Introduction

Builders are important Armstrong customers, and they often have situations arise with respect to the installation and performance of resilient flooring that is unique to their business. For that reason, Armstrong Installation Services and Technical Services have prepared this bulletin to help the builder avoid potential problems such as telegraphing, ridging, and discoloration of the flooring from various substances underneath the flooring. These problems impact the builder, the flooring contractor, the homeowner, and Armstrong. Obviously, anything preventative that can be done to diminish or eliminate these problems will benefit everyone.

Warranty Protection

It is important for the builder to communicate to the flooring contractor that Armstrong adhesive, patching compounds, and latex underlayments must be used as recommended by Armstrong in order to validate applicable Limited Warranties and Performance Guarantees. Armstrong has formulated its installation products to resist mold and mildew discoloration and to perform consistently in the applications for which they are recommended. Armstrong cannot be responsible for discoloration of the flooring or failure of the installation caused by non-recommended products or work practices.

General Work Conditions

Refer to the Armstrong Engineered Installation System booklet (F-5061) for complete information. Armstrong recommends that the temperature of the room and materials should be at least 65 deg. F (18 deg. C) forty-eight hours before, during and forty-eight hours after the installation. Lower temperatures will make the flooring stiffer, making it harder to install and easier to crack. Lower temperatures will also affect adhesive drying time.

Causes of Discoloration of Vinyl Flooring Over Concrete Subfloors

Our experiences in the laboratory and in field investigations have shown that discoloration of vinyl flooring from underneath is caused by one of the following:

Mold/Mildew (Yellow, pink, blue-gray, black). Usually caused by mold/mildew growth in starch-containing gypsum-based patches or underlaments. Armstrong flooring should not be installed over gypsum-based patches or underlaments that have been applied to on-grade or below-grade concrete S-183 Fast-Setting Cement-Based Underlayment, S-184 Fast-Setting Patch and Underlayment, S-194 Patch, Underlayment and Embossing Leveler/S-195 Underlayment Additive may be used to patch or level concrete on any grade level.

Non-Recommended Adhesives. Some competitive adhesives may contain processing oils or other ingredients that can stain vinyl flooring. Discoloration appears in the embossed areas first. It starts yellow and turns orange/yellow with time.
Contaminants. Any of these materials can cause discoloration of vinyl flooring. Usually yellow or orange/yellow in color, except if a particular color chalk, crayon, pencil, paint, or marker was used.

- Asphalt
- Oil and Gasoline
- Plumbing Primer
- Lumber Crayon and Grease Pencil
- Spackling Compound
- Magic Marker
- Construction Adhesive
- Spray Painted Numbers - Framing
- Turpentine and Paint Thinner
- Paint Overspray - Walls, Baseboards
- Wood Stain
- Shellac
- Colored Chalk - Carpenter Snap Lines
- Concrete Curing Inhibitors
- Topical Concrete Treatments
- Lubricants
- Sweeping compounds

It is extremely important to keep these materials off the concrete subfloor. Even if they are removed or are not visible before the flooring is installed, there may be enough residual material absorbed into the concrete to cause discoloration.

Wood Subfloors/Underlayment

Armstrong resilient floors are recommended on wood subfloor construction only if the subfloor is suspended with a minimum of 18” well-ventilated air space below. We do not recommend installing resilient flooring on wood subfloors applied directly to concrete or on sleepers, on or below grade.

The following descriptions of types of subfloors and underlayment panels and Armstrong's recommendations for their use are intended only as a guide. A recommendation by Armstrong for a specific use of an underlayment panel with Armstrong resilient flooring should not be construed as an Armstrong warranty for the underlayment involved.

Wood Subfloor/Underlayment Combination - A.P.A.-Rated STURD-I-FLOOR is a performance-rated panel specially designed as combination subfloor/underlayment. For fully adhered resilient flooring installations, Armstrong recommends an additional 1/4” thick layer of APA plywood underlayment. Other types of underlayment panels (except particleboard) may be used over STURD-I-FLOOR subject to the board manufacturers or supplier's recommendations and warranty. Armstrong resilient floors installed by the Interflex Installation System may be installed directly over APA-Rated STURD-I-FLOOR plywood panels with "sanded face" that do not exhibit a rough or swollen surface due to construction traffic or exposure to the weather and are not contaminated by staining agents. Otherwise, an additional 1/4” underlayment is recommended.

