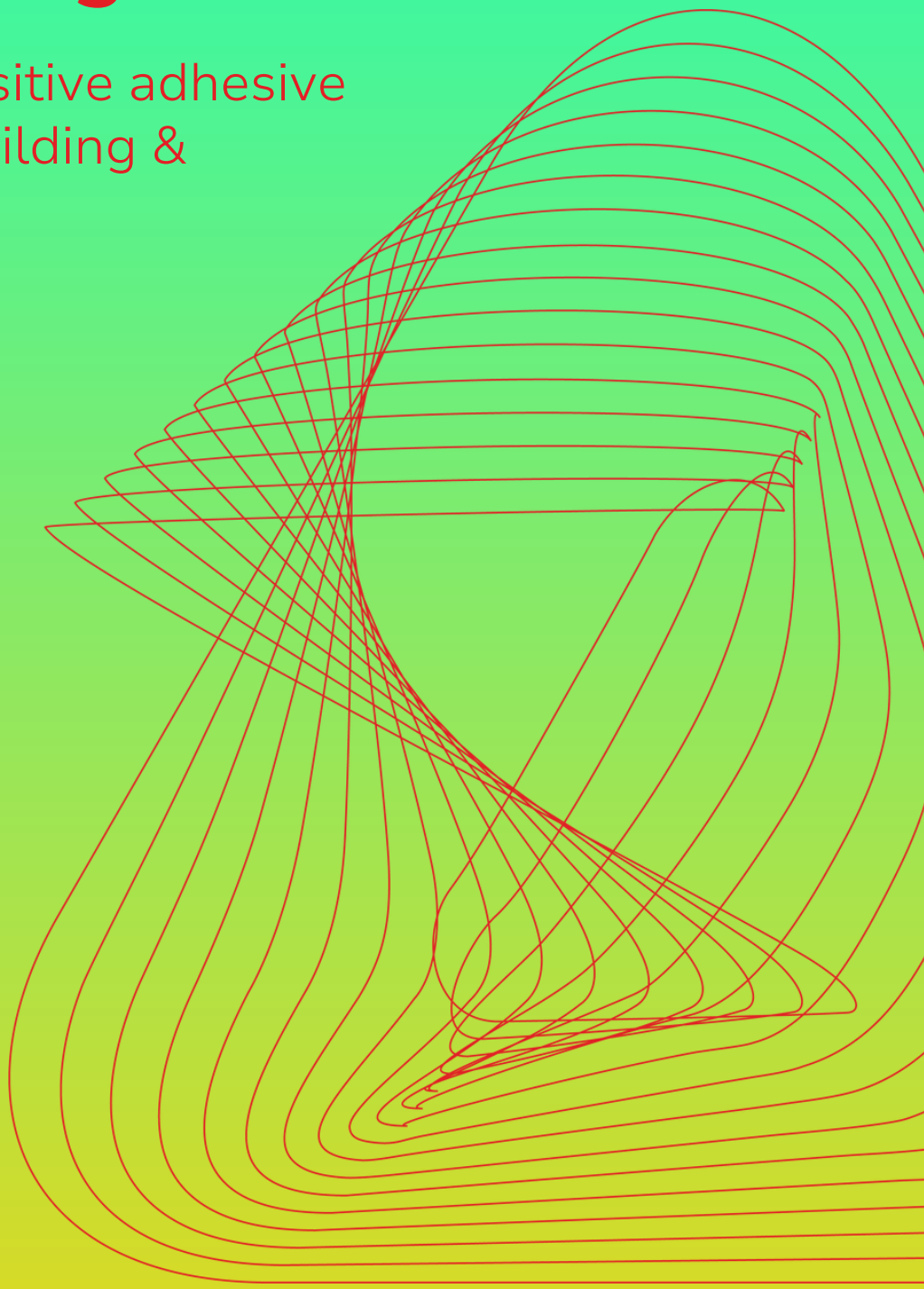
Decarbonizing the buildings sector

– Pressure-sensitive adhesive solutions for building & construction



AVERY DENNISON

tapes.averydennison.com/eu

INTRODUCTION

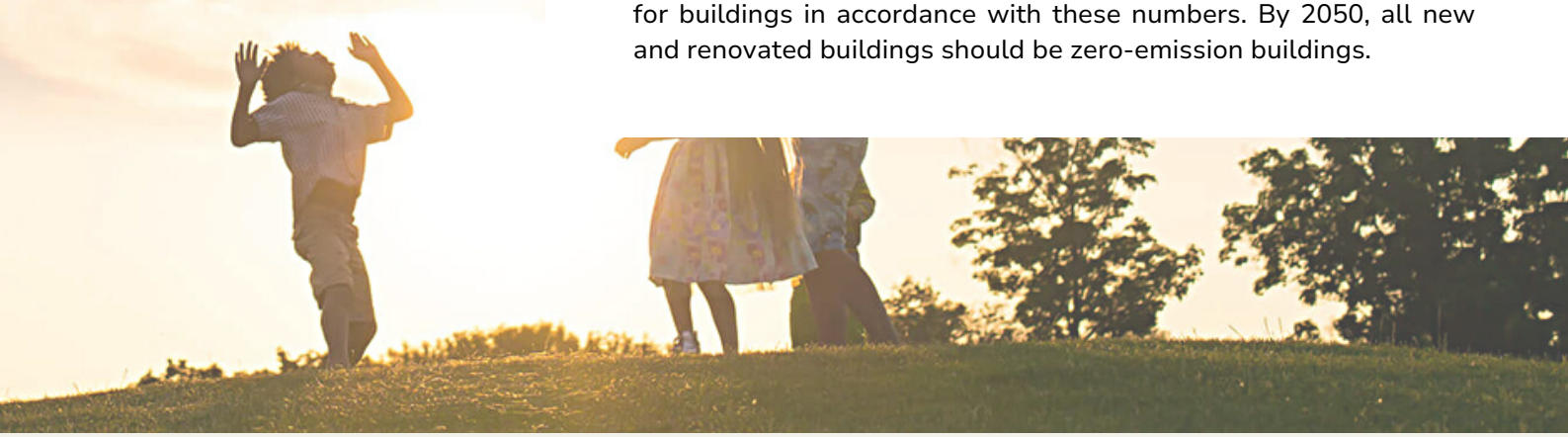
Buildings are responsible for over one third of the greenhouse gas emissions in the EU. Reducing these emissions – either through greater energy efficiency or reduced energy consumption – is crucial in order to achieve climate neutrality by 2050. Decarbonizing the buildings sector is critical to delivering these cuts.

At Avery Dennison, we take pride in an approach that is ahead of that curve. Find out how our pressure-sensitive adhesives contribute to the building techniques of tomorrow.

Building & Construction: energy ratings and regulatory

According to the BPIE, an independent center of expertise on energy performance of buildings and a leading adviser to the Council of the European Union, buildings account for 40 percent of final energy consumption and 36 percent of its energy-related greenhouse emissions. That opens up a huge potential for cuts, as about 75 percent of existing buildings are inefficient in terms of energy and will require large scale renovations.

A recent revision of the EU directive for energy performance of buildings sets up new, more ambitious energy efficiency standards for buildings in accordance with these numbers. By 2050, all new and renovated buildings should be zero-emission buildings.



Translated into practical goals

To reduce overall emissions, the sector must improve building energy performance, decrease building materials' carbon footprint, multiply policy commitments alongside action and increase investment in energy efficiency. The long and short of it: less energy used as well as more green energy amounts to fewer emissions.

New buildings owned by public bodies will have to be zero-emission by 2028. As of 2030, that goes for *all* new buildings. Energy performance certificates will be obligatory for all new buildings in the EU as of 2030. Solar energy installations must be installed on all new public and non-residential buildings by 2027, on all existing public and non-residential buildings undergoing thorough renovation by 2028, and all new residential buildings by 2030.

For existing buildings, the road map is a little more complex, as you can imagine. For non-residential buildings, member states have to set up minimum energy performance standards related to maximum amounts of energy that buildings are allowed to use, annually and per square meter. There will be two thresholds of the worst performing 15 and 25 percent respectively, representing the national building stock above these thresholds. By 2030, buildings in this sector need to be below the 15 percent threshold. By 2034, that shifts to the second threshold. For existing residential buildings, the average primary energy use is at least at level D (energy performance class level) by 2033. By the year 2040, the level will be set by each member state at such a class that ensures reaching zero-emission building stock in 2050, so that all buildings in all shapes and sizes have reached the overall goals.

Now let's take a look at how the technology behind our pressure-sensitive adhesives can help achieve these goals by contributing to sustainability in building & construction.

