

Sanding and Finishing Guidelines And Methods



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 installation of hardwood flooring were developed by the NWFA Installation Guidelines Task Force, using reliable installation principles, with research of all available wood flooring installation 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 your geographic area. Some installation methods and materials may not be suitable in some geographic areas because of local trade practices, climatic conditions or construction methods. All wood flooring installations must conform to local building codes, ordinances, trade practices and climatic conditions.

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

ACKNOWLEDGEMENT

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HARDWOOD PLYWOOD VENEER ASSOCIATION

MAPLE FLOORING MANUFACTURERS ASSOCIATION

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CHAPTER 1

GENERAL SANDING AND FINISHING GUIDELINES

Part I - Job-Site Preparation

FOR SANDING SAFETY GUIDELINES, SEE APPENDIX F

NOTE: When sanding 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. For more information, visit the U.S. Environmental Protection Agency website at www.epa.gov/lead.

- A. Redecorating, such as wall-coverings and painting, should be completed and dry before refinishing the floor or wait until sanding is completed and final finish is completely dry.
- B. Remove the base shoe, quarter round or baseboards as needed.
- C. Vacuum and/or sweep the floor clean before sanding and after every cut.
- D. Inspect the floor carefully — look for protruding nail heads or staples. Set nails as necessary. Repair and replace all damaged boards. **See Chapter 7.**
- E. Cover light fixtures. Warning: Covered lights may be a potential fire hazard; these fixtures should remain off. Tape switch in off position if necessary.
- F. Seal with plastic or appropriate dust blocker. Cover doorways, heat registers, returns, appliances, cabinets, fireplaces and windows in work area. Cover windows to keep out direct sunlight. Use the proper tape to hang plastic. **NOTE: Some tape will damage paint and wall coverings. Use a medium- or low-adhesion tape. Tape manufacturers recommend testing in an inconspicuous location before proceeding.**

PART II – General Sanding Guidelines

- A. 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 flooring manufacturer's recommendation for guidelines on the number of times a floor can be sanded, and for any other recommendations.
- B. Measure 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 T&G 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.

- C. NOTE: 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.
- D. Load the professional sanding machine and edger with the proper sequence of sandpaper as shown in Appendix C and Appendix D.
- E. For specific instructions on sanding and finishing strip, plank and parquet flooring, see Chapters 2 and 3. For specific instructions on recoating an existing finished floor, see Chapter 4.



SAFETY NOTE: SPONTANEOUS COMBUSTION IS A DANGER. Sanding dust is highly flammable. To minimize the risk, never operate the sanding machine when the bag is more than half full. Also, never leave the sanding machine with dust in the bag or any bag of dust in your vehicle or on the job site. For more information on Spontaneous Combustion, see Sanding Safety, Appendix F.

Part III – General Finishing Guidelines

- A. Inspect the floor carefully for all sanding errors. Repair all sander marks as necessary. After sanding is complete and all sander marks have been repaired, wipe or vacuum all dust on baseboards, windows, sills, doors and door frames. Clean from the highest surface to the lowest, in that order. Use a dampened cloth where appropriate on all surfaces except the bare wood floor.
- B. 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 commercial 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.
- C. Vacuum and tack the floor clean. Repeat tacking until floor is clean.
- D. 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 or bleached. For bleaching refer to Chapter 5.
- E. NOTE: Most manufacturers of stains and finishes recommend using products from the same manufacturer to ensure compatibility and optimal adhesion. **BEFORE USING DIFFERENT MANUFACTURERS FOR THE STAIN AND FINISH PRODUCTS, CHECK WITH THE MANUFACTURER FOR COMPATIBILITY.**
- F. 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 depth of color.
- G. Thoroughly wipe the stain from the floor. If the floor contains beveled edges, pay special attention to the beveled areas.
- H. Allow the stain to dry thoroughly, with proper air exchange and circulation. Use the finish manufacturer's recommended drying time. If the environment is excessively humid or cold the stain may take longer to dry. 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.

- I. Apply sealer, if necessary, according to finish manufacturer's recommended coverage rate, application method and procedures. Refer to Applicator Recommendations in Appendix A.
 - 1. For a wax finish apply seal, then wax and buff or burnish into wood.
 - 2. For surface finishes, following intercoat abrasion, (see Appendix E) apply additional coats of finish according to manufacturer's recommendation
- J. Most surface finished floors can be walked on after 24-48 hours. Do not slide furniture on the floor. Lift it into place after 48 hours or as recommended by the finish manufacturer. 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.
- K. Provide customers with information on proper maintenance practices to protect floor finishes. 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. In addition, soft plastic or fabric-faced floor protectors should be placed under the legs of furniture to prevent scuffing and scratching. 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. For more information, see Wood Floor Maintenance, Appendix J.

CHAPTER 2

SAND & FINISH STRIP & PLANK

Job-Site Preparation and General Sanding Guidelines – See Chapter 1

Part I - Sanding Previously Finished Floors

SAFETY NOTE: ALWAYS WEAR NIOSH-APPROVED RESPIRATORY PROTECTION. WHEN APPLYING FINISH PRODUCTS, FOLLOW THE RECOMMENDATION IN THE MSDS SHEET PROVIDED BY THE FINISH MANUFACTURER.

NOTE: When sanding 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. For more information, visit the U.S. Environmental Protection Agency website at www.epa.gov/lead.

- A. 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. A screen and recoat may suffice. See Chapter 4, Recoating a Previously Finished Floor. Cupped floors should not be sanded until the moisture content of the wood flooring and the subfloor have stabilized.
- B. If the floor was factory-finished, determine what type of finish was applied. High-abrasion finishes such as aluminum oxide may be more difficult to sand. High-abrasion finishes may respond better by using a fine-grit (80-grit or finer) abrasion to remove the surface finish.
- C. If the floor was previously site-finished, use a coarse-grade abrasive to remove the previous finish. Refer to Appendix C.
- D. Prior to sanding the entire floor, the bevels of beveled-edge flooring should be cleaned to remove finish, stain and debris. This step should also be repeated after the final sanding and prior to applying finish. Care should also be taken in applying finish on beveled-edge flooring to ensure that finish does not "pool up" within the bevels, especially in butt-joints. In addition, make the customer aware that sanding a beveled-edge product will change the profile of the bevel. In the case of a micro-bevel product, it is possible that the bevel will be eliminated.

