained in this publication represents widely accepted industry practices. There are, however, no universally approved methods of troubleshooting wood floors. The National Wood Flooring Association accepts no risk or liability for application of the information contained in this publication.

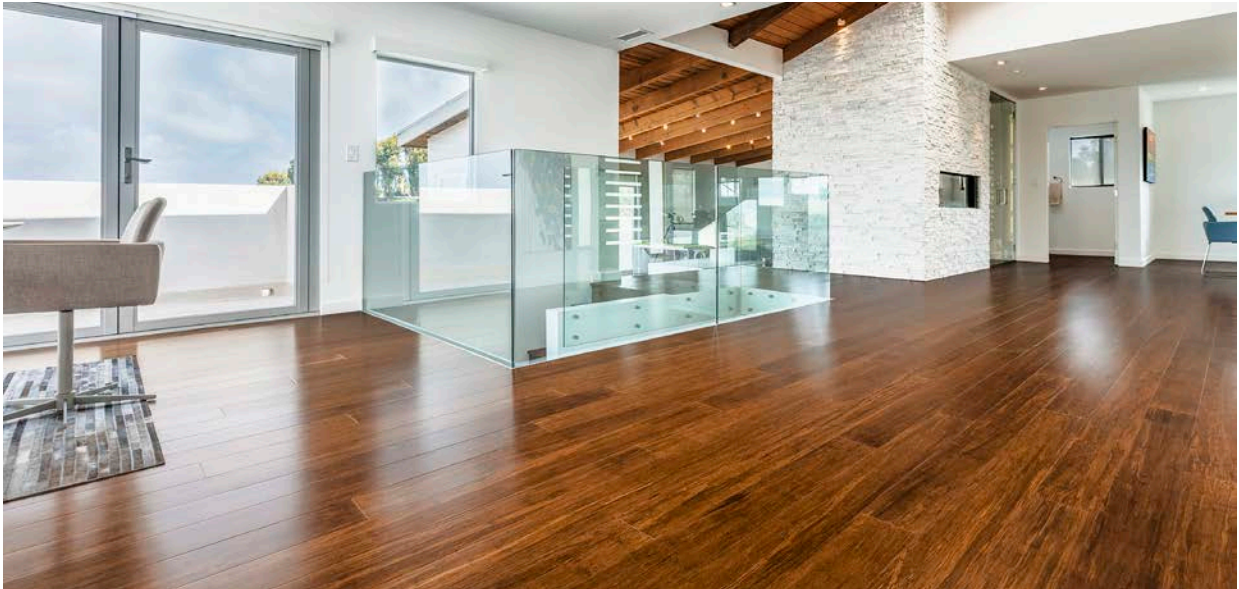


# INTRODUCTION

One of the many benefits of wood flooring is that it can be refinished numerous times throughout its service life. In fact, it is not uncommon to refinish a wood floor that is several centuries old. The beauty of wood is that it is not disposable like other floor coverings.

Many experts say that there are enough wood floors already in existence to keep sand and finishers busy for decades to come. The fact is, sand and finishers are in great demand today – both to refinish those existing floors and to sand and finish the millions of square feet of new wood flooring being installed each year.

Floor sanding is an art. The artistry and skill in sanding a wood floor cannot be taught through a technical publication, nor can it be taught by simply showing someone how to use a piece of equipment. Sanding and finishing a wood floor is an art and a skill that comes with understanding the many complexities involved in the entire process. This publication was put together by many of the experts within the wood flooring industry to help the reader understand the concepts involved in sanding and finishing wood floors. A properly sanded wood floor will dictate the performance of the finish and the longevity of the wood floor. Likewise, an improperly sanded wood floor can ruin the most beautiful installation.



## Hands-on and Online Education Available through NWFA University

The National Wood Flooring Association offers online and hands-on training courses for wood flooring professionals through NWFA University. There is a comprehensive selection of technical education for professionals at all skill levels: Basic, Intermediate, Advanced, Craftsman, and Master Craftsman. For more information, contact NWFA at:

[P] 800.422.4556 [W] [www.nwfa.org](http://www.nwfa.org)

# SAFETY

Before starting any sand and finish job, certain basic standards of safety must be applied. It is important that all crew members are briefed and brought up to date on all requirements and regulations. This is important for the safety of you, the crew, the customer, and their property.

Before considering going out to sand, stain, seal or finish a wood floor, it is imperative to be aware of your company's insurance coverages, worker's comp requirements and the safety issues involved in the process. Besides being a vital health issue, following safety regulations is also required by law. Failure to comply can cost thousands of dollars in fines.

The Occupational Safety and Health Administration (OSHA) has published rules and regulations that aim to protect the safety of workers on the jobsite. These rules may vary according to whether the job is residential or commercial, and requirements are also different for homeowners and professionals. Check OSHA requirements in your area (<https://www.osha.gov>).



## Personal Protective Equipment (PPE)

Personal protective equipment, commonly referred to as "PPE," is equipment worn to minimize exposure to serious workplace injuries and illnesses. These injuries and illnesses may result from contact with chemical, radiological, physical, electrical, mechanical, or other workplace hazards.

When working at residential or commercial construction jobsites, it is your responsibility to check with the superintendent or safety director to address specific site-related safety concerns and requirements.

Many of the solvents we use as well as the wood dust we work with are known human carcinogens and may cause sensitization, dermatitis, allergic respiratory effects, mucosal and non-allergic respiratory effects, and cancer. It is extremely important to protect yourself when working with these products.

Common personal protective equipment we use in the wood flooring industry may include items such as respirators, hearing protection, eye protection, UV protection, skin protection and knee protection. Most of these protective devices are available in different sizes and can be worn with other protective devices. If several different types of PPE are worn together, make sure they are compatible with each other.

### 1. Respirators

The respirators we utilize within the wood floor industry are used for the removal of contaminants from the air. Respirators of this type include disposable particulate respirators, which filter out airborne particles (wood dust), and air-purifying respirators with cartridges/canisters, which filter out chemicals and gases (finish or adhesive solvents).



### Disposable Particulate Respirator

The N95-type NIOSH classification respirator is the minimum filtration recommended when working with wood dust. Wood dust becomes a potential health problem when wood particles from processes such as sanding and cutting become airborne. These respirators are ineffective with any facial hair that impedes the seal around the face. Breathing these particles may cause allergic respiratory symptoms, mucosal and non-allergic respiratory symptoms, and cancer. Proper use of a disposable particulate respirator minimizes the effects of these airborne particulates, but does not protect against gases or vapors.



### Half-Facepiece Elastomeric Respirator (NIOSH approved)

This type of respirator is a tight-fitting, air-purifying respirator with replaceable filters (for particulates) or cartridges or canisters (for gases and vapors). In either case, these are attached to a rubber or silicone facepiece that covers the nose and mouth. This type of respirator needs to be fit tested. These respirators are ineffective with any facial hair that impedes the seal around the face. They can also be cleaned, decontaminated, and reused. The filter or cartridge's useful service life is how long it provides adequate protection from harmful chemicals in the air. The service life of a filter or cartridge depends upon many factors including environmental conditions, breathing

rate, cartridge filtering capacity, and the amount of contaminants in the air. Check with the manufacturer of the filter or cartridge for proper storage and service life recommendations.



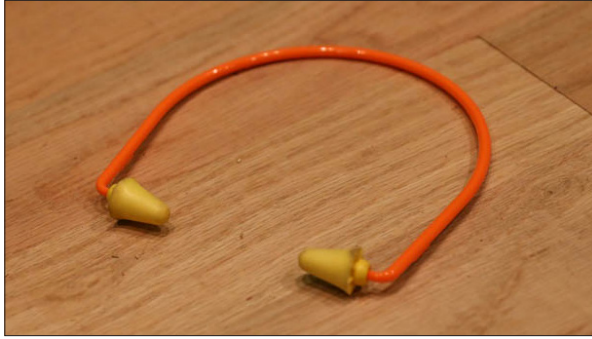
### Full-Facepiece Elastomeric Respirator (NIOSH approved)

This type of respirator provides a higher level of protection than a half-facepiece respirator because it has better sealing characteristics. Since it covers the user's eyes and face, it can also be used to protect against liquid splashes and irritating vapors. Like the half-mask elastomeric respirator, this respirator is a tight-fitting, air-purifying respirator with replaceable filters or cartridges attached to a rubber or silicone facepiece. It needs to be fit tested. The filter or cartridge's useful service life is how long it provides adequate protection from harmful chemicals in the air. The service life of a filter or cartridge depends upon many factors including environmental conditions, breathing rate, cartridge filtering capacity, and the amount of contaminants in the air. Check with the manufacturer of the filter or cartridge for proper storage and service life recommendations.

## 2. Hearing Protection

Use of hearing protection is very important due to the high decibel level of many of the tools we use. Each hearing protective device has a noise reduction rating (NRR). The higher the number, the greater the decibel reduction. Which type of hearing protection you choose depends on a number of factors including level of noise, comfort, and the suitability of the hearing protector. Most importantly, the hearing protector should provide the desired noise reduction. Adequate hearing protection does not include in-ear headphones or ear-buds.





### Ear Plugs

These are inserted to block the ear canal. They may be premolded (preformed) or moldable (foam ear plugs). Ear plugs are sold as disposable products or reusable plugs. Custom molded ear plugs are also available. Insert as follows:

1. Roll the earplug into a small crease-free cylinder.
2. Reach over the head to pull up and back on the ear to straighten the ear canal.
3. Insert the earplug into the ear canal.



### Ear Muffs

These consist of sound-attenuating material and soft ear cushions with hard outer cups that fit around the ear. They are held together by a head band.



## 3. Eye Protection

Thousands of people are blinded each year from work-related eye injuries that could have been prevented with the proper selection and use of eye and face protection. OSHA estimates that eye injuries alone cost more than \$300 million per year in lost production time, medical expenses, and worker compensation. OSHA requires employers to ensure the safety of all employees in the work environment. Eye and face protection must be provided whenever necessary to protect against chemical, environmental, radiological or mechanical irritants and hazards.

The following minimum requirements must be met by all eye protective devices:

1. Provide adequate protection against the particular hazards for which they are designed.
2. Be of safe design and construction for the work to be performed.
3. Be reasonably comfortable when worn under the designated conditions.
4. Fit snugly and not unduly interfere with the movements of the wearer.
5. Be durable.
6. Be capable of being disinfected.
7. Be easily cleanable.

Workers who wear prescription eye glasses must also wear required eye protection.

- Eye and face protection that fits comfortably over glasses is available.
- Safety goggles and spectacles may incorporate prescription lenses.

Dust and chemicals present additional hazards to contact lens wearers. OSHA recommends that workers have an extra pair of contacts or eyeglasses in case of contact failure or loss.



#### 4. UV Light Protection

The UV lights made for curing floor finish emit a light spectrum that is able to penetrate deeply into the different layers of human skin. The two wave lengths of most concern are UVA and UVB. UVA penetrates the deepest causing cell damage, photo aging and immune suppression. UVB penetrates the top layer of skin causing sunburn and cancer. What is most important is to protect yourself and any individuals around you involved when the UV machines are in use.

Always protect your eyes with UV protective eyewear or face shielding, cover your skin, and apply SPF 50+ sunscreen, preferably with zinc oxide, in places where there is partial skin exposure. It is not recommended to simply wear sunscreen instead of wearing long pants, long sleeves, gloves and shoes.

#### 5. Skin Protection

Disposable gloves are used to protect the skin from chemical exposure. These protective gloves should be used when handling finishes, stains or solvents of any type. These gloves are made of different polymers including latex, nitrile rubber, vinyl, neoprene or polychloroprene. Check with your manufacturer for specific recommendations for protection from specific chemicals. Be aware of any latex allergies before using latex gloves.



#### 6. Knee Protection

It is extremely important to protect your knees when doing any type of wood flooring work. Whether installing or finishing wood floors, you spend a lot of time on your knees, this position forces your body weight to the joints of your knees as well as the added weight of the equipment. Knee pads are the solution to preventing occupational knee injuries. Unprotected, sore knees force overcompensation in order to use your knees less. This ultimately means that you are transferring the weight from your knees to your lower back. The result is a sore back and sore knees. Be sure to use knee pads that are comfortable and protect your knees from injury. Avoid knee pads with a hard surface that may mar the flooring surface. There are many different types of knee pads, but the function of all of them is the same: to prevent knee injury and to protect your knees on the job.

#### Fire Extinguishers

Fire extinguishers are an important safety tool on every wood flooring job. Following these guidelines will minimize risk to you, your crew, your customer, and their property.

1. Keep fire extinguishers in your work vehicle and on the job (2 minimum).

#### Using a Fire Extinguisher

The following steps should be followed when responding to incipient/beginning stage fire:

- Sound the fire alarm and call 911.
- Identify a safe evacuation path before approaching the fire. Do not allow the fire, heat, or smoke to come between you and your evacuation path.
- Select the appropriate type of fire extinguisher.
- Discharge the extinguisher within its effective range using the P.A.S.S. technique (Pull, Aim, Squeeze, Sweep).
  - A. Twist and pull pin (this will also break the tamper seal).
  - B. Aim at bottom of fire with the extinguisher nozzle or hose and work upward.

- C. Squeeze trigger to release the extinguishing agent.
  - D. Sweep back and forth, holding flat and level until fire has been extinguished.
  - Back away from an extinguished fire in case it flames up again.
  - Evacuate immediately if the extinguisher is empty and the fire is not out.
  - Evacuate immediately if the fire progresses beyond the incipient stage.
2. Never store fire extinguishers on their side or upside down.
  3. Check for and maintain expiration dates on fire extinguishers.



4. Make sure your extinguisher is rated for the types of fires most common to wood flooring job sites.
  - A, B, C rated (Liquid, Vapor, Electric) fires.
  - Class A - Ordinary combustibles such as wood, cloth, paper, rubber and many plastics.
  - Class B - Flammable liquids such as gasoline, oil, grease, tar, oil-based paint, lacquer and flammable gas.
  - Class C - Energized electrical equipment including wiring, fuse boxes, circuit breakers, machinery and appliances.

Smoking should be prohibited on the jobsite and in the work vehicle.

## Spontaneous Combustion

One of the most important safety issues to consider in the sanding process is spontaneous combustion, 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 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, vacuum or container. Wood dust must reach a temperature of 400°F (204°C) for it to ignite. Combustion happens much more frequently, however, when a floor is being resanded. 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. Abrading between coats or resanding a freshly finished floor can pose additional risks due to the solvent and dust combination.

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 the abrasives striking nails or metal inlays, 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 and abrasives.

Sanding dust should be disposed of safely. Keep an eye on the dust-collection bags, vacuums or containers on all equipment. Empty the bags often in a proper container. Also, 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 and dust collection systems from the jobsite at the end of every day and dispose of them in the proper manner. It's a good idea to remove dust receptacles/dust collection systems and unplug machines any time you leave the jobsite for any length of time. Refinishing old floors poses additional safety issues.

## Seven Potential Flare-Ups

1. Friction: Dull sandpaper, overworked paper, improper paper selection
2. Sparks: Staples, nails, radiator pipes, improper paper tracking
3. Dust: Never leave in truck, machine or job. Empty all dust collection systems daily
4. Stain rags: Dispose in water bucket or metal safety container
5. Electrical fires: Faulty cords, loose connections, breaker box fires, bad switches, faulty equipment, improper cord selection
6. Liquids/vapors: Universal sealers, shellacs, conversion varnish
7. Sources of ignition: Pilot lights, switches, smoking



## Electrical Safety

Electrical hazards can be found on nearly every jobsite. Whether the hazard is posed by damaged or worn power tools or cords, improperly grounded tools or the power sources themselves, it is critical to understand the potential electrical dangers on the jobsite.

1. Locate the breaker panel prior to beginning the job.
2. Hire a licensed electrician to set up electrical connections for both residential and commercial applications when necessary.
3. Check cords regularly for damage or deterioration. The cord itself should never be pulled to disconnect it from the power source; instead, remove it by the plug.
4. Check and tighten connections on the plugs and connectors regularly.
5. Check cords for cut, cracked or broken insulation.
6. OSHA requires three wire extension cords at all jobsites.
7. When the grounding pin on a plug of a power tool is missing, repair or replace before use. Using a tool with a missing grounding pin can be extremely dangerous for the user. If a short were to develop in the tool, the user may become the ground in the system and the electricity may travel through him or her.
8. Always keep a multimeter on hand to test for proper voltage at power sources and through cords. Ensure power at the jobsite is sufficient for the proper operation of the equipment being used.



9. There are several different types of 220 outlets. Have adapters made up prior to arriving at the job in order to connect to the different dryer and stove outlets.
10. Select the proper gauge cords for the machinery you will be using. Longer distances will require heavier gauge cords and/or use of a booster. When improper gauge cords are used, plugs, wires and equipment motors can overheat, causing permanent damage.
11. Never place any cord around your neck or over your shoulders.
12. Disconnect all power when leaving jobsite.

## Equipment Safety

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

1. Proper electrical connections are essential. Follow local electrical codes and use licensed electricians when necessary to ensure connections are appropriate, including proper grounding, proper size wiring, proper breaker protection and proper amperage.
2. Use power booster when applicable to ensure power is adequate for equipment being used.
3. Refer to equipment manufacturer owner's manual to completely understand set-up, operation, warnings and safety of each piece of equipment.
4. Use tools only as they are intended to be used.
5. Make sure you understand operation and maintain control of all equipment.
6. Unplug all machines when you are repairing or adjusting them, when changing abrasives, or when leaving the job site.
7. Use caution wearing the waist belt commonly attached to drum or belt sanders. Know how to quickly release yourself in any event in which your safety would depend on it.
8. Keep electrical cords away from the machine's 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.
9. Empty sanding bags often in a proper container, especially before transporting the machine or leaving the job site. Remove dust container and unplug machines any time you leave the jobsite for any length of time.
10. Clean dust from tools after each job.
11. Wear proper PPE (Personal Protective Equipment) as required by the equipment manufacturer.

## Lead

When sanding a previously finished floor, determine whether the floor finish contains lead. All floor finishes applied before 1978 may contain lead. Prior to 1978, metals (including lead) were used in some oil-modified urethane finishes and stains as a drying agent. Test kits are available to determine the presence of lead in floor finishes and other architectural coatings, including any floor painted surface. Abide by local, state and federal guidelines for handling and disposing of lead-based products as severe fines can be assessed. For more information, visit the U.S. Environmental Protection Agency website at [www.epa.gov/lead](http://www.epa.gov/lead). Check with local Canadian Province regulations for specific lead laws.



## GHS Safety Data Sheet

The Global Harmonized System (GHS) of Classification and Labeling of Chemicals was developed as one universal standard for all countries to follow in the labeling of chemicals. A safety data sheet (SDS) is an important component of product stewardship and occupational safety and health. It is intended to provide workers and emergency personnel with procedures for handling or working with a substance in a safe manner, and includes information such as:

- Identification of material
- Hazard identification
- Composition/information on ingredients
- First-aid measures
- Accidental release or spillage measures
- Handling and storage
- Exposure control/personal protection
- Physical and chemical properties
- Stability and reactivity
- Toxicological information
- Ecological information
- Disposal considerations
- Transport information
- Regulatory information
- Other information

In the United States, OSHA requires that Safety Data Sheets be available to employees for potentially harmful substances handled in the workplace under the Hazard Communication regulation. These Safety Data Sheets are also required to be made available to local fire departments and local and state emergency planning officials under Section 311 of the Emergency Planning and Community Right-to-Know Act in cases of emergency chemical spills or ingestion. These sheets are made available by manufacturers and distributors on every product sold. Keep a binder with Safety Data Sheets for all products in the work vehicle at all times. These need to be reviewed regularly and kept up to date.

## Volatile Organic Compounds (VOCs)

According to the U.S. Environmental Protection Agency, volatile organic compounds (VOCs) are emitted as gases from certain solids or liquids. VOCs include a variety of chemicals, some of which may have short- and long-term adverse health effects. VOCs that are released into the air react with oxides of nitrogen and sunlight to form ground level ozone or smog, a major air pollutant. For this reason, VOCs are regulated as "ozone precursors" under the U.S. Clean Air Act and similar state laws. In order to reduce these ozone levels, the US EPA and numerous state agencies have issued regulations to reduce VOC emissions, including products that contain solvents such as wood floor cleaning products, finishes and adhesives.

The VOC limitations issued by various authorities are in a constant state of evolution. On an ever-increasing basis, new states are issuing VOC limitations, while states with existing limitations are expanding their restrictions. The US EPA is also working toward issuing more stringent national regulations.

Visit the US EPA website for more details on VOC restrictions (<http://www.epa.gov/iaq/voc.html>). Canada has an Architectural Coatings Rule similar to OTC/LADCO. Learn more at (<http://www.ec.gc.ca/lcpe-cepa/eng/regulations>).

# VOC LIMITS

OPTIONS	EPA Federal AIM/VOC Rule	OTC Phase I Model Rule	OTC Phase II Model Rule	CARB AIM SCM	SCAQMD AIM SCM	INDIANA AIM Rule	ILLINOIS AIM Rule	OHIO AIM Rule	UTAH AIM Rule Implemented January 2015. 3-year Sell-through period	CANADIAN AIM Rule
Exceedance Fee Option	Y	N	N	N	N	N	N	N	N	N
Small Container Exemption	Y	Y	Y	Y	N	Y	Y	Y	Y	Y
CATEGORIES										
Conjugated Oil Varnish	Varnish 450	Varnish 350	450	Varnish 275	Varnish 275	Varnish 350	Varnish 350	Varnish 350	450	Varnish 350
Conversion Varnish	725	725	725	Varnish 275	Varnish 275	725	725	725	725	725
Lacquer	680	680	Wood Coating 275	680	680	680	680	680	Wood Coating 275	680
Shellac	730	730	730	730	730	730	730	730	730	730
Stain	550	250	250	250	250	250	250	250	250	250
Varnish	450	350	Wood Coating	275	275	350	350	350	Wood Coating 275	350
Wood Coating	N/A	N/A	275	N/A	N/A	N/A	N/A	N/A	275	N/A

Current states following the EPA Federal AIM/VOC Rule: AK, AL, AR, AZ, CO, FL, GA, HI, IA, ID, KS, KY, LA, MD, MI, MN, MS, MT, NC, NE, NM, NV, OK, OR, SC, SD, TN, TX, WA, WV, WY

The OTC eliminated the following categories in their updated Phase II Model Rule: Penetrating Oils, Varnishes, Lacquers, Sanding Sealers, Clear Stains. The eliminated categories fell under the Wood Coating category in the OTC Phase II Model Rule.

Current states that have adopted OTC Phase I Model Rule: CT, DC, DE, MA, MD, ME, ND, NH, NY, PA, RI, \*VA, VT

\*Northern Virginia and Fredricksburg Emissions Control Area have adopted the OTC Phase I Model Rule. The rest of Virginia follows the EPA Federal AIM/VOC Rule.

Currently, no states have adopted the OTC Phase II Model Rule. This rule includes anti-bundling language.

# SANDING EQUIPMENT

## Equipment

The minimum tools needed for sanding wood floors are eye, ear and approved respiratory protection; a drum or belt floor sander; edger sander; buffer; hand scraper; sanding block; and a variety of abrasives and screen discs ranging in grit from coarse to fine, as well as a vacuum cleaner and broom.



### 1. Drum and Belt Sanders

The “big machines” – drum and belt floor sanders – are large, heavy, walk-behind sanding machines designed for high production. Drum and belt sanders are similar, the difference lying in the way that the sandpaper is attached.



On a drum sander, a sheet of sandpaper is wrapped around the drum and secured by insertion in a diagonal slot on the drum. A drum sander typically cuts slightly heavier on the left side and feathers on the right side. A belt sander, as the name suggests, employs a continuous belt of abrasive. Belt sanders always sand from the left side of the room to the right. This is because of the wheel configuration; the right wheel is located directly behind the drum and the left wheel is offset.



As you sand left to right, the left wheel is always on a freshly sanded surface leaving a much flatter floor. Both types of machines 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. These sanders can utilize abrasive types from open-coat to extra fine grade. Professional training is necessary for proper operation of the “big machines.” Wheels must be inspected prior to sanding. Debris or filler stuck to the wheels will translate to the sanded flooring surface. Do not store big machines on their wheels for long periods of time to avoid creating flat spots or warped wheels. Storage dollies or travel bases are available for most units.



### 2. Edgers

Edgers, or spinners, are small circular sanding machines designed to reach the areas where big machines can't, around the perimeter of the room,

in closets, on stairs and in other small areas. These hand-held rotary-disc floor-sanding machines are used to remove material, flatten the floor and to minimize scratch patterns on the flooring surface.

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 lower the wheels are set, the steeper the pitch of the cut, and the more aggressive the sanding will be.

The offset edger (also called toekick sanders and duckbill sanders) 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, somewhere between 11-1 o'clock. Follow the manufacturer's recommendations for setting the edger. Never store these edgers upright on their pads as this can cause flat spots which translate to vibration that will transfer to the floor. These sanders can utilize abrasive types from open-coat to extra fine grade. Professional training is necessary for proper operation of the edger machines.



### 3. Buffer/Rotary Sanding Machines

Buffers use circular sanding paper, screens, pads or polishing brushes with sizes varying from 13 to more than 22 inches in diameter; however, most common buffers in the wood flooring industry are 16"-18" machines. They are walk-behind machines that abrade in a circular pattern, typically cutting somewhere between 3-6 o'clock (depending on the handle position).

Buffers for floor sanding run at low speeds (175 RPM) and are used for final sanding, abrading 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.

The primary use of these machines is to blend the field with the edges in the final sanding process. This machine is also used to employ mechanical abrasion between coats of finish.

The buffer can also employ a "hard plate" driver. Hard plating is a process often used to flatten a floor and to minimize dishing out of soft grain, multi-directional floors or floors containing multiple species by using a sanding disk, without a driving or backing pad. Professional training is necessary for proper operation of the buffer or rotary sanding machines.



### 4. Multi-Disc or Planetary Machines

Another machine often used in sanding hardwood floors is the multi-disc sander (sometimes called planetary sanders). This machine is often used for fine-finish sanding and for flattening floors. These tools are often used immediately following a medium grit cut with the drum or belt sander, and then used all the way through the fine and extra fine grit cuts. They may have three or more perimeter discs that rotate in one direction around a main disc, which rotates in the opposite direction. This allows for no particular sanding direction to be followed during the final sanding process.

These sanders are designed to utilize abrasive types from medium to extra fine grit. No abrasive grit should be skipped when using multi-disc or planetary sander machines. Most multi-disc sanders are also equipped with dust-containment systems. Some multi-disc driver attachments are also available for buffer/rotary sanding machines. Professional training is necessary for proper operation of these types of sanding machines.





## 5. Oscillating Machines

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



## 6. Random Orbital Sanders

Hand-held random orbital sanders can also be used with the same grit abrasive as the final sanding abrasive, in order to assist in the final detail of the perimeter of the floor.

## 7. Detail Tools

Harder-to-reach places require the use of hand scrapers and sanding blocks. Hand scraping and hand sanding of areas not reached by the edger should also be completed 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. Never sharpen the scraper on the floor to avoid discoloration from the metal shavings.

