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# FLOOR FINISHES AND FLOOR CARE



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## **INTRODUCTION**

As companies strive to prolong the life and enhance the appearance of their flooring, protective coatings, called floor sealers and floor finishes, can be applied. These coatings absorb the abuse that the floor receives in the day-to-day use. Occasionally the finish needs to be restored or removed completely and reapplied. The daily maintenance that the floor receives and the floor care equipment available will determine the type of finish to be applied. High quality finishes used improperly will look and perform just as badly as low quality finishes. This brochure will discuss various aspects of proper floor care and provide basic guidelines in floor maintenance.

## **SUBSTRATES**

The floor that the finish is applied to is called the substrate. There are two groups of flooring types, hard (stone) floors and resilient floors. Hard floors can further be divided into natural stones and manmade tiles. As a general rule, smooth floors allow the use of floor care equipment with pads. Rough floors, such as quarry tile with grout or concrete, require the use of brushes to clean the floors due to the rough surface. Pads cannot reach into the cracks and crevices like brushes can.

### ***A. NATURAL STONE***

Natural stones (rock) are ranked on the Mohr Hardness Scale from 1 to 10. Marble is rather soft at 2.5–3, while granite is much harder at 5.5–7. Natural stones can be divided into three groups: igneous, metamorphic, and sedimentary. Diamond, an igneous stone, is the hardest substance found in nature and is a 10 on the Mohr scale.

Igneous stone is the hardest stone of the three groups. Granite is an example of an igneous stone. These rocks are formed under high heat and pressure. Like most stones, granite is laid down in smooth sheets. If the granite has a rough surface, it is called flame cut. Other cuts of igneous stone are honed and polished.

Metamorphic stone is made using pressure but no heat. While not as hard as igneous stone, they are significantly harder than sedimentary stone. Slate and marble are examples of metamorphic stone. Marble is limestone that has had high pressure and some heat for 7 to 120 million years. This gives the marble a compact crystal structure, yet it can be scratched easily. Marble, like most stone, can be damaged by acids. Marble can also be damaged by alkalinity. It can discolor if a highly alkaline stripper or cleaner is used on bare marble. Slate is a hard, fine-grained rock that cleaves into thin layers. Slate can be scratched easily and has a smooth but uneven surface, so burnishing may give an uneven gloss. Use a brush for cleaning and stripping as the uneven surface may cause finish to build up in the low areas.

Sedimentary stone is formed in layers on the earth's surface. Formed with little pressure and no heat, these stones are soft and rarely make good floors. Sedimentary stones include sandstone, limestone and travertine marble. Travertine marble is not marble, but limestone with concrete filling in the pockmarks.

### ***B. MANMADE TILE***

There are a wide variety of manmade stones used for flooring. Within one group, there may be a wide range in quality of the stone. The most common is an unglazed, unpolished mud brick, called quarry tile.

1. Concrete is a mix of Portland cement, water, and sand. Gravel or other small stones are often added to increase the strength. Concrete has a pH of 11, so it is highly alkaline. When working with a concrete floor, it is important to know the age of the concrete. If it is less than 30 days, do nothing. During the first 30 days, the floor is curing. Acure-seal is applied initially, which is alkali resistant. If other sealers or finishes are applied, they may flake off as the curing releases moisture, which activates the alkalinity allowing it to attack the finish or sealer. When concrete is allowed to be wet for extended periods of time, alkalinity can be leached out. New concrete, even when dry, can leach alkalinity for at least the first year.
2. Terrazzo is poured in 6' x 6' or 12' x 12' sections with metal expansion joints between the sections. Terrazzo is cement with stone chips, usually marble, which have been ground or honed to a flat surface. If the terrazzo was installed before 1965, do not use a solvent stripper; use an alkaline stripper instead. If a solvent-based stripper is used, it may react with the petroleum based sealers used at the time. High alkaline cleaning or stripping solutions can darken or damage the marble in the terrazzo.

3. Quarry tiles are either 4" or 6" squares and may also be called Mexican or Guatemalan tile. There is a cement grout between the tiles, which makes for a very uneven surface on which to clean or apply finish. Ceramic quarry tile is quarry tile with a highly polished (shiny) finish. Adobe is a mud brick similar to quarry tile but duller and less uniform in appearance.
4. Ceramics come in glazed and unglazed types and are made from clay (aluminum silicate) and water, which is baked at high temperatures. Glazed tiles have a glassy layer on top, which is separate from the tile body. They are usually found in bathrooms, but would not have a finish applied if in a bathroom. When wet, ceramics become extremely slippery. If a finish needs to be applied, ceramics require a sealer to form a base for the finish to adhere.
5. Brick pavers are rectangular stones typically used for malls, often having grout between the bricks.
6. Graniti is a rough texture stone that is infrequently used.
7. Black plank floor is an asphalt tile found in post offices and similar facilities.