Avery Dennison Performance Tapes

Our performance tapes have become the option of choice in more than a few industries, as they have proven to be the better alternative for a growing number of applications. The easily tearable peel and stick approach, installed simply by adding pressure and without the use of tools, is completely unique to tapes. However, even with our pressure-sensitive adhesives (PSAs), there's no one size fits all resolution either. Every substrate, every environmental condition and every application method implies unique bonding challenges. *We offer a solution for all of them.*

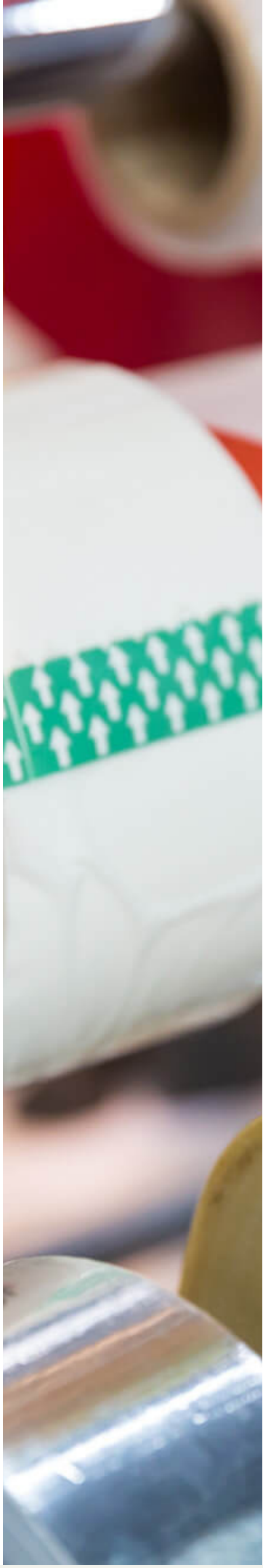
Adhesion with PSAs is not achieved by drying or curing, but the strength of the bond relies on the pressure that was applied during the bonding. This mechanical factor adds up to the chemical factor of the adhesive, creating unique specifications. The constant thickness of engineered adhesive tapes, from low to high coat weights, is a huge benefactor to the use of PSAs in building & construction. PSAs can deliver the constant adhesive layer thickness that is required – applying them allows for easy full surface application with a constant adhesive thickness or adhesive mass on the whole bonding surface. This in turn allows for a perfect weight distribution and a constant quality of application. Such reliability gives greater certainty of a consistent performance that is sometimes hard to achieve with liquid applied glues. In fact, tapes are the only way to design bonding processes into certified applications.

Added value

Tapes – in general – are an efficient way of providing added value. Adding a mounting or bonding solution to a product as a manufacturer unburdens the next player in the value chain by saving time in the application or execution. While self-adhesive products are more expensive compared to non-self-adhesive products, the total applicator's cost of ownership for the product goes down as a result of choosing a time saving bonding method.

On top of that, the expertise needed to select, purchase and handle the bonding method and check compatibility with the building materials needs to be accounted for as well.

If producers integrate and verify this research into their materials, a certain standardization starts to manifest which could prove hugely beneficial. As an added operational advantage, PSA tapes allow you to laminate in place A – under optimal conditions – and mount in place B, where the application is situated but may not have the right conditions, machinery or space for applying the first step – appeasing health and safety to boot.