## 8. Dust Collection/Containment

Most standard sanding machines have dust-collection bags or self contained systems 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 turned inside out and blown or vacuumed frequently as well, or as directed by the manufacturer.

Note that for best dust collection, the bag should be emptied by the time the dust reaches the line that says "full" – usually about 1/3 of the bag. If it isn't emptied by then, the dust-collection system will not function properly and can cause the machine to over-heat.

There are many different types of dust containment systems available. These systems range in size and capacity. Be sure to completely understand the maintenance of the dust containment system as well as its capabilities and limitations when connecting your sanding equipment.

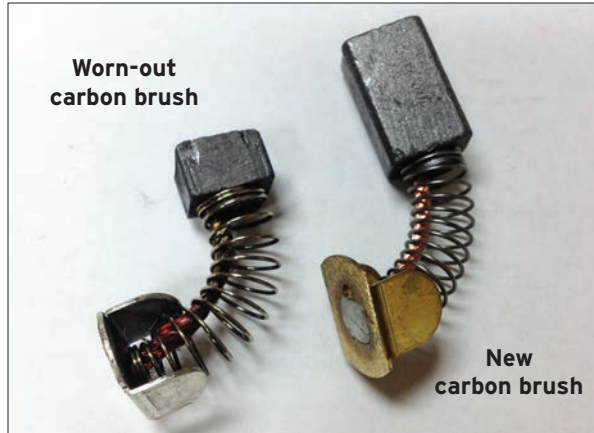
Regardless of how dust is collected, it must be emptied daily and disposed of safely. Contact local agencies or the manufacturer of the flooring for guidelines and directives on proper disposal.

## Equipment Maintenance

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 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 every moving part of the machines 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 read and understand the operator's manual.

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 at peak performance and will greatly extend their service life.

There are nine primary areas to focus on: carbon brushes, machine lubrication, machine bearings, edger pads, sanding drums, sanding chambers, wheels, drive belts and dust bags.



### 1. Carbon Brushes

The brushes are the pathways for electric current. Once the brushes are worn, the electric current will cause heat, arcing and sparking. Also check the brush spring – which keeps the pressure on the brushes, preventing arcing and premature wear of the armature. Inspect the motor brushes once a month and change all the motor brushes at the same time.

### 2. Machine Lubrication

Ask your authorized service center for the correct amount and the type of lubricants to use.

### 3. Machine Bearings

Refer to owner’s manual for service intervals. Periodically check the guide rollers for wear. Always keep an ear tuned to the sound of the machine. Any new or different sound could be a sign of a bad bearing or wear in the bearing. If it remains unrepaired, a bad bearing can cause sanding irregularities.

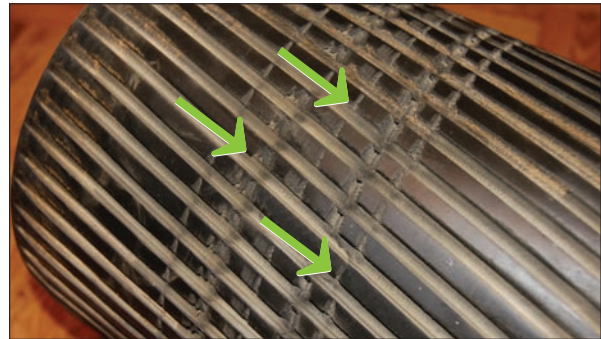
### 4. Edger Pads

Inspect and clean edger pads before each job. An unbalanced or bent edger pad will cause gouging. Worn and improperly adjusted edger pads also result in uneven sanding. Edger pads are designed to hold one piece of edger paper at a time, adding multiple pieces of paper will change the angle of the cut and may cause excessive heat build-up on the pad resulting in damage.

### 5. 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. Clean any debris or dust from the drum and the upper roller prior to every job. Gouged, grooved or badly damaged drum surfaces should be replaced. Do not dress the sanding drum unless the manufacturer specifically recommends doing so. 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.



*A gouged/grooved drum like the one shown above will create lines on a floor similar to the ones shown below.*



### 6. 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 and 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.



### 7. Wheels

Always inspect the wheels before you start any job. Debris on the wheels (filler, grit, finish and stones, for example) can be left on the floor and also cause chatter, wave and damage to the wood during sanding. When transporting the machine, lift it over wet filler, 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.



## 8. Drive Belts

The best way to check drive belts is hands-on: if the belt feels rough, cupped, worn or grooved, it probably needs to be replaced. The most common problem with belts is letting the belts “take a set” or 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 any long-term idle period. Always use a manufacturer recommended belt, and if your machine has two belts replace them both at the same time.

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. Do a visual check with the machine running for belt shake or vibration. Tighten or loosen the belt until it runs true. Check the owner’s manual for correct belt tension. Improper belt tensioning and worn out belts will produce vibrations in the machine which will transfer to the sanded floor. This is possibly the most important element in preventive maintenance. A poorly maintained machine can be costly.



## 9. Dust Bags

The actual weave of the dust bag is an important part of the filtration system. These bags should be turned inside out, shaken vigorously, blown out or vacuumed, and only machine-washed if recommended by the manufacturer. Some dust bags require that the inner layer of dust remain intact. This layer is called the filtercake and actually improves dust pickup. Empty a dust bag when it is about 1/3 full; never leave a dust bag unattended with dust in it. Dust bags will eventually wear out and should be replaced periodically.

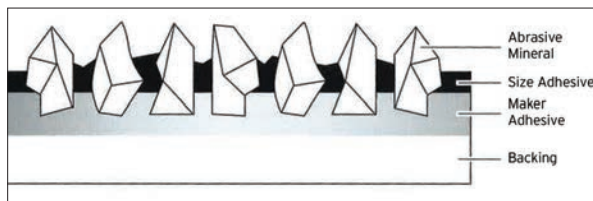


# ABRASIVES

Abrasives are an important consideration for sanding or refinishing wood floors, but it is important to recognize that each job may have different abrasive requirements.

## Abrasives Components

Sand paper is made up of three general components: the backing, the adhesive bond and the abrasive mineral (or grain).



1. The backing is the base for the abrasive minerals to be bonded to. In the wood flooring industry, backings are typically made up of paper, cloth or screen mesh. The type of backing used dictates the intended usage of the abrasive.
2. The adhesive bond is the binding agent used to adhere the minerals to the backing. These adhesives are designed to withstand the high temperatures and pressure produced in the sanding process.
3. The abrasive minerals or grains can be comprised of different man-made materials. The most common minerals used in our industry include:
  - A. Aluminum Oxide  
Blocky, cubic-shaped minerals. These minerals typically fracture into larger pieces, maintaining sharp edges. Commonly used with extra fine abrasives often designed for intercoat abrasion or a first sanding on factory finished floors. These minerals are very friable.
  - B. Silicon Carbide  
A sharp, brittle mineral. May dull relatively quickly on some floors, but tends to leave a very fine scratch pattern. Typically intended for sanding finishes and intercoat abrasion. These minerals are also friable.
  - C. Ceramic Alumina  
A long and sharp viscous mineral. These minerals are designed to micro-fracture into small pieces leaving extremely sharp edges. Typically intended for finish and material removal. These minerals are not as friable.

#### D. Zirconia Alumina

A sharp, highly viscous mineral. These minerals are designed to fracture in small pieces leaving very sharp edges. These minerals are also not very friable.

## Abrasive Storage

Temperature and humidity can affect the performance of the sand paper. Maintain "normal" conditions where abrasives are stored (60-80°F and 30-50%RH). Abrasives should be stored in original packaging and stored away from potential sources of moisture. Do not store abrasives directly on concrete floors due to the possibility of picking up moisture.

## Abrasive Selection

Choosing the proper grit sequence for every situation is nearly impossible to define as there are a wide variety of circumstances that may dictate many different scenarios. The abrasive grade (or grit) provides information about the size of mineral used on the paper. The grit number directly corresponds with the number and size of minerals per inch. The larger the number, the smaller the mineral. Choosing the appropriate grit sequence for the job will dictate the process to achieve the necessary results. The grit chosen for the initial sanding will be determined by several conditions including: existing coatings, degree of unevenness, species and overall condition of the flooring. The grit used on this first sanding step should be the finest grit possible to achieve everything previously mentioned while minimizing the scratches being placed into the flooring surface.

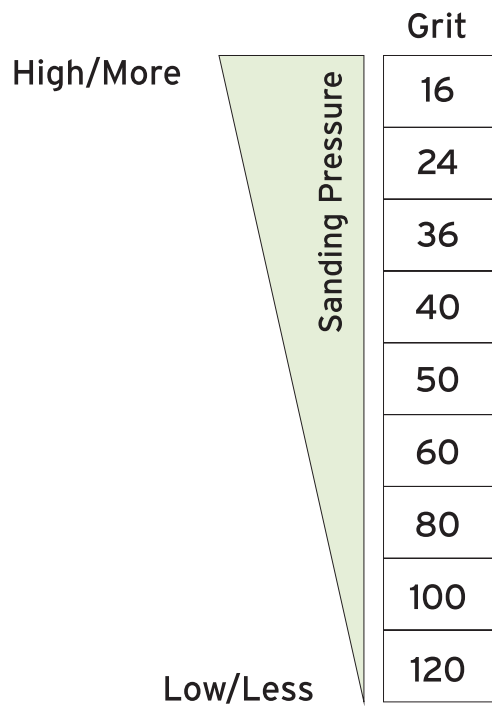


ABRASIVE GUIDE	
PAPER TYPE	ABRASIVE GRADES (GRIT)
Open Coat	12
	16
	20
	24
Coarse	30
	36
	40
Medium	50
	60
Fine	80
	100
Extra Fine	120
	150
	180
	220
	240
	240
	320

- \* Start with the finest grit paper that will remove existing coatings and flatten the floor.
- \* Do not skip more than one grit.
- \* Do not skip grit sequence with fine and extra fine abrasive selections.

### Typical Grit Sequence

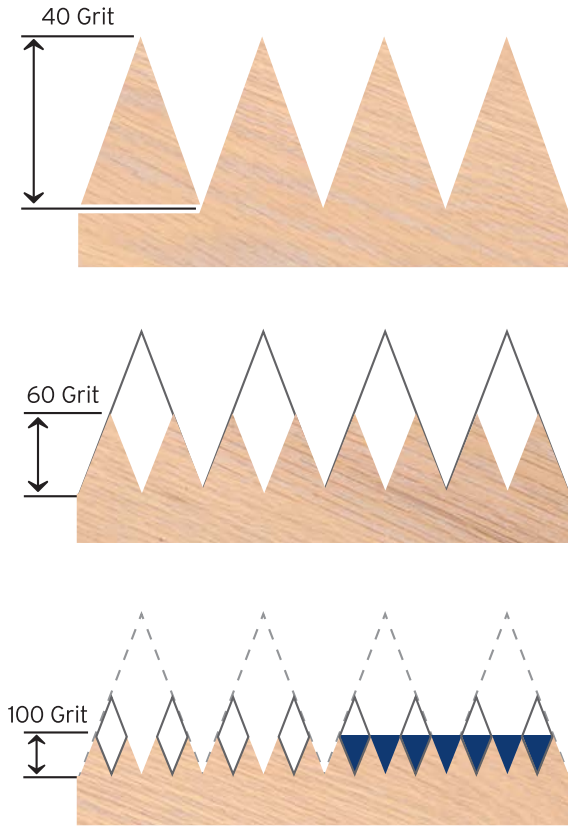
1. The initial sanding of the wood floor should be with the finest grit abrasive possible to flatten the floor and/or remove existing coatings.
2. Drum pressure settings should coincide with the abrasive choice. Finer grits require less pressure settings on the big machine; coarser grits require heavier pressure settings.



3. Load the sanding machine with the proper sequence of sandpaper.
4. Skip no more than one grit from the abrasive used in the first cut. The second cut abrasive removes the deep scratches created by the first cut.
5. Skip no more than one grit from the abrasive used in the second cut. The third cut removes the scratches created by the second cut, leaving shallower scratches that should result in a surface that appears smooth.
6. The final sanding sequence must be fine grit paper or higher.
7. When the final sanding sequence with the belt/drum sander ends at a medium grit, use of multi-head/planetary sanders must be used to follow the abrasive grit sequence to fine or extra fine grits to achieve the desired end result. Do not skip any grits when employing this final sanding process.

The image in the next column is a graphic representation of what happens when a wood floor is sanded. Each subsequent cut with a finer grit of abrasive removes the scratch marks left by the previous cut. Therefore, it is recommended that no more than one grit of abrasive be skipped in each sanding sequence.

Start with the finest grit paper that will remove existing coatings and flatten the floor. Follow NWFPA suggestions for grit sequence with specific species.



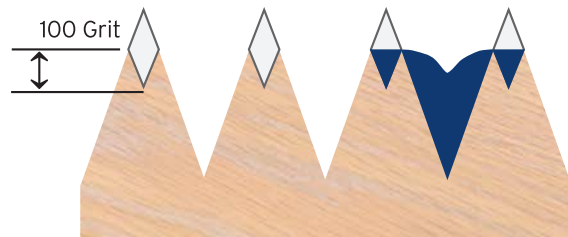
Finished surface with correctly selected grit sequence.

### Improper Grit Sequence

This is what happens when more than one grit of abrasive is skipped in the sanding sequence. The first cut uses a coarse-grit abrasive, which creates deep scratches. If the second cut skips more than one grit from the abrasive used in the first cut, the abrasive used in the second cut will not effectively remove the scratches created by the first cut, removing only the peaks left by the first cut. The deeper scratch marks will remain, resulting in a rough surface. This improperly sanded surface will also cause premature wear of the finish.



This is a close-up image of a floor that has been 1st cut with 40 grit.



Defective finish surface with incorrect grit sequence.



This shows the deep scratches left behind from the 40 grit when more than one grit has been skipped in the sanding sequence, moving straight from 40 grit to 100 grit.

# SANDING PROCESS

## Jobsite 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 as well as the temperature and relative humidity before you begin sanding to ensure that it is within the normal range for that environment. Record your reading in the job file for future reference.

### 1. Other Trades

All wet work must be completed and thoroughly dry before the sanding and finishing process takes place.

This includes:

- A. Tile work
- B. Drywall (texture, tape and mud, patchwork)
- C. Paint
- D. Power-washing any interior surfaces (basements)

Other trades coming into contact with the wood flooring surface must be completed prior to final coat application in order to avoid trade-damage to the finished surface.

### 2. Preparation and Evaluation

Walk the floor and make the necessary repairs. Before sanding, the floor should be vacuumed and evaluated carefully. The floor should be properly fastened or adhered to the substrate before sanding begins. All visible fasteners should be countersunk. Check for water damaged areas, stains, gouges, etc., that will affect the finishing process (see page 60, Repair and Replacement). Remove the base shoe, quarter round or baseboards as needed (follow all lead abatement requirements prior to disturbing any painted surface in facilities built prior to 1978).

### 3. Containing the Dust

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 sheeting. In addition, most floor-sanding equipment today is or can be equipped with dust-containment devices. Vacuum the floor clean before sanding and after every cut.

- A. All doorways should be sealed off when possible.
- B. On some jobs, you may also want to protect

the wall coverings, ceilings and other floor coverings from wood dust. Some wood species have color and oils that may stain.

- C. If light fixtures are covered, fixtures should remain off. Covering light fixtures will create an extreme fire hazard – use extreme caution. Tape the switch in the off position if necessary.
- D. 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. Use a “delicate surface” tape. Tape as much as possible to doorjambes instead of wall paint, and never tape wall coverings such as wallpaper. Always test the surface to be taped in an inconspicuous area to minimize surface damage.
- E. 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 running while operations are ongoing. In such cases, prefilter materials are available to cover HVAC returns. Check with a local HVAC contractor to determine which prefilter materials are appropriate. If the HVAC contractor/manufacturer is unavailable, a standard pleated MERV (Minimum Efficiency Reporting Value) 8 filter is effective in removing wood dust particles from entering the system.
- F. It is also essential to protect smoke and carbon-monoxide detectors and fire-alarm systems, but remember to remove the dust protection before you leave the job site.
- G. Cover the openings of gas fireplaces to avoid downdraft. Turn off pilot lights at all appliances, as well as any auto-ignition devices associated with the fireplace.
- H. When covering appliances, be careful not to seal off the refrigerator fan as this may overheat the appliance.

### 4. Covering Windows

To avoid solar gain within the working space, cover all windows on the flooring surface during the finishing processes. Window coverings should be closed when sunlight is coming through the window to avoid elevated temperatures on the wood floor. Where window coverings are not an option, use a transparent painter’s plastic to cover the window. This allows light in, and keeps heat out. In situations where neither of these options is possible, schedule the finish application during a time when the sun will not be affecting the temperature of the floor.

## Sanding Previously Finished Floors

When sanding a previously finished floor, ascertain whether the floor finish contains lead. All floor finishes applied before 1978 may contain lead. Test kits are available to determine the presence of lead in floor finishes and other architectural coatings. Abide by local, state and federal guidelines for handling and disposal of lead-based products. Failure to do so can result in significant fines. For more information, visit the U.S. Environmental Protection Agency website at [www.epa.gov/lead](http://www.epa.gov/lead).

1. Start a daily job log. Record all information about the job, number of square feet, the weather, the condition of the floor, moisture contents, color notes if staining the floor, finish notes including amount used, name brand and lot numbers, dry times between coats, and amount used in each coat.
2. It is not necessary to fully sand the floor to restore the finish unless the floor has visible dents, wear patterns or permanent cupping, or the customer wants to change the color of the floor. Abrade and recoat may suffice. Cupped floors should not be sanded until the moisture problem has been corrected and the moisture content of the wood flooring and the subfloor have stabilized and are equalized.
3. The number of times a given floor can be sanded depends on the skill of the person sanding the floor, the type of equipment used, the thickness of the remaining wear-layer, and the flatness of the floor. Refer to the floor manufacturer's recommendation for guidelines on the number of times a floor can be sanded, and for any other recommendations. Evaluate wear-layer thickness in several areas and check for flatness to ensure whether you should attempt sanding. Measurements can often be made at floor registers or by removing transition moldings. Where there are sufficient gaps between boards, a feeler gauge may be used to measure the thickness of the flooring down to the tongue. Caution: This method works well with solid wood flooring, but may not be accurate with some engineered flooring. Be aware that the wear layer on some engineered wood flooring may not be as deep as the tongue. Generally, if the wear thickness is less than 3/32", the floor should not be sanded.
4. If the floor was factory-finished, determine what type of finish was applied. High-abrasion finishes such as aluminum oxide may be difficult to sand. High-abrasion finishes may respond better by using a fine-grit (80-grit or finer grit ceramic-fired) abrasive as the first grit used, followed by a coarser grit to begin the upward grit progression to remove these surface finishes.

5. When sanding eased- or beveled-edge flooring, appearance of bevels may not be consistent after sanding. In the case of a micro-bevel product, it is possible that the bevel will be eliminated. The sanding process may require an extra cut in order to completely eliminate these eased edges. When maintaining the beveled edges, carefully clean and/or scrape the bevels (be careful not to damage the face of the board). In addition, make the customer aware that sanding a beveled-edge product will change the profile of the bevel and the look of the floor.

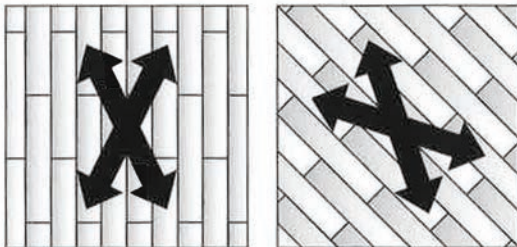


6. If the floor was previously site-finished, use the least coarse abrasive necessary to remove the previous finish. When old paint, shellac or wax is present on an existing floor, move quickly with the machine set at a light pressure setting to minimize heat (which will liquefy these old coatings and may damage your equipment).
7. When resanding a dark-stained or white-stained floor and changing color, the floor can exhibit residual stain in the soft grain and cracks which may require a more aggressive 1st cut in order to remove the previous color.
8. Older installations that undergo the refinishing process may experience filler-pop. This is the result of movement of the wood flooring.
9. Pre-existing conditions such as loose substrates or vertical deflection in the flooring system may cause wavy or chattered appearances in the final sanded product, and are often unavoidable. Here are a couple of suggestions that may not completely alleviate the effects, but may help minimize them.
  - Sand the flooring at a 7-15° angle all the way through the final sanding phases. This will also require additional sanding with a multi-disc, planetary or oscillating machine to properly remove scratch marks in the flooring surface and remove the condition.
  - Secure the substrate from below per local building codes.

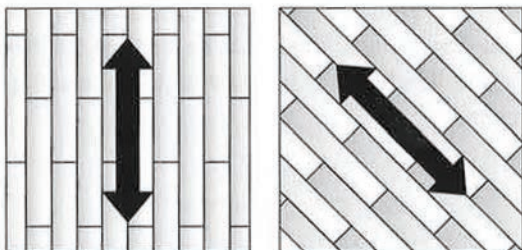


## Sanding Strip & Plank Floors

1. Check the moisture content of the wood floor for any changes that may have occurred since the original acclimation and installation. (For a more-detailed discussion of acclimation, refer to the companion piece to this publication, the National Wood Flooring Association Installation Guidelines and Methods.)
2. If the floor is installed in an adhesive application, sanding and finishing should occur after the adhesive has cured and the moisture content of the wood has returned to the same level as flooring was before gluing. Refer to the adhesive manufacturer's recommendations for proper curing time.
3. Load the sanding machine with the proper sequence of sandpaper as shown on page 16.
4. Make note of a few key variables on the jobsite such as the specie of the wood to be sanded, whether or not it's going to be stained, the nature of the surface finish that is going to be used (sheen level) and the overall lighting intensity that the sand job will be exposed to as a finished product. Determine where any potential sanding challenges might lie and plan out your sand job, abrasive selection and which machines/tools are going to be most suitable for the job. If the wood is a specie (or mixture of species) that contains a relatively high degree of material hardness, it may require attention beyond traditional sanding procedures to flatten the floor and minimize scratch patterns.
5. 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 1st cut should be at a minimum 7-15° angle to the length of the boards.



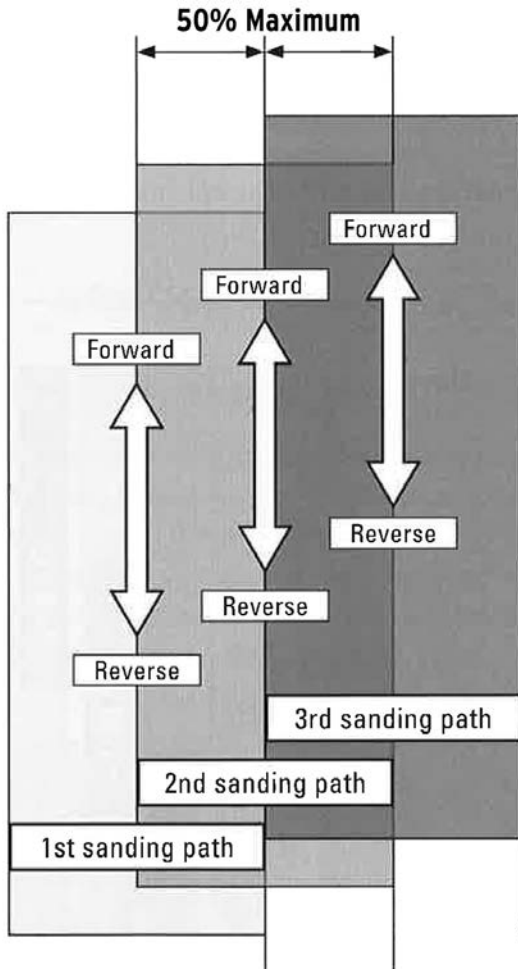
Subsequent cuts should be parallel to the length of the boards.

6. The first cut with the big machine should be at a minimum 7-15° angle to the length of the boards, using the finest grit possible that will flatten the floor. More aggressive angles (up to 45°) may be necessary to achieve a flat surface in extreme cases. Wider plank floors, excessive overwood/underwood (exceeding 1/8") or uneven flooring systems may benefit from a steeper angle first cut. The more uneven the flooring surface, the steeper the angle of the cut should be.

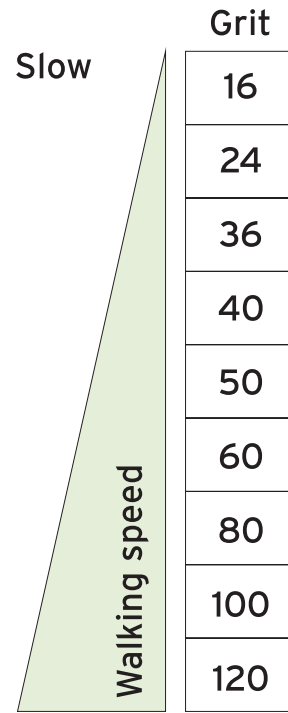


- In cases of permanent cupped floors, it is recommended that the big machine's first cut follows directly in line with the board lengths before cutting at a 7-15° angle.
- When the 1st cut exceeds a 15° angle to the direction of the floor, the subsequent straight cut must be made with the same grit paper used on the first cut at the exact opposite angle in order to remove the scratches and flatten the floor.

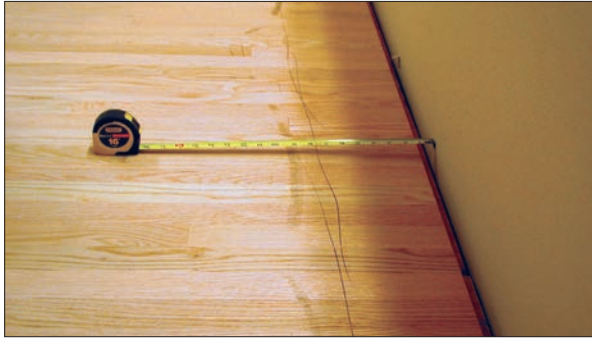
- Start the machine with the drum raised off the flooring surface. As you begin to move forward, gradually begin to lower the drum to the floor and continue moving forward. Before reaching the opposite wall, gradually raise the sanding drum from the floor, then move backward over the same path, again 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, then repeat the forward and backward passes.
- The area of the floor being sanded should be at approximately 1/3 to 2/3 of the length of the room. Be sure not to start and stop in highly visible areas when possible.
- When one side of the floor is complete, turn the sander in the opposite direction and repeat the process on the remaining floor. Cuts made in the one-third area must overlap the first cuts by two to three feet to blend the two areas together. To avoid creating a trough (noticeable overlap area), be careful not to stop the sander in the same spot each pass by staggering the overlap every 2-3 passes.



- Walking speed with the big machine should be slow and consistent. Coarse grit abrasives usually require slower walking speeds than finer grit abrasives. Harder, denser species will require slower walking speeds than softer, less dense species.
- The purpose of all succeeding cuts is to refine the scratches left by the preceding cuts. If the result is not satisfactory, the previous step must be repeated.
- Vacuum between cuts.
- The second cut with the big machine should be the same as the last cut, but at the exact opposite angle, using the next appropriate grit of sandpaper, not skipping more than one grit between sanding cuts.
- All subsequent cuts with the big machine should be parallel to the grain, not skipping more than one grit between sanding cuts.
- Use an edger to sand edges and other places inaccessible to the sanding machine, using the finest grit possible that will flatten the floor. The first purpose of the edger is to flatten the floor as much as possible and, in the case of a previously finished floor, to remove old finishes. The most effective way to flatten the floor with the edger is to cut across the grain. The edger should overlap into the areas where the big machine sanded in order to blend the perimeter with the field.