Part II – Sanding Newly Installed Strip & Plank

- A. Check the moisture content of the wood floor prior to sanding. Sanding and finishing or sealing should occur when the floor has been acclimated to the proper moisture content for normal living conditions for temperature and humidity. (For a more detailed discussion of acclimation, refer to the companion piece to this publication, the National Wood Flooring Association's *Installation Guidelines and Methods*.) 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 normal. Follow the adhesive manufacturer's recommendations for proper curing time.

- B. Load the professional sanding machine and edger with the proper sequence of sandpaper as shown in Appendix C and Appendix D.
- C. The first cut with the big machine should be at a 7-15 degree angle to the length of the boards, using the finest grit possible that will flatten the floor. (The National Wood Flooring publication *Wood Species Used in Wood Flooring* includes suggestions on sanding sequences for some of the more difficult to sand species.)

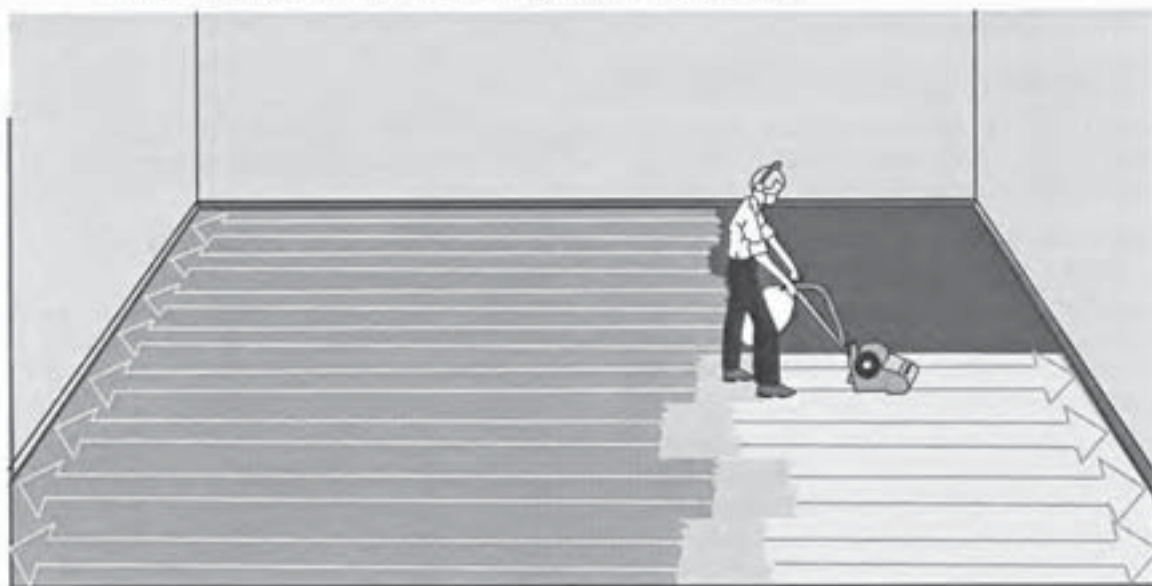


Figure 2-1

- D. When two-thirds of the floor is complete, turn the sander in the opposite direction and repeat the process on the remaining third. 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, be careful not to stop the sander in the same spot each pass by staggering the overlap every 2-3 passes. (See Figure 2-1)
- E. After the first cut with the big machine, use an edger to sand edges and other places inaccessible to the sanding machine, using the finest grit possible that will flatten the floor.
- F. The second cut with the big machine should be parallel to the grain, using the next appropriate grit of sandpaper, not skipping more than one grit between sanding cuts. See Appendix D.
- G. After the second cut, use an edger to sand edges and other places inaccessible to the big machine, using the same grit that will be used on the final sanding cut with the big machine.
- H. Fill the floor before the final straight cut. Spot-fill beveled-edged products; square-edged products may be spot- or trowel-filled. Use a commercial filler or putty that is compatible with the stain and/or finish that will be applied, or make your own filler with dust from the final edging mixed with a compatible mixing agent to form a thick paste.

- I. The final sanding cut should be parallel to the grain, using the last sequenced grit, not skipping more than one grit between sanding cuts. See Appendix D.
- J. Hand scrape corners, around doorjambs 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.
- K. Examine for visible edger and sander marks. To prevent dishing out the grain from excessive screening, use a buffer, multi-disc sanding machine or oscillating sander over the entire floor to remove sanding imperfections. This step may not be appropriate for all wood species.



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Part III – Finishing – See Chapter 1

CHAPTER 3

SAND & FINISH PARQUET

Job-Site Preparation and General Sanding Guidelines – See Chapter 1

Part I - Sanding Previously Finished Floors

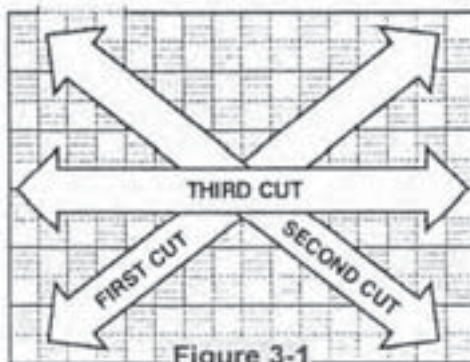
SAFETY NOTE: ALWAYS WEAR NIOSH-APPROVED RESPIRATORY PROTECTION. WHEN APPLYING FINISH PRODUCTS, FOLLOW THE RECOMMENDATION IN THE MSDS SHEET PROVIDED BY THE FINISH MANUFACTURER.

NOTE: When sanding 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. For more information, visit the U.S. Environmental Protection Agency website at www.epa.gov/lead.

- A. 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. A screen and recoat may suffice. See Chapter 4, Recoating a Previously Finished Floor. Cupped floors should not be sanded until the moisture content of the wood flooring and the subfloor have stabilized.
- B. If the floor was factory-finished, determine what type of finish was applied. High-abrasion finishes such as aluminum oxide may be more difficult to sand. High-abrasion finishes may respond better by using a fine-grit (80-grit or finer) abrasion to remove the surface finish.
- C. If the floor was previously site-finished, use a coarse-grade abrasive to remove the previous finish. Refer to Appendix C.
- D. Prior to sanding the floor, the bevels of beveled-edge flooring should be cleaned to remove finish, stain and debris. This step should be repeated after the final sanding, prior to applying finish. Care should also be taken in applying finish on beveled-edge flooring to ensure that finish does not "pool up" within the bevels, especially in butt-joints. Make the customer aware that sanding a beveled-edge product will change the profile of the bevel. In the case of a micro-bevel product, it is possible that the bevel will be eliminated.