### **C. RESILIENT FLOORING**

1. Vinyl Composite Tile (VCT) has been made since 1983, and like VAT, it is produced in 12" x 12" squares from clay, filler and vinyl. Don't use solvent based strippers for the first 2 years of the floor life. Don't use any floor machines on this tile for the first 4-5 days after installation or strip the floor for at least a month after installation. Don't use black pads when scrubbing as this scratches the tiles easily. Use a green pad. If you are unsure if a floor is rubber or VAT/VCT, tap a tile with a quarter. VCT and VAT give a high sharp pinging sound.
2. Vinyl Asbestos Tile (VAT) was made only until 1983, in 12" x 12" squares. Don't dry buff these tiles. Keep them wet or have a finish on them to avoid putting asbestos into the air. Stripping must use low abrasion pads with speeds of 300 rpm or less. Burnishing may only be done if there is a sufficient buildup of finish to protect the tile. When burnishing, it is a good practice to treat the dust as though it may contain asbestos. When buffing or burnishing an asbestos floor, wear appropriate protective equipment and use a HEPA equipped vacuuming device.
3. Asphalt Tiles are tiles made with asphalt as a binder and are typically made in 9" x 9" squares. Asphalt tiles are a mixture of clay and petroleum based fillers. The ingredients are mixed, heated, rolled into sheets and cut to size. The colors of asphalt tiles are divided into 4 groups, A, B, C and D. A is the darkest and D is the lightest. A and B are made with asphalt binders, while C and D are made with resin binders. Oils and solvents should be avoided on asphalt tiles. Solvent strippers should not be used on asphalt tiles as this can discolor the tiles. To brighten asphalt tiles that have dulled in color, mix 3 parts boiled linseed oil and 1 part mineral spirits. Buff the floor using this solution and the 175 rpm swing machine. Follow the treatment by removing the solution with a strong cleaning solution and a red scrubbing pad. This process will reactivate the dyes present in the old tiles. These tiles can be buffed and burnished, but there must be ample coats of finish on the tile to prevent damage to the tile. If the tile has asbestos, the asbestos fibers may become airborne if the bare tile is buffed or burnished.
4. Linoleum (sheet vinyl) is made in 6' or 12' sheets from sawdust, linseed oil, ground cork, wood flour and vinyl. The ingredients are mixed together, rolled into sheets and compressed onto a backing. Heat is applied during compression, which fuses and sets the materials. Solvent based strippers can remove the linseed oil from linoleum making it brittle. Black pads can scratch and permanently damage the linoleum. Use a green pad for stripping. Strippers should only need 3 to 5 minutes to work. High alkalinity should also be avoided in cleaning linoleum.
5. Rubber tile is a mixture of natural rubber, synthetic rubber and inert fillers. The raw materials are mixed, heated, and rolled out under pressure. The strips of rubber are then cut to size. Rubber gives better traction than vinyl tiles and can also come with square studs. When tapped with a quarter, it gives a softer, lower ping than a VCT. Do not use solvent strippers or black pads on rubber flooring.
6. Wood has been used in floors for thousands of years. SC Johnson Wax was started with the concept of applying a wax paste on wood floors. Wood floors are hard to care for and warp badly when wet, such as when applying water based sealers and finishes. Gym floors, which are usually wood, require a special type of solvent (non water) based product for sealers and finishes. Gym floors are considered a highly specialized part of floor care and are beyond the scope of this brochure.

Regular wood floors can be finished if they have a urethane, solvent or epoxy based sealer to protect the wood from water. If the wood was never urethane sealed, the floor should not be finished.

7. Wood Laminates are designed to look like wood. They are more durable, cheaper, and can easily be maintained with conventional products. However, compared to other resilient floorings, wood laminates are a poor flooring choice. They do not warp when exposed to water like wood does, but they are not a very durable flooring. Don't use solvent based strippers or a black pad, as they both will damage the flooring. Use a green pad instead.
8. Marley Flooring or PVC Flooring is also known as pure vinyl flooring. Often requiring a sealer, PVC flooring should not be stripped for 30 days after installation and should have ample coats of finish to protect the floor if it is to be burnished. Burnishing will damage PVC flooring if it sands through the finish. Alkaline residues from stripping will inhibit sealers and finishes from adhering. High alkaline cleaners should be avoided in daily cleaning.
9. Stonetex, produced by Armstrong, is vinyl with stone chips. Don't use solvent-based strippers. When selecting a finish, select one that works on both stone and vinyl.
10. Nonconductive Flooring is often used around electronic equipment because it prevents static electricity from building up on the floor. However, the nonconductive property wears off in several weeks if it is not reapplied. When the floor is installed, it needs to be grounded as well. Applying any sealer or finish on this flooring eliminates the nonconductive property.
11. Marble Laminates look like marble but are a synthetic surface. Solvent based strippers will damage the floor. Black pads scratch the flooring, so using a green pad is recommended.
12. Sure Trac is a highly textured flooring that resists slips and falls. Because of the texture, it is tough to clean.
13. Cork Flooring is made from compressed wood curlings. The tree sap in the curlings acts as a binder during the heat treatment. Hotter temperatures produce darker colors of cork flooring. Like wood, a urethane, solvent or epoxy sealer must be applied before any water based finishes can be applied or the floor will swell.

#### ***D. ADHESION TEST***

If the concrete is older than 30 days, perform an adhesion test as follows before proceeding. This test can also be performed with finishes or sealers on other floors where adhesion may be a problem.

1. Clean a 2' x 2' area and outline it with duct tape.
2. Using a gray foam rubber paintbrush, apply one coat of sealer.
3. Wait until sealer appears dry and then check to see if it is dry to the touch. If it is dry, not tacky, wait 5–10 minutes more.
4. Place hand flat on dry sealer for 10 seconds and remove hand. If there is a white hazy impression from the hand, the sealer is not dry (cured) yet. Wait 15 minutes and try the test again.
5. When dry, take packing tape and place a strip on the cured sealer. Rub the tape onto the floor and then rip the tape off. If the sealer flakes or is removed, the floor has an adhesion problem and must be acid etched. If the sealer stays down, we can seal the entire floor.

#### ***E. ACID ETCHING A CONCRETE FLOOR***

1. Acid etching a floor will both clean the floor and rough up the surface to allow a sealer to adhere.
2. Using an acidic cleaner, such as Mixmate™ Reduced Slip Floor Cleaner at a 1:32 dilution or QuarryGrip® at 1:4 dilution, apply the cleaning solution to the concrete floor.
3. When it stops foaming, use a brush to scrub the floor.

4. Using an alkaline cleaner, such as Mixmate™ All Purpose Cleaner Degreaser, rinse the floor with an appropriate concentration to bring the pH of the floor back up to 9, which is the pH of floor finishes and sealers. This allows the finish or sealer to adhere properly.
5. After the concrete floor dries, redo the adhesion test. If the sealer adheres, proceed with sealing the floor. If the sealer does not adhere, repeat the acid etching of the floor with a stronger concentration of the Mixmate Reduced Slip Floor Cleaner.