17. As with the big machines, care should be taken to keep the machine moving to prevent gouges with the machine. Never apply pressure onto the edger to attempt getting more aggressive. This is not only hard on the machine, but also results in unsightly sanding marks on the floor.
18. The purpose of all succeeding cuts with the edger is to refine the scratches left by preceding cuts.
19. Vacuum between cuts.
20. For the final cut with the edger, use the same grit that will be used on the final sanding cut with the big machine.
21. Hand scrape corners, around doorjamb and other areas where the edger cannot be used. Apply even pressure, scraping in the direction of the grain. After scraping, use a sanding block and paper (same grit as on sanding machine) to blend the flooring. Sanding the bevel with the corner of the block may be necessary on bevel-edged products.



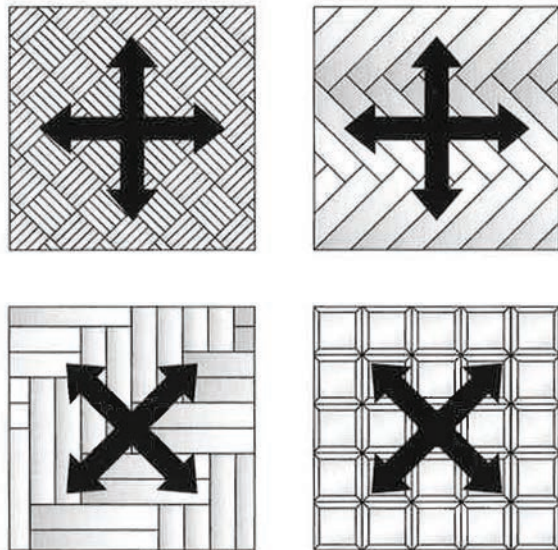
*Do not sharpen scrapers on raw wood when using waterborne finishes. The filings may cause rust spots or black spots in the finish.*

22. The final sanding processes involve examination of visible edger and sander imperfections. These must be removed by hand prior to the final sanding stages. When using hand-held random orbital sanders or other sanding machines to remove perimeter scratches, be sure to use the same grit as was used in the final sanding process. If the result is not satisfactory, the previous steps must be repeated.
23. Tools such as buffers/rotary sanding machines, multi-disc/planetary or oscillating machines will refine the scratch patterns in the entire flooring surface to bring the scratches to an

acceptable level. Grit sequence and sanding procedures will play a key role in how the floor accepts the finish. This final sanding process blends the scratch patterns from the big machine, edgers, scrapers and hand-held sanders. It is important to take additional time during this step of the process.

## Sanding Parquet Floors

1. Check the moisture content of the wood floor prior to sanding to ensure moisture content is at the same level as properly acclimated/conditioned flooring from the installation process. (For a more detailed discussion of acclimation, refer to the companion piece to this publication, the National Wood Flooring Association Installation Guidelines and Methods.)
2. If the floor is installed in an adhesive application, sanding and finishing should occur after the adhesive has cured and the moisture content of the wood has returned to the same level as properly acclimated/conditioned flooring from the installation process. Refer to the adhesive manufacturer's recommendations for proper curing time.
3. Load the sanding machine with the proper sequence of sandpaper.



*All cuts should be at a 45° angle to the direction of the wood.*

4. The first cut should be at a 45° angle to the wood grain using the finest grit possible that will flatten the floor. This prevents dish-out of the material.
5. Vacuum between cuts.
6. The second cut should be on the opposite angle to the wood grain, using the next appropriate grit of sandpaper, not skipping more than one grit between sanding cuts. This prevents dish-out of the material.



7. Use an edger to sand edges and other places inaccessible to the sanding machine, using the finest grit that will flatten the floor.
8. Vacuum between cuts.
9. For the final cut with the edger, use the same grit that will be used on the final sanding cut with the big machine.
10. All subsequent sanding cuts with the big machine should remain at an angle to the wood grain to prevent dish-out of the material. The cut angle on the floor will be dictated by the many variations in grain direction, species and condition of each individual floor. Use the last sequenced grit, not skipping any grits between sanding cuts. Typically, the final sanding grit for a parquet floor will be finer than for a strip or plank floor.
11. Hand scrape corners, around doorjamb and other areas where the edger cannot be used. Apply even pressure, scraping in the direction of the grain. After scraping, use a sanding block and paper (same grit as on the sanding machine) to blend the flooring. Sanding the bevel with the corner of the block may be necessary on bevel-edged products. Do not sharpen scrapers on raw wood when using waterborne finishes. The filings may cause rust spots or black spots in the finish. (See photo, page 22.)
12. Vacuum thoroughly.
13. Examine for visible edger and sander imperfections by closely inspecting the floor with bright lights and on hands and knees, then make repairs as necessary. Extra sanding may be required using hand-held orbital sanders, scrapers or by hand to remove imperfections. If the result is not satisfactory, the previous steps must be repeated.
14. When using random orbital sanders or other sanding machines to remove scratches, be sure to use the same grit as was used in the final sanding process.
15. Vacuum thoroughly.
16. Parquet floors should be final sanded using a hard plate attachment on the buffer, a multi-disc sanding machine or an oscillating sander in order to minimize dish-out and uneven flooring. When transitioning to these types of sanders, start with the last grit you used on the big machine and progress to the desired finish grit without skipping any grits. These types of sanders will also mask or alleviate any cross-grain scratch patterns, which may otherwise become apparent on the final product.



## Sanding End Grain Floors

1. Check the moisture content of the wood floor prior to sanding to ensure moisture content is at the same level as properly acclimated/conditioned flooring from the installation process. (For a more-detailed discussion of acclimation, refer to the companion piece to this publication, the National Wood Flooring Association Installation Guidelines and Methods.)
2. If the floor is installed in an adhesive application, sanding and finishing should occur after the adhesive has cured and the moisture content of the wood has returned to the same level as properly acclimated/conditioned flooring from the installation process. Refer to the adhesive manufacturer's recommendations for proper curing time.
3. Load the sanding machine with the finest abrasive selection possible to flatten the flooring. It is recommended to not skip any grits when sanding end grain flooring.
4. The first cut should be at a 45° angle to the direction of the installation. Walking speed is slower than normal due to the density of the material.
5. Vacuum between cuts.
6. The second cut should be on the opposite 45° angle, using the next grit of sandpaper, not skipping any grits between sanding. Again, walking speed is slower than normal.
7. Use an edger to sand edges and other places inaccessible to the sanding machine, using the finest grit that will flatten the floor.
8. For the final cut with the edger, use the same grit that will be used on the final sanding cut with the big machine.
9. Each of the subsequent sanding cuts with the big machine should also be at a 45° angle to the direction of the installation. Typically, the final sanding grit for end grain flooring will be finer than for a strip or plank flooring.
10. Vacuum thoroughly.



11. Hand scrape corners, around doorjamb and other areas where the edger cannot be used. Apply even pressure, scraping in the direction of the grain where possible. After scraping, use a sanding block and paper (same grit as on the sanding machine) to blend the flooring. Do not sharpen scrapers on raw wood when using waterborne finishes. The filings may cause rust spots or black spots in the finish. (See photo, page 22.)
12. Examine for visible edger and sander imperfections and make repairs as necessary. If the result is not satisfactory, the previous steps must be repeated.
13. When using random orbital sanders or other sanding machines to remove perimeter scratches, be sure to use the same grit as was used in the final sanding process.
14. Vacuum thoroughly.
15. End grain floors should be final sanded using a hard plate attachment on the buffer, a multi-disc sanding machine or an oscillating sander in order to minimize gouging, dish-out and uneven flooring. These types of sanders will also mask or alleviate any discernible scratch patterns that may otherwise become apparent on the final product.

## Sanding Cork Floors

1. Determine if the cork flooring is sandable (some cork products have a veneer pattern of approximately .2mm thickness. These types of floors should be recoated only. Do not attempt to fully resand).
2. If the floor is installed in an adhesive application, sanding and finishing should occur after the adhesive has cured and the moisture content of the wood has returned to the same level as the flooring was before gluing. Refer to the adhesive manufacturer's recommendations for proper curing time.
3. Due to the resilience of cork, special caution must be used when sanding it. Cork floors should be sanded using a hard plate attachment on the buffer, a multi-disc sanding machine or an oscillating sander. If using a drum/belt sander, use the lightest pressure setting and be cautious of sanding through the cork material.
4. Load the sanding machine with the proper sequence of sandpaper. Do not start with too coarse of grit. Generally, it is best to start with 80-100 grit. Note that with unfinished cork tiles or planks, you may find it unnecessary to use a big machine to make your first cut. Simply using a buffer with 100-120 grit abrasive will cut into cork quite nicely, and that particular grit size can easily cut through any high/low conditions that may exist between planks or tiles. If the result is not satisfactory, the previous steps must be repeated.
5. Vacuum thoroughly.

6. Finish abrading the floor with a fine grit (150-180) abrasive to give a smooth finish. If filling any gaps or holes is necessary, it is best to use color-matched/coordinated wood filler or the fine cork dust created during the sanding process mixed with a liquid binder.
7. The finish used may be dictated by the type of finish that was previously on the cork.

## Sanding Bamboo Floors

1. If bamboo is factory finished, refer to page 19, Sanding Previously Finished Floors, at the beginning of this chapter for recommendations on removing the factory finish coatings.
2. If the floor is installed in an adhesive application, sanding and finishing should occur after the adhesive has cured and the moisture content of the bamboo has returned to the same level as the flooring was before gluing. Refer to the adhesive manufacturer's recommendations for proper curing time. Refer to the moisture meter manufacturer for proper meter settings for bamboo.
3. Load the sanding machine with the proper abrasive sequence.
4. Vacuum between cuts thoroughly.
5. Typically, the final sanding grit for bamboo flooring will be finer than for wood flooring. Oversanding can cause bamboo fibers to dishout.
6. Water popping bamboo prior to final sanding may minimize fiber/grain raise often caused by some sealers. Fiber raise on bamboo may leave a rough appearance.
7. Bamboo typically doesn't take stains uniformly. Test flooring for color acceptance prior to application.
8. Finish abrading the floor with a fine grit abrasive to give a smooth finish.
9. If filling any gaps or holes is necessary, it is best to use the fine bamboo dust created during the sanding process mixed with a liquid binder.
10. Strand woven bamboo must be tested for compatibility with finishes prior to sanding and/or finish application.

## Sanding Metal Inlays

1. When sanding brass, aluminum or other non-ferrous metals with a drum or belt sander, be aware that the metals will dull the abrasive at a quicker rate than wood materials. This may cause streaks in the abrasive which will transfer to the flooring surface.
2. Use caution when using an edger to not overheat the metals, which can burn adjacent wood or cause metal expansion that may lead to adhesive bond failure.

3. If the metal inlay is protruding above the surface of the flooring surface, use a router with a pattern bit to cut the metal down to slightly below the flooring surface, or sand the metal flush using 50 or 60 grit paper.
4. Sand at short intervals and move to different areas, allowing the metal to cool.
5. Thoroughly vacuum the metal filings from the floor surrounding the inlay. When applicable, use a solvent such as lacquer thinner or denatured alcohol to clean the floor before application of finish. Always check with the finish manufacturer for compatible tacking solvents with specific finishes.
5. Alternatively, recoating these types of floors may often be the best option (see page 64).
6. Routine maintenance on these types of floors is extremely important to the longevity of the products. Unfortunately, when improperly maintained, these floors are extremely difficult to bring back to the intended appearance.

## Stone Inlays

1. Stone and tile inlays are common decorative flooring options. When applicable, remove the stone or tile inset and replace with a plywood blank during the sanding phase. Once the sanding is completed, remove the blanks and replace with the stone or tile.
2. In order to maintain proper expansion space around the stone or tile, use of a silicone or flexible grout caulking should separate the wood from the stone or tile.
3. In situations where the stone or tile is not removable, sand with extreme caution around the fixated flooring material.
4. It is not recommended to sand stone inlays.

## Sanding Distressed/Sculpted Floors

1. When sanding a distressed or sculpted floor use extreme caution. Distressed flooring may be classified as hand scraped, wire brushed, textured or similar.
2. These types of floors cannot be resanded using traditional methods to maintain the textured appearance.
3. Due to the variation in the surface wear layer thickness, these types of floors are extremely difficult and often cannot be sanded. The wear layer may be less than the recommended 3/32" thickness in many areas of the floor, which would become the lowest point that the remaining floor would need to be sanded to in order to get it flat.
4. When a sculpted floor is at the point of needing to be refinished, the alternative methods are either rescraping, rewire brushing, or retexturing using alternative methods and equipment. Massive amounts of work must typically be done by hand in order to restore the original intended sculpture of these floors. When resculpting an existing floor, the appearance will likely change.

# FILLING

Fillers are substances used to fill holes, cracks and irregularities in the wood surface. The floor should be filled before the final straight cut during the sanding process. There are several types of fillers; all are typically applied with a trowel or putty knife.



## Types of Filler

1. 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 an abrasive. Sanding grain fillers with an abrasive 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 open wood grain.



2. Spot filler (also called "wood patch") is typically used for larger cracks or holes and for spot filling during the sanding process. 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.



3. Trowel filler is a thinner version of spot filler that is designed to spread across the entire surface of the wood floor while removing all excess as you proceed across the floor. This is done during the sanding process. It may also fill cracks and small holes.
4. Touch-up putty is typically used on factory finished floors or after all of the coats have been applied to a jobsite finished floor. These putties come in a variety of color options. Check with the manufacturer of these products to determine compatibility with wood floor finishes. Some may be used between coats of finish, but should never be used on raw wood.
5. Hard wax sticks are usually either rubbed or melted into cracks and holes. Use of a "burn-in knife" is often required to melt these fillers into the hole. Check with the manufacturer of these products to determine compatibility with wood floor finishes. These products should never be used on raw wood.

## Filler Process

1. Prior to filler application, the floor must be thoroughly vacuumed to remove dust and debris from nail holes, knots and between floor boards.
2. Spot-fill beveled-edged products; square-edged products may be spot-filled or trowel-filled.
3. Use a filler or putty that is compatible with the stain and/or finish that will be applied.
4. Most latex-based fillers cannot be bleached. Some touch-up putty and hard wax sticks cannot be stained or bleached.
5. The color of the filler must be consistent with the overall color tone of the floor.

6. For light-sensitive wood, filler should be reasonably consistent with the overall color tone of the floor. Light-sensitive wood species will change color over time, as compared to the color of the wood filler.
7. You can make your own filler with the fine dust from the sanding process mixed with a compatible mixing agent to form a thick paste. This process is ideal for color sensitive species of wood and for difficult-to-match colors of wood since you are using the same material. If the floor is to be colored, make sure your mix can be colored by testing before application.
8. Wood filler must be pushed into the gaps and voids, not just bridging the gap.
9. Nail hole filler must be flat with the surface of the floor (not indented or depressed) and reasonably consistent with the overall color tone of the flooring. Filler may not be recommended or required on every floor.
10. In areas with humidity swings, do not fill seasonal gaps during the dry seasons (winter months). Filler used in these situations will likely cause damage to the flooring when the wood expands again in the humid seasons.
11. Loose floors will not hold floor filling compounds.



12. Popped filler can occur when filler pops and sinks in cracks when the environmental conditions are unstable from season to season.



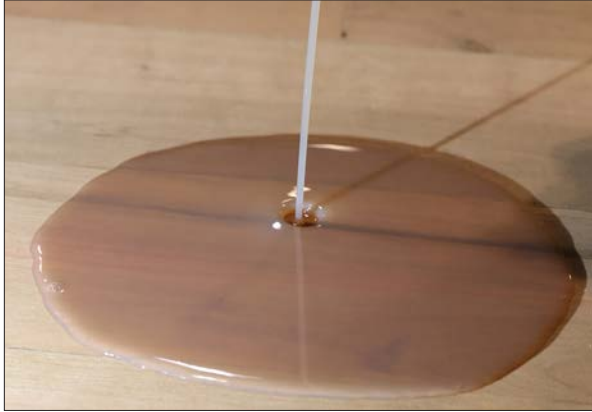
## Wood Slivers

1. Wood slivers (dutchmen) may be used in larger gaps.
2. To make dutchmen/slivers, standard flooring or dimensional lumber may be used. Ideal dimensions of the material to cut from are about 18-20" lengths and 3/8" thickness.
3. Use blue tape or a zero clearance blade guard on the table saw to avoid dutchmen from falling through.
4. Set the table saw blade at a 7° angle and adjust its distance from the fence to the width of the board. Then cut a thin sliver from both sides of the board.
5. Adjust the blade back to 90° and cut thin slivers from the board. Continuously adjust the distance of the blade to the fence.
6. Identify a dutchman by color and grain orientation to reasonably match a surrounding board.
7. Cut the dutchman with a sharp razor knife to the necessary length of the gap being filled. Apply quality wood glue to only one side of the dutchman.
8. Insert the dutchman narrow side down, to fill the space in the void.
9. Use a sharp razor blade and/or block plane to shave the dutchman flush with the adjoining flooring.
10. Allow the repair to completely dry prior to sanding.

Do not begin the final sanding phase until all filler material has thoroughly dried.



# FINISHES



## Basic Chemistry of Finish

Wood floor finishes have evolved over the many years they have been used within our trade. The chemistry of wood floor coatings is a continuously developing science and although the ingredients have changed over the years, the basic components remain the same. In general, wood floor coatings are made up of solvents, dryers, leveling agents and matting agents, all of which form the coating's film. Additional ingredients may include viscosity-modifiers, surfactants, defoamers and chemical catalysts or hardeners.

The chemistry of each one of these ingredients differentiates one product from another. It is these differences that dictate the unique qualities of application, coverage rates, dry times and final appearance of each finish.

A general knowledge of the coatings industry is important in our trade to help us understand the products we are using, how to properly apply them, and the health and safety concerns associated with them. As always, follow the finish manufacturer's specific directions for the proper application, intended uses and coverage rates of all finishes. GHS Safety Data Sheets (see page 8) are required for all products and are made available through the manufacturers of the products.

## Drying and Curing

Each finish type is unique in the rate and mechanics in which it dries and cures. Drying is the act of changing from a liquid to a solid film by the evaporation of solvents, oxidation, polymerization or by a combination of these processes.

The different phases of drying are relatively common among all finish types.

1. **Set Point (or Dry Tack Free)**  
The first stage in the drying process in which the film forming finish will no longer flow or level. It is not dry, it may be tacky or may even feel liquid when touched, but enough of the liquid carrier has evaporated so that the product will not flow or level any further.
2. **Dry to Touch (or Surface Dry)**  
The second stage in the drying process in which the film of the finish has dried sufficiently that it can be touched lightly without finish material sticking to the fingers. The finish film is dry on the top, but remains relatively soft on the bottom. This is the stage in which air movement should be reintroduced to the room to further assist in the drying process.
3. **Dry to Sand (or Dry Hard)**  
The third stage of solidification of a film-forming finish when it can be sanded without undue softening, clogging or sticking to the sandpaper. This is the point in which the finish may be abraded for another coat to be applied, or opened to light traffic. The finish should not be covered at this stage of drying, even though this is the stage that people typically release the final product to the consumer.
4. **Cured**  
This is the phase of the drying process in which the properties of the finish achieve 100% of its intended properties. Depending on the type of finish, this process may take days or months.

## Sealer Types

### Oil Modified Sealers

1. **Characteristics**
  - A. Chemical Properties
    1. Oil modified sealers are similar to an oil modified topcoat finish with a much lower solids content.
    2. This lower solids formula has a higher percentage of solvents, allowing it to penetrate the wood and dry quickly.
    3. Most oil modified sealers have solids content between 30-35% whereas traditional oil modified topcoats have solids content between 40-50%.

B. Aesthetics

1. Amber in color.

C. Odor

1. Moderate odor, which can permeate but will dissipate after sealer has dried.

D. Dry Time

1. Follow all manufacturer recommendations on the product including dry time.
2. Slow dry times during application.
3. Dry to touch can range from 2-6 hours.
4. Dry to sand can range from 4-12 hours.
5. Dry times will be affected by the ambient temperature and relative humidity.

## 2. Application Guidelines

A. Mixing

1. Follow all manufacturer recommendations on the product including mixing.

B. Application Method

1. Follow all manufacturer recommendations on the product including applicator recommendation.
2. Lambswool, natural bristle brushes, rollers, t-bars and cut-in pads are most commonly used with these sealers.
3. One to two coats are recommended for oil modified sealers.
4. Apply sealer at the manufacturer recommended coverage rate.

C. General Guidelines

1. Ensure room and floor temperature is between 60-80°F and floor has been properly sanded and prepared prior to application of seal coat.
2. Previously applied stains must be completely dried, clean and adequately adhered to the surface.
3. Map out the room to determine starting points, cut-off points and exit points.
4. Begin application along one edge in the direction of the flooring.
5. Cut-in at the walls and in corners.
6. Remove excess sealer from the applicator and apply liberally with smooth, even strokes along the grain. Overworking can cause bubbles and splatter.
7. Work in a path narrow enough to keep a wet edge, and lap strokes back into the area just covered.
8. All application strokes should be feathered into the wet edge of the sealer.

9. Maintain consistency with the application of the sealer to obtain a consistent mil-film thickness in accordance with the recommended coverage rates.

10. Application of the sealer too thin or too heavy will adversely affect performance, dry times, and final appearance.

D. Abrasion Requirements

1. These sealers must be abraded between coats. Failure to abrade will result in lack of adhesion.
2. Abrade to the manufacturer recommended grit for proper adhesion.

E. Clean-Up/Disposal

1. Clean up using mineral spirits or paint thinner for application tools.
2. Rags, applicators or wood dust containing oil modified urethane sealers may spontaneously combust if they are disposed of improperly. Place all items in an approved metal safety container or a water bucket to avoid spontaneous combustion.
3. Treatment, storage or disposal of this product, or waste containing this product, must follow all applicable federal, state and/or local regulations.

## 3. Safety

A. Personal Protective Equipment

1. Follow all manufacturer recommendations on the product including safety.
2. Use only with adequate ventilation.
3. Respiratory protection required.
4. Use eye protection designed to protect against splash of liquids.
5. Use gloves to prevent prolonged skin contact.

B. Flammability Rating

1. Classified as a combustible material, meaning it is able to catch fire and burn easily.
2. Do not store above 100°F.

C. Special Considerations

1. Contain solvents that have been known to cause nervous system damage and permanent brain damage.
2. Contains chemicals known to cause cancer, birth defects or reproductive harm.
3. Misuse can be harmful or fatal.

#### 4. VOC Restrictions

- A. AIM Varnish or Wood Coating Category
  1. VOC regulations have limited the use of some of these sealers in some parts of the country.
  2. VOC levels vary from >275 to 550 g/L within this product category.

### Water Based Sealers

#### 1. Characteristics

- A. Chemical Properties
  1. Chemically speaking, most waterborne sealers break down into three categories: acrylic, urethane and acrylic/urethane blends.
  2. Some are available as single and two-component products.
  3. Their primary functions are to prevent tannins from discoloring/interfering with top coats, to inhibit panelization and to create a film build.
  4. Film formation is the result of water and solvent evaporation.
- B. Aesthetics
  1. Range from clear to slightly amber in color.
  2. Some may contain ambering pigments or pigment emulsions to mimic the look of oil modified sealers.
- C. Odor
  1. Mild odor that will dissipate after sealer has dried.
- D. Dry Time
  1. Fast dry times during application.
  2. These sealers are fast setting due to water absorption by the wood. Ensure the coating process accounts for quick dry times.
  3. Dry to touch can range from 1-4 hours.
  4. Dry to sand can range from 4-12 hours.
  5. Dry times will be affected by the ambient temperature and relative humidity.

#### 2. Application Guidelines

- A. Mixing
  1. Follow all manufacturer recommendations on the product including mixing.

#### B. Application Method

1. Follow all manufacturer recommendations on the product including applicator recommendation.
2. Rollers, t-bars and cut-in pads are most commonly used with these finishes.
3. One to two coats are usually recommended for these sealers (dependent upon manufacturer specifications).
4. Apply sealer at the manufacturer recommended coverage rate.

#### C. General Guidelines

1. Ensure room and floor temperature is between 60-80°F and floor has been properly sanded and prepared.
2. Previously applied stains must be completely dried, clean and adequately adhered to the surface.
3. When applying two coats in one day, take moisture readings of the flooring in numerous areas of the floor to keep as a baseline for subsequent coats. It is not recommended that more than two coats of waterbase be applied in a day.
4. Map out the room to determine starting points, cut-off points and exit points.
5. Begin application along one edge in the direction of the flooring using the "snowplow" method.
6. Cut-in at the walls and in corners.
7. Remove excess sealer from the applicator and apply liberally with smooth, even strokes along the grain. Overworking can cause bubbles and splatter.
8. Work in a path narrow enough to keep a wet edge, and lap strokes back into the area just covered. All application strokes should be feathered into the wet edge of the sealer.
9. Maintain consistency with the application of the sealer to obtain a consistent mil-film thickness in accordance with the recommended coverage rates. Application of the sealer too thin or too heavy will adversely affect performance, dry times, and final appearance. However, the coverage rates with the first coat of sealer will vary based on wood specie and final abrasive selection.
10. Before considering application of the next coat, check moisture content of flooring in the same areas. Moisture content must be the same before proceeding with another coat.

- D. Abrasion requirements
  1. Follow manufacturer recommendations for intercoat abrasion and dry times.
  2. These sealers do not always need to be abraded between coats.
- E. Clean-Up/Disposal
  1. Clean up using water for application tools.
  2. Dispose of rags and applicators according to manufacturer recommendations.
  3. Treatment, storage or disposal of this product, or waste containing this product, must follow all applicable federal, state and/or local regulations.

### 3. Safety

- A. Personal Protective Equipment
  1. Follow all manufacturer recommendations on the product including safety.
  2. Use only with adequate ventilation.
  3. Respiratory protection required.
  4. Use eye protection designed to protect against splash of liquids.
  5. Use gloves to prevent prolonged skin contact.
- B. Flammability Rating
  1. Classified as non-combustible materials, meaning they are not flammable.
- C. Special Considerations
  1. Many products contain solvents that have been known to cause nervous system damage and permanent brain damage.
  2. Contains chemicals known to cause cancer, birth defects or reproductive harm.
  3. Misuse can be harmful or fatal.

### 4. VOC Restrictions

- A. AIM Varnish or Wood Coating Category
  1. VOC regulations have limited the use of some of these sealers in some parts of the country.
  2. VOC levels vary from >0 to 450 g/L within this product category.

## Shellac

A clear alcohol-based sealer often used as a standard base coat. These sealers have many uses and benefits in the wood industry with excellent adhesion qualities.