Part II – Sanding Newly Installed Parquet Floors

- A. Check the moisture content of the wood floor prior to sanding. Sanding and finishing or sealing should occur when the floor has been acclimated to the proper moisture content for normal living conditions for temperature and humidity. (For a more detailed discussion of acclimation, refer to the companion piece to this publication, the National Wood Flooring Association's *Installation Guidelines and Methods*.) 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 normal. Follow the adhesive manufacturer's recommendations for proper curing time.



will flatten the floor.

- E. The second cut should be on the opposite diagonal, using the next appropriate grit of sandpaper, not skipping more than one grit between sanding cuts. See Appendix D.
- F. After the second cut, use an edger to sand edges and other places inaccessible to the big machine, using the same grit that will be used on the final sanding cut with the big machine.
- G. Fill the floor before the final cut. Trowel-filling is the most common method used on parquet floors. Use a commercial filler or putty that is compatible with the stain and/or finish that will be applied, or make your own filler with dust from the final edging mixed with a compatible mixing agent to form a thick paste.
- H. The final sanding cut with the big machine should be parallel with the room's longest dimension, using the last sequenced grit, not skipping more than one grit between sanding cuts. See Appendix D. Typically, the final sanding grit for a parquet floor will be finer than for a strip or plank floor.
- I. Hand scrape corners, around doorjambes 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.
- J. Examine for visible edger and sander marks. To prevent dishing out the grain from excessive screening, use a buffer, multi-disc sanding machine or oscillating sander over the entire floor to remove sanding imperfections. This step may not be appropriate for all wood species. Make this cut in the most logical direction, based on the pattern of the floor.



SAFETY NOTE: SPONTANEOUS COMBUSTION IS A DANGER. Sanding dust is highly flammable. To minimize the risk, never operate the sanding machine when the bag is more than half full. Also, never leave the sanding machine with dust in the bag or any bag of dust in your vehicle or on the job site. For more information on Spontaneous Combustion, see Sanding Safety, Appendix F.

Part III – Finishing – See Chapter 1

CHAPTER 4

RECOATING A PREVIOUSLY FINISHED FLOOR

PART 1 – GENERAL RECOATING GUIDELINES

SAFETY NOTE: ALWAYS WEAR NIOSH-APPROVED RESPIRATORY PROTECTION. WHEN APPLYING RECOAT AND FINISH PRODUCTS, FOLLOW THE RECOMMENDATION IN THE MSDS 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. For more information, visit the U.S. Environmental Protection Agency website at www.epa.gov/lead.

- A. If the floor has visible dents, wear patterns or permanent cupping, recoating is not a viable solution, and it will be necessary to fully sand the floor to restore the finish. See Chapters 2 & 3.
- B. Finish adhesion is affected by surface contaminants, i.e. wax, grease and many other maintenance products. One brand or type of finish may not be compatible with another. Always test in several areas in accordance with finish manufacturer's recommendations to be sure the finish will adhere and dry properly. If the floor has been waxed, NWFA guidelines suggest rewaxing the floor whenever possible, rather than resanding.
- C. There are several methods to test for wax. One is to 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 is probably present. Another method involves taking a piece of screen or sandpaper and lightly abrading the floor. If residue balls up, it is a paraffin-based product. Yet another test involves putting two drops of water on the floor. If white spots appear after about 10 minutes, the finish is probably wax.
 - 1. **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.
 - 2. **NOTE: TESTING IN ONE AREA DOES NOT GUARANTEE ACCEPTABLE PERFORMANCE. ADVISE THE CLIENT OF THIS BEFORE PROCEEDING.**
- D. Factory-finished floors that include a high-abrasion finish may need to be pretreated with an approved chemical etching solution, as recommended by the finish manufacturer.
- E. There are two basic recoat methods: a screen and recoat and a chemical etching and recoat system. A screen and recoat involves lightly abrading the top surface of the finish with a screen or a pad and abrasive strip, then applying another topcoat. In a chemical etching and recoat system, the existing surface is chemically etched, then recoated. No

sanding or screening is performed. When using the chemical etching and recoat system, use a chemical etching solution approved by the finish manufacturer.

Part II - Screen and Recoat Method

- A. Clean the floor in accordance with the finish manufacturer's recommendations.
- B. Lightly abrade the old finish according to finish manufacturer recommendation. (See Appendix E)
- C. Vacuum and tack floor with proper solvent, dependent on finish, and allow to dry thoroughly. (See Appendix E)
- D. Apply surface finish according to manufacturer's recommended cover rate using manufacturer's recommended applicator and procedure. See Appendix A, Applicator Recommendations.

Part III - Chemical Etching and Recoat System

- A. Clean and pretreat the floor according to the finish manufacturer's recommendations.
- B. Follow manufacturer's instructions for applying the chemical etching agent.
- C. Apply surface finish according to manufacturer's recommended cover rate using manufacturer's recommended applicator and procedure. See Appendix A, Applicator Recommendations.

Part IV - Preventive Maintenance

- A. Most surface finished floors can be walked on after 24-48 hours. Do not slide furniture on the floor. Lift it into place after 48 hours or as recommended by the finish manufacturer. 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.
- B. Provide customers with information on proper maintenance practices to protect floor finishes. 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. In addition, soft plastic or fabric-faced floor protectors should be placed under the legs of furniture to prevent scuffing and scratching. 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. For more information, see Wood Floor Maintenance, Appendix J.

CHAPTER 5

WATER POPPING & BLEACHING

Part I – Water Popping Guidelines and Methods

- A. 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.
- B. 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. Measure the moisture content before water popping to establish the baseline moisture content, and then test to see how long it takes for the wood to return to its original moisture content.
- C. The effect of water popping will vary, depending on the amount of water used, the length of time it's allowed to dry, the species of wood, and the type and color of stain to be applied.
- D. Record the moisture content of the wood flooring before water popping. The wood must be allowed to dry completely and the flooring must return to the correct moisture content before proceeding with finish application.

Part II – General Bleaching Precautions

- A. Aggressively ventilate the room with open windows and fans, and wear approved respirators.
- B. Bleaching wood flooring retains the general tone and reduces variations in color without obscuring the grain pattern.
- C. Bleaching softens the surface fibers of the wood.
- D. Bleaching a wood floor will change the existing color. It will not make the floor white. Red oak will lighten to a pink cast and white oak may have a greenish cast.
- E. Make sure the flooring is clean and free from oils, grease and old finish.
- F. Bleach may be caustic and can cause burns. Safety glasses and rubber gloves are recommended.
- G. Bleaching will cause the grain of the wood to raise.
- H. Sanding with fine paper or buffing may be necessary after bleaching will be necessary to restore flooring to a smooth surface. Refer to finish manufacturer's recommendation.
- I. Most wood fillers cannot be bleached.

