

ARFA Technical Bulletin 002

Guide To Adhesives for Resilient Floor and Wall Coverings

This document provides an overview of the diverse types of adhesives for resilient floor and wall coverings, explaining their functions and appropriate uses.

Foreword

This information is based on industry best practices to enhance installers knowledge and the performance of the adhesive system. Always follow the adhesive manufacturer's guidelines and verify that the correct adhesive is specified and approved by the resilient floor covering manufacturer.

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01 Adhesive Options

Reactive Flooring Adhesives

Reactive adhesives are available as either single-component or two-component and typically made from polyurethane, modified silane, or epoxy. Once fully cured, these adhesives offer greater resistance to water, soap, and heat, making them suitable for wet-area installations such as kitchens and bathrooms.

Single-Component MS (Modified Silane) Adhesives

These adhesives rely on interactions with moisture in the air or substrate to cure.

Two-Component or Two-Part Adhesives

These adhesives cure via a thermosetting chemical reaction between Part A and Part B. Once mixed, they have a set open and working time. Any leftover mixed adhesive cannot be reused and must be disposed of properly.

Water-Based/Emulsion-Based Flooring Adhesives

Mostly based on acrylic or styrene-butadiene polymer emulsions, these adhesives require the dispersion of water for curing. They are unsuitable when both bonding surfaces are impervious. Water-based adhesives can break down upon moisture exposure, limiting their use to dry areas.

Pressure Sensitive Adhesive (PSA/Tackifier adhesive)

Pressure-sensitive/tackifier adhesives are applied by rolling or spreading, allowing the adhesive film to dry before placing flooring materials and once cured, the adhesive remains very tacky and soft. These adhesives prevent materials like carpet tiles and VCT from sliding horizontally, enabling easy replacement. However, they are typically not recommended for bonding LVT or sheet flooring.

What is known as PSA in Australia is referred to as a tackifier adhesive in Europe so some overseas installation instructions may state tackifier adhesive rather than PSA.

Transitional Adhesives (Soft Set or Hybrid Adhesives)

Transitional adhesives offer good tack when dry and have stronger peel strength than PS adhesives. For optimal results, they should partially dry to let moisture escape before applying floor/wall coverings. Installers sometimes use the double-drop method to expedite moisture evacuation. These adhesives are formulated for sheet vinyl, rubber, and broadloom carpets. If recommended, they can be used for LVTs and LVPs, but installers must carefully follow manufacturer instructions. A common mistake is allowing the adhesive to cure too much before placing flooring materials, leading to insufficient adhesive transfer and potential failure.

Hard Set Adhesives/Wet Set Adhesives

Hard-set adhesives are designed for bonding floor and wall linings like LVP, LVT, and sheet vinyl in high-traffic and temperature-fluctuating areas. They require installation into the wet adhesive film for full coverage. When applied correctly, they provide high bond strength and resistance to temperature fluctuations, helping to control expansion, contraction, or movement.

Hard set adhesives can also be known as wet set adhesives due to the fact they must be laid into wet.

Contact Adhesive

Contact adhesive provides an instant and strong bond, making it particularly useful for coving and wrapping vinyl around internal and external corners. Adhesive is applied to both surfaces, and once dried, forms a strong, immediate bond upon contact.

Types of Contact Adhesives

- *Water-Based Contact Adhesives:* Recommended by most manufacturers due to their solvent-free composition, low VOC levels, non-flammability, and user safety.
- *Solvent-Based Contact Adhesives:* Emit harmful vapours and should only be used in well-ventilated areas.

Application Guidelines

For optimal results, apply contact adhesive according to the manufacturer's instructions. Ensure both surfaces are fully coated with the adhesive and allowed to dry completely before carefully placing the materials together.

Note:

For water dispersion adhesives, typically the substrate should be absorbent to a depth of at least 2-3mm. ASTM F3191, referenced in AS 1884:2021, specifies the testing procedure for substrate absorbency. Installation failures often result from installation over incorrectly prepared and non-porous substrates. A non-absorbent substrate extends the adhesive's open time beyond the recommended period, resulting in poor adhesive transfer. In contrast, an absorbent substrate allows adhesive polymers to penetrate during the hydration process, resulting in a stronger bond.