## 1. Characteristics

- A. Chemical Properties
  1. The resinous material secreted by an insect (*Laccifer lacca*) that feeds upon the twigs of certain trees in India. It is soluble in alcohol to form liquid shellac, which is widely used as a sealer and finishing material for wood.
  2. Natural shellac contains wax and is not widely used as a top coating for wood flooring. However, dewaxed shellac (universal sealer) is common as a sealer for wood flooring.
  3. This family of sealers is fairly common for wood floors. They are 100% dewaxed shellac, which are compatible with most types of coatings.
  4. These sealers are often used as knot sealers, chemical blockers and odor barriers.
- B. Aesthetics
  1. Clear to dark amber color.
  2. Depth and clarity of grain.
- C. Odor
  1. Very strong odor which can permeate absorbent goods/materials, but will dissipate after finish has dried.
  2. After finish has dried, proper ventilation that creates air exchange is important.
- D. Dry Time
  1. Follow manufacturer recommendations for dry times.
  2. Fast dry times during application.
  3. Dry to touch can range from 30 minutes to 1 hour.
  4. Dry to sand can range from 2-3 hours.

## 2. Application Guidelines

- A. Mixing
  1. Follow all manufacturer recommendations on the product including mixing and tinting.
  2. Mixing or thinning shellac may allow for easier application of the product.
  3. Check with manufacturer for specific details on amount of alcohol to mix.
  4. May be tinted with universal colorants.
- B. Application Method
  1. Follow all manufacturer recommendations on the product including applicator recommendation.



2. Natural bristle brushes or lambswool are most commonly used with these sealers. Some short nap rollers work as well.
3. One to two coats are recommended prior to application of top coats.
4. Apply finish at the manufacturer recommended coverage rate.

#### C. General Guidelines

1. Ensure room and floor temperature is between 60-80°F and floor has been properly prepared for finish.
2. Previously applied stains and finishes must be completely dried, clean and adequately adhered to the surface.
3. Map out the room to determine starting points, cut-off points and exit points.
4. Begin application along one edge in the direction of the flooring.
5. Apply sealer from wall to wall.
6. Remove excess sealer from the applicator and apply liberally with smooth, even strokes along the grain.
7. Shellac dries very quickly; do not over-brush or over-work.
8. Work in a path narrow enough to keep a wet edge, and lap strokes back into the area just covered. All application strokes should be feathered into the wet edge of the finish.
9. Maintain consistency with the application of the sealer to obtain a consistent mil-film thickness in accordance with the recommended coverage rates.
10. Application of the sealer too heavy will adversely affect performance, dry times, and final appearance.
11. Multiple thin coats are more effective than thicker coats and will improve film build and grain sealing qualities.

#### D. Abrasion Requirements

1. Follow manufacturer recommendations for intercoat abrasion.
2. Intercoat abrasion is not always necessary for these types of sealers; however, for a smoother appearance and prior to final coat, it is recommended.

#### E. Clean-Up/Disposal

1. Follow manufacturer recommendations for clean up.
2. Clean up with denatured alcohol or an ammonia/water solution for application tools.
3. Treatment, storage or disposal of this product or waste containing this product

must follow all applicable federal, state and/or local regulations.

### 3. Safety

#### A. Personal Protective Equipment

1. Follow all manufacturer recommendations on the product including safety.
2. Prevent contact with eyes, skin and clothing.
3. Use only with adequate ventilation.
4. Respiratory protection required with organic vapor cartridges.
5. Full face respirator or fresh air supply mask strongly recommended.
6. Use eye protection designed to protect against splash of liquids.
7. Use gloves to prevent prolonged skin contact.

#### B. Flammability Rating

1. Classified as a flammable material, meaning it is able to catch fire and burn easily, even at normal temperatures.
2. Vapors are heavier than air and may travel considerable distances to ignition sources resulting in potential flash fires.
3. Turn off all open flames including pilot lights and electronic ignition switches until coating has completely dried and room has been thoroughly ventilated.
4. Do not store in extreme hot conditions.

#### C. Special Considerations

1. Many products contain solvents that have been known to cause nervous system damage and permanent brain damage.
2. Contains chemicals known to cause cancer, birth defects or reproductive harm.
3. May cause asthma or breathing difficulties if inhaled.
4. May cause allergic skin reaction.
5. Misuse can be harmful or fatal.

### 4. VOC Restrictions

#### A. Shellac Category

1. These sealers fall within their own category for VOC regulations in most states.
2. VOC levels may fall within the limit of 730 g/L.
3. VOC restrictions have limited the use of these finishes in some parts of the country.

## Stains

Some wood floor stains are considered sealers. Check with the manufacturer of the stain to ensure compatibility, dry times, application procedures, sealing qualities and whether sealer or finish is required (see page 51).

## Coating Types

### Varnish

Any homogenous 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.

A term that is not very useful, given its ambiguity or generic description – could be used to describe almost all film forming oil-based and waterborne finishes, both one- and two-component. In effect, the word “varnish” was first used to describe modifications to natural oils for wood protection, like adding solvents and doing simple synthesis to add urethane functionality for adhesion, performance and durability.

### Oil-Modified Urethanes

A transparent, oil-based varnish enhanced with urethane that provides durability, easy application, self-leveling, and great adhesion qualities that can be used in residences or in commercial settings.

#### 1. Characteristics

##### A. Chemical Properties

1. Natural oils such as linseed, soya, sunflower, tung oil, or hybrids and/or modified (synthesized) versions of these and others, blended with driers, matting agents, and other film-forming ingredients that are carried/dissolved in mineral spirits, or other solvents.
2. Dries by solvent evaporation and cures by oxidation (a reaction of the polyurethane with driers and air).
3. Cures from the top down.

##### B. Aesthetics

1. Amber in color and will yellow with age and exposure to UV light.
2. Available in different gloss levels, from matte to gloss.

##### C. Odor

1. Moderate odor, which can permeate but will dissipate after finish has cured.

##### D. Dry Time

1. Follow all manufacturer recommendations on the product including dry time.
2. Slow dry times during application.
3. Dry to touch can range from 6-24 hours.
4. Dry to sand can range from 24-48 hours.
5. Cure time for most oil-modified urethane finishes can range from 14-30 days (under normal conditions).
6. Dry and cure times will be affected by the ambient temperature and relative humidity.

## 2. Application Guidelines

### A. Mixing

1. Follow all manufacturer recommendations on the product including mixing.
2. Batch multiple containers of finish together to ensure variations between one container and another are not noticeable on the finished floor.

### B. Application Method

1. Follow all manufacturer recommendations on the product including applicator recommendation.
2. Lambswool, natural bristle brushes, rollers, t-bars and cut-in pads are most commonly used with these finishes.
3. Two to three coats are recommended for oil modified urethanes.
4. Apply finish at the manufacturer recommended coverage rate.

### C. General Guidelines

1. Ensure room and floor temperature is between 60-80°F and floor has been properly prepared for finish.
2. Previously applied stains and finishes must be completely dried, clean and adequately adhered to the surface.
3. Map out the room to determine starting points, cut-off points and exit points.
4. Begin application along one edge in the direction of the flooring.
5. Cut-in at the walls and in corners.
6. Remove excess finish from the applicator and apply liberally with smooth, even strokes along the grain. Overworking can cause bubbles and splatter.
7. Work in a path narrow enough to keep a wet edge, and lap strokes back into the area just covered.
8. All application strokes should be feathered into the wet edge of the finish.
9. Maintain consistency with the application

of the finish to obtain a consistent mil-film thickness in accordance with the recommended coverage rates. Application of the finish too thin or too heavy will adversely affect performance, dry times, and final appearance.

D. Abrasion Requirements

1. These finishes must be abraded between coats.
2. Abrade to the manufacturer recommended grit for proper adhesion.

E. Clean-Up/Disposal

1. Clean up using mineral spirits or paint thinner for application tools.
2. Wood dust containing oil modified urethane may spontaneously combust if disposed of improperly. Do not store this type of dust in black plastic trash bags.
3. Treatment, storage or disposal of this product, or waste containing this product, must follow all applicable federal, state and/or local regulations.

**3. Safety**

A. Personal Protective Equipment

1. Follow all manufacturer recommendations on the product including safety.
2. Use only with adequate ventilation.
3. Respiratory protection required.
4. Use eye protection designed to protect against splash of liquids.
5. Use gloves to prevent prolonged skin contact.

B. Flammability Rating

1. Classified as a combustible material, meaning it is able to catch fire and burn easily.
2. Do not store above 100°F.

C. Special Considerations

1. Contain solvents that have been known to cause nervous system damage and permanent brain damage.
2. Contains chemicals known to cause cancer, birth defects or reproductive harm.
3. Misuse can be harmful or fatal.

**4. VOC Restrictions**

A. AIM Varnish or Wood Coating Category

1. VOC regulations have limited the use of some of these finishes in some parts of the country.

2. VOC levels vary from >275 to 550 g/L within this product category.

**Waterborne Urethanes (Waterbase)**

A transparent, water-carried polyurethane that provides exceptional durability, easy application, self-leveling, and great adhesion qualities that can be used in residences or in commercial settings.

**1. Characteristics**

A. Chemical Properties

1. Generally these finishes are made up of emulsions of urethane or acrylic binders, or mixtures of the two, carried by water and other solvents. This is combined with other additives to adjust viscosity, flow and leveling, sheen and other ingredients.
2. Film formation is the result of water and solvent evaporation.
3. Cures by various methods, including oxidation, oxidation + catalyzed cross-linking (polyfunctional aziridine), or cross-linking (polyisocyanate).
4. Waterborne finish is categorized within two classifications: two-component and single component.

Two-component waterborne finishes require two parts: the finish and the catalyst/crosslinker or hardener.

- The second component (crosslinker or hardener) is added immediately before application of the finish.
- Catalyzed products fall into two types of categories:

Polyfunctional aziridine catalyst

- A. Water soluble/dispersible.
- B. Stirred into finish.
- C. Resin part of the system will both dry and cure without the catalyst, but with significantly decreased adhesion, scuff, wear and chemical resistance, and overall durability.
- D. Typically can be recatalyzed for use as a build coat. It is not recommended to use recatalyzed product for the final coat.
- E. Careless use and lack of proper disposal can cause skin to become sensitized to the aziridine.

Poly-isocyanate hardeners

- A. Water dispersible.
- B. Resin part of system will not

dry or cure properly without the addition of the catalyst.

- C. Once the product has been mixed, the pot-life is typically about four hours.
- D. To mix, you must shake vigorously (in order to break up the hardener and disperse it in the resin).
- E. Once mixed, an induction period is required for the dispersed isocyanate to soak into the polymer. Follow the manufacturer's recommended induction period.
- F. Careless use and lack of proper disposal can cause skin to become sensitized to the Isocyanate.

There are two main types of conventional single component waterborne finishes.

- The first types are ready to use straight from the container. These products cure by oxidation from the top down.
- The second types are also ready to use from the container. They contain water based urethane acrylic and an internal/factory-added catalyst for curing, which speeds up the dry time and aids in the cure.

Neither type has a pot life; they may be used on different jobs until the entire container is empty.

- B. Aesthetics
  - 1. Range from clear to slightly amber in color.
  - 2. Some waterborne urethanes contain UV screens and blockers which minimize color change when exposed to UV light.
  - 3. These finishes are available in different gloss levels, from matte to gloss.
- C. Odor
  - 1. Mild odor which will dissipate after finish has dried.
- D. Dry Time
  - 1. Fast dry times during application.
  - 2. These finishes dry relatively quickly. Ensure the coating process accounts for quick dry times.
  - 3. Dry to touch can range from 1-4 hours.
  - 4. Dry to sand can range from 4-12 hours.
  - 5. Cure time for most waterborne finishes is typically between 3-7 days.
  - 6. Dry and cure times will be affected by the ambient temperature and relative humidity.

## 2. Application Guidelines

- A. Mixing
  - 1. Follow all manufacturer recommendations on the product including mixing.
  - 2. Batch multiple containers of finish together to ensure variations between one container and another are not noticeable on the finished floor.
- B. Application Method
  - 1. Follow all manufacturer recommendations on the product including applicator recommendation.
  - 2. Rollers, t-bars and cut-in pads are most commonly used with these finishes.
  - 3. Two to four coats are recommended for waterborne urethanes.
  - 4. Apply finish at the manufacturer recommended coverage rate.
- C. General Guidelines
  - 1. Ensure room and floor temperature is between 60-80°F and floor has been properly prepared for finish.
  - 2. Previously applied stains and finishes must be completely dried, clean and adequately adhered to the surface.
  - 3. Map out the room to determine starting points, cut-off points and exit points.
  - 4. Begin application along one edge in the direction of the flooring using the "snowplow" method.
  - 5. Cut-in at the walls and in corners.
  - 6. Remove excess finish from the applicator and apply liberally with smooth, even strokes along the grain. Overworking can cause bubbles and splatter.
  - 7. Work in a path narrow enough to keep a wet edge, and lap strokes back into the area just covered. All application strokes should be feathered into the wet edge of the finish.
  - 8. Maintain consistency with the application of the finish to obtain a consistent mil-film thickness in accordance with the recommended coverage rates. Application of the finish too thin or too heavy will adversely affect performance, dry times, and final appearance.
- D. Abrasion requirements
  - 1. These finishes do not always need to be abraded between coats.
  - 2. Follow manufacturer recommendations for intercoat abrasion and dry times.
- E. Clean-Up/Disposal
  - 1. Clean up using water for application tools.



2. Dispose of rags and applicators according to manufacturer recommendations.
3. Treatment, storage or disposal of this product, or waste containing this product must follow all applicable federal, state and/or local regulations.

### 3. Safety

- A. Personal Protective Equipment
  1. Follow all manufacturer recommendations on the product including safety.
  2. Use only with adequate ventilation.
  3. Respiratory protection required.
  4. Use eye protection designed to protect against splash of liquids.
  5. Use gloves to prevent prolonged skin contact.
- B. Flammability Rating
  1. Classified as non-combustible materials, meaning they are not flammable.
- C. Special Considerations
  1. Many products contain solvents that have been known to cause nervous system damage and permanent brain damage.
  2. Contains chemicals known to cause cancer, birth defects or reproductive harm.
  3. Misuse can be harmful or fatal.

### 4. VOC Restrictions

- A. AIM Varnish or Wood Coating Category
  1. VOC regulations have limited the use of some of these finishes in some parts of the country.
  2. VOC levels vary from >0 to 450 g/L within this product category.

## Moisture-Cured Urethanes

A transparent, extremely durable and chemical resistant solvent-based urethane finish.

### 1. Characteristics

- A. Chemical Properties
  1. These finishes cure by absorbing minute quantities of moisture vapor from the air, which causes the urethane to dry and harden. Relative humidity is critical to the curing process.
  2. A natural byproduct of this reaction is carbon dioxide gas.
  3. Dries by solvent evaporation.
- B. Aesthetics

1. Clear to dark amber in color.
2. Usually available in gloss only.
- C. Odor
  1. Strong odor, which can permeate but will dissipate after finish has dried.
- D. Dry Time
  1. Application dry times vary, depending on relative humidity (RH). Recommended RH for these finishes to dry properly is between 30-70%.
  2. Dry to touch depends on the relative humidity. Can be as short as 30 minutes at 50% RH or higher.
  3. Dry to sand can depend on the relative humidity. Can be as short as 1 hour at 50% RH or higher.
  4. While these types of products take a while to cure, they will have 90-95% of their full properties overnight. Cure time for most moisture-cure urethane finishes is typically 3-7 days.

### 2. Application Guidelines

- A. Mixing
  1. Follow all manufacturer recommendations on the product including mixing.
  2. Batch multiple containers of finish together to ensure variations between one container and another are not noticeable on the finished floor.
- B. Application Method
  1. Follow all manufacturer recommendations on the product including applicator recommendation.
  2. Natural bristle brushes, lambswool, t-bars and rollers are most commonly used with these finishes.
  3. Two to three coats minimum are recommended for moisture-cure urethane finishes.
  4. Apply finish at the manufacturer recommended coverage rate.
- C. General Guidelines
  1. Ensure room and floor temperature is between 60-80°F and floor has been properly prepared for finish.
  2. Do not apply these finishes over other types of coatings.
  3. Map out the room to determine starting points, cut-off points and exit points.
  4. Begin application along one edge in the direction of the flooring.
  5. Cut-in at the walls and in corners.

6. Remove excess finish from the applicator and apply liberally with smooth, even strokes along the grain. Overworking can cause bubbles and splatter.
7. Work in a path narrow enough to keep a wet edge, and lap strokes back into the area just covered. All application strokes should be feathered into the wet edge of the finish.
8. These finishes will dry relatively quickly in humid conditions. Ensure the coating process accounts for quick dry times. When humidity levels reach 75% and greater, coating can become extremely difficult (toluene is a common solvent used to somewhat retard the dry times in such cases).
9. Maintain consistency with the application of the finish to obtain a consistent mil-film thickness in accordance with the recommended coverage rates. Application of the finish too thin or too heavy will adversely affect performance, dry times, and final appearance.

#### D. Abrasion Requirements

1. Due to their high degree of durability and hardness, may pose a challenge when resanding or intercoat abrading.
2. The adhesion characteristics require meticulous floor preparation to avoid peeling. These finishes do not adhere well to themselves, and because they form such a hard surface are difficult to abrade.
3. Follow manufacturer recommendations for intercoat abrasion and dry times.

#### E. Clean-Up/Disposal

1. Clean-up must be performed with a solvent such as lacquer thinner (which contains alcohol), which will keep the finish soft enough for easy clean-up. This is not good for the finish film on the flooring surface. Toluene may be used for thinning or surface cleaning.
2. Treatment, storage or disposal of this product or waste containing this product must follow all applicable federal, state and/or local regulations.

### 3. Safety

#### A. Personal Protective Equipment

1. Follow all manufacturer recommendations on the product including safety.
2. Prevent contact with eyes, skin and clothing.
3. Use only with adequate ventilation.
4. Respiratory protection required.

5. Full face respirator or fresh air supply mask strongly recommended.
6. Use eye protection designed to protect against splash of liquids.
7. Use gloves to prevent prolonged skin contact

#### B. Flammability Rating

1. Classified as a combustible to flammable material, meaning it is able to catch fire and burn easily, even at normal temperatures.
2. Vapors are heavier than air and may travel considerable distances to ignition sources resulting in potential flash fires.
3. Turn off all open flames including pilot lights and electronic ignition switches until coating has completely dried and room has been thoroughly ventilated.

#### C. Special Considerations

1. Many products contain solvents that have been known to cause nervous system damage and permanent brain damage.
2. Contains chemicals known to cause cancer, birth defects or reproductive harm.
3. May cause asthma or breathing difficulties if inhaled.
4. May cause allergic skin reaction.
5. Misuse can be harmful or fatal.

### 4. VOC Restrictions

#### A. AIM Varnish or Wood Coating Category

1. VOC levels are around 550-700 g/L.
2. VOC restrictions have limited the use of these finishes in some parts of the country.

## Conjugated Oil Varnishes

A clear, semi-transparent, film-forming coating for sealing wood that is typically applied as single component products.

### 1. Characteristics

#### A. Chemical Properties

1. May consist of a multitude of blends including natural penetrating oils and resins.
2. Naturally occurring conjugated vegetable oils, tung oil, or hybrids and/or modified with other synthetic resins; a minimum of 50% of the resin solids consisting of conjugated oil.
3. Film formation of finish is due to the polymerization of these naturally occurring conjugated vegetable oils, modified with other natural or synthetic resins.

- B. Aesthetics
  1. Amber in color.
  2. Some blends will yellow with age and exposure to UV light.
  3. Available in different gloss levels from satin to gloss.
- C. Odor
  1. Strong odor, which can permeate but will dissipate after finish has dried.
- D. Dry Time
  1. Follow all manufacturer recommendations on the product including dry time.
  2. Slow dry times during application.
  3. Dry to touch can range from 2-4 hours.
  4. Dry to sand can range from 24-48 hours.
  5. Cure time for most conjugated oil varnishes can range from 30-90 days (under normal conditions).
  6. Dry and cure times will be affected by the ambient temperature and relative humidity.

## 2. Application Guidelines

- A. Mixing
  1. Follow all manufacturer recommendations on the product including mixing.
  2. Batch multiple containers of finish together to ensure variations between one container and another are not noticeable on the finished floor.
- B. Application Method
  1. Follow all manufacturer recommendations on the product including applicator recommendation.
  2. Lambswool or natural bristle brushes are most commonly used with these finishes.
  3. Three to four coats are usually recommended for conjugated oil varnishes.
  4. Apply finish at the manufacturer recommended coverage rate.
- C. General Guidelines
  1. Ensure room and floor temperature is between 60-80°F and floor has been properly prepared for finish.
  2. Previously applied stains and finishes must be completely dried, clean and adequately adhered to the surface.
  3. Map out the room to determine starting points, cut-off points and exit points.
  4. Begin application along one edge in the direction of the flooring.
  5. Cut-in at the walls and in corners.

6. Remove excess finish from the applicator and apply liberally with smooth, even strokes along the grain. Overworking can cause bubbles and splatter.
  7. Work in a path narrow enough to keep a wet edge, and lap strokes back into the area just covered.
  8. All application strokes should be feathered into the wet edge of the finish.
  9. Maintain consistency with the application of the finish to obtain a consistent mil-film thickness in accordance with the recommended coverage rates. Application of the finish too thin or too heavy will adversely affect performance, dry times, and final appearance.
- D. Abrasion Requirements
    1. Follow manufacturer recommendations for intercoat abrasion.
    2. Intercoat abrasion is not always necessary for these types of finishes; however, for a smoother appearance and prior to final coat, it is recommended.

- E. Clean-Up/Disposal
  1. Clean up using mineral spirits or paint thinner for application tools.
  2. Rags, applicators or wood dust containing conjugated oil varnishes may spontaneously combust if improperly disposed of. Place all items in an approved metal safety container or a water bucket to avoid spontaneous combustion.
  3. Treatment, storage or disposal of this product or waste containing this product must follow all applicable federal, state and/or local regulations.

## 3. Safety

- A. Personal Protective Equipment
  1. Follow all manufacturer recommendations on the product including safety.
  2. Prevent contact with eyes, skin and clothing.
  3. Use only with adequate ventilation.
  4. Respiratory protection required.
  5. Use eye protection designed to protect against splash of liquids.
  6. Use gloves to prevent prolonged skin contact.
- B. Flammability Rating
  1. Classified as a combustible material, meaning it is able to catch fire and burn easily.

2. Do not store above 100°F.

C. Special Considerations

1. Contains solvents that have been known to cause nervous system damage and permanent brain damage.
2. Contains chemicals known to cause cancer, birth defects or reproductive harm.
3. Misuse can be harmful or fatal.

**4. VOC Restrictions**

A. AIM Varnish or Wood Coating Category

1. VOC levels may range from 350-750 g/L.
2. VOC restrictions have limited the use of these finishes in some parts of the country.

**Conversion-Varnish**

A clear alcohol-based, acid-curing sealer/ finish producing a durable, hard film with excellent adhesion qualities, often referred to as "Swedish finishes" because of its national origin, or "acid cure finishes."

**1. Characteristics**

A. Chemical Properties

1. Conversion varnish sealers/finishes are commonly two-component (but may also be a single component/pre-catalyzed product), acid-curing, alcohol-based products.
2. Film formation is the result of acid-catalyzed condensation reaction.

B. Aesthetics

1. Clear to light amber color.
2. Gloss levels available from matte to gloss.
3. Depth and clarity of grain.

C. Odor

1. Very strong odor which can permeate absorbent goods/materials, but will dissipate after finish has dried.
2. After finish has dried, proper ventilation that creates air exchange is important.

D. Dry Time

1. Follow manufacturer recommendations for dry times.
2. Fast dry times during application.
3. Dry to touch can range from 1-4 hours.
4. Dry to sand can range from 4-16 hours.
5. Full cure ranges from 30-90 days.

**2. Application Guidelines**

A. Mixing

1. Follow all manufacturer recommendations on the product including mixing.
2. Batch multiple containers of finish together to ensure variations between one container and another are not noticeable on the finished floor.

B. Application Method

1. Follow all manufacturer recommendations on the product including applicator recommendation.
2. Natural bristle brushes, lambswool or t-bars are most commonly used with these finishes.
3. Two to three coats are recommended for conversion varnishes.
4. Apply finish at the manufacturer recommended coverage rate.

C. General Guidelines

1. Ensure room and floor temperature is between 60-80°F and floor has been properly prepared for finish.
2. Previously applied stains and finishes must be completely dried, clean and adequately adhered to the surface.
3. Map out the room to determine starting points, cut-off points and exit points.
4. Begin application along one edge in the direction of the flooring.
5. Cut-in at the walls and in corners.
6. Remove excess finish from the applicator and apply liberally with smooth, even strokes along the grain. Overworking can cause bubbles and splatter.
7. Work in a path narrow enough to keep a wet edge, and lap strokes back into the area just covered. All application strokes should be feathered into the wet edge of the finish.
8. Maintain consistency with the application of the finish to obtain a consistent mil-film thickness in accordance with the recommended coverage rates. Application of the finish too thin or too heavy will adversely affect performance, dry times, and final appearance.

D. Abrasion Requirements

1. Follow manufacturer recommendations for intercoat abrasion.
2. These finishes must be abraded between coats.



3. Do not over-abrade; abrade to the manufacturer recommended grit for proper adhesion.
- E. Clean-Up/Disposal
1. Follow manufacturer recommendations for clean up.
  2. Clean-up must be performed with a solvent such as lacquer thinner, requiring disposal in accordance with federal, state and/or local regulations.
  3. Treatment, storage or disposal of this product or waste containing this product must follow all applicable federal, state and/or local regulations.

### 3. Safety

- A. Personal Protective Equipment
1. Follow all manufacturer recommendations on the product including safety.
  2. Prevent contact with eyes, skin and clothing.
  3. Use only with adequate ventilation.
  4. Respiratory protection required with organic vapor and formaldehyde cartridges.
  5. Full face respirator or fresh air supply mask strongly recommended.
  6. Use eye protection designed to protect against splash of liquids.
  7. Use gloves to prevent prolonged skin contact.
- B. Flammability Rating
1. Classified as a combustible to flammable material, meaning it is able to catch fire and burn easily, even at normal temperatures.
  2. Vapors are heavier than air and may travel considerable distances to ignition sources resulting in potential flash fires.
  3. Turn off all open flames including pilot lights and electronic ignition switches until coating has completely dried and room has been thoroughly ventilated.
  4. Do not store in extreme hot conditions.
- C. Special Considerations
1. Many products contain solvents that have been known to cause nervous system damage and permanent brain damage.
  2. Contains chemicals known to cause cancer, birth defects or reproductive harm.
  3. May cause asthma/breathing difficulties if inhaled.
  4. May cause allergic skin reaction.
  5. Misuse can be harmful or fatal.

### 4. VOC Restrictions

- A. Conversion Varnish and Varnish Category
1. These finishes fall within their own category for VOC regulations in most states.
  2. VOC levels may fall within the limit of 725 g/L.
  3. VOC restrictions have limited the use of these finishes in some parts of the country.

### On-Site UV-Cured Finish

A transparent, water-carried polyurethane that provides exceptional durability, easy application, self-leveling, and great adhesion qualities, which can be used residentially or commercially with the added benefit of being able to be cured instantly.