## **FLOOR CARE EQUIPMENT**

In maintenance of floor finishes, the type of equipment used can be divided into three groups. Conventional equipment includes 175 rpm swing machines and any equipment that operates at less than 300 rpm. High speed equipment operates in the range of 300–1500 rpm. Ultra high speed equipment operates at 1500 rpm or higher. Floor finishes made for conventional equipment can powder and flake if high speed or ultra high speed equipment is used on them.

### ***A. 175 RPM SWING BUFFERS***

175 rpm swing buffers are used for daily scrubbing or occasional deep cleaning and stripping of floors. They have a self tightening chuck to control the head. The pad is also self tightening. Lifting up on the buffer moves it to the left and pushing down moves it to the right. A slight up pressure should be used when starting the buffer to control the spin speed up. The head turns counter clockwise when viewed from the top. Swing buffers have one set of wheels in the back and are run side to side from right to left over the floor. This makes them different from all of the other floor equipment, which is run from one end of the area to the other.

### ***B. AUTO SCRUBBERS***

Auto scrubbers lay down a cleaning solution and vacuum it up in one pass. These machines typically have a 16 gallon tank for detergent solution, a set of pads, a vacuum pump and a squeegee on the back. When filling the detergent solution tank, always fill with water first and then add chemicals to the water, never the opposite. There is also a recovery tank to collect the dirty water. Using a floor scrubbing pad, these machines have a shroud or cover to protect against splashing and a ball valve in the recovery tank to prevent foam. Adding defoamer to the recovery tank is often necessary to control foam; although, a urinal block in the recovery tank will work in a pinch. When cleaning the squeegee, use a rag, not your finger as small sharp objects present a cut hazard. The machine controls allow for changing the pad pressure and the rate at which the detergent solution is applied to the floor. A typical cleaning procedure for a facility would be to sweep, autoscrub and then optionally damp mop afterwards. Many facilities do not damp mop because of the labor costs.

### ***C. BURNISHERS***

Burnishers run at 1500–3000 rpm and are designed to restore the gloss of a finish by using mild abrasion to take imperfections out of the finish. Contrary to popular belief, burnishing is a sanding process, not a heating or thermoplastic process, because it only raises the temperature of the finish by 10°F. Burnishing sands the finish to grind out scratches and relevel the floor. Today's pads can't handle 3000+ rpm, so the pads wear out quickly. Making machines with higher rpms is not a problem; the pad technology is the limiting factor. Burnishing an uneven floor gives brown scorch marks. When this happens, strip and refinish the floor. Harder finishes can stand burnishing with rougher pads. Softer finishes need softer pads. A good practice is to start with a medium pad and adjust according to the speed of the machine and the hardness of the film. Some maintenance systems burnish with one pass with a coarse pad and then a second pass with a finer (softer) pad. After burnishing, dust mopping is needed to remove the sanded finish. Over burnishing can degrade the floor finish causing a problem called dusting. Unlike powdering, which occurs from the floor up into the finish, dusting occurs on the top of the finish.

- Burnishers can either be propane, electric (cord) or battery powered.
- Propane burnishers have the most horsepower, but can cause emission problems. Always shut off a propane burnisher at the gas valve, not by the key. This can cause air bubbles in the gas line.
- Battery powered burnishers generally give 2 hours of life per charge.
- Cord electric burnishers have 2 sets of wheels in the back so that the machine can be brought up to speed before the pad is put on the floor.

#### **D. PAD SELECTION**

While the quality and colors of pads vary from manufacturer to manufacturer, below is a list of a “typical” pad selection in order of most aggressive pad to least aggressive pad.

<b>PAD COLOR</b>	<b>APPLICATION</b>	<b>RECOMMENDED EQUIPMENT SPEED</b>
BLACK	STRIPPING	150-350 RPM
BROWN	STRIPPING	150-350 RPM
GREEN	SCRUBBING	150-350 RPM
BLUE	SCRUBBING	150-350 RPM
RED	SCRUBBING	150-350 RPM
RED	BUFFING	150-350 RPM
TAN	BUFFING, BURNISHING	150-3000 RPM
YELLOW	BUFFING, BURNISHING	150-3000 RPM
WHITE	BUFFING, BURNISHING	150-3000 RPM

#### **CHEMISTRY OF FLOOR FINISHES**

SC Johnson was the first company to provide protective coatings for floors. Samuel Curtis Johnson sold wood parquet flooring for the Racine Hardware Company. In 1886 he bought Racine Hardware’s flooring business forming SC Johnson Company. While many European companies sold waxes for wood flooring, no product on the market could protect floors from scratching and scuffing. Samuel Johnson developed a carnuba (hardest natural wax) wax paste to do this and the floor care industry was born. In 1933, liquid waxes were introduced and sold with the wax pastes. The first liquid waxes were glossy, but they scuffed easily and discolored with age. Next came anti-slip waxes with colloidal silica, but they still scuffed. Before WWII, microcrystalline non-slip waxes were introduced. During WWII, the rubber shortage forced a search for other materials and polystyrene was discovered, but the finishes still discolored and scuffed. In 1966, SC Johnson Wax developed the first basic polymers for floor care. In 1969, the SCJ product Complete was introduced. This was the first polymer based floor finish. It marked the end of using waxes because of its excellent durability and ease of cleaning. It had zinc interlocks between the polymers. This made it resistant to alkaline cleaners, but not to the ammonia in strippers, which could break the zinc interlocks. Over the years, advances in floor finish polymer technology have driven the business into a multibillion dollar market. Today, there are 3 main purposes for a floor finish: protect the floor, improve the appearance (shine or gloss) and make the floor easy to clean.