Importance of Adhesive Application and Timing

Adhesive manufacturers guarantee the product quality when used correctly. However, improper use or inadequate substrate preparation can weaken the assembly, increasing the likelihood of bonding failure. Water-based and moisture-cured adhesives dry from the surface, forming a film that reduces their ability to wet out the floor covering backing, leading to weaker adhesion. Proper acclimatization of floor and wall linings, as well as controlling environmental conditions during and after installation, are critical for hard-set adhesives.

02 Limitations of Adhesives

Surface Preparation

Most adhesives require a well-prepared, clean, porous, and dry substrate. Dust, porosity, grease, old adhesives, screeds, or other contaminants can significantly reduce the adhesive's effectiveness.

Substrate or Material Suitability

Not all adhesives bond well with certain substrates or floor/wall coverings. Some formulations are specific to materials like vinyl, rubber, or wood and may require primers.

03 Causes for Adhesion Breakdown or Failure

Common causes of adhesion failure include:

- **Water Exposure:** Water exposure in moisture prone areas may weaken water-based adhesives.
- **Dirt, Oil, Grease:** Contaminants on the surface prevent proper adhesion.
- **Dust and Particles:** Any particulates can function as a barrier between the adhesive and the surface.
- **Rough or Smooth Surfaces:** Both overly rough and overly smooth surfaces can reduce adhesion effectiveness.
- **Solvents and Cleaners:** Exposure to solvents, soap, or harsh cleaning agents can degrade adhesives.
- **Temperature Fluctuations:** Extreme temperatures can cause adhesives to soften or become brittle, weakening the bond.
- **Humidity and Moisture:** High humidity and direct water exposure can cause adhesives to swell and weaken.
- **PH Levels:** Extreme pH levels in substrates or environments can degrade the adhesive.
- **Sunlight and UV exposure:** Prolonged UV exposure can degrade adhesives not designed for outdoor use.
- **Incomplete Curing:** Inadequate curing time or poor curing conditions can result in adhesives not reaching full bond strength.
- **Premature Exposure:** Exposure to stress, moisture, or adverse conditions before full curing can compromise adhesive integrity.
- **Vibration and Shock:** Continuous mechanical stress can weaken adhesive bonds.
- **Load Bearing:** Excessive load or stress beyond the adhesive's capacity can cause failure.
- **Substrate Compatibility:** Using adhesives with materials that are not compatible can result in poor adhesion.
- **Natural Aging:** Over time, adhesives can lose their properties due to aging.
- **Oxidation:** Exposure to air and oxidation can degrade adhesive materials.
- **Insufficient or Excessive Adhesive:** Both too little and too much adhesive can cause problems.
- **Incorrect Curing:** Inadequate curing time or conditions can lead to weak bonds.

04 Trowel Sizes and Application Rates

Notched trowels are tools designed to apply a specific amount of adhesive to the substrate. Larger notches dispense more adhesive per square meter, while smaller notches dispense less. Factors like trowel wear, angle of application, substrate porosity, surface profile and adhesive viscosity also affect the amount applied. Always follow manufacturer recommendations for trowel notch size and monitor trowel wear regularly, replacing worn trowels immediately.

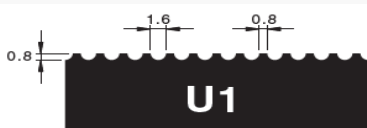


Figure F.2 — “U” notch trowel

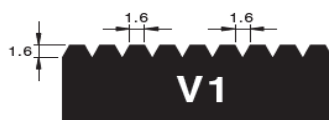
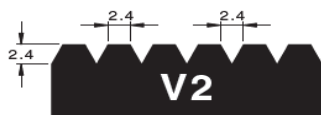


Figure F.3 — “V” notch trowel



Always use the trowel size recommended by the adhesive and floor covering manufacturer and replace worn tools as soon as the teeth show wear to ensure the correct amount of adhesive is applied.