#### 1. Characteristics

- A. Chemical Properties
1. UV cured finishes contain synthetic resins, plasticizers, urethane, acrylic or blends and a photo-initiator.
  2. When exposed to high intensity UV light, the photo-initiator triggers a chemical crosslinking reaction within the polymer, which cures the film instantaneously.
  3. Desired finish properties like durability, sheen and chemical resistance are achieved immediately.
  4. UV cured finishes can be categorized in two classes: waterborne UV curable finishes and 100% solids UV finishes.

#### Waterborne UV curable finishes

- A. Contain water as solvent and dry to the touch by evaporation.
- B. The uncured dry film is somewhat soft but will withstand the UV curing equipment and light foot traffic.
- C. The application of the finish is the same as other waterborne finishes.
- D. Dry to the touch in 2-4 hours.
- E. Curing happens when the dry film is exposed to UV light.
- F. Dry to sand immediately after light cure.

#### 100% solids UV finishes

- A. 100% solids is a liquid coating that consists completely of solids and reacts to polymerize upon exposure to a specific spectrum of light.
- B. During curing with the UV light, they change from liquid to solid (film).
- C. The coating cures without any difference in wet mil to dry mil thickness.

- D. These finishes have a quick build, with no wait time for water to evaporate.
- E. 100% solids UV finishes are coated, then dried by use of UV light while the finish is still in a wet state.

**B. Aesthetics**

- 1. Clear with no color.
- 2. These finishes are available in different gloss levels, from matte to gloss.

**C. Odor**

- 1. Mild odor which will dissipate after finish has dried.

**D. Dry Time**

- 1. Follow manufacturer recommendations for dry times.
- 2. These finishes can dry relatively quickly. Ensure the coating process accounts for quick dry times during application.
- 3. Dry time will be affected by the ambient temperature and relative humidity.
- 4. Cure time is instantaneous once the UV lights react with the photo initiators.
- 5. There is a risk of leaving footprints or tracks behind in the wet finish if not cured properly.

**2. Application Guidelines**

**A. Mixing**

- 1. Follow all manufacturer recommendations on the product including mixing.
- 2. Batch multiple containers of finish together to ensure variations between one container and another are not noticeable on the finished floor.

**B. Application Method**

- 1. Follow all manufacturer recommendations on the product including applicator recommendation.
- 2. Rollers, t-bars and cut-in pads are most commonly used with these finishes.
- 3. Three to four coats are recommended for UV Cured finishes (which may include seal coats).
- 4. Apply finish at the manufacturer recommended coverage rate.
- 5. When using portable UV curing machines, follow the machine manufacturer's instructions for proper use.



**C. General Guidelines**

- 1. Ensure room and floor temperature is between 60-80°F and floor has been properly prepared for finish.
- 2. Previously applied stains and finishes must be completely dried, clean and adequately adhered to the surface.
- 3. Map out the room to determine starting points, cut-off points and exit points.
- 4. Begin application along one edge in the direction of the flooring using the "snowplow" method.
- 5. Cut-in at the walls and in corners.
- 6. Remove excess finish from the applicator and apply liberally with smooth, even strokes along the grain. Overworking can cause bubbles and splatter.
- 7. Work in a path narrow enough to keep a wet edge, and lap strokes back into the area just covered. All application strokes should be feathered into the wet edge of the finish.
- 8. Maintain consistency with the application of the finish to obtain a consistent mil-film thickness in accordance with the recommended coverage rates. Application of the finish too thin or too heavy will adversely affect the performance, dry times, and final appearance.

**D. Abrasion Requirements**

- 1. These finishes do not always need to be abraded between coats. Follow manufacturer recommendations for intercoat abrasion.

**E. Clean-Up/Disposal**

- 1. Clean up using water for application tools.
- 2. Dispose of rags and applicators according to manufacturer recommendations.

3. Treatment, storage or disposal of this product or waste containing this product must follow all applicable federal, state and/or local regulations.

### 3. Safety

- A. Personal Protective Equipment
    1. Follow all manufacturer recommendations on the product including safety.
    2. Use only with adequate ventilation.
    3. Respiratory protection required.
    4. Use eye protection designed to protect against splash of liquids.
    5. Use gloves to prevent prolonged skin contact.
    6. The UV lights made for curing floor finish emit a light spectrum that is able to penetrate deeply into the different layers of human skin. The two wave lengths of most concern are UVA and UVB. UVA penetrates the deepest causing cell damage, photo aging and immune suppression. UVB penetrates the top layer of skin causing sunburn and cancer. What is most important is to protect any exposed skin. Protection is required for yourself and any individuals working around the UV machine when in use. Always protect your eyes with UV protective eyewear or face shielding, cover your skin, and apply SPF 50+ sunscreen, preferably with zinc oxide, in places where there is partial skin exposure. It is not recommended to simply wear sunscreen instead of wearing long pants, long sleeves, gloves and shoes.
  - B. Flammability Rating
    1. Classified as non-combustible materials, meaning they are not flammable.
  - C. Special Considerations
    1. Many products contain solvents that have been known to cause nervous system damage and permanent brain damage.
    2. Contains chemicals known to cause cancer, birth defects or reproductive harm.
    3. Misuse can be harmful or fatal.
- ### 4. VOC Restrictions
- A. AIM Varnish or Wood Coating Category
    1. VOC regulations have limited the use of some of these finishes in some parts of the country.
    2. VOC levels vary from >150 to 350 g/L within this product category.

## Natural Oils

Oxidizing natural oils typically consist of tung, linseed, vegetable or other oxidizing oils that penetrate to varying degrees into the wood surface, filling and surrounding the wood fibers.

### 1. Characteristics

- A. Chemical Properties
  1. These oxidizing natural oils cure and harden within the wood by reacting with oxygen from the air (oxidation).
  2. Natural oils can be classified in two categories: penetrating natural oils and film forming natural oils.

#### Penetrating natural oils

- A. If applied as designed, none of the components leave a film on the surface, which allows easy spot repair.
- B. Some penetrating natural oils can be topcoated with film-forming finishes. Check with the manufacturer for specific product details.

#### Film-forming natural oils (hardwax oils)

- A. Typically contain some wax or other film forming substances.

- B. Aesthetics
  1. Multitude of color options.
  2. In combination with reactive colorants, certain aging effects can be achieved.
  3. Since there is no film on the surface, penetrating oils achieve a very natural appearance.
  4. Gloss levels may vary from no sheen to glossy levels.
- C. Odor
  1. Mild to no odor which dissipates soon after finish has dried.
- D. Dry Time
  1. Follow manufacturer recommendations for dry times.
  2. Dry to touch for most of these finishes is about 6-8 hours, but varies from product to product.
  3. Full cure may take 5-10 days.

### 2. Application Guidelines

- A. Mixing
  1. Follow all manufacturer recommendations on the product including mixing.
  2. Batch multiple containers of finish together to ensure variations between one container

and another are not noticeable on the finished floor.

**B. Application Method**

1. Follow all manufacturer recommendations on the product including applicator recommendation.
2. Application is specific to product and manufacturer recommendation.
3. Synthetic applicator pads, non-abrasive buffing pads, clean towels and steel trowels are most commonly used with these finishes.
4. Depending on the product and manufacturer, single or multi-coat applications are recommended.
5. Apply finish at the manufacturer recommended coverage rate.

**C. General Guidelines**

1. Ensure room and floor temperature is between 60-80°F and floor has been properly prepared for finish.
2. Map out the room to determine starting points, cut-off points and exit points.

3. Begin application along one edge in the direction of the flooring.
4. Cut-in at the walls and in corners with rags or recommended applicators.
5. Trowel-in or buff-in the oil until product has penetrated per manufacturer requirements
6. Maintain consistency with the application of the finish to obtain a consistent penetration and/or build in accordance with the recommended coverage rates.
7. Application of the finish too thin or too heavy will adversely affect performance, dry times, and final appearance.
8. Single component or two component natural oils with a hardener to be added are available. Hardeners are typically isocyanate and improve the oil performance.
9. All oxidizing oils are applied in excess with varying methods. Once the wood fibers are saturated, the excess is removed.
10. Follow procedure for removal of remaining product from flooring surface when applicable.

## FINISH PROPERTIES

	Oil Modified Urethane	Waterborne Urethane	Moisture Cure Urethane	Conversion Varnish	Conjugated Oil Varnishes	Onsite UV Cured Urethane	Natural Oil	Wax
<b>Respiratory Protection</b>	Required (refer to MSDS)	Required (refer to MSDS)	Required (refer to MSDS)	Required (refer to MSDS)	Required (refer to MSDS)	Required (refer to MSDS)	Required (refer to MSDS)	Required (refer to MSDS)
<b>Number of Coats</b>	2-3	2-4	2-3	2-3	2-4	2-4	1-3	1-3
<b>Dry to Touch</b>	Slow (4-8 hours)	Fast (1-2 hours)	Slow to fast (dependant on humidity)	Fast (1-2 hours)	Fast (1-2 hours)	Fast (1-2 hours)	Slow to fast (2-12 hours)	Fast (1-2 hours)
<b>Appearance</b>	Amber	Clear to Amber	Clear to Dark Amber	Clear to Slight Amber	Slight Amber	Clear to Amber	Many Color Options	Slight Amber
<b>Gloss Level</b>	Matte to Gloss	Matte to Gloss	Matte to Gloss	Matte to Gloss	Satin to Gloss	Matte to Gloss	Matte to Satin	Matte to Satin
<b>Odor</b>	Moderate	Mild	Strong	Very Strong	Moderate	Mild	Mild	Mild
<b>Flammability</b>	Combustible	Non-Combustible	Combustible to Flammable	Flammable	Combustible	Non-Combustible	Combustible	Combustible

*Note: Check with manufacturer for specific details about products.*



**D. Abrasion Requirements**

1. These finishes do not require intercoat abrasion.
2. Follow manufacturer recommendations for number of coats and preparation between coats.

**E. Clean-Up/Disposal**

1. Clean up using mineral spirits or paint thinner for application tools.
2. Rags, applicators or wood dust containing natural oil residue may spontaneously combust if improperly disposed of. Place all items in an approved metal safety container or a water bucket to avoid spontaneous combustion.
3. Treatment, storage or disposal of this product or waste containing this product must follow all applicable federal, state and/or local regulations.

**3. Safety****A. Personal Protective Equipment**

1. Follow all manufacturer recommendations on the product including safety.
2. Prevent contact with eyes, skin and clothing.
3. Use only with adequate ventilation.
4. Respiratory protection optional.
5. Use eye protection designed to protect against splash of liquids.
6. Use gloves to prevent prolonged skin contact.

**B. Flammability Rating**

1. Because the oxidation reaction is an exothermic reaction (emitting heat), anything that comes in contact with these oils, especially rags, buffing pads etc., need to be soaked in water before they can be discarded. There is a possibility of spontaneous combustion.
2. Classified as a combustible material, meaning it is able to catch fire and burn easily.
3. Do not store above 100°F.

**C. Special Considerations**

1. Many products contain solvents that have been known to cause nervous system damage and permanent brain damage.
2. Many products contain chemicals known to cause cancer, birth defects or reproductive harm.
3. Misuse can be harmful or fatal.

**4. VOC Restrictions****A. AIM Category**

1. VOC levels can vary depending on the product and manufacturer.

**Wax**

For surface protection, wax is spread in thin coats, following the application of a sealer and/or stain, and then buffed.

**1. Characteristics****A. Chemical Properties**

1. Floor wax is made of carnauba wax, and has been used on wood floors for hundreds of years.
2. Waxes are suspended in a gel state (paste) or mineral spirits (liquid form).

**B. Aesthetics**

1. Light amber in color.
2. Sheen adjustment can be made by burnishing.
3. Wax penetrates the wood fibers and hardens, leaving a low sheen finish.

**C. Odor**

1. Mild odor which will dissipate after finish has dried.

**D. Dry Time**

1. Follow manufacturer recommendations for dry times.

**2. Application Guidelines****A. Mixing**

1. Follow all manufacturer recommendations on the product including mixing.

**B. Application Method**

1. Follow all manufacturer recommendations on the product including applicator recommendation.
2. Applied with a buffer and maintained with a buffer.
3. Clean towels, rags, burlap sacks and non-abrasive buffing pads are most commonly used with these finishes. Liquid waxes may be applied with lambswool.
4. One to three coats recommended.
5. Apply wax at the manufacturer recommended coverage rate.

**C. General Guidelines**

1. Ensure room and floor temperature is

- between 60-80°F and floor has been properly prepared for finish.
- 2. Requires stain or sealer prior to wax application.
- 3. Map out the room to determine starting points, cut-off points and exit points.
- 4. Begin application along one edge in the direction of the flooring.
- 5. Apply or hand-rub the wax into the flooring until the product has thoroughly penetrated per manufacturer requirements.
- 6. The wax is then buffed with polishing pads or steel wool pads. Sheen may be adjusted at this stage.

#### D. Abrasion Requirements

- 1. These finishes do not require intercoat abrasion.
- 2. Follow manufacturer recommendations for number of coats and preparation between coats.

#### E. Clean-Up/Disposal

- 1. Clean up using mineral spirits or paint thinner for application tools.
- 2. Rags, towels, burlap, buffing pads, applicators or wood dust containing wax residue may spontaneously combust if improperly disposed of. Place all items in an approved metal safety container or a water bucket to avoid spontaneous combustion.
- 3. Treatment, storage or disposal of this product or waste containing this product must follow all applicable federal, state and/or local regulations.

#### F. Special Considerations

- 1. Needs frequent reapplication and/or buffing.
- 2. Once a floor has been waxed, it must remain waxed.
- 3. If water is used, it may make the floor very slippery and will generally turn white.
- 4. Other types of finishes will not adhere to paste-waxed floors.

### 3. Safety

#### A. Personal Protective Equipment

- 1. Follow all manufacturer recommendations on the product including safety.
- 2. Prevent contact with eyes, skin and clothing.
- 3. Use only with adequate ventilation.
- 4. Respiratory protection required.
- 5. Use eye protection designed to protect against splash of liquids.

- 6. Use gloves to prevent prolonged skin contact.

#### B. Flammability Rating

- 1. Classified as a combustible material, meaning it is able to catch fire and burn easily.
- 2. Do not store above 100°F.

#### C. Special Considerations

- 1. Many products contain solvents that have been known to cause nervous system damage and permanent brain damage.
- 2. Many products contain chemicals known to cause cancer, birth defects or reproductive harm.
- 3. Misuse can be harmful or fatal.

### 4. VOC Restrictions

#### A. Wood Floor Wax Category

- 1. VOC levels near 550 g/L.

## Lacquer

Lacquer and lacquer sealers are not recommended for use as a floor finish or recognized as a wood floor finish.

## Testing Finishes

Always use a known finish system on your wood floors. Test the complete finish system on the wood floor prior to proceeding with the job.

Test finishes over tropical and unfamiliar species. Some woods may need to be treated with specified sealers prior to finish application due to the natural oils, tannins or resins within the wood.

# FINISHING PROCESS

## Finish Applicators



1. Applicators  
Although there are many types of applicators, not all types can be used with all types of finishes. Consult the finish manufacturer's specific instructions to be sure which type is recommended and how to use it.

- A. Wood block applicators are manufactured in widths from 10"-24". These applicators are designed to hold lambswool, synthetic lambswool and synthetic fiber pads. Metal fasteners lock in place to hold the applicator in place.
- B. Cut-in pads are for cutting in edges and are manufactured from 6"-12" widths. These applicators are traditionally flat and rectangular with a tapered handle. They also have removable synthetic fiber pads.
- C. T-bar applicators are manufactured in widths from 12"-36". These applicators are thin cylinders with removable sleeve covers. They have swivel handles and are available in lightweight and heavy weight options.
- D. Rollers are manufactured in widths from 9"-18". These applicators have removable sleeve covers.
- E. Brushes can be made from natural bristle, nylon bristle, foam or other synthetic products.

## APPLICATOR COVER SELECTIONS

	Oil Modified Urethane	Waterborne Urethane	Moisture Cure Urethane	Conversion Varnish	Conjugated Oil Varnishes	Onsite UV Cured Urethane	Natural Oil	Wax	Shellac
100% Lambswool	X		X	X	X			X	X
Synthetic Lambswool	X	X			X	X		X	
Synthetic Pad	X	X		X		X	X		
Rags							X	X	
Brush	X	X	X	X	X	X		X	X
Roller	X	X		X	X	X			
Trowel							X		
Non-abrasive Buffing Pads							X	X	

- F. Steel trowels can be used to apply natural oils and some other types of finishes. Trowels must be recommended by the finish manufacturer.
2. Covers
    - A. Lambswool or genuine lambskin is a natural or synthetic material that is wrapped around the wood block or the t-bar applicators. These applicators are typically used for application of solvent-based finishes. They must be cleaned prior to use to minimize shedding.
    - B. Synthetic fiber material is typically used on t-bars and cut-in pads. These synthetic fiber applicators may be made up of different materials to accommodate different types of finishes. Be sure to check with the manufacturer of the applicator to match the proper sleeve with the finish type. They must be cleaned prior to use to minimize shedding.
    - C. Roller sleeves may be made up of many different materials. The nap size of the roller dictates the spread rate of the finish being applied. Refer to the finish manufacturer to determine whether the finish is rollable and which nap roller is recommended to achieve proper coverage rates. They must be cleaned prior to use to minimize shedding.
    - D. Rags may be used to apply stains. Clean, cotton, lint-free rags should be used.
    - E. Buffing pads are used to apply some natural oils, stains and to maintain waxes. These pads may include polishing pads, clean carpet remnants, or similar buffing pads used on a buffer/rotary sanding machine.
  3. Applicator Maintenance
 

When cleaning and reusing applicator covers, be sure to use the manufacturer recommended cleaning procedures and products. For oil modified finishes, virgin mineral spirits can be used for applicator clean up. Waterborne finishes can be cleaned with clean water. Lacquer thinner should be used for conversion varnishes. Xylol should be used for cleaning moisture cure finishes. Storage containers are available for many types of applicators as well.
  4. When reusing an old applicator, be careful of contamination. Do not use an applicator for one type of finish that was previously used on another type of finish. This includes different types of finishes within the same finish family or even from the same manufacturer, including but not limited to different types of waterborne finishes, natural oils and hardwax oils.
  5. Be cautious of reusing applicators for the same finish type with a different sheen level.
  6. A contaminated applicator can cause streaky

finish or undesirable results. The cost of applicator sleeves and refills is minimal in comparison to recoating or resanding an entire job.

## Finish Preparation

1. Secure the jobsite to minimize or completely alleviate all foot-traffic from the work space.
2. Set up a staging area to place tools, finishes and other items necessary for the job. This staging area should be directly accessible from the floor being coated. This also minimizes unnecessary trips to and from your work vehicle, which also introduces potential contamination to the floor.
3. Inspect the floor carefully for all sanding imperfections. Repair all imperfections as necessary. If the result is not satisfactory, the previous steps must be repeated. After sanding is complete and all sander marks have been repaired, remove or vacuum all dust from the baseboards, windows, sills, doors and door frames. Clean from the highest surface to the lowest, in that order. Use a cloth where appropriate on all surfaces except the bare wood floor.
4. Inspect the floor for cracks and nail holes that may have been missed in the sanding phase. Spot fill cracks and nail holes with a professional filler or putty that is compatible with stain and/or finish. When dry, hand-sand with the grain with the last abrasive used in the final sanding operation.
5. Vacuum and dry-tack the floor clean. Repeat dry-tacking until the floor is clean and free of dust. Use of a bristle brush vacuum head may help loosen dust from the open grain within the wood.
6. Read and understand the mixing and application instructions for the finish.
7. Ensure HVAC system is operating to maintain "normal living conditions."
8. Shut down direct air-flow when possible.

## Application Procedures

1. First Coat (Sealer)
  - A. If the floor is to be a natural finish, apply sealer followed by the appropriate finish. If other than a natural color is desired, the floor must be stained, bleached, oiled, dyed or chemically treated as specified (see page 51).
  - B. Most manufacturers of stains and finishes recommend using products from the same manufacturer to ensure compatibility and optimal adhesion. Before using different manufacturers for stain and finish products, check with the manufacturers for compatibility. Run your own tests if the customer insists on a process you are unfamiliar with.
  - C. Use multiple angles for a visual inspection of imperfections. Remember, direct light



highlights imperfections and may be used as a tool for the flooring mechanic to evaluate the proper abrasive selection.

- D. Inspect for imperfections. Then use a scraper and/or sandpaper to remove imperfections, and finish by hand rubbing with appropriate abrasive pad.
- E. Bring all necessary tools, materials and supplies into the jobsite to acclimate to the environment. This also limits the number of times you need to leave the jobsite, minimizing potential introduction of contaminants to the flooring surface. Secure the jobsite. Hang signs at all entrances and do not allow traffic onto the floor.
- F. Vacuum and dry-tack. Tack the floor several times until there is no dust remaining. It is essential to start with an absolutely clean floor.
- G. Stir or mix sealer as recommended by the manufacturer.
- H. Batch together appropriate amount of sealer to complete the entire job (based on the recommended coverage rates). Mix sealer in a clean tray, bucket or container.
- I. Apply first coat/sealer according to finish manufacturer's recommended coverage rate, application method and procedures.
- J. Refer to applicator recommendations.
- K. Map out the entire jobsite to determine where to begin and where the exit will be during sealer application. Always use the direction of the flooring to determine cut-off points.
- L. Begin the application along one edge of the room in the direction of the flooring. Cut in at the walls. Remove excess sealer from the applicator and apply liberally with smooth, even strokes along the grain. Do not overwork the sealer as this can produce bubbles and splatter.
- M. Work in a path narrow enough to maintain a wet edge, and feather strokes back into the area just covered.
- N. Sealers applied too thin or too thick can negatively affect the top coat's appearance and performance.
- O. Missed spots or skips can be retouched if the sealer has not yet begun to skin over. If the sealer has skinned over, wait until the entire floor has dried before attempting to touch up.
- P. Follow the manufacturer's recommendations for dry times. The entire floor must be thoroughly dried before it can be abraded. For waterbased sealers, use a surface moisture meter to determine when to abrade or when the next coat can be applied (use readings taken prior to sealing as a reference). Temperature and humidity will affect the dry times of the sealer.
- Q. Check with the manufacturer of the sealer for

abrasion requirements, which may include abrasive choice, whether the sealer needs to be abraded, dry times prior to abrasion and recommended conditions.

- R. Apply the next coat of the finish system as directed by the finish manufacturer.
2. Second Coat
- A. Fresh coats of finish may chemically bond without intercoat abrasion. Always follow the finish manufacturer's specific product recommendations.
  - B. Intercoat abrasion ensures proper adhesion between coats of finish by creating a "profile" or "tooth" known as a mechanical bond. By removing raised grain and irregularities in prior coats, intercoat abrasion also assists in achieving a smooth, even appearance after the final coat has dried.
  - C. Using the finish manufacturer's recommended abrasive, hand-abrade all edges and corners with the grain direction where the buffer will not reach.
  - D. Vacuum floor thoroughly as before.
  - E. Load the buffer with an appropriate abrasive and driver pad, as recommended by the finish manufacturer.
  - F. Abrade the floor by clocking the buffer with the grain direction. For parquet, clock the buffer in the long direction of the room, overlapping passes by 1/2 the buffer width. Operate the buffer smoothly and at an appropriate pace to avoid leaving swirl marks or damaging the finish.
  - G. Vacuum and tack thoroughly with a dry, clean microfiber pad/cloth or dampened with a solvent compatible with the finish system. Tack the floor several times, until there is no dust remaining.

### TACKING SOLVENT CHART

Waterborne Urethane	Water
Oil Modified Urethane	Water or Virgin Mineral Spirits
Moisture Cure Urethane	Water or Xylene
Conversion Varnish	Water or Denatured Alcohol

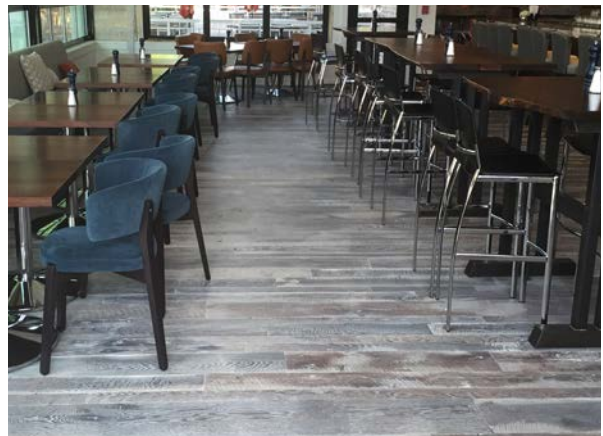
- H. Map out the entire jobsite following the same process used during sealer application.
  - I. Begin the application along one edge of the room in the direction of the flooring. Cut in at the walls. Remove excess finish from the applicator and apply liberally with smooth, even strokes along the grain. Do not overwork the finish as this can produce bubbles and splatter.
  - J. Work in a path narrow enough to maintain a wet edge, and feather strokes back into the area just covered.
  - K. Finish applied too thin or too thick can negatively affect the intended appearance and performance.
  - L. Missed spots or skips can be retouched if the finish has not yet begun to skin over. If the finish has skinned over, wait until the entire floor has dried before attempting to touch up.
3. Final Coats
- A. The number of coats necessary will vary from job to job, specie to specie, finish type to finish type and by customer expectations.
  - B. Inspect for imperfections. Remember, direct light highlights imperfections and may be used as a tool for the flooring mechanic to evaluate the proper abrasive selection. Then use a scraper and/or sandpaper to remove imperfections, and finish by hand sanding with appropriate abrasive pad.
  - C. Be cognizant of extreme jobsite conditions and make necessary adjustments to create an environment conducive to proper application of the finish. Regardless of how many situations will adversely affect the final coat of finish, if you don't take everything into account, the finish will not perform as intended. These conditions may include, but are not limited to:
    - 1. Other trades on the jobsite
    - 2. Inaccessible or inoperable HVAC system
    - 3. Water leaks
    - 4. Contaminates
    - 5. Airborne debris
    - 6. Unsecured jobsite
    - 7. Exterior weather conditions
    - 8. Lack of weather stripping at exterior doors and windows
    - 9. Large windows introducing heat
  - D. Bring all necessary tools, materials and supplies into the jobsite to acclimate to the environment. This also limits the number of times you need to leave the jobsite, minimizing potential introduction of contaminants to the flooring surface.
  - E. Secure the jobsite. Hang signs at all entrances and do not allow people onto the floor.