A floor finish is a liquid that is applied to a flooring and dries to a hard, durable and smooth film. A coat of floor finish is about the same thickness as a sheet of waxed paper. High quality floor finishes may contain as many as 25 ingredients. The ingredients in floor finishes can be divided into volatiles and nonvolatile solids. While both groups play an important role in determining the quality of the finish, the nonvolatile solids are what is left behind on the floor after the finish has dried. The volatiles evaporate during the drying process. As with other products, the quality of the solids matters as much as the quantity present. The ASTM method for evaluating floor finishes measures only the nonvolatile solids portion. The quality of the solids present is at least as important as the percent solids of a finish. Lower solids finishes with higher quality polymers are frequently better products than higher solids finishes made with low quality polymers. The polymer portion of a product is 70–80% of the nonvolatile solids. The resin and waxes are between 5–15% each, making up the rest of the nonvolatile solids.

Volatile ingredients assist in the film formation, drying and curing of the finish. Once they have finished their job, they evaporate. The nonvolatile ingredients are solid materials that stay on the floor and make up the floor finish film. Ingredients are chosen to provide hardness, gloss, clarity, scuff resistance, slip resistance, water and detergent resistance, buffability, removability, recoatability and toughness. The five basic categories of floor finish ingredients are as follows.

#### **A. POLYMER EMULSIONS**

Chemists suspend the floor finish polymers in water, creating polymer emulsions. While this process is a trade secret, it is generally known that the emulsions are made from acrylic and styrene type chemicals. Polymer emulsions are the backbone of a floor finish and are evaluated by their hardness and the temperature at which they form a solid film. For the technical reader, polymers have a water resistance that is dependent on the degree of carboxyl substitution in the polymer. The more carboxyl groups, the more it is affected by water.

Many polymers use zinc to cross link the polymers. This ties up the carboxyl groups and keeps the polymer from dissolving in water. Ammonia and strong alkalinity (or strong amines, such as monoethanolamine) will break these zinc bonds, allowing the water to liquefy the polymer during stripping. Zinc is the best and most cost effective material to use for this purpose. The larger the polymer molecule, the more durable the finish but also the more difficult the finish is to level.

## ***B. FILM FORMERS***

Without film formers, the polymers would produce dry, loose crystals on the floor. Improper film formation causes poor adhesion, powdering, poor gloss, streaking, cratering, fisheyes (surface flaws seen as bubbles), blushing, peeling and poor leveling. Film formers are coalescing agents, plasticizers, wetting and leveling agents and antifoamers.

1. Coalescing agents, such as glycol ethers, glycol ether esters and ester alcohols, allow the polymer molecules to form a continuous film and help emulsify the polymer in water. While they do eventually evaporate, they stay behind after most of the water has evaporated, keeping the polymers soft so that the film can form properly. Problems with coalescing agents include poor finish adhesion, low gloss and poor durability.
2. Plasticizers make a floor finish flexible and impact resistant. Over-plasticized finishes cause tackiness, poor soil resistance and plasticizer migration. Under-plasticized finishes can create powdering, low gloss, slippery floors and recoatability problems. Plasticizer migration of the floor finish should not be confused with plasticizer migration of the tiles, which can occur when plasticizers which are present in some vinyl, VCT and VAT floorings attack the floor finish, making it tacky. Plasticizers are present in some vinyl, VCT and VAT floorings.
3. Leveling and wetting agents overcome the high viscosity of the polymers, allowing spreading and flowing over the floor uniformly and evenly. Floor finishes generally have a viscosity of less than 10 centipoise to ensure that they level properly.
4. Antifoaming agents are added to counteract the small amounts of surfactants present in a water based floor finish. Surfactants can produce bubbles and foam in the dried film. These surface flaws, often called fisheyes or cratering, destroy the smooth reflective surface of the finish. Antifoaming agents rapidly break the bubbles and keep the imperfections from forming.

## ***C. MODIFIERS***

Modifiers are added to improve the gloss, clarity, hardness, buffability, scuff and scratch resistance, slip resistance and durability of the polymers. Modifiers include:

1. Resins containing acrylic and styrene maleic anhydrides added for leveling, gloss and clarity.
2. Wax emulsions with polyethylene and polypropylene synthetic waxes to improve slip resistance, durability, toughness and high speed buffability.
3. Urethanes for improved adhesion, chemical and water resistance, impact resistance and flexibility.
4. UV absorbers to prevent the finish from yellowing in sunlight.
5. Metal crosslinks with zinc compounds for durability and removability..

## ***D. PRESERVATIVES***

Preservatives protect the ingredients from attack by microorganisms, both during manufacture and storage. Some finishes contain an antifreeze agent as well.

## ***E. WATER***

Deionized or purified water is used so that impurities in the water cannot damage or discolor the floor finish film.

## MEASURING THE QUALITY OF A FLOOR FINISH

### A. GLOSS

There is a meter to measure the light reflected at a 60° angle from the floor. This meter, called a gloss meter, allows for measuring the shininess or brightness of the floor. The following chart provides a frame of reference for interpreting gloss.

COATS	GLOSS METER READING
BARE FLOOR	3-5
1 COAT	30-35 (OVERHEAD LIGHTS ARE VISIBLE IN GLOSS)
2 COATS	55-60 ("WET LOOK" FOR END OF AISLES)
3 COATS	70+
4 COATS	75+

### B. SLIP RESISTANCE

ASTM standard D-2047-93 is the slip resistance test used for floors. A testing device, called a James machine, is used to test the slip resistance of a floor. If the slip resistance is less than 0.5, the floor is too slippery. If it is greater than 0.8, it can be too "sticky." Acceptable floor finishes leave the slip resistance of the floor between 0.5–0.8. When a finished floor becomes wet, the slip resistance quickly falls below 0.5. For the finish to have the appropriate slip resistance, the floor must be dry. Finishes should never be applied to surfaces that are frequently wet, such as bathroom floors, as they become areas with a high incidence of slip and fall accidents.