Underlayment - Underlayment for resilient floors should be structurally sound and designed for resilient flooring underlayment purposes with a minimum thickness of 1/4”. Subject to the board manufacturer's recommendations and warranties, the following underlayment may be used with Armstrong flooring products with certain limitations indicated:
Plywood
- APA trademarked plywood rated as suitable underlayment for resilient floor coverings such as tile or sheet vinyl is acceptable under all Armstrong resilient floors. It should have an Exterior or Exposure 1 exposure durability classification and a fully sanded face. APA plywood underlayment grades recommended for areas to be covered with resilient nontextile flooring are Underlayment, Underlayment A-C, B-C, C-C Plugged or C-C Plugged EXT when marked “sanded face.” Also, Marine EXT or sanded plywood grades (A-C, B-C, A-D or B-D) marked “Plugged Crossbands Under Face,” “Plugged Crossbands (or Core),” “Plugged Inner Plies” or “Meets Underlayment Requirements.”
- Poplar plywood with a fully sanded face, exterior glue and recommended by the manufacturer as underlayment for resilient flooring is acceptable under all Armstrong resilient floors.
- Lauan when used as an underlayment should be Type 1 (Exterior). The best grade is BB and the next best is CC, while OVL (overlay grade) is the minimum acceptable face grade. Lauan is acceptable under all Armstrong resilient floors. However, there is a wide variety of quality and species classed as lauan. Some may present severe problems such as discoloration, indentation, loss of bond, and delaminating when used as an underlayment.

Particleboard - Particleboard is frequently referred to as “chipboard,” with panels comprised of small particles usually arranged in layers by size but not oriented. Particleboard underlayment is not recommended by Armstrong under fully adhered resilient flooring.

Fiber Reinforced Cement Panels - FiberBond underlayment is not presently recommended by Armstrong under fully adhered resilient flooring. There are other manufacturers of fiber reinforced underlayment panels that may be suitable for use as an underlayment for resilient flooring. Consult them for their recommendations.

Other Materials
- Treated Plywood - Armstrong does not recommend the installation of resilient flooring directly over fire-retardant treated plywood or preservative treated plywood.
- Glass Mesh Mortar Units - Armstrong does not recommend the installation of resilient flooring directly over glass mesh mortar units designed for ceramic tile.

Summary of Underlayment Recommendations
Underlayment Types

<table>
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<tr>
<th>Plywood</th>
<th>All Armstrong Floors</th>
<th>Fully Adhered Felt-Backed Sheet Floors &amp; Tile</th>
<th>Armafelt Options Perimeter Bond</th>
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<td>APA Underlayment</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Poplar or Birch Plywood</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Lauan*</td>
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<td>Hardboard</td>
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<td>Particleboard CPA</td>
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<td>Fiber Reinforced Gypsum,</td>
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<td>Cementitious Backerboards</td>
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*Some Lauan may present severe problems such as discoloration, indentation, loss of bond and delaminating when used as an underlayment.

Regardless of the type of underlayment used under Armstrong resilient flooring, the responsibility for warranties and/or performance guarantees for the underlayment rests with the manufacturer of the underlayment and not with Armstrong. We strongly suggest that flooring contractors secure a written guarantee and installation instructions from the supplier or manufacturer of the underlayment board being used.

C. Underlayment Joint Show-Through, Ridging, and Tunneling

It is not an easy task to identify exactly what causes these problems, but the most likely causes are (1) movement of the underlayment panels and (2) problems associated with the patching compound used to fill or flash the underlayment joints.

All wood product panels will change in size with changes in water content. Since panels received from the mill generally have very low moisture content compared to the interior of the building and the structural subfloor, we recommend that for best results the panels be allowed to gain environmental moisture before installing the new flooring. This will minimize the chance of tunnels or ridges over the underlayment joints.

It is important to follow the underlayment manufacturer's installation recommendations exactly, since Armstrong cannot be responsible for problems associated with underlayment movement.

Some underlayment manufacturers recommend that the joints between panels be filled or flashed with patch. It has been Armstrong's experience that this procedure may increase the tunneling and/or ridging over these joints. If the underlayment manufacturer does not specifically recommend filling the joints, or offers the option of not filling the joints, Armstrong recommends that the panels be lightly butted and not filled or flashed. Differences in thickness should be corrected by sanding.

If the underlayment manufacturer does recommend filling or flashing the joints, the choice of patching compound is important. Armstrong does not market a patch compound that we recommend to fill underlayment joints. Several underlayment manufacturers recommend the use of a Portland cement-based patch, and our experience would support the use of this type patch rather than gypsum-based patch. Portland cement-based patches usually require overnight drying, however, and most builders and
flooring contractors don't want to wait that long before installing the resilient flooring. In considering this situation, the best solution would appear to be a fast-setting Portland cement-based patch. One such product we are aware of is Ardex Feather Finish. There may be other similar products available.

D. Discoloration of Vinyl Flooring From Underneath (Bottom-Up Staining)

There are a number of causes of discoloration of vinyl flooring over wood that are a result of staining agents originating from beneath the flooring itself.