- F. Control the temperature on the jobsite.
  - 1. The finish must be at the same temperature as the jobsite prior to application.
  - 2. The jobsite must be between 60-80°F.
  - 3. The floor temperature must be similar to the air and the finish. Cover windows to block heat.
- G. Shut off all airflow on the jobsite during finish application to minimize airborne debris from falling into the wet finish.
  - 1. HVAC systems can be controlled from the thermostat. When applicable, set the thermostat to come on about an hour after finish has been applied. Do not turn the HVAC completely off unless it's required due to a finish being applied or for safety purposes.
  - 2. Turn all ceiling fans off during application.
  - 3. Vacuum out all vents, window sills, door jams, baseboards, etc., to avoid dust/debris from falling into the wet finish.
  - 4. Airflow is important to the drying process of the finish. Stagnant air will not allow the finish to dry properly. Try to resume airflow after the finish has skinned over.
- H. Vacuum and dry-tack the entire floor. It is essential to start with an absolutely clean floor. Tack the floor several times, until there is no dust remaining.
- I. Stir or mix the finish as recommended by the manufacturer.
- J. Batch together appropriate amount of finish to complete the entire job (based on the recommended coverage rates). Mix in a clean tray, bucket or container.
- K. Apply according to finish manufacturer's recommended coverage rate, application method and procedures.
- L. Refer to applicator recommendations for finish being used. Use new or thoroughly cleaned applicators for the final coat.
- M. Map out the entire jobsite to determine where to begin and where the exit will be during final coat application. Always use the direction of the flooring to determine cut-off points.
- N. Begin the application along one edge of the room in the direction of the flooring. Cut-in at the walls. Remove excess finish from the applicator and apply liberally with smooth, even strokes along the grain. Do not overwork the finish as this can produce bubbles and splatter.
- O. Work in a path narrow enough to maintain a wet edge, and feather strokes back into the area just covered.
- P. Finish applied too thin or too thick can negatively affect the appearance and performance of the finish.

- Q. Missed spots or skips can be retouched if the finish has not yet begun to skin over. If the finish has skinned over, wait until the entire floor has dried before attempting to touch up.
4. Provide customers with information on proper maintenance practices to protect floor finishes such as:
    - A. Most surface finished floors can be walked on after 24-48 hours.
    - B. Do no slide furniture on the floor.
    - C. Lift furniture into place after 48 hours or as recommended by the finish manufacturer.
    - D. Area rugs can be put down after the finish is fully cured, generally after 7 to 30 days, or as recommended by the finish manufacturer.
    - E. Furniture or rugs placed too soon may result in finish or surface damage. Some area rugs and padding may damage or discolor the finish. This type of damage as well as color change due to aging and UV sunlight is not the responsibility of the flooring contractor.
    - F. Soft plastic or fabric-faced floor protectors should be placed under the legs of the furniture to prevent scuffing and scratching.
    - G. To prevent scratching, walk-off mats both inside and outside doorways will help prevent grit, dirt and other debris from being tracked onto wood floors.
    - H. Keep pets off of the floor for longer periods of time and ensure their nails are trimmed.
    - I. Oils from bare feet can affect the finish as it's curing. Walk on floor with clean, dry socks. For more information, see Care & Maintenance section.
  5. If it is necessary to cover the floor so other trades can work on the floor or in the building, cover with a breathable paper such as heavy brown craft paper. Do not tape to the floor. Tape paper to paper, but never to the floor as the tape can pull the finish from the floor when the plasticizers in the tape become bonded to the surface finish.



*Film-forming urethane finish, satin sheen*



*Penetrating hard-wax oil*

# COLORANTS

Many manufacturers of stains and finishes recommend using a system, a series of products from the same manufacturer, to ensure compatibility and best adherence. Be sure to run tests prior to using any of the systems listed in this section.

## Stains

Preparation for stains is as follows:

1. Use multiple angles for a visual inspection of imperfections. Direct light highlights imperfections and may be used as a tool for the flooring mechanic to evaluate the proper abrasive selection.
2. Inspect for imperfections. Then use a scraper and/or sandpaper to remove imperfections, and finish by hand rubbing with appropriate abrasive pad.
3. Vacuum and dry-tack. It is essential to start with an absolutely clean floor.
4. Tape off baseboards, door jams, cabinets, adjoining floor coverings and any other surface that comes into direct contact with the wood floor being stained using a "delicate surface" tape.
5. Test stain for color and compatibility prior to completing the entire floor.

## Oil-Based Stains

1. The colors in oil-based stains are made up of pigments. Pigments are finely ground, insoluble dispersed particles that when dispersed in a liquid vehicle to make stain will provide color.
2. Oil-based stain may be applied to properly prepared flooring surfaces with clean rags. Pour stain onto rags, not the flooring surface, to avoid excessive stain penetration between the floor boards. Thoroughly remove the stain from the floor using clean rags or towels. Dispose of stain rags in an approved metal safety container or a water bucket to avoid spontaneous combustion.
3. Oil-based stain may also be applied to properly prepared flooring surfaces with a wood floor applicator or brush. When using this technique, be extremely cautious when pouring stain directly on flooring to avoid excessive stain penetration between the floor boards. Thoroughly remove the stain from the floor using clean rags or towels. Dispose of stain applicators and rags in an approved metal safety container or a water bucket to avoid spontaneous combustion.

4. Oil-based stain may also be applied to a properly prepared flooring surfaces using a buffer with a nonabrasive pad. Pour approximately a pancake-sized amount of stain onto the nonabrasive pad and begin buffing the stain into the floor. Thoroughly remove the stain from the floor using a clean nonabrasive pad on the buffer, clean towels or rags. Dispose of these nonabrasive buffing pads and stain rags in an approved metal safety container or a water bucket to avoid spontaneous combustion.
5. Apply the stain according to manufacturer's coverage rate, recommended application method and procedures. The final sanding procedure and the species of the wood will determine the floor color. The coverage rates will vary based on species, beveled edges, grade of wood and final sanding procedures used.
6. Apply the stain to the floor in sections, according to the direction of the flooring. Begin staining the floor at the furthest section from the final exit point and work your way toward the exit.
7. Thoroughly remove the stain from the floor as you work. If the floor contains beveled edges, pay special attention to removing stain from the beveled areas. Any stain residual left behind will likely affect adhesion of sealers and finish coats.
8. Areas with too much stain, overlapping or sloppy application may show lap marks. Use of tape lines along board edges can assist in preventing lap marks.

## Water-Based Stains

1. Water-based stains dry through evaporation of the water carrier. Water-based stains tend to dry more rapidly than oil-based stains due to the rapid evaporation of the water.
2. Record the moisture content of the wood before applying the stain. Stained wood must be allowed to dry completely and the flooring must return to the correct moisture content before proceeding with the sealer or finish application.
3. Application of water-based stains is different from oil-based stains. Do not treat them the same.



4. Water-based stains should be wiped on and off with clean rags or synthetic applicators along the direction of the flooring.
5. Apply small rows at a time, taking care to wipe the stain off thoroughly and quickly.
6. Apply the stain according to manufacturer's coverage rate, application method and procedures. The final sanding procedure and the species of the wood will determine the floor color. The coverage rates will vary based on species, beveled edges, grade of wood and final sanding procedures used.
7. Apply the stain to the floor in sections, according to the direction of the flooring. Due to the fast dry times of water-based stains, exit areas may be stained first to help eliminate lap marks. Begin staining the floor at the furthest section from the final exit point and work your way toward the exit.
8. Thoroughly remove the stain from the floor as you work. If the floor contains beveled edges, pay special attention to removing stain from the beveled areas.
9. Areas with too much stain, overlapping or sloppy application may show lap marks. Use of tape lines along board edges can assist in preventing lap marks.
10. Typical dry times range from 1-3 hours depending on the jobsite conditions.
11. Water-based stains inherently raise the grain of the wood. Be cautious when abrading subsequent coats of finish to not go through the stain color.
12. Only use sealers recommended by the stain manufacturer.

Allow all stains to dry thoroughly, with proper air exchange and circulation. Use the stain manufacturer's recommended drying time. If the environment is excessively humid or cold, the stain will take longer to dry due to the slower evaporation of the solvents. Darker pigmented stains will typically require longer dry times. The stain must be completely dry before finishing begins. Be aware that some wood species may require more dry time for stain than the finish manufacturer recommends. Refer to the NWFA publication, Wood Species Used in Wood Flooring (A200), for more information on how various species react to stain and finish application.

## Water/Grain Popping

1. Water popping, also sometimes called grain popping, is a process used to open the grain of the wood flooring so it will accept stain more readily and evenly.
2. Before attempting to use the water popping technique on a floor, do a test on a sample board. The key to successful water popping is controlling the amount of water applied to the wood and the amount of time the wood needs to dry before applying the stain.

3. Record the moisture content of the wood flooring before water popping. The wood must be allowed to dry completely and the floor must return to the correct moisture content before proceeding with stain application.
4. Water should be applied to the wood flooring very liberally and evenly. Do not over wet the wood during application, which could cause cupping and damage to the flooring. Over wetting would be described as water running down the cracks between the boards.



- A. Rag or sponge application – use a clean rag or sponge to apply even amounts of water to the floor, moving from wall to wall. Be careful not to leave puddles.
- B. Hand-held tank sprayer application – spray an even amount of water to the flooring surface with the sprayer. Be careful not to leave puddles. While the floor is wet, follow the sprayer with a clean, wet microfiber mop or finish applicator to smooth the water and even out the saturation.



5. The effect of water popping will vary, depending on the species of wood, and the type and color of stain to be applied.

6. Be aware that water popping will raise the grain of the wood and perhaps additional steps may be necessary to smooth the surface during the coating process.
7. After the wood has been water popped, be extremely cautious not to drag anything across the flooring surface. Scuffs and drags will crush the wood fibers and will result in uneven color on the floor.



## Aniline Dye

1. These colors are made from aniline oils or coal tar derivatives.
2. Aniline dyes are made in different grades which can be soluble in water, alcohol or oil-based solvents. These dyes are available in powder or liquid form.
3. Aniline dyes are available in an array of colors and the application of these dyes can be compatible with stains to achieve multi-level color systems.
4. The dye molecules are much smaller than the pigments in stain, which allow for a deeper and easier penetration into the wood fibers. This results in a more even color across all parts of the wood, especially noticeable with some species that may become blotchy with oil-based stains.
5. Aniline dyes can lose color intensity and tend to fade over time.
6. Application
  - A. Record the moisture content of the wood before applying dye. Dyed wood must be allowed to dry completely and the flooring must return to the correct moisture content before proceeding with the next step.
  - B. Aniline dyes should be applied using synthetic applicators along the direction of the flooring.



- C. They can be very difficult to apply without leaving lap-lines or color variations. Typically, the more you apply, the darker it gets. Tape off sections with the direction of the flooring to avoid overlapping.
- D. Map out the entire jobsite to determine where to begin and where the exit will be during application. Always use the direction of the flooring to determine cut-off points. Tape off areas along floor boards where overlapping may become an issue.
- E. Begin the application along one edge of the room in the direction of the flooring. Move the applicator consistently from wall to wall. Do not leave stop marks or skips as they may become apparent when dried.
- F. Work in a path narrow enough to maintain a wet edge, and feather strokes back into the area just covered.
- G. Missed spots or skips should be addressed while the dye is still wet.
- H. Do not use water-base sealers or finishes directly over water-soluble dyes. Water-soluble dyes will reconstitute with water-based finishes (color can pull).
- I. Either apply oil stain, de-waxed shellac or quick-dry oil sealer to lock in color prior to finish application.
- J. Alcohol or oil-based dyes may be top coated with approved sealers. Stain can intensify color and give a nice variation in the end result.
7. Dyes may be mixed with some types of finishes to create color within the finishes themselves. These mixes can be extremely difficult to apply. Check with the finish manufacturer for compatibility.

## Wood Bleach

1. There are three types of wood bleaches. Use only bleach specified for wood flooring.
  - A. Two-part wood bleach consists of sodium hydroxide (caustic soda or lye) and a hydrogen peroxide. This type of wood bleach is the only type that removes some of the natural color from the wood. This type of bleach will change the existing color. It will not make the floor white. For example, red oak will lighten to a pink cast and white oak may have a greenish cast.
  - B. Chlorine bleach, which is like ordinary laundry bleach, will remove dye color from wood, but not the wood's natural color.
  - C. Oxalic acid is commonly employed to bleach out water stains, rust stains or sometimes pet urine from wood floors.
2. All of the bleaching chemicals pose health and safety hazards to varying degrees. Be sure to read the manufacturer's instructions and warnings before use. Bleach may be caustic and can cause burns. Always wear rubber gloves and eye protection.
3. Bleaching softens the surface fibers of the wood, by removing the tannins and other chemicals from the wood that are the "glue" that hold the cellulose fibers of the wood together. This not only softens the wood, it also weakens the surface.
4. Most wood fillers cannot be bleached.
5. Do a test area in an inconspicuous place or on a test panel, as the length of time the bleach remains on the floor will affect the degree of color removal.
6. Application
  - A. Aggressively ventilate the room with open windows and fans, and wear approved respirators.
  - B. Make sure the flooring is clean and free from oils, grease and old finish.
  - C. Record the moisture content of the wood before applying bleach. Bleached wood must be allowed to dry completely and the flooring must return to the correct moisture content before applying the second part of bleach or proceeding with the finish application.
  - D. Bleaching will cause the grain of the wood to raise and perhaps additional steps may be necessary to smooth the surface. Sanding with fine grit abrasive after bleaching will be necessary to restore flooring to a smooth surface.
  - E. For traditional two-part bleach systems, part one should be applied to the wood flooring very liberally and evenly. Do not over wet the wood during application which could cause cupping and damage to the flooring. Over wetting would be described as bleach running down the cracks between the boards.
    - Synthetic applicator application – use a new applicator to apply even amounts of part one to the floor, moving from wall to wall. Be careful not to leave puddles.
    - Hand-held tank sprayer application – spray an even amount of part one to the flooring surface with the sprayer. Be careful not to leave puddles. While the floor is wet, follow the sprayer with a clean, wet microfiber mop or finish applicator to smooth part one and even out the saturation.
  - F. Allow to penetrate for 5-10 minutes. While part one is still wet, apply a liberal amount of part two using the same process as described above. Be sure to use new applicators and/or sprayers for part two.
  - G. Allow the surface to dry overnight.
  - H. Repeat the process if more color needs to be removed. Abrade the flooring between applications and remove all dust from the surface prior to second application. Note that every application of these chemicals will continue to soften the wood fibers, making them more and more prone to indentations.
  - I. Once the desired color has been achieved, neutralize the surface using a 2:1 ratio of water to vinegar.
  - J. Allow to thoroughly dry before application of stains, sealers or finishes.
  - K. Follow specific wood bleach manufacturer instructions for applications, dry times, neutralizing requirements, safety and compatibility.
  - L. The bleaching process drastically changes the chemistry of the wood, but does not affect the ability of the wood to accept finishes. Be sure to test the wood prior to application of finish to ensure color and compatibility are acceptable.
  - M. Always use non-ambering finishes with bleached/white floors and pastels.

## Reactive Conditioners

Reactive products typically react with the tannins within the wood. Woods with higher levels of tannic acid will react greater than those with less. Reactives may include stains, patina agents, antiquing agents or minerals. Prior to application of any reactive product, completely understand the safety and intended uses of the chemicals.

### 1. Tannic Acid/Tannin

Various soluble astringent complex phenolic substances found in trees (and plants) used in tanning animal hides into leather, ripening of fruit, aging of wine, coloring and taste in teas and bourbons, dyeing, the making of ink, and in medicine. It also protects the tree from insects, fire and bacteria.

#### Tannin Discoloration

- Reaction between highly tannic acidic species of wood and the water and pH adjusters found in water-base finish.
- This discoloration occurs on the surface of the wood and may partially bleed up into the finish.
- Tannic acid discolors when introduced to products that are alkaline by nature (like ammonia).
- The more tannic acid within the specie, the more dramatic the color change.
- Tannic acid is also water soluble and can discolor when in contact with iron and water.
- Water-based finishes are typically manufactured with pH adjusters (such as ammonia) and may potentially contribute to tannic acid discoloration.

### 2. Ammonia Fume

A wood finishing process that darkens wood. It consists of exposing the wood to fumes from a strong aqueous solution of ammonium hydroxide, which reacts with the tannins in the wood. The process works best on woods with high tannin content, such as white oak.

- This process is typically done in a sealed chamber designed specifically to allow the heavy concentration of fumes to react with the tannic acid in the wood, which can result in the color of the wood changing anywhere from a deep brown to nearly black color throughout the thickness of the material.
- Fuming wood changes the chemistry of the wood, but does not affect the ability of the wood to accept finishes. Be sure to test the wood prior to application of finish to ensure color and compatibility are acceptable.

### 3. Iron Acetate

A wood finishing process that darkens the wood. The iron acetate solution chemically reacts with the tannins within the wood. The process works best on woods with high tannin content, such as white oak, but may be used on any specie.

- Use a fine grade steel wool (4/0 is preferred).
- Vinegar (which is a weak acetic acid) chemically reacts with the iron to create iron acetate. The longer this mixture sits, the stronger the solution. Any vinegar will

work. Using an apple cider vinegar or red wine vinegar may allow you to achieve darker variations in color than white vinegar.

#### C. Application

STEP 1: Mix the vinegar and steel wool in a clean container and allow it to sit a minimum of 24 hours.

STEP 2: Thoroughly filter the steel wool from the vinegar solution prior to application.

STEP 3: Moisture test the wood floor to determine a reference point for when the application has dried.

STEP 4: Apply to the wood flooring very liberally and evenly. Do not over wet the wood during application which could cause cupping and damage to the flooring. Over wetting would be described as liquid solution running down the cracks between the boards.

- Rag or sponge application – use a clean rag or sponge to apply even amounts of the solution to the floor, moving from wall to wall. Be careful not to leave puddles or drips.
- Synthetic applicator application – use a new applicator to apply even amounts of the solution to the floor, moving from wall to wall. Be careful not to leave puddles or drips.
- Hand-held tank sprayer application – spray an even amount of solution to the flooring surface with the sprayer. Be careful not to leave puddles or drips. While the floor is wet, follow the sprayer with a clean microfiber mop or finish applicator to smooth out the saturation.

STEP 5: Allow the surface to dry overnight. Test moisture content of the wood prior to proceeding with further steps.

STEP 6: The application process will naturally cause the grain of the wood to raise and perhaps additional steps may be necessary to smooth the surface.

- The iron acetate solution changes the chemistry of the wood, but does not affect the ability of the wood to accept finishes. Be sure to test the wood prior to application of finish to ensure color and compatibility are acceptable.



# TEXTURED FLOORS

## Hand Scraping

All wood floor sanders are familiar with scraping the corners of a room or other areas of the floor inaccessible by sanding equipment. The following section discusses tools and procedures for scraping, whether corners or to achieve a texture in the entire flooring surface.

One of the most common and historic textures on a wood floor is a hand scraped texture. Before the wood flooring industry was introduced to sanding equipment, wood floors were installed and scraped by hand. The scraping process is a labor-intensive process that requires skill and artistry. There are machines that many factory finished manufacturers use to try and replicate a true hand scraped floor, but none achieve the same feel or appearance as a real hand scraped wooden floor.

There are no standards established for scraped floors as each board scrapes differently, each scraper scrapes differently and each craftsman and consumer have a different perception of acceptable texture on the flooring surface.

1. The Blade
  - A. The scraper blade is typically made of a heavy-duty tempered metal designed to remove material from the floor.
  - B. When scraping areas of a sanded floor inaccessible by the sanding equipment, it is important to replicate the flat results of the sanders. A flat blade, hand sandpaper and a sanding block will achieve these results.

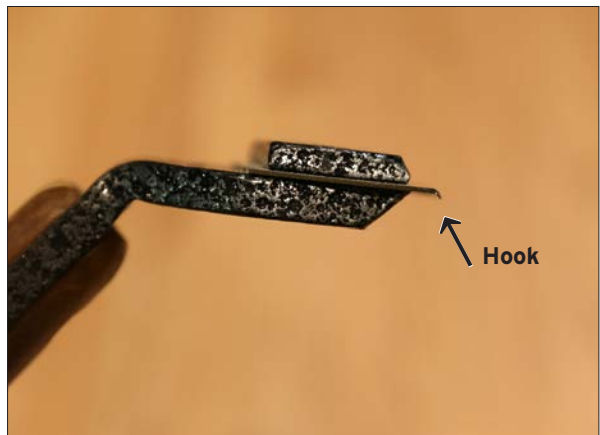


- C. When scraping a wood floor, the shape of the blade dictates the texture on the floor. A flat blade will result in a flatter, smoother surface.

A curved blade will produce a slight gouge in the flooring surface. The tighter the radius on the blade shape, the deeper the gouge.



- D. Sculpted floor scraper blades can usually be shaped on a standard grinder.
- E. After the blade has been shaped to the desired radius, it must then be hooked.



1. The hook is formed by "turning over" the edge of the blade, which does the cutting of the wood.
  2. This hook is created by using a smooth steel rod that must be made of a harder steel than the blade itself, and forcefully burnishing against the cutting edge of the blade. The ultimate goal is to turn the edge over at about a 90° angle to achieve a "hook," which when sharpened, can remove wood at a rapid rate.
- F. Once a blade is shaped and hooked, it must be sharpened by use of a mill/bastard file.



2. The Mill/Bastard File

- A. Sharpening a blade with a file by hand is an art. It takes practice and technique to determine how to properly use the file to create a profile on the blade adequate to remove material. Pitch, pressure and angle will all dictate how the blade is sharpened and ultimately how it cuts into wood.
- B. Mill files are the most common shape; they are rectangular in cross section and taper slightly in both width and thickness from tang to end. They are all single-cut, meaning they have one set of teeth all running parallel to each other.
- C. When the blade crosses a nail, it will create a burr in the blade which must be removed immediately. This burr will translate to the flooring surface leaving unsightly lines. These burrs can be removed by use of a mill/bastard file.
- D. Once the blade begins sliding against the surface it is time to resharpen.

3. The Handle

- A. The scraper handle will typically be made up of many different materials. Most common are wood handles or metal handles.
- B. The most important aspect of the handle is the grip and the length of the handle. The scraper must also have a comfortable place for your fingers. When scraping, place the front hand on the area above the blade using a downward pressure. The back hand must grip the handle and pull toward the mechanic.

4. Other Scraping Tools

- A. Hand planes or block planes will work well to scrape material away from the surface, but often not as effectively as a hand scraper. The blades can be modified or shaped to be more aggressive. Planes are usually pushed rather than pulled, which can give different effects to the surface.



- B. Spoke-shave scrapers utilize a similar blade, with handles on either side. These are similar to a draw knife, but are for use on wood floors.





- C. Paint scrapers work well and can also be modified and shaped to be more or less aggressive.



- D. Chisels can work to give a “scraped” appearance.

## 5. The Scraping Process

### A. Bench scraping

1. It is common to place the flooring material on a bench to scrape from a standing position.
2. The bench must have a stop to not allow the flooring to move when being scraped.
3. This process allows the flooring to be prescraped before being installed.
4. The benefit of prescraping is maintaining the ability to define all four edges of the flooring when detailing the edge profiles. On a bench, it is easy to focus on the sides and butts of each piece to sculpt each individual board.

### B. Floor scraping

1. Whether an existing floor or a newly installed floor, scraping on a floor that already is installed is considered traditional floor scraping.
2. The benefit of this process is the ability to customize the flooring in place. To simplify this process, you can sand existing finishes off of the floor to expose raw wood.

3. You may also wet the flooring to make it a little easier to scrape.

- C. Never sharpen the scraper on the flooring surface. The metal shavings can become sources for oxidation, or rust spots on the newly finished floor after finish has been applied. (See photo, page 22.)
- D. Knots, burls or other decorative features of the wood will scrape harder than regular grain patterns. This can add to the appeal of the finished flooring. The “time worn” appearance is one that can be replicated by use of the scraper following specific characteristics of each board.
- E. Different species scrape at different rates. Never treat all floors the same. Walnut, oak, hickory/pecan, pine and similar species adapt well to scraping. Harder species such as maple and some tropical/exotics are more difficult to scrape and will show differently when completed.



- F. Everybody scrapes with a different angle, a different pressure and a different idea of how the scraped floor should look. When scraping with more than one craftsman on the jobsite, be sure to mix up who and where the scraping is taking place to achieve a truly random texture.
- G. Different effects
  1. The angle at which the scraper blade comes into contact with the floor will determine the rate at which material will be removed.
  2. Cross-grain scrape for a torn-grain appearance.
  3. Chatter the scraper to achieve a chattered appearance.
  4. Highlight the edges of boards with the scraper blade.
  5. Once the entire floor has been completed, it is recommended to lightly abrade the surface by hand or with a hand held random orbital or a buffer/swing machine using a thick pad and finer grit abrasive to somewhat smooth out the rough surfaces.





## Wire Brush

Wire brushing is an effect designed to remove the soft grain of the wood from the flooring surface. The finished effect gives a unique texture to the wood floor that resembles the weather-worn appearance of wood after being exposed to the elements.

Wire brushing can be achieved on an existing wood floor with the proper tools. Hand-held wire brushes or grinder wheels with a wire brush attachment can be aggressive enough to remove soft material from the flooring surface, but on larger jobs this can be slow, tedious work. Most wire brushed floors are given this effect prior to installation of the flooring by use of automated machines specifically designed to produce the brushed effect.

## Distressed

Distressing a wood floor can include many different characteristics. These characteristics and processes can be very unique and are different from one job to the next. Distressed may include, but is not limited to:

1. Creating indentations and gouges in the flooring surface.
2. Creating texture on the wood floor with scrapers, sanders or grinders.

3. Use of heavy chains, hammers and chisels to create dents and cracks on the wood.
4. Drills and ice picks tends to create worm hole effects.
5. Soldering irons, propane torches or hot sand to add burn mark effects.
6. Saw marks, or any other method of causing wear to a wood floor.
7. After the character marks have been made, many contractors accentuate them by adding black wood filler, resin, acid inks or dyes. Applying dark stain traps the color in the nooks and crannies of the floor.
8. Experiment on test samples and acquire client approval and signatures before proceeding.



# REPAIR AND REPLACEMENT

## Repair

After thorough evaluation of the flooring, address any areas that need repair. One of the most critical components to repairing a wood floor is to determine whether the damage should be repaired or replaced.

Damages can usually be grouped into one of several categories:

1. Scratches may require isolation repairs, recoating or resanding of the affected areas.
  - A. Surface scratches are typically only in the finish coats. A fingernail can't feel the ridge.
  - B. Deep scratches are typically through the finish coats and have torn the wood fibers.
  - C. Cross-grain scratches are deep scratches, and are oriented perpendicular to the direction of the flooring, often crossing multiple board widths.
2. Dents/gouges may require isolation repairs, resanding or replacement of affected areas.



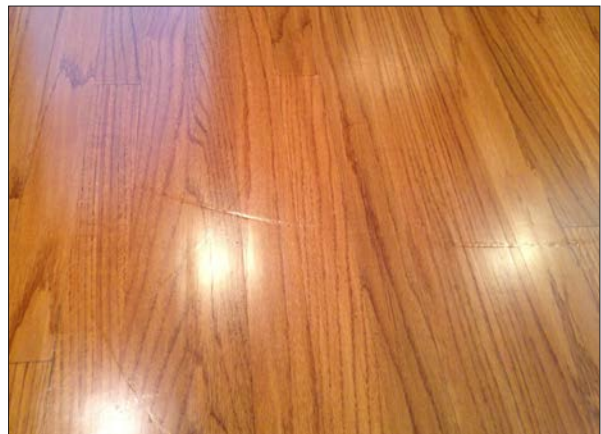
- A. Indentations are notches or depressions on the surface of the flooring. Indentations are caused by the excessive force of an object on the flooring surface. Surface finishes minimally influence the effects of these forces. Janka hardness ratings give us an idea of approximately how each species can be affected by such forces. Objects that can cause indentations can include, but are not limited to:



• High heels



• Dog claws



• Appliances and furniture



- Heavy grain tear or chunks of wood torn away or removed.
3. Stains can include permanent damage from pet urine, chemical/moisture spills, or may just be residues or minor characteristics of the wood itself. Oftentimes stains require resanding and/or replacement of the affected areas.
  4. Water damage can vary in severity, from minor cupping to severe buckling. Each case must be dealt with on an individual basis for repair options. The most important aspect of repairing water damaged flooring is having a thorough understanding of the moisture content of the flooring, substrate and ambient conditions in the space surrounding the flooring system prior to assessing repair options.
  5. Isolation repairs of damaged areas may include using fillers, putties or colored markers to make the blemish disappear. Many times, use of these repair tools and products involves filling the damaged area to the flooring surface level, adding color to the area and replacing natural wood characteristics by use of graining tools. Once the area has been reasonably matched to the surrounding surfaces, sheen level and film build are the final steps.