### C. HARDNESS

Dirt trapped in the floor finish and scratches due to wear make the finish rough, dull the gloss and yellow the appearance. If a finish is too badly damaged, it may be necessary to strip the floor. Harder finishes repel dirt better but tend to scratch more easily and are harder to repair than softer finishes. The Konig value of a finish is its relative hardness. The higher the number, the harder the finish. If a finish is scratching too easily because of a close proximity to sand, switch to a softer finish and increase the maintenance cycle.

### D. SCUFF RESISTANCE

There is a test for black heel mark resistance (scuff resistance), called a Snell test. The ability of a floor finish to resist scuffing and black heel marks is another method of evaluating the quality of a floor finish.

### E. SCRUBBABILITY AND REMOVABILITY

To test scrubability, there is an ASTM test run on a piece of equipment called a Gardner Abrasion Tester. (This test shows how the finish is removed while being scrubbed and gives a measure of the removability.)

## STRIPPING A FLOOR

There are 2 types of strippers, alkaline strippers and solvent strippers. Both strippers are diluted with hot water. Alkaline strippers contain caustics, silicates or monoethanolamine that breaks the polymer bonds of the floor finish. Strippers containing silicates should not be used on marble, because the silicates can turn the granite gray. Alkaline strippers can also damage asphalt tiles but are a better choice than solvent strippers on asphalt tiles. Alkaline strippers are generally faster than solvent strippers but need more thorough rinsing. Solvent strippers contain glycol ethers or alcohols to break down the finishes. Alcohol based strippers should only be mixed with cold water and should not be used on asphalt, rubber, terrazzo or linoleum floors. Solvent strippers are the best for stone floors and alkaline strippers are the best for resilient floors. New tiles have a finish applied during manufacturing, called a mill finish, that needs to be stripped off before the tiles can be sealed or finished.

Solvent based strippers should not be used on tile floors that are less than 2 years old as they can lift the tiles by dissolving the adhesive. Asphalt tiles (usually 9" squares) should not have solvent based strippers used on them, because the solvent leaches the color of the tile. Solvent strippers will remove the paraffin from rubber floors, making them brittle. When used on terrazzo they can leave glycol ether residues, which can be reactivated by a water-based finish. This can strip the floor from the bottom up.

Stripping solution should be applied with a mop and bucket, not an auto scrubber. If an auto scrubber is used, stripping solution can be left in the scrubber, which can damage the scrubber, and then the scrubber can't be used for the rinse water. Before

measuring the stripper, make sure that the mop bucket is marked with gallon increments. This allows for easy measuring of the stripping solution. A diluted gallon of stripper solution will strip approximately 600 sq. ft. of floor with an average number of coats of sealer and finish on it.

## **STEPS IN FLOOR STRIPPING**

1. Look for problem areas.
2. Remove any equipment or moveable objects from the area to be stripped. Tape off the area to be stripped if desired so that sharp lines can be seen between the area to be stripped and the areas not being stripped.
3. Sweep the floor. Put out “Wet Floor” signs.
4. Remove foreign objects such as gum and tar from the floor using a putty knife. Be careful not to scratch or gouge the floor tiles.
5. Gather needed equipment including bucket, mop, mop head, stripper, wet vac, etc. Put on slip resistant stripping shoes and lay out walk off mats at the edge of the area to be stripped. Use the mats when entering or leaving the area to avoid tracking stripping solution onto other parts of the floor.
6. Prepare the stripping solution according to the label directions using hot water (or cold water if the stripper is alcohol based).
7. Apply the stripping solution by flood mopping the area. During the stripping operation, allowing the floor to dry can cause white silicate films which are difficult to remove but can usually be removed by scrubbing with a black pad. Use a squeegee to pull the stripping solution away from doorways. If you splash an area, such as baseboards or under a doorway, wipe it up immediately.
8. Allow the stripper to work for 15 minutes. During this time, scrub the edges and corners with hand pads made for this purpose. Many hand pads have applicator holders to allow this to be done from a standing position. Longer stripper contact times may be needed if the floor has many coats of sealer or finish, if the coats are old or if the floor has grout.
9. Using the 175 rpm swing machine with a black pad, or an auto scrubber with the vacuum off, the pad down and the squeegee up, scrub the floor. Green or blue pads are used for selective stripping. Red pads are used for highly sensitive areas. If you are using an auto scrubber to strip the floor, change pads between stripping and rinsing the floor. If the pad becomes gooey or the floor gets grainy or cottage cheesy, apply more stripping solution. This means that there is a lot of finish or sealer on the floor and the stripper is having trouble liquefying it all. Be generous with the amount of stripping solution applied to the floor.
10. Move the swing machine from right to left. The counterclockwise (as viewed from the top) motion of the pad will pull the stripping solution towards you while stripping the floor and keep baseboards and carpeting safe. Pull the puddle with you as you move over the area by overlapping passes.
11. Pick up the slop with an autoscrubber, a wet/dry vacuum or use a squeegee to pull the slop away from the walls and collect it in the center of the work area for wet vacuuming or pickup with a clean mop and bucket. Black rubber squeegees can leave black marks on the floor so an alternate type of rubber is preferred.
12. Before the floor dries, flood with cold rinse water. This helps keep the stripper from drying to the floor, thins the slop on the floor making it easier to remove and floats the solids to the top making them easier to remove. Pick up with an auto scrubber, a wet/dry vac or a mop and bucket.
13. Repeat the flooding with a second cold water rinse. Allow the floor to dry. It is then ready for sealing and finishing. You can speed drying by using fans.
14. Check for white films on the dried floor by wiping your hand across an area. If there is a white powder on your hand, you need to rinse the floor again because there are alkaline residues left on the floor.

15. Look for shiny spots on the dried floor indicating that all of the finish has not been removed. If this is the case, restrip those areas until all of the old finish and sealer is gone.