Nails and Staples. Some fasteners recommended for underlayment panels or single-layer subfloor panels are coated with resin, rosin or cement that can discolor vinyl flooring. Coating fasteners should not be used to install underlayments unless the installer knows they will not stain the finished flooring product and assumes responsibility for their use. To evaluate fasteners for staining potential, "weave" or "thread" the coated nail through two small cuts, made about 1" apart, in a small sample of white vinyl flooring. Sample size should be approximately 2" x 4". Coated staples can be crimped over the edge of the sample. Make sure the coated fastener is in direct contact with both the face and back of the flooring sample. Tightly wrap each sample (with coated fastener) in aluminum foil and place in conventional oven set at 200 deg F for one hour. Do not exceed temperature or time recommendation. Do not place in microwave oven. Remove sample from oven and allow to cool. Inspect flooring for discoloration.

Non-Recommended Adhesives. Some competitive flooring adhesives may contain processing oils or other ingredients that can stain vinyl flooring. Discoloration starts in the embossed areas as yellow and turns orange/yellow with time.

One precaution to help prevent staining of vinyl flooring from construction adhesives is to be sure that the nails or staples used to fasten the underlayment board to the subfloor do not penetrate through the subfloor into the construction adhesive. We have found that physical contact of the construction adhesive with the vinyl flooring is not necessary; the solvent vapors alone apparently can cause staining.

If an adhesive is used to adhere underlayment boards to the subfloor, a water-based adhesive rather than a solvent-based adhesive should be used. One underlayment manufacturer recommends a polyvinyl acetate adhesive ("white glue").

Mold/Mildew. Discoloration is usually yellow, pink, blue-gray, or black. Usually caused by fungal growth in some gypsum-based patching compounds containing starch, but fungal growth can also occur in spackling compound or drywall dust on subfloor or underlayment. It is important to keep the substrate clean and dry before installing the vinyl flooring.

Wood Underlayment. Underlayment panels may contain pieces of staining wood or bark that may or may not be visible on the surface. They may also have edge sealers, logo markings, printed nail patterns, and synthetic patches which could potentially stain vinyl. It is possible also that glues used as binders in the panels may cause staining. Armstrong recommends that builders or flooring contractors secure a written warranty from the supplier or manufacturer of the underlayment board used.

Contaminants. These materials may cause discoloration of vinyl flooring. It is important to keep these materials off the subfloor (if single layer) and underlayment panels.

- Asphalt
- Plumbing Primer
- Lumber Crayon and Grease Pencil
- Magic Markers
Replacement of Discolored Flooring

If the vinyl flooring has discolored due to bottom-up staining, and the decision has been made to replace the floor, it is important to consider how to prevent the discoloration from reoccurring.

If the discolored flooring is removed, the source of the stain must be eliminated or effectively masked. If not, the discoloration can reoccur on the newly-installed vinyl. If the discoloration is in spots, and the staining agent is readily identifiable (nails, staples, wood chips, contaminants), it may be feasible to cover those areas with aluminum foil or tape. The foil or tape should not be thick enough to telegraph through the vinyl flooring. Some flooring contractors have reported success also in using "stain blockers" sprayed or brushed on the wood underlayment. Two such products recommended to us by flooring contractors are "Kilz" (Masterchem Industries, Inc.) and Duron Acrylic Stain Killer. Please note that Armstrong does not necessarily recommend or endorse these particular products or any similar products as solutions to these types of problems.

If the discoloration is due to a non-recommended adhesive, removing the old floor and reinstalling a new one using the recommended adhesive may not guarantee that discoloration will not reoccur unless the old adhesive is completely removed. If it is not practical to remove the old adhesive, it may be easier to install new underlayment over the old floor and then install new flooring. Using S-194/S-195 Embossing Leveler over the discolored floor does not absolutely guarantee that the discoloration will not migrate to the newly-installed flooring (also applies to discoloration from mold/mildew).

If the vinyl flooring has discolored due to mold/mildew, it is important to eliminate the cause of the mold/mildew growth. Plumbing leaks, or leaks from patio doors, shower enclosures, etc. must be repaired. Any patching compound that has mold/mildew growth must be replaced with a recommended patch.

Summary
Builders and their servicing flooring contractors play a key role in preventing "callbacks" on vinyl flooring.
- Follow the guidelines and recommended work practices as presented in this bulletin and in the Armstrong Guaranteed Installation System booklet (F5061).
- Use Armstrong adhesives, underlayments, and patch/skim coat as recommended.
- Carefully select wood underlayments and fasteners.
- Educate other trades, including plumbers, carpenters, electricians, and drywall contractors on the importance of keeping the surface to receive resilient flooring clean and dry.
- Rely on your Armstrong Sales Representative to provide you with the latest recommendations from Armstrong Flooring Products Installation Services and Technical Services.