Part III – General Bleaching Guidelines

- A. Use only bleach specified for wood flooring.
- B. Follow the bleach manufacturer's instructions for application. Some bleach may need to be neutralized.

- C. 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.
- D. Do not do multiple applications. Subsequent applications soften the wood and make it prone to denting.
- E. A stain may be applied before the surface finish.
- F. Always use non-ambering finishes with bleached/white floors and pastels.
- G. 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 proceeding with finish application.
- H. NOTE: Many manufacturers of stains and finishes recommend using a system, a series of products from the same manufacturer, to ensure compatibility and best adherence.
- I. BEFORE USING DIFFERENT MANUFACTURERS FOR THE BLEACH, STAIN AND FINISH PRODUCTS, CHECK WITH THE MANUFACTURER FOR COMPATIBILITY.**

CHAPTER 6

FINISH TYPES:

COATINGS, STAINS & SEALERS

Follow the finish manufacturer's directions
for the proper application of all finishes.

FINISH PROPERTIES							
PRODUCT	Respiratory Protection	Number of Coats	Drying Time	Color	Sheen	Odor	Flammability
Oil-modified Urethane	Required	2-3	Slow	Amber	Satin to Gloss	Moderate	Combustible
Water-borne Urethane	Required	2-4	Fast	Clear to Amber	Satin to Gloss	Mild	Non-combustible
Moisture-Cured Urethane	Required	2-3	Slow to Fast (depends on humidity)	Clear to Dark Amber	Satin to Gloss	Strong	Combustible to Flammable
Conversion Varnish	Required	2-3	Fast	Clear to Slight Amber	Satin to Gloss	Very Strong	Combustible
Wax	Optional	1-3	Fast	Slight Amber	Wax Luster	Mild	Combustible

PART I - OIL-MODIFIED URETHANES

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

PART II - WATER-BORNE URETHANES

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

PART III - MOISTURE-CURED URETHANE

- A. These finishes cure by absorbing minute quantities of moisture vapor from the air, which causes them to dry and harden. Relative humidity is critical to the curing process.

PART IV - CONVERSION-VARNISH SEALERS

- A. Because of their national origin, conversion varnish sealers are often referred to as Swedish finishes. Conversion varnish sealers are two-component, acid-curing, alcohol-based sealers.

PART V - PENETRATING SEALERS

- A. Penetrating solvent-based sealers are spread on the floor and allowed to penetrate. The excess is removed with rags or buffed in with steel wool or synthetic pads. These types of finishes may include a color and can be used to seal and stain the floor.

PART VI - PASTE WAX

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

PART VII - VARNISH

- A. A product commonly used before the introduction of urethane finishes. Vinyl-alkyd varnishes have superseded natural varnish (made from vegetable oils).

PART VIII - LACQUER

- A. Lacquer is not recommended for use as a floor finish. Many manufacturers do not recommend using lacquer sealers due to incompatibility and flammability.

PART IX - SHELLAC

- A. Natural shellac contains wax and is not widely used as a top coating for wood flooring today. However, dewaxed shellac is becoming more common as a sealer for wood flooring.

PART X -PENETRATING OIL SEALERS

- A. Most penetrating oil sealers are made from linseed or tung oil, with additives to improve hardness and drying.

PART XI – INSPECTION OF FINISHES

- A. NOTE: Inspection of finishes should be done from a standing position (five feet up and two feet away) with normal lighting. Glare, particularly from large windows and flood lighting, magnifies any irregularity in the floors and should not determine acceptability.

CHAPTER 7 REPAIR & REPLACEMENT

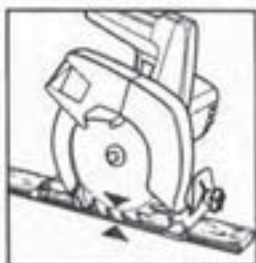


Figure 7-1

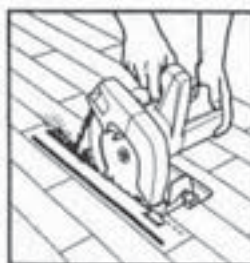


Figure 7-2

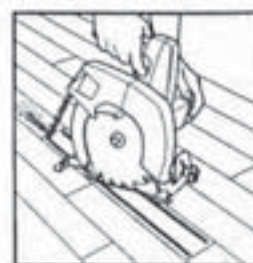


Figure 7-3

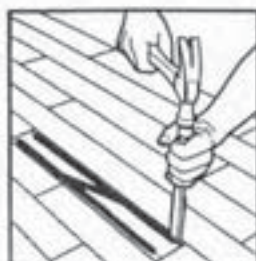


Figure 7-4



Figure 7-5



Figure 7-6



Figure 7-7



Figure 7-8



Figure 7-9

Part I – Before Beginning the Repair

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. Prefinished boards should be selected for gloss and color match.

- D. Replacement boards do not have to be from original manufacturer, as long as tongue and groove profile match as well as width, edge profile, cut and grade.
- E. If the board to be replaced is more than four feet long, consider doing the repair in two sections so as to minimize the risk of the opening closing up width-wise while you are completing the repair.
- F. Make sure you have a replacement board before beginning the repair.
- G. Protect adjoining boards from damage with tape, cardboard or paper.

Part II - Removing the Plank or Strip

- A. 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. Figure 7-1.
- B. Make a second cut inset 3/8" from tongue side running from end to end on the board to be removed. Figure 7-2.
- C. Make a third cut across the center of the board at a 30 - 45-degree angle from first long cut to second long cut. Figure 7-3.
- D. With a chisel or specialty 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. Figure 7-4 & Figure 7-5.
- E. Carefully remove nails or staples and tongue-side piece. Avoid damage to adjoining boards. Figure 7-6.

Part III - Alternate Method

- A. Using a chisel, split the board down the center and with the grain. Pry out pieces. Avoid damaging the adjoining boards.

Part IV - Alternate Method

- A. Use a router to remove board being replaced. Avoid damaging adjoining boards.

Part V – Alternate Method on Wood Subfloors Only

- A. Drill a series of large holes across center and against grain of board to be removed. Avoid drilling too far into subfloor.
- B. Using a sharp chisel, cut off the tongue of the board being replaced. Avoid damaging adjoining boards. Remove the board and trim the edges of the opening.