## **MOP SELECTION AND CLEANING**

Stripping and cleaning mops should be cotton, while finish mops should be synthetic with rayon being the most popular. If quaternary disinfectants are used for mopping the floors, such as is the case in most nursing homes, a synthetic mop should be used to avoid black mop syndrome. Black mop syndrome is a problem caused by quaternary disinfectant building up in the cotton mop and causing removal of the finish, which then builds up in the mop strands. The mop strands then turn black and hard.

Mops should be laundered frequently to prevent buildups. New cotton mops should be laundered before use to remove the cottonseed oil from the mop. One simple technique to clean finish mops prior to laundering is to make a "Bubble Bucket," by taking a 5 gallon pail, cutting a hole for a hose in the lid and then punching several holes in the lid. Place the dirty mops in the bucket in a slop sink or over a floor drain, fill with water and then add 16 oz of Mixmate™ All Purpose Cleaner Degreaser. Allow to soak for 15 minutes. Place the hose into the hole in the lid, pushing the hose to the bottom of the pail and turn on the water. With a moderate flow rate, allow the bucket to flush for 5 minutes. This will remove cottonseed oil from new mops or remove floor finish buildups from synthetic mops prior to laundering. Don't mix new mops and finish mops in the Bubble Bucket. When laundering, use a high alkaline break and a high surfactant, preferably with solvents, suds product in a heavy soil wash formula. Never use fabric softener on mops.

When fitting an employee for a mop, place the mop end on the floor between the employee's feet. The tip of the handle should be level with the bridge of their nose. If the handle is too long or too short, it can cause back injuries. Cut off long handles or buy longer ones if needed to properly fit employees. It is also a good idea to label the mop handles to make them personalized for an employee. The employee takes better care of the equipment if it is personalized. When the employee mops, the top hand should be held stationary under the chin. When both hands move, an employee tends to reach and strain their back. Mopping should also be done in an area that can be reached without stepping, such as a 7-tile square area (for VCT).

## **CODING THE LAYERS**

1. After stripping a floor, walk through the area to be finished. Using a grease pencil (china marker), write S-1 in 1/2 inch letters in the various traffic areas in the path of the heaviest traffic. This will allow us to monitor the wear on the sealer and finish.
2. Apply the sealer and allow it to dry. Mark S-2 just above the S-1. Apply the second coat of sealer and allow to dry.
3. Mark F-1 just above the S-2 and put down the first coat of finish. Allow to dry. Even if you are using the same product as a sealer and a finish, consider the third coat to be your first coat of finish.
4. Mark F-2 just above the F-1 and put down the second coat of finish. Allow to dry.
5. If additional coats are desired to build gloss, wait 24 hours and add the additional coats. Never add more than 4 coats of sealer or finish in a 24 hour period, as the hygroscopic nature of the finish will cause streaking if the undercoats have not dried properly. Partially dried layers of finish can be ripped up resulting in the need to strip, reseal and refinish the floor.

When the top coat of finish is gone, the F-2 mark will disappear. Use a green (medium) pad and deep scrub the floor with an auto scrubber (using a cleaner not a stripper in the auto scrubber). Remark the F-2 and put down a new top coat of finish. This top coat is called a sacrificial coat because we allow it to be destroyed, rather than the floor itself. If this procedure is followed carefully, a floor need not be stripped. Rather, new top coats can be applied indefinitely. Many high volume facilities have gone in excess of five years before deciding to strip the floor.

To review, dirt trapped in the floor finish and scratches from use make the finish rough, dull the gloss and yellow the appearance. If a finish is too badly damaged, it may be necessary to strip the floor. If it is desirable to strip the floor, strip until all of the numbers are gone. Then reseal and refinish the floor. Remember that harder finishes repel dirt better but are scratched more easily than softer finishes.

## APPLYING THE FINISH OR SEALER

Sealers and finishes are hygroscopic. This means that when a coat of sealer or finish is applied to a floor, the top layer dries first and then the remaining water evaporates through the outer layer drying the bottom. The speed at which this happens is largely dependent on the floor temperature, air flow and the humidity in the room. A finish or sealer can tear if the surface is abraded before the bottom layer has cured. Four coats of sealer/finish takes 72 hours to cure. Never add more than 4 coats of sealer or finish in a 24 hour period, as the hygroscopic nature of the finish will cause streaking if the undercoats have not dried properly.

When applying coats of finish or sealer, stay 6–8 inches from the edges and with alternate coats stay 1 inch from the wall, unless in a nursing home. In nursing homes, all coats go to the wall, because residents tend to walk along the walls.

When finish is being applied in an area with low air circulation, such as a school where the air conditioning is turned off, apply one coat in the morning and one coat in the afternoon. This allows for extra drying time to compensate for the lack of air movement. It is a good idea to use fans to speed the drying process by increasing the air circulation. The fans should be elevated so that the air flow doesn't blow directly on the wet finish as this can cause ripples. Cold floors (<50°F) or extremes in humidity will cause problems in laying finishes as well.

Peeling of the finish can be caused by too cold a floor, not curing properly between coats, or alkaline residues left on the floor. Sunlight dirt in the finish and quat or phenolic disinfectants can cause yellowing.

Sealers come in two basic types, water based urethanes and water based epoxys. Some companies sell a solvent based two-part epoxy, but it is much more difficult to work with and the odor is much stronger. A one-part water based epoxy generally has no odor and almost no VOCs. Epoxys are strong sealers that are difficult to remove. They are usually used on concrete and many stone floors. Many resilient floorings will not require a sealer and the first coat of finish is used as the sealer. For any polished stone (marble), glazed tiles (such as glazed quarry tile) and rubber, a sealer is needed to provide a base for the finish to adhere. If there is any doubt, perform an adhesion test before applying finish to the entire floor.