05 Adhesive Transfer

A strong bond between the adhesive, substrate, and vinyl ensures the resilient flooring is securely adhered to the subfloor. Unfortunately, this adhesion is only scrutinized when installation issues arise, such as gapping or peaking of LVT/LVP or voids under sheet vinyl.

All the adhesives mentioned, except for pressure-sensitive adhesives, require wet adhesive transfer onto the back of the product. To gauge how well the adhesive is bonding to the vinyl, observe the adhesive transfer, which can vary significantly depending on the adhesive type and the specific resilient flooring. This is especially critical when adhering LVT/LVP flooring, as the backing system can vary widely between products and manufacturers. Some flooring backings are cushioned, some are embossed, and some are exceptionally smooth, all of which can impact adhesive transfer and performance once the adhesive has cured.

To ensure proper adhesive application, check that the adhesive trowel ridges are fully compressed by lifting the resilient flooring and inspecting the transfer. This confirms that the flooring has been laid into sufficiently wet adhesive and properly rolled. Adhesive manufacturers usually require 100% adhesive transfer to the back of the flooring after rolling or pressing into the adhesive while the adhesive is wet. If the transfer is less than 80%, reposition the flooring into the adhesive and re-roll.

During investigations, lifting the resilient flooring from the subfloor will reveal a failure point, which occurs at the weakest point in the flooring system. Adhesive transfer to the substrate and back of the floor covering at the time of installation significantly affects this break point. The main types of adhesive failure are:

- 1. Substrate failure:** The failure occurs within the substrate itself.
- 2. Adhesive failure:** The failure occurs at the interface between the adhesive and the substrate or flooring.
- 3. Cohesive failure:** The failure occurs within the adhesive film itself.
- 4. Adhesion failure:** A strong adhesive bond between the surfaces was never achieved.

06 Adhesive Failure Table

Failure Type	Description	Causes
Adhesive Failure (at product backing)	Adhesive detaches from the flooring backing.	Installation errors, insufficient adhesive application, incorrect ambient conditions (too hot or too cold) or late placement into the adhesive film.
Adhesive Failure (at substrate material)	Adhesive detaches from the substrate material e.g. plywood, levelling compound, concrete etc.	Installation errors, dust on substrate, contaminated substrate (adhesive/oil etc.), weak substrate, inadequate substrate surface profile (too smooth).
Adhesion failure	Adhesive did not bond the flooring material to the substrate	Can be a result of incorrect adhesive selection, improper use, incorrect trowel size, worn notched trowel, late placement into adhesive film and other potential factors such as substrate moisture content.
Cohesive Failure	Adhesive splits, leaving adhesive on both substrates.	Weakness in the adhesive bond itself when compared to the substrate attachment points. Could be the result of an adhesive fault or chemicals/moisture weakening the adhesive itself.
Substrate Failure	Detachment of the underlying substrate material from itself (e.g. internally within the plywood, levelling compound, concrete, or other substrate.)	Weak substrate (low tensile strength) or fractured substrate, improper substrate preparation.
Note	<p>Upon destructive removal of the floor covering, there must be a break point somewhere in the flooring system. Identifying where this break point has occurred can provide an indication of the weakest attachment point in the system and can also help to identify or confirm installation practices.</p> <p>The above listed points of failure do not always provide a clear indication of the entire installation process or all relevant factors which may have led to a flooring failure.</p>	