Part VI - Replacing the Damaged Flooring:

- A. Clean all debris from the area.
- B. Measure the moisture content of the new and existing flooring. There should be no more than a 2 percent difference in moisture content between the new and existing flooring. If the difference is greater, allow the new flooring to acclimate until it is within 2 percent of the existing flooring.
- C. Measure the opening and cut replacement board to size. Figure 7-7.
- D. Carefully test the new board against the opening for precise fit.

- E. 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. Hand planing the underside of the replacement board can help the board slide into place more easily.
- F. Carefully dry fit the replacement board
- G. Coat tongue and groove with adhesive. If available, use a fast setting epoxy to coat the back of the board to avoid the use of nails (described below) in the repair. Figure 7-8.
- H. Insert tongue, and then drive it into place, using a wood block and hammer or mallet. Figure 7-9.
- I. Use color putty to fill holes and joints. If unfinished refinish to match original flooring.

SECTION II

APPENDICES

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APPENDIX A

APPLICATOR RECOMMENDATIONS

	Oil Modified Urethane	Water Borne Urethane	Moisture Cure Urethane	Conversion Varnish	Stains	Shellac Sealer	Varnish Sealer	Lacquer Sealer	Wax	Varnish	Bleach
100% Lambswool	X	X	X	X	X	X	X	X	X	X	
Synthetic Lambswool	X	X			X		X		X	X	
Synthetic Pad	X	X		X							
Rags					X				X		X
Brush	X	X	X	X	X	X	X	X	X		
Roller	X	X		X	X						

APPENDIX B FINISH CHART

FINISH PROPERTIES							
PRODUCT	Respiratory Protection	Number of Coats	Drying Time	Color	Sheen	Odor	Flammability
Oil-modified Urethane	Required	2-3	Slow	Amber	Satin to Gloss	Moderate	Combustible
Water-borne Urethane	Required	2-4	Fast	Clear to Amber	Satin to Gloss	Mild	Non-combustible
Moisture-Cured Urethane	Required	2-3	Slow to Fast (depends on humidity)	Clear to Dark Amber	Satin to Gloss	Strong	Combustible to Flammable
Conversion Varnish	Required	2-3	Fast	Clear to Slight Amber	Satin to Gloss	Very Strong	Combustible
Wax	Optional	1-3	Fast	Slight Amber	Wax Luster	Mild	Combustible

APPENDIX C

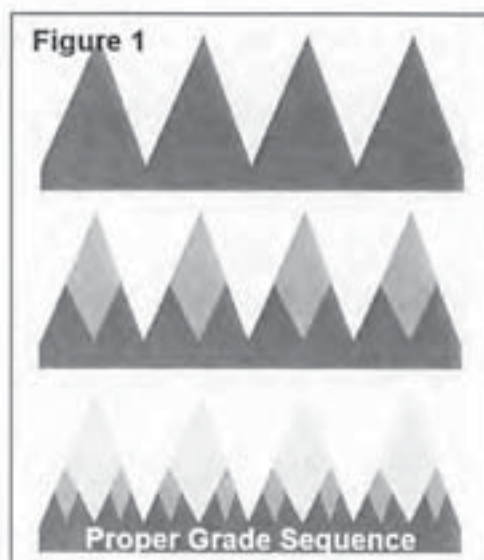
ABRASIVE GUIDE

Paper	Grit		Use
Open Coat	4-1/2	12	Remove
	4-0	16	Old
	3-1/2	20	Coatings
	3-0	24	
Coarse	2-1/2	30	Fast Cutting of
	2-0	36	Uneven Floors
	1-1/2	40	
Medium	1	50	1 st Sanding - New
	1/2	60	2 nd Sanding - Old
Fine	1/0	80	Final Sanding
	2/0	100	New or Old
Extra Fine	3/0	120	For Very
	4/0	150	Fine Finish
Use the finest grit paper that will flatten the floor.			
Do Not Over-Sand			

APPENDIX D GRADE SANDING SEQUENCE

Below is a graphic representation of what happens when a wood floor is sanded. As seen in Figure 1, each subsequent cut with a finer grade of abrasive removes the scratch marks left by the previous cut. Therefore, it is recommended that no more than one grade of abrasive be skipped in each sanding sequence. Figure 2 shows what happens when more than one grade is skipped.

A typical sanding sequence might be Grade 36, followed by Grade 50, followed by Grade 80. (See Appendix C for a listing of abrasive grades.)



Proper Grade Sequence: (Figure 1)

First cut: The initial sanding of the wood floor should be with a coarse-grade abrasive. Use the finest grit abrasive possible to flatten the floor.

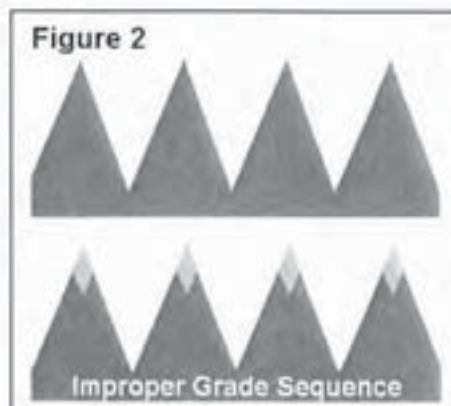
Second cut: Use a medium-grade abrasive, skipping no more than one grade from the abrasive used in the first cut. The second cut abrasive removes the deep scratches created by the first cut.

Third cut: Use a finer-grit abrasive, again skipping no more than one grade 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.

Improper Grade Sequence: (Figure 2)

This is what happens when more than one grade of abrasive is skipped in the sanding sequence.

The first cut uses a coarse-grade 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.



APPENDIX E

INTERCOAT ABRASION

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, it also assists in achieving a smooth, even appearance after the final coat has dried. Fresh coats of finish may chemically bond without intercoat abrasion. Always follow the finish manufacturer’s recommendation.

- Use multiple angles for a visual inspection of imperfections such as debris, lap marks, drips or swirl marks. Remember, strong light highlights imperfections.
- Hand inspect to determine the extent of the problem. Then use a scraper and/or sandpaper to remove imperfections, and finish by hand rubbing with an abrasive pad.
- Sweep and vacuum. It is essential to start with an absolutely clean floor.
- Using the finish manufacturer’s recommended abrasive, hand abrade all edges or corners where the buffer will not reach.
- Clean the floor thoroughly as before.
- Load the buffer with a steel wool pad, screen or abrasive pad with self-adhering sandpaper strips, as recommended by the manufacturer.
- Abrade the floor by running a buffer with the grain, or for parquet in the long direction of the room, overlapping passes by $\frac{1}{2}$ the buffer width. Run the buffer smoothly to avoid leaving swirl marks.
- Vacuum and tack with a clean cloth, wet with a solvent compatible with the finish system.