## Replacement

1. Removal of Damaged Flooring:

*NOTE: wear safety glasses and hearing protection.*

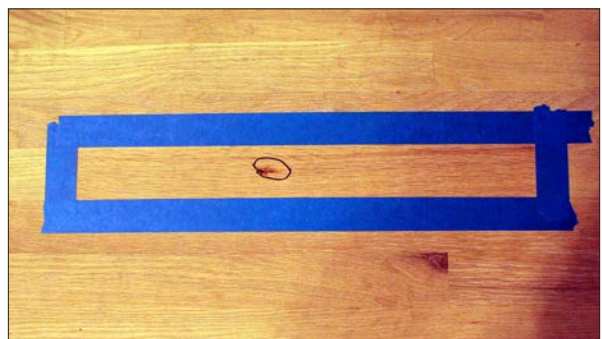
- A. Individual wood flooring boards can be repaired/replaced in solid, engineered and parquet products without affecting adjoining boards.
- B. Always check the species to ensure a proper match (red oak, white oak, etc.).
- C. Factory finished boards should be selected for sheen level, color match, grade, cut of wood and bevel profiles.
- D. Always check moisture content of replacement boards to ensure they are properly acclimated to the environment and surrounding boards. There should be no more than 2 percent difference in moisture content between the new flooring and existing flooring. If the

difference is greater, allow the new flooring to acclimate until it is within 2 percent of the existing flooring.

- E. Replacement boards do not have to be from original manufacturer, as long as tongue and groove profile, width, edge profile, cut of wood and grade all match.
- F. If the board to be replaced is more than four feet long, consider doing the repair in two sections to minimize the risk of the opening closing up width-wise while you are completing the repair.
  1. When breaking longer boards into smaller repairs, use a carpenter's square to mark cutting area and score with a razor knife.

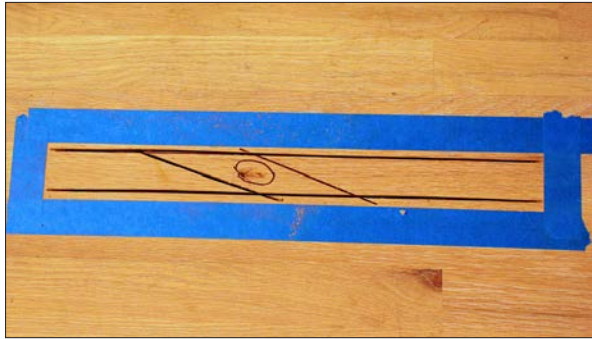


2. Use an oscillating saw to make a precise cut developing an end joint (ensure the newly made end joint falls at least 6" from adjoining end joints for strip flooring, 8-10" for plank).
- G. In areas where high humidity is prevalent/ or during humid seasons, only remove and replace one board at a time to ensure the existing flooring doesn't close in on the exposed repair area.
  - H. Make sure you have a replacement board selected and prepared before beginning the repair.





- I. Protect adjoining boards from damage with tape, cardboard or paper specifically on any previously finished or factory finished floor.
- J. Set a circular saw to the depth of the thickness of the board to be removed. Make one cut inset 3/8" from groove side running from end to end on the board to be removed. Stop the cut approximately 1/8" from the ends of the board. (Alternative tools include a router with the appropriate up-cut bit or an oscillating saw with appropriate wood/metal blade).
- K. Make a second cut inset 3/8" from tongue side running from end to end on the board to be removed. Stop the cut approximately 1/8" from the ends of the board. CAUTION: Older floors may have been installed with cut-nails. The blade on a circular saw will not cut through these types of nails. On older floor installations, make first and second cuts approximately 1/2" inside the edges of the boards to ensure not hitting these types of nails.



- L. Make 1-2 additional cuts across the center of the board at a 30-45° degree angle from first long cut to second long cut.



- M. With a chisel or oscillating saw, cut completely through both ends at cut lines and lift out the center of the board. The groove-side piece can now be removed.
- N. Carefully remove nails or staples and tongue-side piece. Avoid damage to adjoining boards.
- O. For glue down board replacements, carefully

remove all board pieces as well as the remaining adhesive from the substrate thoroughly. Oscillating type saws work great for cuts and glue clean-up.

- P. For floating floor board replacements, carefully remove all board pieces from the adjoining board locking mechanisms or tongue and grooves. Be careful not to damage adjoining boards.
- Q. Clean all debris from the area and adjoining floor, including from all remaining tongues and grooves.

## 2. Replacing the Damaged Flooring

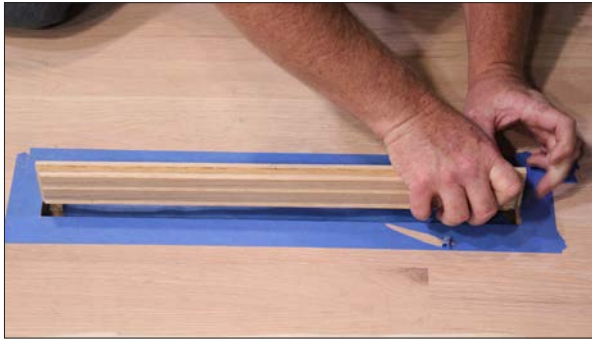


- A. Measure the opening and cut replacement board to size, cutting the butt-end tongue of the new board. When applicable, use miter saw to cut from the bottom of the wear layer to the underside of the material at a 5-10° angle to allow for easier placement.
- B. Carefully check the new board against the opening for precise fit.
- C. For factory finished flooring with beveled or eased edge, replicate the bevel using saw, sand paper or steel rod (depending on the extremity of the bevel). This may also require color matching and finish replacement on the bevels.
- D. From the back side of the replacement board, chisel off or cut lower half of its groove side and end match so that it will fit over the tongue of the adjoining boards in the replacement area. Set the table saw or hand plane the underside of the replacement board at an angle to help the board slide into place more easily.





E. Carefully dry fit and loose-lay the replacement board without damage to adjoining boards.



- F. Apply liquid or sheet vapor retarder to the exposed substrate as necessary in order to control moisture migration from below.
- G. For glue down applications, spread approved wood flooring adhesive to the substrate using notch trowel recommended by the adhesive manufacturer.
- H. For wide plank board replacement, adhesive applied to the entire substrate is recommended to ensure proper holding power and to minimize movement.



I. Coat top side of adjoining tongues with fast setting adhesive.



- J. Insert tongue, and then drive it into place, using a wood block and hammer or mallet.
- K. Check that flooring is relatively flush with surrounding boards.
- L. Use color putty to fill holes and joints. If unfinished, refinish to match original flooring.
- M. When replacing multiple boards in one area, blind nail the replacement flooring where possible. Follow instructions above for remaining installation procedures.



# RECOATING A PREVIOUSLY COATED FLOOR

## General Recoating Guidelines

**SAFETY NOTE:** Always wear NIOSH-approved respiratory protection. When applying finish products, follow the recommendation in the SDS sheet provided by the finish manufacturer.

**NOTE:** When abrading a previously finished floor, ascertain whether the floor finish contains lead. Floor finishes applied before 1978 may contain lead. Test kits are available to determine the presence of lead in floor finishes and other architectural coatings. Abide by local, state and federal guidelines for handling and disposal of lead-based products. Failure to do so can result in significant fines. For more information, visit the U.S. Environmental Protection Agency website at [www.epa.gov/lead](http://www.epa.gov/lead).

1. If the floor has visible dents, wear patterns or permanent cupping, recoating may not be a viable solution, and it may be necessary to fully sand the floor to restore the finish.
  - A. Dents, gouges and scratches may be recoated, but will still remain in the flooring surface and may become more apparent after the new coating has been applied.
  - B. Wear patterns indicate a loss of finish from the existing floor, typically resulting in exposed wood fibers. Wear patterns may be recoated, but will often accept the new coat of finish different from the remaining flooring, will remain unsightly and may become more apparent after the new coating has been applied.
  - C. Permanently cupped floors may be recoated, but will still remain and may be more apparent after the new coating has been applied. Hand abrading may be required.
2. Always clean the floor prior to testing for contaminants and prior to testing for new finish adhesion. Use a wood floor cleaner recommended by the wood floor finish manufacturer. Cleaning the floor includes extraction of any dirt, debris or contamination from the flooring surface as well as beveled edges, cracks or open knots.
3. Finish adhesion is affected by surface contaminants (i.e., wax, grease and many other maintenance products). Always test in several areas of the floor to be sure the finish will adhere properly. The test areas should be used to check for contaminants as well as testing finish adhesion.

**NOTE:** Closets may not be the best test area because wax, maintenance and other finishes are used on the main body of the floor, but usually not in closets.

**NOTE:** Testing in one area does not guarantee acceptable performance. Advise the client of this before proceeding.

## Field Testing for Wax

1. Prepare a test site on the main body of the floor (do not prepare area under area rugs, in closets or under furniture). Thoroughly clean test site to remove dirt and debris from surface.
2. Use a small amount of mineral spirits on a clean, white rag in an area that has not been exposed to high traffic. If a slight yellow or brown color appears on the rag, paste wax may be present.
3. Another test involves placing two drops of water on the floor. If white spots appear after about 10 minutes, the finish may be wax.
4. If the floor has been waxed, re wax the floor whenever possible. When sanding a previously waxed floor to bare wood, be cautious of the remaining wax in the seams and soft grain of the flooring. The safest option is to go back with a wax finish to avoid adhesion issues.

## Field Testing for Acrylic Polish

1. Prepare a test site on the main body of the floor (do not prepare area under area rugs, in closets or under furniture). Thoroughly clean test site to remove dirt and debris from surface.
2. Place one to two drops of acrylic stripper or ammonia on the floor. If milky white spots appear after approximately two minutes, acrylic polish may be present.
3. If the floor is contaminated with an acrylic polish, it must be completely removed from the flooring prior to a new finish application.
4. Use extreme caution when chemically stripping any wood floor as to not damage the floor with excessive moisture. Be cautious of any remaining contamination in the seams and soft grain of the flooring.
5. Resanding the floor may be the best option.

## Field Testing for Grease and Other Mild Contaminates

1. Many wood floor cleaners will safely remove greases, oils and other mild contaminants. Check with the finish manufacturer for recommended cleaning products and the chemical capabilities of these products.
2. Use these cleaners on a test site in the main body of the floor with a microfiber mop or a white towel.
3. Compatibility of finishes: one brand or type of finish may not be compatible with another.
4. Factory-finished floors that include a high-abrasion finish may need to be pretreated with an approved chemical solution to promote adhesion, as recommended by the finish manufacturer.
5. Factory-finished floors that have finishes infused with Teflon cannot be recoated. To test for Teflon infused finishes, use a permanent marker on the finish. If it wipes away, Teflon is present. If it does not wipe away, carefully use a mild solvent like mineral spirits to remove from the surface.
6. When testing for adhesion in the test area, wait for a minimum of 24 hours after applying finish to allow finish to dry. After the finish has dried perform a cross hatch adhesion test on the new finish in accordance with ASTM D3359.
  - A. The X-cut tape test is primarily intended for use at job sites. Using a sharp razor blade, scalpel, knife or other cutting device, two cuts are made into the coating with a 30-45° angle between legs and down to the substrate which intersects to form an "X." A steel or other hard metal straightedge is used to ensure straight cuts. Tape is placed on the center of the intersection of the cuts and then removed rapidly. The X-cut area is then inspected for removal of coating from the substrate or previous coating and rated.
  - B. The cross hatch tape test is primarily intended for use in the laboratory or shop on coatings less than 5 mils thick. It uses a cross-hatch pattern rather than the X pattern. A cutting guide or a special cross-hatch cutting tool with multiple preset blades is needed to make sure the incisions are properly spaced and parallel. After the tape has been applied and pulled off, the cut area is then inspected and rated.



### CLASSIFICATION OF ADHESIVE TEST RESULTS

Classification	Percent Area Removed	Surface of cross-cut area from which flaking has occurred for six parallel cuts and adhesion range by percent
5B	0% None	
4B	Less Than 5%	
3B	5-15%	
2B	15-35%	
1B	35-65%	
0B	Greater than 65%	

7. There are two basic ways a new finish will adhere to an existing finish: mechanical adhesion and chemical adhesion.



- A. Mechanical adhesion involves lightly abrading the top surface of the finish using abrasive pads or abrasive paper/screens, then applying another topcoat.
  - B. Chemical adhesion systems involve using chemical solutions in order to promote adhesion to the existing surface, then applying another topcoat. When using these chemical adhesion systems, use a complete system developed and approved by the finish manufacturer.
8. Before any abrading or chemical recoating is done, it will be necessary to remove all contaminants, grease and oils from the floor. Use a strong detergent-based cleaner to break up any grease and oil on the floor. This can be done with an automatic wood floor scrubber that has a vacuum or by hand using a buffer, red pads and a wet vacuum to pick up all liquid from the cracks and surface of the floor. Work in small sections so the water and cleaner do not soak into the floor or get under the floor. When done scrubbing the floor clean with the detergent, tack rag the floor with towels dampened with water or a surfactant-based cleaner solution. Keep toweling until the towels come away clean.

## Mechanical Adhesion Methods

1. Load all tools, equipment, finishes, abrasives, etc., in the area of the floor where work will be performed to avoid potentially tracking in contaminants from outside and to allow the finish to get to room temperature.
2. Vacuum floor.
3. Inspect floor for damage and areas of potential concern.

4. Clean the floor in accordance with the finish manufacturer's recommendations. See number 8 in the left column for recommendations.
5. Test floor for contaminants and finish compatibility prior to accepting and scheduling the job.
6. Lightly abrade the old finish according to finish manufacturer recommendation for abrasive type and grit choice.
7. Lightly abrade all edges of the floor by hand with same abrasive used in the field.
8. Vacuum and dry-tack or tack floor with proper solvent, dependent on finish, and allow to dry thoroughly.
9. Turn off all airflow to control the environment for finish application.
10. Maintain room temperature between 60-80°F during and after finish application.
11. Control the temperature of the floor. Avoid direct sunlight on the floor by either covering the windows with transparent painter's plastic or avoiding finish application during the time of the day direct sunlight will be on the floor.
12. Apply surface finish at proper cover rate using manufacturer's recommended applicator and procedure.
13. Mechanical adhesion methods may not always be the best option for recoating all existing floors including:
  - A. Some factory finished floors with high abrasion finishes.



- B. Beveled edge floors (unless every beveled edge can thoroughly be abraded by hand).
- C. Sculpted (hand scraped, wire brushed, sawn) or reclaimed floors with high and low elevations where the abrasive may not physically scratch all surfaces (unless every low area can thoroughly be abraded by hand).
- D. Floors that have been previously coated with natural oil finishes.

## Chemical Adhesion Systems

1. Load all tools, equipment, finishes, etc., in the area of the floor where work will be performed to avoid potentially tracking in contaminants from outside and to allow the finish to get to room temperature.
2. Vacuum floor.
3. Inspect floor for damage and areas of potential concern.
4. Clean the floor according to the finish manufacturer's recommendations.
5. Test floor for contaminants and finish compatibility prior to accepting and scheduling the job.
6. Turn off all airflow to control the environment for finish application.
7. Maintain room temperature between 60-80°F during and after finish application.
8. Control the temperature of the floor. Avoid direct sunlight on the floor by either covering the windows with clear plastic or avoiding finish application during the time of the day direct sunlight will be on the floor.
9. Follow manufacturer's instructions for applying the chemical adhesion promoting product. Allow the adhesion promoting product to dry in accordance with the manufacturer's instructions.
10. Apply surface finish at proper cover rate using manufacturer's recommended applicator and procedure.



# CARE & MAINTENANCE

## The Importance of Maintenance

Unlike most other floor coverings, wood floors are a long-term investment that, when properly maintained, will last for the lifetime of the home. Routine and preventative maintenance for wood flooring involves protecting the finish from scratches and moisture. Customers who have been educated to understand their floors aren't impervious to spills, grit and water will also be less likely to call back with complaints in the future. Inform customers about proper maintenance practices for wood flooring.

## Educating the Customer

Creating realistic expectations of wood floor maintenance up front, before the contract is even signed, is critical to the long-term performance of the wood floor. Educating the customer includes:

1. Explanation of proper maintenance, both preventative and routine.
  - A. Preventative maintenance may include use of floor protectors and throw rugs.
  - B. Routine maintenance may include using the proper cleaning products.
2. Make the customer aware of which cleaning product they should use on their wood floors. They also need to know that improper cleaning products can void manufacturer and labor warranties and can cause adhesion problems with future maintenance coats.
3. Explain the maintenance coat schedule. Depending on traffic on the floor, most floors will need to be recoated at some point.
4. Explain how humidity and temperature affects the wood floor performance. They also need to know that temperature and relative humidity are often a part of the warranty of their flooring. The use of humidification will compliment this necessity. This will also help avoid complaints about gaps between boards in the dry seasons.
5. In addition to a verbal explanation of these items, give them all of the pertinent information in writing.

## General Maintenance

1. Wipe all spills immediately.
2. Only use vacuum cleaners that have a setting for hard-surfaces. Turn off the beater bars/brush on vacuum cleaner when present.
3. Do not wet-mop a wood floor. Standing water will result in cracks, splits, cupping, warping, degradation of the finish, and leave a discoloring residue.
4. Do not use steam cleaners on wood floors. Water in a vapor form will penetrate the wood fibers and cause irreversible damage to the wood flooring and the finish.
5. Use breathable throw rugs both inside and outside the doorways to help prevent grit, salt, chemicals, sand, moisture and other debris from being tracked onto wood floors. This will minimize scratching and premature wear. Do not use non-breathable floor coverings or floor protectors on wood floors.
6. For wood flooring in the kitchen, place a breathable area rug in front of the kitchen sink and stove.
7. Rugs should be shaken out, cleaned and thoroughly dried when they get wet.
8. Check with the finish manufacturer for when rugs can be placed on the floor. In general, they should not be placed on a newly finished wood floor for a minimum of seven days after the final coat of finish has been applied.
9. Take special precautions with special non-skid pads that are frequently placed under area rugs. Some of these pads may imprint their pattern onto the finish and/or wood floor. (Natural fibers may not transfer as much as some synthetic pads.)



10. Be aware that area rugs cover the wood floor, protecting it from UV/sun exposure, which results in color differences in the wood floor.
11. Put fabric-faced glides under the legs of furniture to prevent scuffing and scratching. Periodically check these floor protectors for embedded soil and replace as necessary.
12. Avoid walking on your wood floors with cleats, sports shoes and high heels. A 125-pound woman walking in high heels has an impact of 2,000 pounds per square inch. An exposed heel nail can exert up to 8,000 pounds per square inch. This kind of impact can dent any floor surface.
13. Keep pet claws trimmed and in good repair.
14. When moving heavy furniture, do not slide it on wood flooring. It is best to pick up the furniture completely to protect the wood flooring.
15. When moving appliances (refrigerators, stoves, etc.), use safety glides. On newly finished floors, wait a minimum of three days before replacing appliances.
16. Use an appropriate humidifier throughout the winter/dry months and/or dehumidifier in the summer months to keep wood movement and shrinkage to a minimum. It is important to maintain a consistent environment throughout the year to minimize floor movement.
17. When the floor loses its luster, it's time for a recoat.

## What Products to Use

### 1. Factory Finished Floors

- A. For factory finished wood floors, consumers should follow the directions of the flooring manufacturer as to which cleaning products to use.
- B. This is extremely important because not following those directions may void the manufacturer's warranty of the floor.

### 2. Site Finished Floors

- A. For site finished wood floors, follow finish manufacturer's maintenance recommendations.
- B. When the wood or finish manufacturer is unknown, use a wood floor cleaning product available from a local wood flooring professional.
- C. Using a non-recommended product to clean the floor may ruin the intended appearance of the finish, and it may also cause problems when it is time for the floor to be recoated.
- D. Do not use sheet vinyl or tile floor care products on wood floors. Self-polishing acrylic waxes cause wood to become slippery and appear dull quickly.
- E. Excessive use of wood floor cleaners can damage the wood floor. Only use as recommended by the manufacturer.
- F. Do not use household dust treatments.
- G. Never use wax on non-waxed surface finishes.
- H. Do not use petroleum-based cleaners on waterborne finishes.
  - I. Do not use vinegar on wood floor finishes. Vinegar is acidic and will degrade the floor finish.

### 3. Waxed Floors

- A. On a wax finish, do not over-wax a wood floor. If the floor dulls, try buffing instead. Avoid wax buildup under furniture and other light traffic areas by applying wax in these spots every other waxing session.
- B. On a waxed floor, to remove water spots, use a fine steel wool, a soft cloth or synthetic pad and a small amount of mineral spirits. Rub gently in a circular motion until the spot is gone. Then rewax the area and buff.
- C. On waxed and oiled floors, never use water-based cleaners. Only use specific maintenance products from the finish manufacturer.

### 4. Oiled Floors

- A. On oil-finished floors, use only what the manufacturer recommends to clean floors. The oil finish may periodically need to be reapplied by a professional. There are many different types of oil finishes and each has a specific maintenance program.
- B. Use of a dry microfiber mop will safely and effectively remove loose debris from the surface.
- C. Many natural oil manufacturers recommend a specific maintenance routine of using oils and soaps on a regular basis. Failure to follow specific maintenance procedures will result in a finish that will not perform as it's intended to.

5. Nonurethane Coated Acrylic Impregnated Floors
  - A. Use a low speed buffer/rotary machine with the pads and cleaning products recommended by the flooring manufacturer as needed. Some manufacturers will specify different pads for different steps within this maintenance process.
  - B. Only use flooring manufacturer recommended dust-mop treatments to enhance dust mopping.
  - C. For white/bleached acrylic enhanced products, always use an untreated mop. Never use water or petroleum-based products. The floor should be buffed with a low-speed buffer and a recommended product specifically for white/bleached floors. More maintenance will be required for white/bleached floors.
  - D. Some flooring manufacturers recommend that floors that have become dull can be lightly screened. Then, a recommended conditioning product should be used.
  - E. Follow the manufacturer's directions for spot cleaning stubborn stains. Methods may include spot sanding or screening and then applying the recommended cleaner and conditioner, or using mineral spirits or hydrogen peroxide and a hand-sized piece of synthetic pad to remove the stain.
  - F. Note that recoating these types of floors with a urethane will typically void any manufacturer's warranty.

6. Sports Floors
 

Sports floors from basketball to aerobics studios usually take a beating from heavy daily use. Specific recommendations for sports floors are available from the Maple Flooring Manufacturers Association:

Maple Flooring Manufacturers Association:  
 111 Deer Lake Rd, Suite 100  
 Deerfield, IL 60015  
 Phone: 847-480-9138  
 Fax: 847-480-9282  
 mfma@maplefloor.org  
 www.maplefloor.org

General MFMA guidelines include the following:

- A. Dry mop the floor daily with a properly treated dust mop. Floors with especially heavy use should be swept up to three times per day.
- B. Use walk-off mats at all doorways.
- C. Wipe up spills or any other moisture on the floor immediately.
- D. Remove heel marks/scuffs using a floor finish manufacturer's approved wood floor cleaner applied with a soft cloth or dust mop.

- E. Do not use household cleaning products or products designed for other flooring surfaces, which may damage the floor finish and also may leave the floor sticky or slippery.
- F. Do not clean the floor with scrubbing machinery or power scrubbers, unless flooring and finish manufacturer recommends doing so.
- G. Ensure HVAC system is working properly, with normal humidity levels and temperatures. Indoor relative humidity should be maintained between 30-50% and a temperature between 60-80°F year-round.
- H. Do not shut down the HVAC system for prolonged periods of time.
- I. Inspect the floor for abnormal shrinkage and swelling. During the summer months/humid seasons, carefully monitor all exterior doors and windows for leaks.
- J. Remove debris from expansion voids within the flooring system.

# IRREGULARITIES

## Evaluation of Irregularities

1. Sand and finish evaluation must be observed from a standing position on the floor being assessed.
2. Sand and finish evaluation must be conducted with ambient lighting. Glare from a direct light source must not be used during evaluation.
3. Stained/colored floors should be uniform in color. Color tones may vary from board to board or within individual boards due to natural variances within the wood.
4. Proper evaluation of finish cannot take place until final coats have been applied and are fully cured.
5. Mil/film thickness of finish can be evaluated, but should not determine acceptability.
6. Sheen/luster levels should be reasonably consistent across the floor and should not be evaluated until all finish coats have been applied and are fully cured.
7. Minimal amounts of debris within reason can be expected in a final coat of finish. When debris in final coat is predominant and takes away from the overall appearance (standing position/ ambient lighting) of the final coat, repairs may be required.
8. Sand and finish inspection by an NWFA Certified Wood Flooring Inspector can take place from floor level and/or with assistance of magnification in order to determine causes of irregularities, but not to determine acceptability.
9. Refinishing is job specific with respect to the precondition of the existing floor. The sanding process for old flooring may exhibit conditions not acceptable in new flooring and, as such, conditions may affect acceptance of the sanded product.



## Sanding Irregularities

1. Sanding Marks: Sanding imperfections seen as scratches, drum marks, side cuts, dishouts, sanding scratches, swirl marks and stop marks. Considered unacceptable if noticeable from standing position and takes away from the overall appearance of the floor within reason.



2. Chatter Marks/Waves: Chatter marks are consistent sanding imperfections across the grain of the wood varying from 1/4" to 1" apart. Wave marks are two or more irregularities in a floor occurring along the direction of travel of a sander. Waves are usually 1" to 3" from peak to peak. These are considered unacceptable if they are noticeable from a standing position. If joist design or loose flooring is the problem, the structural flaws must be corrected before the floor is repaired.





3. Dish Out/Dishing of Springwood: Areas on the wood floor where softer parts of the wood appear to have been sanded or hollowed out more than other areas. It is inherent in wood species that exhibit pronounced spring (soft) and summer (hard) grain patterns.



4. Picture Framing: The edges of the room appear to be a slightly different color than the rest of the room due to improper sanding sequence. This is considered unacceptable.

## Filler Irregularities

Filler may not be recommended/required on every floor.