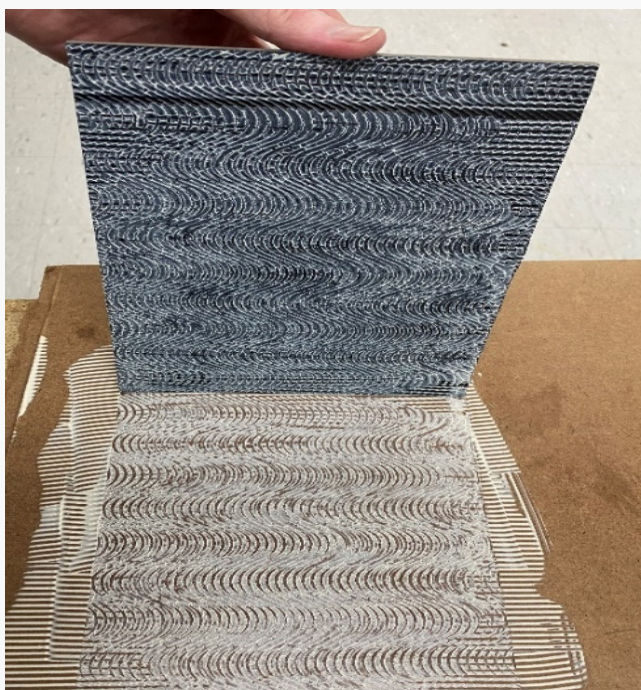
07 Successful and Failed Adhesive Applications

Satisfactory Transfer for Smooth-Backed LVP



Smooth-backed LVP laid into wet adhesive achieves good adhesive transfer onto the back of the LVP.

Embossed-Back LVP



An LVP with a heavily embossed backing allows the embossed design to be observed through the adhesive on the substrate, indicating good adhesive transfer.

Adhesive Transfer Over Time

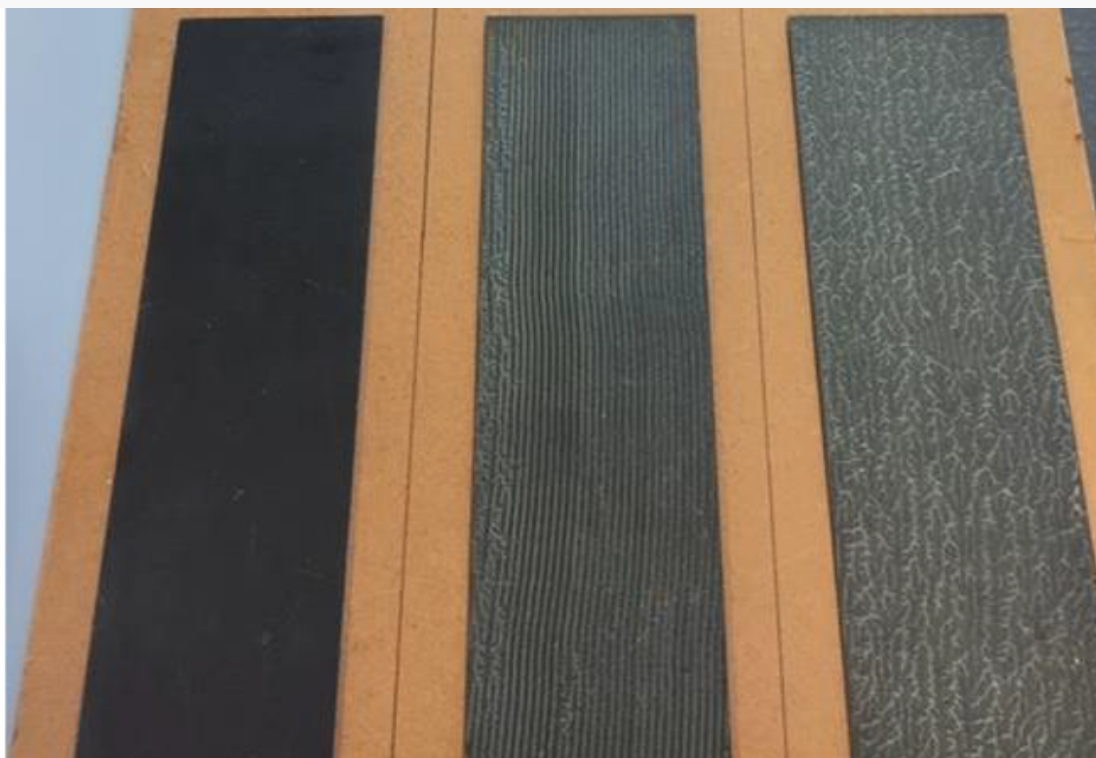
The diagram below illustrates the adhesive transfer on the back of planks at 5, 30, and 60 minutes after placement. After 5 minutes, there is 100% adhesive transfer onto the back of the plank. At 30 minutes, adhesive transfer significantly decreases, with the trowel ridges still visible and not fully compressed. By 60 minutes, there is little to no adhesive transfer.