Once a floor has been stripped and has dried, it is ready to be sealed or finished. See the previous discussion on coding the layers. The first layer of sealer or finish will use 1 gallon for each 500–800 sq. ft of flooring. This first coat fills the pores of the floor. Each additional coat will cover at a rate of 1500–2500 sq. ft per gallon. To apply finish or sealers, follow these steps.

1. Put a clean synthetic mop head in the mop handle. Many people soak the mop head in water to pre-wet it and to help ensure that it is clean. Be sure to wring all of the water out of the mop head before use.
2. Place a garbage bag liner in a clean mop bucket. Fill the liner with an appropriate amount of sealer or finish. While too much finish will have to be thrown away (it can't be stored), too little will mean extra trips to refill the mop bucket. An open mop bucket of finish will resist forming a surface film for 8–10 hours, so all of the finish needed should be poured at once.
3. Place the mop head in the floor finish. Wring out the excess finish or sealer from the mop head, do not use the wringer but by pressing down on the mop in all four corners of the wringer. When lifted up, the mop should be wet but never dripping.
4. Starting in the opposite corner of your exit from the area to be finished, "picture frame" or outline an area by mopping finish on three sides of a box. The box is an area of the floor that will be finished at one time. Never try to apply finish to too large of an area at once. It is always better to break a large area into several smaller areas or boxes. Don't go to the edge of the floor with each coat unless in a nursing home hallway as explained above. Every other or every third coat should go to the wall.
5. Starting at the top of the box, mop figure-eights, pulling finish from one side of the box to the opposite side of the box.
6. Flip the mop over halfway through. Don't let the mop run out of finish but don't leave puddles. Thin coats of finish can cause streaking. If there isn't enough finish for it to level properly, it tends to tear under stress. If the mop runs out of finish, rewet the mop.
7. Finish an area by squaring it off. Once finish has been applied to an area, the film starts to form in 10–20 seconds. Going over the same area after the film has started to form will cause streaking or tears in the film.

8. Allow each coat to dry for 30–60 minutes before applying the second coat. Wait until the coat appears dry and then check to see if it is dry to the touch. If it is dry, not tacky, wait 5–10 minutes more.
9. Place your hand flat on dry coat for 10 seconds and remove your hand. If there is a white hazy impression from the hand, the finish or sealer is not dry (cured) yet. Wait 15 minutes and try the test again. Once your hand doesn't leave an impression, wait 15 minutes more and continue with the next coat. When switching from sealer to finish, use a different mop head.
10. Never apply more than 4 coats in 24 hours. Never buff or burnish between coats unless allowing to dry overnight first. If streaking does occur, allow to dry overnight with no further coats. Burnish the next morning, damp mop, and apply the next coat. If the streaking is gone, continue with the remaining coats. If streaking remains, strip the floor and start over. As an industry average, most floors will be given between 4 and 8 coats of sealer/finish after stripping.
11. Unused U S Chemical floor finishes can go down the drain into a sanitary sewer if local sewer codes allow its disposal in this manner.

## **REPAIRING A LARGE SCRATCH**

Using a green scratch pad and by hand, scrub the scratched area to level (sand) the floor finish in the scratched area. This can be thought of as hand burnishing the floor finish. Using a gray foam paint brush, fill in the scratch with 2 coats of finish (allowing to dry between coats). Mop a larger area with a covering coat and allow to cure for 72 hours. After curing, buff or burnish the area and the scratch will be gone.

## **ROUTINE MAINTENANCE**

The maintenance program for a facility will vary based on the flooring type, the amount of traffic, the equipment available, and the amount of labor that the customer is willing to use. A typical daily maintenance program with conventional or high speed equipment is as follows.

1. Vacuum walk-off mats.
2. Dust mop the floor.
3. Check for foreign objects such as gum or tar. Using a putty knife, remove foreign objects, but be sure not to scratch the flooring material.
4. Put out floor signs.
5. Damp or wet mop the floor.
6. Spray buff the floor. Go over the floor three times, turning the pad over between passes or when the pad starts to accumulate gray or white specks. The spray buff has floor finish in it and takes 24 hours for the finish to cure and build gloss, so the gloss will not appear to change dramatically at the time of spray buffing.
7. If desired, spray buffing can be skipped and deep scrubbing followed by recoating can be done instead; although, recoating can be done after spray buffing as well. Deep scrubbing is done with a swing buffer or auto scrubber using a red, blue or green scrubbing pad, depending on the amount of soil present. A moderately aggressive pad is needed, but not a black pad. If too harsh a pad is used, significant amounts of floor finish may be accidentally removed. Flood mop a pH neutral cleaning solution (made with warm water) with a mop and bucket. Cleaning with hot water or an alkaline cleaner may cause the cleaner to “bite” into the finish damaging it. If the swing buffer is being used for daily scrubbing, use the red pad or some other less aggressive pad to avoid having the pad remove too much finish.
8. Scrub three to four times with the swing buffer or the auto scrubber. When using the auto scrubber, use one pass for light cleaning and a double pass method for deep scrubbing. If using the auto scrubber to deep scrub, it is important not to pick up the cleaning solution on the first pass. Run the auto scrubber with the squeegee up and the vacuum off on the first pass

and then lower the squeegee and turn the vacuum on for the second pass. This allows the cleaning solution an extended contact time to work.

9. Pick up the cleaning solution with the auto scrubber (see above), wet vac or a mop and bucket. Rinse the floor with fresh water if recoating. If using an auto scrubber, trail mop with fresh water to pick up the excess chemical before rinsing and recoating.
10. Recoat the floor as needed. Remember to code the layers using up to 4 new coats of finish (if needed or desired). Recoating should only be done on a clean floor after deep scrubbing or spray buffing. Recoat when daily or interim maintenance no longer gives desired results. Spray buffing can also be done after deep scrubbing or top coat scrubbing if recoating is not being done.