Tacking Solvent Chart	
Water-borne urethane	water
Oil-modified urethane	mineral spirits
Moisture-cured urethane	xylene or water
Conversion varnish	denatured alcohol or water

- Apply the next coat of the finish system as directed by the finish manufacturer.

APPENDIX F

SANDING SAFETY

NOTE: When sanding 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. For more information, visit the U.S. Environmental Protection Agency website at www.epa.gov/lead.

Part I - 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 and least common is the wood dust starting on fire in the dust-collection bag when a new floor is being sanded. The heat created from the friction of the machine and sandpaper on the floor can increase to the point that the sawdust begins to smolder inside the bag. Wood dust must reach a temperature of 400 degrees Fahrenheit for it to ignite. Combustion happens much more frequently, however, when an old floor is being sanded. The old finishes that are on the floor become ground into a fine powder. Again, the heat created by the friction can cause spontaneous ignition.

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

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

Always remove dust receptacles from the job site at the end of every day and dispose of them in the proper manner. For that matter, it's a good idea to remove dust receptacles and unplug machines any time you leave the jobsite for any length of time. Refinishing old floors poses additional safety issues.

Six Potential Flare-ups

Friction: Dull sandpaper, overworked paper, improper paper selection
 Sparks: Staples, nails, radiator pipes, improper paper tracking
 Dust: Never leave in truck, machine or job
 Stain rags: Dispose in water bucket or metal safety container
 Electric fires: Faulty cords, loose connections, breaker box fires
 Liquids/vapors: Lacquer sealers, universal sealers, shellacs, conversion varnish

- Keep fire extinguishers in the truck and on the job.
- Smoking should be prohibited on the jobsite and in the truck.

Part II – Equipment Operation

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

- A. Proper electrical connections are essential. Refer to local electrical codes and to manufacturers' guidelines for each piece of equipment.
- B. Read the warnings and operational instructions that are provided by the manufacturer of each sanding machine.
- C. Wear eye, ear and approved respiratory protection devices as required by OSHA.
- D. Safe work shoes (with laces tied) are important.
- E. Make sure you are always in complete control of all equipment.
- F. Use extra caution when wearing a waist belt attached to drum or belt sanders.
- G. Keep electrical cords away from machines' moving parts. Also keep cords out from underfoot and off your shoulders, since electrical cords can be the cause of injury. Use the manufacturer's recommended apparatus for proper cord control.
- H. Unplug all machines when you are repairing or adjusting them, when changing abrasives, or when leaving the jobsite.
- I. Empty sanding bags often in a proper container, especially before transporting the machine or leaving the job site. Remove dust receptacles and unplug machines any time you leave the jobsite for any length of time.

SAFETY NOTE: Make sure all electrical equipment has proper grounding.

APPENDIX G

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 before you begin sanding to ensure that it is within the normal range for that environment. Record the moisture content. You can use that moisture content for comparison later, when you are checking moisture content between coats of water-based finish.

Part I – Preparation and Inspection

Walk the Floor/Make Necessary Repairs

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

Dust Containment

While dust cannot be completely eliminated from the sanding process, the flooring professional should take steps to minimize the dust. It is especially important in remodeling work, but also necessary on many new-construction jobs, to seal off the area with plastic. In addition, most floor-sanding equipment today is or can be equipped with dust-containment devices.

- If possible, use a fan to exhaust dust from the working area.
- All doorways should be sealed off.
- On some jobs, you may also want to protect the wall coverings and ceilings.
- If light fixtures are covered, fixtures should remain off. Tape switch in the off position if necessary.
- There are a variety of ways to hang plastic to seal off the area. Do not use fastening methods that will damage paint and wall coverings. Tape as much as possible to doorjamb instead of wall paint, and never tape to wall coverings such as wallpaper. Always check in an out-of-sight place that the tape will not cause damage.
- Also, protect other floor coverings from wood dust.
- In the doorways you must pass through, overlap plastic for an extra barrier.
- Be sure to protect HVAC (heating, ventilation and air-conditioning) openings. While you are sanding, you may want to shut off the HVAC system. However, some climates will necessitate that the HVAC system be running while sanding 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.
- It is also essential to protect smoke and carbon-monoxide detectors, fire-alarm systems and elevator shafts, but remember to remove the dust protection before you leave the job site.
- Cover the openings of gas fireplaces and turn off the pilot light, as well as any auto-ignition devices associated with the fireplace.

APPENDIX H

SANDING EQUIPMENT AND TOOLS

BASIC AND SPECIALTY EQUIPMENT AND SUPPLIES

The primary tools needed 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.

Drum and belt sanders are similar, the difference lying in the way 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 belt sander, as the name suggests, employs a continuous belt of abrasive.

Edgers are hand-held rotary-disc floor-sanding machines used to sand closely around the perimeter of the room, as well as in closets, on stairs and in other small areas.

Harder-to-reach places require the use of hand scrapers and sanding blocks.

The buffer, fitted with fine-grit screen or abrasive discs, is used after the final cut — typically with the drum or belt sander — to blend the field and the edge. A detailed discussion of sanding equipment can be found in the National Wood Flooring Association's Technical Publication No. A300: Tools of the Trade.

DRUM AND BELT SANDERS

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

BUFFERS, OSCILLATING MACHINES AND MULTI-DISC MACHINES

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

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

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

Buffers can be difficult for beginners to operate. On start-up, they tend to "kick" to one side, usually the left. It's best to practice initially with a polishing pad in the middle of a large room. Start with the handle adjusted to waist height. You will notice that as you raise it, it will move to

the right And as you lower it, it moves to the left. An easy way to remember this is raise-right (R-R) and lower-left (L-L).

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.

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

EDGERS

Edgers, or spinners, are small circular sanding machines designed to reach the areas where big machines can't. Several types of edgers are available, most consisting of a seven-inch shrouded disc connected to a motor. Two wheels on the housing hold most of the machine's weight; each is adjustable to vary the depth and angle of cut. The edger pad is set to hold the sandpaper disc at a slight angle to the floor. The offset edger drives a disc offset from the motor, with a belt-and-pulley arrangement. This configuration allows reaching under difficult areas like cabinet toe kicks and radiators. Some companies offer integrated dust collection for edgers, directly connecting a portable vacuum system to the edger to gather dust as it is produced. Some edgers can be set to cut on the left, right or near center of the leading edge of the paper. Follow the manufacturer's recommendations for setting the edger.