1. Color  
Color of filler must be consistent with the overall color tone of the floor.



2. Popped Filler  
Filler may pop and sink in cracks when the environmental conditions are unstable from season to season. Older installations that undergo the refinishing process may also experience filler pop. This type of pop is the result of vertical movement of the wood. This is considered normal. Note that filler that pops with "newly" installed strip and/or plank floors is considered abnormal if the condition was caused by an improperly installed floor (i.e., nailing schedule outside the range specified by the flooring manufacturer or industry standards, which resulted in a loosely installed floor/subfloor).
3. Filler on Board Surface  
Filler that hasn't been sanded from the flooring surface. This is considered unacceptable.
4. Nail Hole Filler  
Filler must be flat with the surface of the floor (not indented or depressed) and reasonably consistent with the overall color tone of the flooring.
5. Light-sensitive wood  
Filler should be reasonably consistent with the overall color tone of the floor. Note that light-sensitive wood species will change color over time, as compared to the color of the wood filler.

## Finish Irregularities

1. Applicator Streaks  
After the floor dries, marks still are visible from the path of the applicator. Can typically be corrected with abrade and recoat. Considered unacceptable if noticeable from standing position, and after final coat has completely cured.



2. **Bleed Back**  
Bleed back of oil-based stain occurs when excess stain seeps up after it has been applied on open grain or from the gaps between the boards. This is considered unacceptable.



3. **Bubbles**  
Dried bubbles are visible on the surface of a finish. This is considered unacceptable.



4. **Chipping**  
Dried finish separates from the surface in the form of flakes or chips. This is considered unacceptable.

5. **Cloudy Finish**  
Finish appears cloudy or milky (not to be confused with sheen). This is considered unacceptable.



6. **Cratering**  
The formulation of small bowl-shaped depressions in the finish. This is considered unacceptable.



7. **Crawling**  
Defect in which the finish recedes from small areas of the surface, leaving them apparently uncoated. This is considered unacceptable.
8. **Debris in Finish**  
Dust, hair, applicator fibers, foreign contaminate within the final coat of finish. Minimal amounts of debris within reason can be expected in a final coat of finish. When debris in final coat is predominant and takes away from the overall appearance (standing position/ambient lighting) of the final coat, it is considered unacceptable.





9. **Discoloration**  
The floor changes color (darkens or lightens) over time. Some areas may change color more than others. Considered normal, especially with light-sensitive species and flooring with exposure to direct sun.



10. **Fish Eyes**  
Defect that manifests itself by the crawling of wet finish into a recognized pattern resembling small "dimples" or "fisheyes." They can measure up to 1" in diameter. You may find a tiny particle in the middle of some fisheyes, which may be the cause for some to form. These are considered unacceptable.



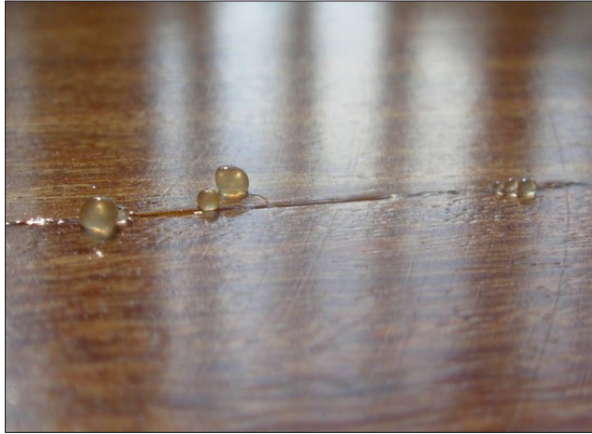
11. **Orange Peel**  
The surface of the finish has a texture that resembles an orange peel. This is considered unacceptable if noticeable from a standing position.



12. **Peeling**  
The finish releases from the wood floor or previous finish coat. This is considered unacceptable.



13. **Pin Holes**  
A defect similar to fisheyes, but very, very small. These are considered unacceptable if they are noticeable from a standing position.



14. **Poly Beads**  
 Beads or BBs of finish that form along the edges of flooring pieces. They can be soft and sticky when first formed, but will become quite hard if left undisturbed. These are typically caused by unstable jobsite conditions and are considered unacceptable.



15. **Roughness/Grain Raise**  
 The surface of the wood floor is rough to the touch. This is considered unacceptable.



16. **Stains**  
 Discoloration on one area of the floor. Pet stains and water stains on pre-existing floors are common culprits for stains. These must be addressed on an individual basis as determined by the contractor and end-user. Stains on a newly installed floor must be addressed prior to sanding/finish coat application.

17. **Sticky Board Syndrome**  
 The finish will not adhere or cure properly on one or more boards. This tends to be species specific, is considered unacceptable, and must be addressed on an individual basis.



18. **Tannic Acid Discoloration/Pull/Bleeding**  
 A dark/greenish/brown discoloration that may occur with a freshly applied coat of waterborne floor finish on a wood species containing high levels of tannic acid. This is considered unacceptable.
19. **Uneven Sheen Levels**  
 The sheen of the final coat of finish is inconsistent. This is considered unacceptable assuming the final coat of finish has fully cured.





20. **White Lines**  
White lines appear between the board edges. This can be caused by movement between boards resulting in finish shrinkage due to seasonal fluctuations in RH levels. This is considered an undesirable environmentally related condition. The contractor has no control of the environment post-finish application. This can also be caused by trapped stain solvent between the boards being blocked by the finish film bridging the gap.



21. **Wrinkling**  
Once the finish starts to dry, it takes on the appearance of the skin of a dried prune. Wrinkling may happen with all types of finish, but is more likely to occur with oil-modified urethanes. This is considered unacceptable.

# GLOSSARY

## **Abrasion Resistance**

The property of a finished floor that is resistant to abrasion by rubbing or friction. See Taber Abrasion.

## **Abrasives**

Natural and synthetic materials in fine granular form attached to cloth or paper. Abrasives are generally used in grits of coarse to fine and may be identified by a numerical system (paper and cloth-backed abrasives). In wood flooring applications, abrasives can also refer to screens or pads. Not all abrasives are identified by number.

## **Acid**

Chemical substance rated below 7 on the pH scale.

## **Acrylic Resin**

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

## **Acrylic/Wood**

The generic name for wood-plastic composites using wood impregnated with acrylic monomers and polymerized within the wood cells by gamma irradiation. Some versions are cured by heat radiation.

## **Additives**

Chemicals that are added to coatings in the manufacturing process that alter the physical or chemical properties of the finish. Some examples may include products that modify surface tension, increase flow and leveling properties, increase the wet edge, anti-freeze additives, thickeners, emulsifiers, stabilizers, adhesion promoters, UV stabilizers, matting agents and many others.

## **Adhesion**

The property that causes one material to stick to another. See Mechanical Adhesion and Chemical 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.

## **AIM**

Architectural and Industrial Maintenance.

## **Alkalinity**

A measurement of an alkaline rated above 7 on the pH scale.

## **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.

## **Ambering**

A yellowish color change from either the wood or finish. See Discoloration.

## **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.

## **Aniline Dyes**

Whereas pigmented stains contain small particles of color that remain on the surface of the wood, aniline dyes penetrate the wood fibers.

## **Applicator**

A tool that is used to apply something to a surface.

## **Applicator Streaks**

After the floor dries, marks still are visible from the path of the applicator. Can typically be corrected with abrade and recoat. Considered unacceptable if noticeable from standing position, and after final coat has completely cured.

## **Binders**

The part of the film forming finish system that forms the basic solid film that remains after the solvent has evaporated. The binders determine many of the qualities of individual finish film properties such as adhesion, gloss level, abrasion resistance, scuff resistance, hardness, chemical resistance, elasticity, durability and speed of drying. Some common binders in wood floor finishes include urethanes (both oil based and waterborne) and acrylics. See Resin.

**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 material. Bleed back of oil-based stain occurs when excess stain seeps up after it has been applied on open grain or from the gaps between the boards.

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

**Boiling Point**

The temperature at which the vapor pressure of a liquid equals the air pressure, or the temperature at which a liquid begins to boil.

**Bond**

The adhesion between two materials.

**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.

**Brushability**

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

**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 applied finish system.

**Burnish**

The process by which wax or finish is applied as a top coat. A commercial rotary buffer is used for the application. Burnishing can also be the process of using a fine-grit abrasive for the final cut on a floor to reduce grain raise. Steel wool is also sometimes used for burnishing.

**Catalyst**

A chemical that increases the rate of a chemical reaction. An ingredient that is added to a product to provide additional performance characteristics, such as chemical resistance or increased durability. Cross-linked or catalyzed products are mixed immediately before application of the finish. Cross-linked or catalyzed finishes fall into two categories: polyfunctional aziridine catalyst and polyisocyanate catalyst.

**Chatter Marks**

Slight indentations causing a ripple effect or "bars" that run perpendicular to the wood's grain direction on the surface of a wood floor. The width of these "bars" can range from just a few millimeters to nearly an inch and can occur in limited regions or span the entire floor. They are usually caused by sanding machines that have out-of-balance drums, bad drive belts, quality of abrasives used, foreign objects stuck to the wheels, the structural integrity of the floor being sanded, or the structural integrity of the subfloor. The marks are the most noticeable on stained floors, gloss finishes, in direct-light areas or at eye level. Considered unacceptable if noticed from standing position. If joist design or loose flooring is the problem, the structural flaws must be corrected before the floor is repaired.

**Checking (Finish)**

Similar to alligating, 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 the parallel line, the defect is known as line checking. Irregular checks without a definite pattern are known as irregular checking.

**Chemical Adhesion**

A chemical property that causes one material to stick to another.

**Chipping**

The condition that occurs when a dried film of finishing material separates from the underneath surface in the form of flakes or chips.

**Cloudy Finish**

Finish appears cloudy or milky (not to be confused with sheen).

**Coating**

A material applied to a surface for protective, decorative or functional purposes.

**Colorant**

A concentrated dye, pigment or other substance dispersion in water, solvent and/or binder that colors something.

**Combustible**

Able to catch fire and burn easily. OSHA defines a combustible liquid as any liquid having a flash point at or above 100°F (37.8°C).

**Conjugated Oil Varnish**

A clear or semi-transparent wood coating based on natural occurring conjugated vegetable oils (tung oil) and modified with other natural or synthetic resins, with a minimum of 50% of the resin solids consisting of conjugated oil.

**Conversion Varnish**

Conversion varnish coatings are single- or two-component, acid-curing, alcohol-based finishes with an alkyd or other resins blended with amino resins, often referred to as "Swedish finishes" or "acid cure."

**Cratering**

The formulation of small bowl-shaped depressions in the finish.

**Crawling**

Defect in which the finish recedes from small areas of the surface, leaving them apparently uncoated.

**Crazing**

The appearance of minute, interlacing cracks or checks on the surface of a dried film of finishing material. Cross Hatch Adhesion Test (ASTM D 3359)  
Standard test method for measuring adhesion of finishes by tape test.

**Cross Pull**

A condition occurring when adjoining boards are pulled in opposite directions resulting in the film forming finish stretching across the surface.

**Crowfooting**

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

**Crowning**

A convex condition (or appearance) of individual strips where the center of the strips are higher than the edges. The opposite of cupping.

**Cupping**

A concave or dished appearance of individual strips with the edges raised above the center. The opposite of crowning.

**Cure**

To change the properties of a product by a chemical action as opposed to drying when the product reached its optimum state.

**Cut**

To sand a floor. As a noun, cut refers to one pass over an area of floor with sanding equipment.

**Cut Nails**

A nail having a tapering rectangular form with a blunt point, made by cutting from a thin rolled sheet of iron or steel. Often used in older (pre 19th century) wooden floors, and used as decorative features in some modern floors.

**Debris in Finish**

Dust, hair, applicator fibers, and other foreign contaminate within the final coat of finish. Minimal amounts of debris within reason can be expected in a final coat of finish. When debris in final coat is predominant and takes away from the overall appearance (standing position/ambient lighting) of the final coat, it is considered unacceptable.

**Discoloration**

The floor changes color (darkens or lightens) over time. Some areas may change color more than others. Considered normal, especially with light-sensitive species and flooring with exposure to direct sun.

**Dish Out/Dishing of Springwood**

Areas on the wood floor where softer parts of the wood appear to have been sanded or hollowed out more than other areas. It is inherent in wood species that exhibit pronounced spring (soft) and summer (hard) grain patterns.

**Distressed**

A heavy artificial texture in which the floor has been scraped, scratched or gouged to give it a time-worn look. A common method of distressing is wire brushing.

**Drier**

A catalytic material that improves the drying or hardening properties of oils or varnishes when added in small amounts.

**Drum Mark**

A sanding mark left in the flooring surface from the drum of the big machine.

**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 processes.



**Dry-Tack**

Use of a dry cloth or microfiber pad on a floor to pick up dust and debris prior to application of finish and for general maintenance practices.

**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 or Dry Hard**

The third stage of solidification of an applied film of finishing material when it can be sanded without undue softening, sticking or clogging of the sandpaper. Finish should not be covered at this stage of drying, even though this is typically the stage in which people begin moving on to the floor.

**Dry to Touch**

The second 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. Dust will no longer stick to the surface. Most of the time, it will still be wet below the surface.

**Durability**

The ability of the wood species or finish 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**

Small particles of solid matter.

**Dust-Free**

The 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.

**Dutchman**

A wedge or sliver of wood used to conceal a void in a wood floor.

**Factory Finished**

A wood floor that has been sanded and finished in a manufacturing facility.

**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 material either by the method of finish 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 decrease the porosity of the surface before applying finish coatings. Wood filler used for cracks, knotholes, worm holes, etc., is often a 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 an appropriate solvent sealer or finish.

**Fire Resistance**

The property of a material or assembly to withstand fire or given protection from it. Certain species naturally provide greater fire resistance than others. Classes are I-II-III or A-B-C with Class I or A being the most fire resistant.

**Fire Retardant**

A chemical or preparation of chemicals used to reduce flammability or to retard the spread of a fire over a surface.

**Fisheyes**

Defect that manifests itself by the crawling of wet finish into a recognized pattern resembling small "dimples." They can measure up to about 1" in diameter. Tiny particles may be found in the middle of some fisheyes, which may be the cause for some to form.

**Flame Spread**

The propagation of a flame away from the source of ignition across the surface of a liquid or solid, or through the volume of a gaseous mixture. NOTE: Most wood species are Class C Flame Spread unless the wood floor has been treated and marked as to flame spread.

**Flammable**

Any liquid having a flash point below 100°F (37.8°C), except any mixture having components with flashpoints of 100°F (37.8°C) or higher, the total of which make up 99 percent or more of the total volume of the mixture.

**Flattening 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.

**Friable**

The tendency of an abrasive mineral to fracture into smaller pieces when coming in contact with wood floors.

**Gloss**

The sheen of a finish that typically ranges between 60-80 (specific to individual manufacturer).

**Gloss Level**

A property of reflected light. Gloss reflectance is measured by shining a single beam of light at a 60° angle from the perpendicular (or a 30° angle from the floor). Gloss is measured on a scale of 0 to 100; the higher the number, the shinier the surface.

**Gloss Meter**

An instrument used for measuring the gloss level 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**

Hard-plating, dinking and sand-plating are all names that refer to using a large paper disc on a hard-plate driver under a rotary sander. The hard-plate method of sanding is used primarily on patterned floors, such as parquets, mixed media, or other inlaid floors to keep the floor flat prior to finishing and keep from dishing out the springwood or softer grain.

**Hard Wax Oils**

Finish that consists of a combination of natural oils and waxes. Hardwax oil is an oxidative finish; it dries out on open air. In hardwax oil finish, oil easily penetrates into wood pores, deeply saturating the wood, strengthening and protecting it from the ill-effects of moisture, dirt, etc. Waxes create a hard protective film on the wood surface.

**Hardness**

The property of the wood species or 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.

**Humidity**

The amount of water vapor in the air.  
See Relative Humidity.

**Hygrometer**

An instrument used for measuring the degree of humidity or relative humidity of the atmosphere.

**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.

**Jobsite Finished**

The process of sanding and finishing a wood floor after it has been installed.

**Lacquer**

A thin body, nitrocellulose resin material, highly flammable coating that can be used as a sealer or a hard film finish, typically not used in the wood flooring industry.

**Lap**

The portion of a coat of finishing material that extends over the edge of and onto a previous coat from the applicator.

**Leveling**

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

**Matte**

A sheen of finish that typically ranges from 5-20 gloss level (specific to individual manufacturer).

**Mechanical Adhesion**

A mechanical property that causes one material to stick to another. Abrasives are the most common method of creating a mechanical bond.

**Metamerism**

An apparent change in color when exposed to differing wavelengths of light. A human perception.

**Microfiber Mop**

Microfiber is a synthetic fiber made up of a blend of polyester and polyamide or nylon. The static charge created in this fiber aids in the effectiveness of cleaning.

**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 solvent product used as a reducer, thinner and/or cleaner with oil-based finishes.

**Moisture-Cure Urethane**

See "Urethane."

**Non-Volatile**

The portion of a material that doesn't evaporate at ordinary temperatures. The solid substances left behind after volatiles have evaporated.

**Odor**

That property of a substance that is perceptible by the sense of smell. The smell, scent or fragrance of material.

**Oil-Modified Urethane**

See Urethane.

**Orange Peel**

The surface of the finish has a texture that resembles an orange peel.

**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. Caused by lack of adhesion.

**Penetrating Hardening Oil Finish (Danish)**

An oil-based finish that penetrates into wood fibers and hardens inside. It can be colored. Very low gloss.

**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.

**pH Value**

The concentration of the hydrogen ion in a material. A pH value of 7 is considered neutral. Lower values are acidic; higher values are alkaline.

**Picture Framing**

The edges of the room appear to be slightly different color than the rest of the room due to improper sanding sequence.

**Pigment**

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

**Pigment Stains**

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

**Pin Holes**

A defect similar to fisheyes, but very, very small. Considered unacceptable if noticeable from standing position.

**Poly Beads**

Beads or BBs of finish that form along the edges of flooring pieces. They can be soft and sticky when first formed, but will become quite hard if left undisturbed. Are typically caused by unstable jobsite conditions. Considered unacceptable.

**Polyfunctional Aziridine**

A chemical crosslinker used for some waterborne finishes. A water soluble catalyst that is typically stirred into the finish. PPE (Personal Protective Equipment) including respirators, gloves and eye protection should always be used due to its sensitization characteristics as per manufacturer safety data sheets.

**Polyisocyanate**

A chemical crosslinker for some waterborne finishes. This catalyst is not water soluble and typically requires agitation for proper mixing. PPE (Personal Protective Equipment) including respirators, gloves and eye protection should always be used due to its sensitization characteristics as per manufacturer safety data sheets.

**Polyurethane**

See Urethane.

**Prefinished**

Flooring that has been finished prior to installation.

**Puckering**

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

**Raised Grain**

A roughened or fuzzy condition of the face of the flooring in which the dense summerwood is raised above the softer springwood, but not torn or separated.

**Reduce**

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

**Refinish**

Sanding a previously finished floor to bare wood and applying new stain or finish.

**Relative Humidity**

Ratio of the amount of water vapor present in the air to that which the air would hold at saturation at the same temperature. It is usually considered on the basis of the weight of the vapor, but for accuracy should be considered on the basis of vapor pressures.

**Resin (natural)**

Inflammable, water soluble, vegetable substances secreted by certain plants or trees, and characterizing the wood or many coniferous species.

**Resin (synthetic)**

An ingredient in synthetic coatings that acts as a binder and gives the coating physical properties such as hardness and durability. In flooring, a polymeric material used for impregnating and bonding layers of engineered flooring.

**Retarder**

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

**Safety Can**

An approved container, of not more than 5 gallons capacity, having a spring-closing lid and spout cover, and so designed that it will safely relieve internal pressure when subjected to fire exposure.

**Sanding Marks**

Sanding imperfections seen as drum marks, dishout, sanding scratches, swirl marks and stop marks.

**Sanding Sealer**

A clear or semi-transparent wood coating formulated for application to bare wood in order to seal the wood and to provide a coat that can be abraded to create a smooth surface for subsequent coats.

**Satin**

The sheen of a finish that typically ranges between 20 - 40 (specific to individual manufacturer).

**Scratch Pattern**

The pattern of scratches left behind by either the machine or the abrasive on any abraded surface. On a site-sanded wood floor, these patterns will vary widely in nature depending upon the motion characteristic in which any particular sanding machine imparts to its abrasive medium.

**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.

**Semi-Gloss**

The sheen of a finish that typically ranges between 40 - 60 (specific to individual manufacturer).

**Sensitization**

A chemical that causes an individual to develop an allergic reaction in normal tissue after repeated exposure to the chemical. Also known as chemical hypersensitivity.

**Separation**

The breaking up or segregation of two or more integral parts of a mixture into its component parts.

**Set Point**

The first stage that a finish arrives at is the point at which it will no longer flow and level. It is not dry, it may be tacky, or may even feel liquid when touched, but enough liquid carrier has evaporated so that the product will not flow or level any further. This is also sometimes referred to as the gel point in two part systems.

**Settling**

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

**Shade**

The degree to 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**

Used to describe the low angle gloss of a surface. Variations in the sheen of a surface are most noticeable in low gloss coatings. Sheen is measured by shining a single beam of light at an 85° angle from the perpendicular (or a 5° angle from the floor).

**Shellac**

The resinous material secreted by the lac beetle (*Lacifer lacca*), an insect that feeds upon the twigs of certain trees in India. It is soluble in alcohol to form liquid shellac. Dewaxed shellac is compatible with most wood floor finishes and is common as a sealer for wood flooring.

**Skin**

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

**Solids**

With wood floor finishes, they are the nonvolatile ingredients that are left on the floor after the solvents have evaporated.

**Solvents**

The liquids that carry all of the solid components of the coating. The main purpose of the solvent is to carry the binder to its final destination on the floor. Secondly, solvent type and amount plays a large role in determining the viscosity of the coating. It is volatile and does not become part of the coating film. Different types of finishes contain different types of solvents. The binder or resin is typically dispersed or dissolved within the solvent. After application, the solvent evaporates leaving behind the solid dry film on the flooring surface.

**Spontaneous Combustion**

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

**Spot Fill Method**

To fill small areas on a wood floor where small gaps appear between boards. Compare with Trowel Fill Method.

**Stain**

A clear, semi-transparent, or opaque coating formulated to change the color of a surface, but not conceal the grain pattern or texture.

**Stain/Discoloration**

Discoloration on one area of the floor. Pet stains and water stains on pre-existing floors are common culprits for stains. These must be addressed on an individual basis as determined by the contractor and end-user. Stains on a newly installed floor must be addressed prior to sanding/finish coat application.



**Staining**

The act of changing the color of wood without disturbing the texture or markings, through the application of transparent or semitransparent liquids.

**Sticky Board Syndrome**

The finish will not adhere or cure properly on one or more boards. Species specific. Considered unacceptable and must be addressed on an individual basis.

**Surface Tension**

The inherent molecular attraction in liquids that causes them to diminish their surface area and thereby exhibit properties resembling those of a stretched elastic membrane.

**Swedish Finish**

A term sometimes used to refer to water-borne finishes, which, like conversion varnishes, originated in Sweden. See Conversion Varnish.

**Taber Abrasion (ASTM D 1044)**

A test to determine a finished surface's resistance to abrasion.

**Tack-Free**

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

**Tack Rag**

Used to remove dust after sanding or screening.

**Tannic Acid Discoloration/Pull/Bleeding**

A dark/greenish/brown discoloration that may occur with a freshly applied coat of waterborne floor finish on a wood species containing high levels of tannic acid. Considered unacceptable.

**Tannic Acid/Tannin**

Various soluble astringent complex phenolic substances found in trees (and plants) used in tanning animal hides into leather, ripening of fruit, aging of wine, coloring and taste in tea and bourbon, dyeing, the making of ink, and in medicine. It also protects the tree from insects, fire and bacteria.

**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 (mil-thickness – wet film/dry film)**

The body on the work after the film of finishing material has been fully dried.

**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.

**Toner**

A transparent or semi-transparent color used to even the tone of the wood.

**Top Coat**

The final or protective layer of a protective film finish system. A finish system may have a number of top coats and all top coats may have different properties and characteristics.

**Trough**

A long, narrow undulation in the flooring surface creating the visual effect of a dip, or channel. Caused by improper sanding techniques.

**Trowel Fill Method**

To fill an entire floor or large area. Compare with Spot Fill Method.

**TSP**

Tri Sodium Phosphate commonly used to remove surface contaminants from flooring.

**Ultraviolet**

Rays that are outside the visible spectrum at its violet end. These rays have a chemical effect upon the dried film of finishing materials. Ultraviolet light is commonly used in curing finishes at the factory for prefinished flooring. Ultraviolet light also causes wood to lighten or darken. See Discoloration.

**Ultraviolet-Cured Polyurethane**

See Urethane.

**Undercoats**

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

**Unfinished**

A product that must have a stain and/or a finish applied after installation.

**Urethane**

A synthetic chemical structure formed by one of three specific chemical reactions. There are various types of urethanes:

**Moisture-Cure Urethane**

- A solvent-base polyurethane that dries by solvent evaporation and cures by a reaction of the polyurethane with atmospheric moisture. It cures with the presence of moisture and fails to do so in its absence.

**Oil-Modified Urethane**

- An oil-based varnish enhanced with urethane that dries by solvent evaporation and cures by a reaction of the urethane with dryers and air.

**Polyurethane**

- A large molecule of chemically joined urethane units, having the capacity to solidify or "set." Any of various synthetic resins used to make tough resistant coatings or adhesives.

**Ultraviolet-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.

**Water-Base Urethane**

- A water-borne urethane that is fully cured and dries by water evaporation.

**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.

**Volatile Organic Compound (VOC)**

Organic chemicals that have a high vapor pressure at ordinary room temperature. Their high vapor pressure results from a low boiling point, which causes large numbers of molecules to evaporate or sublime from the liquid or solid form of the compound and enter the surrounding air.

**Waterborne (Water-Based) Urethane**

This large family of finishes has a common trait of having solids that are suspended in water and dry by water evaporation. See Urethane.

**Waves**

Indentations, usually repeating undulations, visible on a site-sanded wood floor's surface, most often visible after a finish has been applied. Sometimes described as "ripples" or "washboard," waves are strictly an undesirable trait of a floor's surface shape. Its causes range from a lack of any floor's structural integrity (harmonic vibrations) to poor belt or drum sander tuning to improper sanding techniques. If joist design or loose flooring is the problem, the structural flaws must be corrected before the floor is repaired.

**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. Available in liquid and paste form.

**White Lines**

White lines appear between the board edges. Usually caused by vertical movement between boards resulting in finish shrinkage due to seasonal fluctuations in RH levels or caused by trapped solvents between floor boards.

**Wiping Stains**

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

**Wire Brush**

A method for imparting an artificial texture or distressed appearance to the surface of hardwood flooring.

**Wood Filler**

See Filler.

**Wrinkling**

Once the finish starts to dry, it takes on the appearance of the skin of a dried prune. Wrinkling may happen with all types of finish, but is more likely to occur with oil-modified urethanes.

**Yellowing**

See Ambering.

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- American Society for Testing & Materials (ASTM)  
[www.astm.org](http://www.astm.org)
- US Environmental Protection Agency (EPA)  
[www.epa.gov](http://www.epa.gov)
- Occupational Safety and Health Administration (OSHA)  
[www.osha.gov/](http://www.osha.gov/)
- Maple Flooring Manufacturers Association (MFMA)  
[www.maplefloor.org](http://www.maplefloor.org)