This highlights the importance of installing planks into the adhesive while it is still sufficiently wet, especially when using hard-set or transitional adhesives.

Insufficient
60 minutes

Partial (still
insufficient) 30
minutes

Full
transfer 5
minutes ✓



The adhesive bonding process occurs in three phases:

Adhesive application (Wet Phase): In this phase, the adhesive is applied to the substrate surface. The adhesive is in a liquid or semi-liquid state, allowing it to spread evenly and create strong contact with both surfaces at installation. Proper surface preparation is critical to ensuring the adhesive effectively bonds to both surfaces effectively.

Open Time (Tack Phase): This phase refers to the duration between adhesive application to a surface and when it begins to lose its ability to bond effectively. During this period, the adhesive remains tacky or wet enough to create a strong bond when joined with another surface. Open time can vary significantly depending on the adhesive type, the amount applied, environmental conditions (temperature and humidity), and the specific formulation used.

Curing Phase: In the final phase, the adhesive fully cures or hardens, creating a permanent bond between the surfaces. Curing may involve evaporation of solvents, chemical reactions (e.g., polymerization), or heat activation. Once fully cured, the adhesive reaches its maximum bonding strength and durability.

Note: The time required to reach full cure is dependent on many factors, including the adhesive type, temperature, open time, ambient and substrate humidity, and other environmental factors.

Substrate breakdown

Substrate breakdown during adhesive bonding occurs when the surface material (substrate) weakens or deteriorates, compromising the bond. To prevent this, ensure the subfloor is properly prepared by following the manufacturer's instructions.



Bubbling in sheet vinyl

Vinyl flooring bubbling can be caused by several factors:

- **Moisture:** Excess moisture under the vinyl flooring can cause the adhesive to lose its grip, leading to bubbles.
- **Poor Adhesive Application:** Uneven or insufficient application of adhesive can result in areas where the vinyl does not stick properly, causing bubbles.
- **Temperature Changes:** Extreme temperature fluctuations can cause the vinyl to expand and contract, leading to bubbling.
- **Dirty Substrate:** Dirt, dust, or debris on the substrate can prevent proper adhesion, resulting in bubbles.
- **Improper Installation:** If the vinyl flooring is not installed correctly, such as not being rolled out properly to remove air pockets, bubbles can form.
- **Substrate Issues:** An uneven or improperly prepared substrate can cause the vinyl to bubble as it settles.

- **Adhesive off gassing:** Failing to allow adequate tack-up time (early placement) for water-dispersed adhesives can lead to off-gassing, which in turn can cause bubbling in sheet flooring.
- **Trapped air:** When sheet flooring is placed onto fresh adhesive, air can become trapped between the floor covering and the wet adhesive. To remove the trapped air, use a palm/push board, working from the centre of the sheet toward the seams or edges. Afterward, roll the sheet into the tacky adhesive as it begins to develop.

Ensuring proper installation techniques and addressing underlying issues can help prevent vinyl flooring bubbling.



Water dispersion adhesive used over checker plate flooring

This is an example of multiple poor choices leading to issues: the adhesive bond to the subfloor is non-existent, allowing the flooring to expand and contract due to site conditions.



08 Tools for Successful Adhesive Transfer

Achieving good transfer requires a palm/push board or hand roller to push out trapped air, followed by heavy rolling (approximately 45kg minimum recommended by most manufacturers). This process embeds the flooring into the adhesive, flattening or dispersing the trowel notches, ensuring maximum transfer to the back of the floor/wall lining.



Palm/push board



Heavy roller

09 Terms and References

For Terms, References and Glossary of Terms see AS 1884:2021

www.standards.org.au/standards-catalogue/standard-details?designation=as-1884-2021