DUST COLLECTION

Most standard sanding machines have dust-collection bags attached. This performs two functions: It collects large dust particles and also filters the air that passes through by catching the smaller particles on the inside of the bag. The key to keeping such machines performing optimally is permitting air flow through the system. That means that the bag should not only be emptied often, but cleaned as well.

Note: For best dust collection, the bag should be emptied by the time the dust reaches the line that says "full" - usually about halfway up the bag. If it isn't emptied by then, the dust-collection system will not function properly.

Periodically, the bag should be turned inside-out and vacuumed to help remove the edger sander smaller particles that clog the bags pores. Some manufacturers' bags can be washed.

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

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

MAINTENANCE OF EQUIPMENT

Proper maintenance will keep your equipment operating at peak efficiency and keep it operating longer. Perhaps just as important, it will prevent costly down-time when you can least afford it. Keeping sanding machines properly tuned and adjusted also will help their vacuums perform optimally. Pulley belts that are loose will reduce air movement and inhibit dust collection, and can also cause chatter marks. Cleaning the machines out after every job by mechanically

blowing out the motor and fan system with an air hose greatly reduces wear on the machines. Maintenance practices vary among the different kinds of equipment, so follow manufacturers' guidelines. Keep in mind that many repairs should be done by an authorized service center. Repairs performed by an unauthorized center may void your warranty. Knowing the equipment and recommended service intervals will help keep your equipment running for years. There are nine primary areas to focus on: carbon brushes, dust bags, bearings, lubrication, sanding chambers, wheels, belts, pads and drum covers.

CARBON BRUSHES should be replaced after every 500 hours of use. The brushes are the pathways for electric current. Once the brushes are worn, the electric current will find the path of least resistance, causing a short-circuit. Also check the brush spring — it keeps the pressure on the brushes, preventing arcing and premature wear of the armature. The big machines that have carbon brushes have a wear indicator. Inspect the motor brushes once a month and change all the motor brushes at the same time. Brushes must slide freely in the brush holder. Dust accumulated around the brush block must be cleaned out frequently. This prevents the brushes from sticking in an open position and keeps the motor from overheating.

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

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

EDGER PADS - Inspect and clean edger pads before each job. An unbalanced or bent edger pad will cause gouging. Worn and improperly dressed edger pads also result in uneven sanding.

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

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

WHEELS - Always inspect the wheels before you start any job. Debris on the wheels (grit, finish and stones, for example) can be left on the floor and also may cause chatter, wave and damage to the wood during sanding. When transporting the machine, lift it over stones and rough areas. After each grit or cut, clean the wheels, since grit can build up and cause the machine to

cut unevenly. Keep the weight of the machine off of the wheels during storage and transportation. This prevents flat spots and prolongs the life of the wheels.

DRIVE BELTS - The best way to check drive belts is hands-on: If the belt feels rough, cupped, worn or grooved, it 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 for any long-term idle period. Always use a high-speed belt per the manufacturer's recommendations. Most belts from a hardware store are for general use only, not high-speed. Belt tension is important. If it is too tight, the belt life will be short. If it is too loose, the machine can slip and vibrate. Do a visual check with the machine running for belt shake or vibration. Tighten or loosen the belt until it runs true. Check with your service center for correct belt tension. Read the operator's manual. This is possibly the most important element in preventive maintenance. A poorly maintained machine can be costly.

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

APPENDIX I

TROUBLESHOOTING FINISHES

Although many problems can result with the finish, the source is not necessarily the finish itself. Consult the following list for some of the most common problems and solutions.

Problem: Excessive and early wear

This can be caused by improper floor maintenance that fails to remove grit from the floor, or the introduction of water or strong cleaners. Pet nails and unprotected furniture legs also contribute to the problem. Proper maintenance requires regular dust-mopping with an approved wood-floor cleaner. If recoating is necessary, the owner should pay for it. Educate homeowners that the use of floor protectors on furniture will eliminate excessive and early wear.

Problem: Discoloration

Oil-modified finishes will amber in appearance and will yellow further over time. Wood in direct sunlight will change color and lighten over time. Recoating an oil-modified finish recoated with water-based finish will not stop ambering. Shading the floor can minimize lightening. Wood also changes color through oxidation.

Problem: Stains

Spilled water, pet stains and other liquids, including improper cleaners, can stain finish. Cloudy surface finish can be fixed by lightly rubbing with a proper cleaner and buffing, although some stains require screening and recoating. Some boards may need to be replaced.

Problem: Alligatoring

The finish pulls away from itself, causing ridges in the finish. Causes can include poor wetting of the finish, contamination of the finish, application under cold temperatures, application of a new coat before the previous coat has dried, application of a heavier coat than is recommended, or the use of thinners that cause the finish to dry too quickly. The solution is to screen and recoat after the finish has dried sufficiently. Sometimes a complete resand is required.

Problem: Roughness

The cause is often contamination of the finish during dry time, as well as by failure to screen or abrade between coats of water-borne finish. Moisture can also cause the wood grain to rise. If a moisture problem is evident, this must be corrected before screening and recoating. Sometimes a complete resand is required.

Problem: Uneven gloss levels

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

Problem: Sticky board syndrome

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

Problem: Peeling/Bubbles

Bubbles and blisters in the finish usually mean that the floor was not screened or sufficiently cleaned between coats of finish, or the finish was overworked during application, or that soap or some other contaminant was not removed before coating. It can also be caused by the finish drying too fast as a result of hot spots from sunlight. Problems in the topmost finish coat can be screened and recoated, while cases of delamination require complete sanding and refinishing.

Problem: Orange peel

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

Problem: Fisheyes

Called by many others names (crawling, cratering, holes, spots, flow marks), this condition can be caused by contamination in the surface. The new coat "crawls" away from the wet or contaminated areas, giving the appearance of fisheyes when the finish sets. It can also be caused by finish that has not been properly agitated. A disproportionate amount of flow and leveling agents may be put on the floor, causing a fisheyed appearance. The solution is to screen and recoat. Sometimes a complete resand is required.