An ultra high speed (UHS) program would be very similar but with the following differences:

1. When using UHS equipment for scrubbing, use a soft pad, such as a red pad. Use a brown, green or black pad for deep scrubbing. Never use a dark pad for polishing a floor with UHS equipment.
2. If using an auto scrubber, trail mop to pick up the excess.
3. Rinse with fresh water if recoating or burnishing. Although some people use a spray buffing product when burnishing, dry burnishing is generally the preferred method.
4. Always dust mop after burnishing. Some people will also damp mop after burnishing and dust mopping to ensure that the floor is clean before recoating or restoring.

## **OTHER PRODUCTS**

### ***A. MOP ON RESTORERS***

Mop on restorers sometimes do a limited amount of cleaning. These products primarily lubricate the floor, allowing the pad to spin faster, giving more sanding and bringing up the shine of the floor. Some have floor finish polymers to put down a small additional layer of finish. Often used in autoscrubbers, these products do two jobs at once by cleaning and bringing up the gloss. They are usually applied with a mop and bucket in the same way that recoating is done. Restorers don't remove the traffic patterns (heel marks) like scrubbing does. These products are diluted and are used to fill in scratches and add a little gloss to the floor.

### ***B. SPRAY BUFF***

Spray buff is a light duty cleaner with floor finish in it. A light mist of spray buff is sprayed on the floor and then the 175 rpm swing buffer is used to restore the shine to the floor.

## **PRODUCT SELECTION**

Product selection is based on several factors. To pick appropriate products, we need to answer the following questions.

1. What flooring type(s) will be treated?
2. What maintenance schedule does the facility have for each area?
3. What type of equipment does the facility have for maintaining its floors?

We can divide floor finishes into "soft" finishes and "hard" finishes. Soft finishes need daily scrubbing and buffing or burnishing to maintain their high gloss. Hard finishes generally have a lower gloss but don't require daily maintenance or minimal buffing or burnishing. When selecting a finish, we need to know how the floor will be maintained to pick a finish that will give us the maximum gloss for the amount of maintenance that the facility is willing to do. Once this is determined, we can look at their equipment and pick an appropriate product for the speed of the equipment being used. The type of flooring may dictate the use of a sealer or special finish for that flooring type.

## **COMMON FLOOR CARE PROBLEMS: TROUBLESHOOTING**

This section discusses common problems that can occur in floor care. Where possible, the easiest solutions are also presented. Alkaline residue may or may not be visible after stripping a floor. It can cause a white powdery film. When finish or sealer is applied on a floor with an alkaline residual, the finish will powder and flake off as the alkalinity attacks the finish.

After stripping, wiping your hand across the dried floor will often tell you if there is a residual. If a white powder is present, there probably is an alkaline residual. To remove the residual, rinse the floor again before finishing.

Bleeding refers to the color loss of a floor tile due to leaching out of pigments by over aggressive stripping compounds, such as using solvent strippers on tile floors less than 2 years old. This problem is not correctable.

Brown spots can be caused by burnishing an uneven floor. Stripping and refinishing the floor is the best way to solve this problem. If the flooring material has irregularities, this problem may not be completely avoided. Dusting is caused by over burnishing a floor, damaging the finish. Unlike powering, which attacks the bottom layer of finish or sealer, dusting is damage to the top layer of finish.

Fish eyes or bubbles are caused by improper drying or poor leveling. Among other things, too hot of temperature or low humidity can cause these problems.

Hazing can be caused by overly aggressive maintenance or anything that scratches the finish. Strip and refinish to eliminate this problem.

Leveling problems can be seen as waves in the dried finish. Lower quality floor finishes made by other manufacturers often have problems leveling, but it can also be caused by applying the finish to too cold of a floor (<50°F), too hot of a floor (>100°F or where the humidity is too low, causing rapid drying. This can also be caused by applying too heavy of a coat of finish. Never try to build the gloss of 4 coats by applying 3 thicker coats. The finish will not level properly, leaving waves in the finish. Strip and refinish the floor to remove waves.

Peeling of the finish can be caused by not sealing a marble, glazed quarry tile or rubber floor. It can also be caused by the floor being too cold during finishing, alkaline residues left on the floor or not allowing the finish to cure properly between coats. To fix this problem, strip the finish, apply a sealer (if needed) and then refinish the floor. Ice melt residue can gel or dissolve finishes, so the floor should be cleaned to remove ice melt residue.

Plasticizer migration causes a tackiness of the floor finish. This can be caused either by a low quality floor finish (made by other manufacturers), or it can also be caused by the plasticizers in some vinyl, VAT and VCT tiles attacking the floor finish. In mild cases, the floor may pick up dirt more quickly. In severe cases, the tiles may cause furniture to stick to the tile, damaging the tile.

Powdering (see also alkaline residue) is a partial or total disintegration of the floor finish film resulting in a white or off-white powder. This can also be caused by temperature or humidity problems when laying the floor finish.

Streaking is the tearing or damage of a lower coat of finish in the process of laying another coat on top. This is usually caused by not allowing the bottom coat to dry sufficiently before adding the next coat. Never add more than 4 coats in a 24 hour period and always check for curing by placing your palm on the dried finish for 10 seconds and observing if a white haze imprint of the palm is present when your hand is removed. If you see the imprint, allow the floor to dry for another 15 minutes and repeat. The only solution is to strip and refinish the floor.

Yellowing is usually caused by a buildup of dirt in the finish. In some cases, direct sunlight or extreme age can cause the finish to yellow, but this is rare. To prevent yellowing, the maintenance schedule should be increased so that the facility does a better job of keeping their floor clean. Once a floor finish has yellowed the only solutions are to deep scrub the floor, in the hopes of getting out all of the dirt, or stripping and refinishing the floor.

## **SUMMARY**

This brochure explained the basic elements of using floor finishes. All aspects of floor maintenance, including the equipment used and factors that affect product selection were explained in detail. A successful floor care program starts with knowing what the customer's needs are. Only then can the best products be selected to minimize maintenance while maximizing the appearance of the floor.