Problem: Bleed-back

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

Problem: Application streaks

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

Problem: Poly beads

Poly beads are droplets of finish that form along strip edges. They can be soft and sticky when first formed, but will become hard. They are generally associated with a slow drying condition and excessive sealer, stain or finish that seep into cracks. When soft, the beads can be smeared, leaving an unsightly appearance that may require screening and recoating. For hardened beads, the solution is to mechanically remove them with a sharp edge and, if necessary, screen and recoat. Do not attempt to screen the hardened beads. Make sure the polybeads are at the end of the cycle before adding more finish. The end of the cycle is two weeks after the last patch of polybeads, or when flooring is completely tight.

Problem: Cratering

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

APPENDIX J

WOOD FLOORING MAINTENANCE

Educate customers about proper maintenance practices for wood flooring.

- 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.
- Use throw rugs both inside and outside doorways to help prevent grit, dirt and other debris from being tracked onto your wood floors. This will prevent scratching.
- Do not wet-mop a wood floor. Standing water can dull the finish, damage the wood and leave a discoloring residue.
- Wipe up spills immediately with a slightly dampened towel.
- 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.
- Put soft plastic or fabric-faced glides under the legs of furniture to prevent scuffing and scratching.
- 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.
- 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.
- For wood flooring in the kitchen, place an area rug in front of the kitchen sink.
- Use a humidifier throughout the winter months to keep wood movement and shrinkage to a minimum.

SECTION III
GLOSSARY
OF
SANDING
AND
FINISHING TERMS

SANDING & FINISHING GLOSSARY

Abrasives Natural and synthetic materials in fine granular form incorporated in buffing compounds and attached to cloth or paper. Abrasives are generally used in grades 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.

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

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.

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

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

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.

Amber A yellowish color change from either the wood or finish. See Color Change.

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.

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

Blistering The formation of bubbles or pimples on the surface of finished work. It is caused by exposure to excessive heat, grease or other volatile material under the finish, by moisture in the

wood or by the too frequent application of coats. Anything that causes a gas or vapor to form under the film may cause blistering.

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

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

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 dissimilar materials.

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

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

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

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

Burnish – In wood flooring applications, the term is generally used to describe the process by which wax is applied as a top coat or the process recommended by some manufacturers to apply stain. In either case, a commercial rotary buffer is used for the application. Some stain manufacturers recommend using a buffer with a pad to help the stain penetrate into the wood. Stain should not be applied with the burnishing method unless recommended by the stain manufacturer. Steel wool is also sometimes used for burnishing. Burnishing can also refer to the process of using a fine-grit abrasive for the final cut on a floor to reduce grain raise.

Chatter Marks Slight indentations causing a ripple effect on the surface of a wood floor. They are usually caused by sanding machines that have out-of-balance drums, bad drive belts or foreign objects stuck to the wheels. The marks are most noticeable on gloss finishes, in direct-light areas or at eye level.

Checking Similar to alligatoring, except that the finish is broken into smaller segments. Crowfoot checking is the name given to the defect when the breaks in the film form a definite three-prong pattern with the breaks running outward from a central point of intersection. When the checks are generally arranged in parallel lines, the defect is known as line checking. Irregular checks without a definite pattern are known as irregular checking.

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

Conversion Varnish Because of their national origin, conversion varnish sealers are often referred to as Swedish finishes. Conversion varnish sealers are two-component, acid-curing, alcohol-based sealers.

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

Cross Pull A condition occurring at an end-joint with the ends of flooring strips pulled in opposite directions.

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

Crowning A convex or crowned condition or appearance of individual strips with the center of the strip 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 chemical action as opposed to drying when the product has 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. Usually, a mechanic will make two or more cuts with progressively finer grits of sandpaper.

Dispersed In reference to finishing materials, finely divided or colloidal in nature.

Distressed A heavy artificial texture in which the floor has been scraped, scratched or gouged to give it a time-worn antique 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. They are usually organic salts of lead, cobalt, manganese, zinc and iron, such as naphthenates, resinsates and linoleates.

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

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

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

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

Durability The ability of 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. Also, a grading or size of natural resin.

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

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

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

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

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.

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.

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

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

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

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

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

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

Hard plate Hard-plating, discing and sand-plating are all names that refer to using a large paper disc on a hard-plate driver under a buffer/polisher. Typically the hard plate has a felt pad attached to the plate. 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. When using sandpaper on a hard plate, the flatness of the plate and disc of sandpaper keeps from dishing out the springwood or softer grain.

Hardness That 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.

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

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

Hygrometer An instrument 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.

Intumesce To expand with heat to provide a low-density film. The term is used in reference to certain fire-retardant coatings.

Lacquer A thin-bodied, quick-drying coating material that forms a hard film. Originally, it referred to solutions of shellac and other resins that dried by evaporation alone. Then the term was applied to Oriental products derived from the sap of certain trees in China, Burma and Japan. Still later, the term was applied to thin, hard-baking varnishes used for coating food cans made from tinplate and similar metal articles. More recently, the term applied to mixtures of solutions of nitrocellulose, ethyl cellulose, and natural and synthetic resins that dry by evaporation alone.

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

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

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

Mineral Spirits A solvent product used as a thinner and/or cleaner.

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

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

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

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

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

Penetrating 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.

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.

Polyurethane A large molecule of chemically joined urethane units, having the capacity to solidify or "set" irreversible when acted upon by heat, radiation or chemical crosslinking or curing agents. See Urethane.

Prefinished Factory-finished flooring that only requires installation.

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

Pure Free of adulteration.

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 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.

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

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

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

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

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

Set to Touch See Dry to Touch.

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

Shellac The resinous material secreted by an insect that feeds upon the twigs of certain trees in India. It is soluble in alcohol to form liquid shellac, which was once widely used as a sealer and finishing material for wood. Natural shellac contains wax and is not widely used as a top coating for wood flooring today. However, dewaxed shellac is becoming more 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.

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

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

Surface The outside or exterior boundary of any substance. One is said to surface the work when it is rubbed or sanded to a smooth, level plane.

Surface Drying When a coating dries on top, but remains relatively soft on the bottom, it's said to surface dry.

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

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

Tack Rag Used to remove dust after sanding or screening. May be used dry or with an appropriate liquid compatible with the finish to be used.

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

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

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

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.

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 Light 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 woods to lighten or darken. See Color Change.

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

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

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

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

Vapor Barrier A material, such as foil, plastic film or specially coated paper, with a high resistance to vapor movement, used to control condensation or prevent migration of moisture.

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

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

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

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

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

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

Wood Filler See Filler.

Yellowing See Ambering.