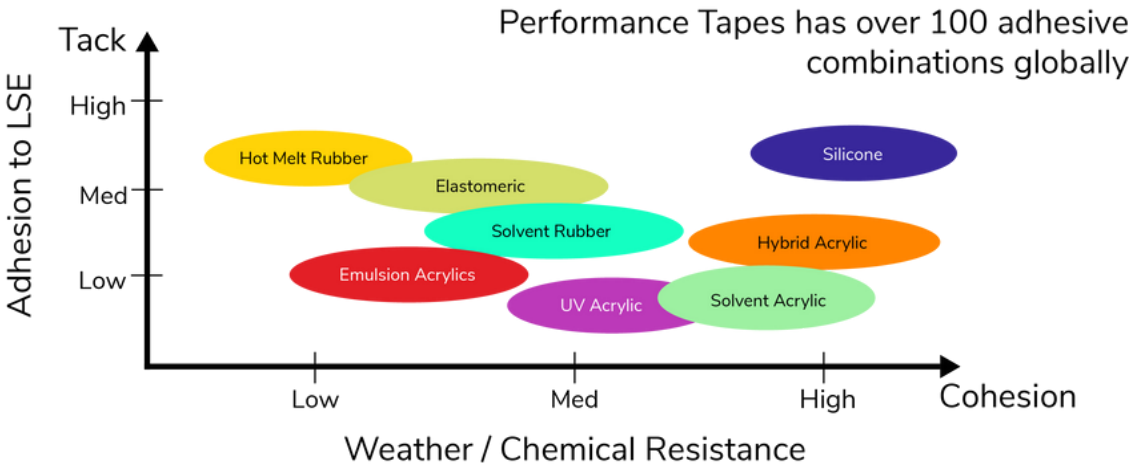


Adhesive properties of PSAs

The three adhesive properties that are most useful for characterizing the nature of a PSA are the tack (initial adhesion), the peel adhesion (adhesion), and the shear strength (cohesion). Tack measures an adhesive's ability to adhere quickly; the adhesion measures the adhesive's ability to resist removal by peeling, and the cohesion measures the adhesive's ability to remain in position under shearing forces. Hard to bond to substrates like plastics, painted metals and silicone rubber can be bonded by a PSA using a combination of good wetting ability of the adhesive, immediate tack and adhesion and a high bonding surface.

Furthermore, our PSA tapes cater to a diverse range of applications, while maintaining high standards. Our innovative tapes are resistant to plasticizers, extreme temperatures, chemicals, water and UV light. They deliver climate-appropriate structurally and aesthetically pleasing solutions. That multiplicity also applies to the hard- or softness of the adhesive, the initial tack, shear resistance and resistance to stress and load.

In fact, our Performance Tape division has over 9 different adhesive technologies in our portfolio to meet our customer's specific needs, totaling well over 100 adhesive combinations.



The variety offered here is a key enabler in discovering the right adhesive for the job. But that's not all. Differential solutions allow you to bond the unbondable – including materials like plastic, paper, metal, glass, wood, and some of the low surface energy materials like Polyethylene, and Polypropylene. Weather resistance and flame retardancy are covered too.

Additional advantages in lamination

Laminating within the context of building and construction refers to the process of layering two or more materials together to form a single composite material.

La-mi-nate [noun] – ˈlæm.ən.ət:
Any material that is made by sticking several layers of the same material together

As such, lamination covers a wide variety of applications. For example, they make draft strips, gas and moisture barriers, acoustical- and thermal insulation for buildings and homes. But tapes can also be used to temporarily fix building materials during construction or to tape various surveillance equipment to the ceiling – while they offer solutions for permanent mounting as well.

Common building materials who are made self-adhesive by lamination include foils/films and sheets of various materials, felt/cork/fibre and woven/nonwovens, soft foams (open cell foams for application in sound absorbing constructions, insulation and shock absorption and closed cell foams for application in moisture, thermal or UV resistant constructions, insulation, various sealings, filtrations), hard foams and hard common building materials for mounting applications, both permanent and temporary.

Of particularly high importance to this process are:

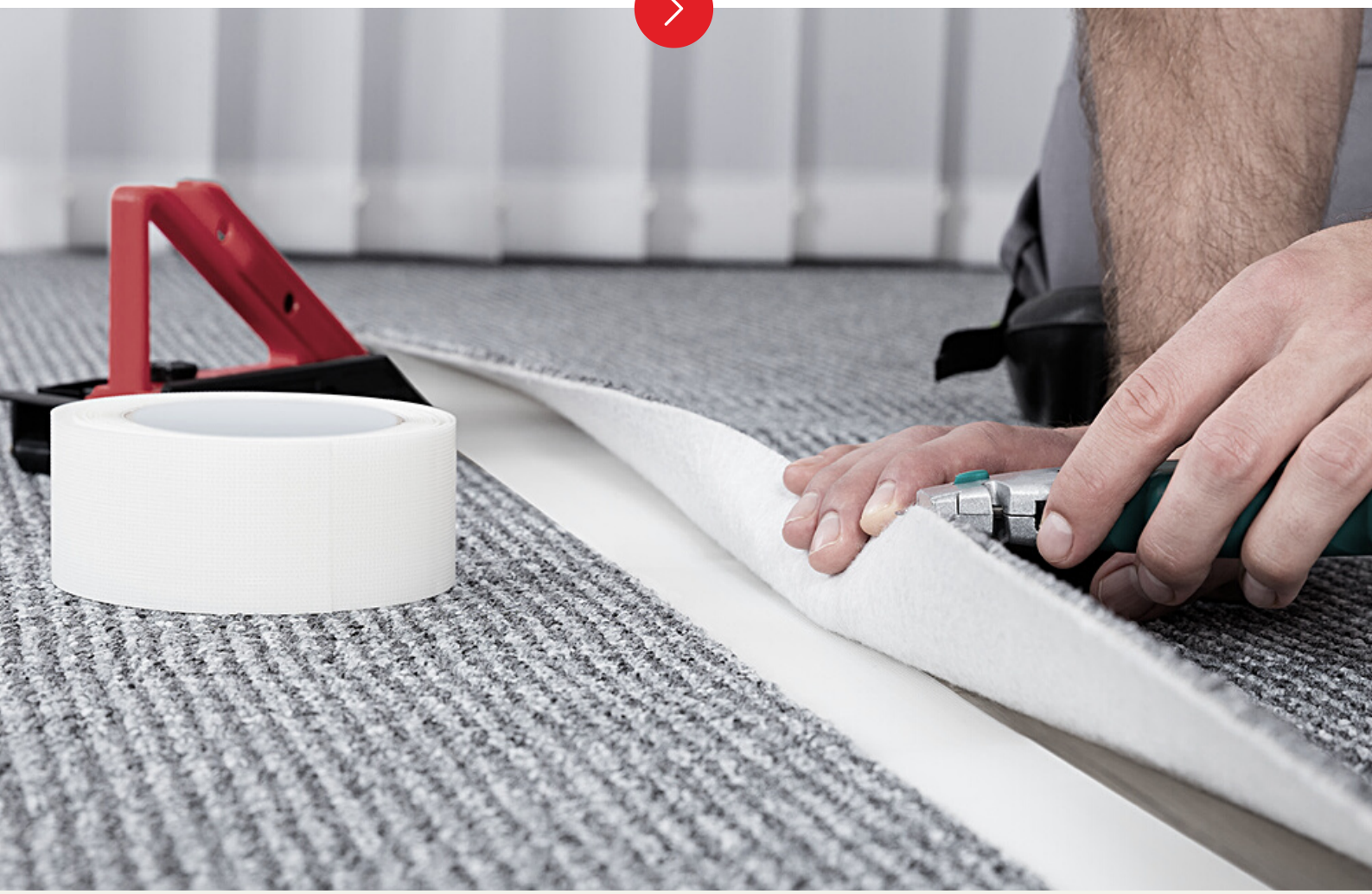
- Adhesive specs – Are the substrates to laminate a good match? This is key to achieve a high lamination and in turn efficiency and production speed. Higher initial tack and adhesion have a strong effect on conversion speeds as well.
- Flexibility in size – To match substrates in the right dimensions to minimize the generation of waste / scrap material. Avery Dennison is able to slit on various widths and deliver customized roll lengths as well as spooled tapes.
- Surface and surface energy – Flat, smooth, textured, rough, even, uneven? Surface variables have an effect on the type and the thickness of the adhesive layer to apply. Furthermore, low and extra-low surface energy substrates provide a bonding challenge for some adhesives – a challenge that our technologies have countered.

Tips, tricks and converting technologies

There are several more things to consider and a few converting technologies to touch upon here. For instance, there is pattern coating, which is when the adhesive is coated in patterns so as to not cover the full surface of the substrate it is coated on. In other words, perfect to create adhesive-free zones. Then there are additional finishing options to PSA tape solutions, like fingerlifts. To ease the liner removal on the construction side, several tools can be integrated in the tape design, from a full coverage to a fingerlift edge or an extended linger. A backsplit is available as well, while printed liners can be used to apply corporate branding or integrate any other form of communication to the end-user.

Available finish options

When any material is laminated with a tape, it often goes into the finishing process that will give it its application-ready state. Converting processes include shaping, die-cutting, kiss-cutting (splitting the liner), stamping, pressing and slitting or slotting.



Handling PSA tapes on the construction site

Building & Construction is an industry full of challenges. Luckily, anything from thermal insulation and sound absorption, heating and cooling units and weather strips, to pipe wrapping, fascia and cladding, and internal and external mounting – either permanent or temporary, and anything from decorative to smoke detectors and protection strips – can be demonstrably improved with the PSA tape solutions from our in-house R&D department.

Safety first, though. Building requirements for fire safety and complying to rigorous burning tests requires a holistic view to determine the right tape choice for a closure solution of pipe insulation. When it comes to the choice of adhesive, there are two routes to explore: there are flame-retardant adhesives that will help to prevent or slow down flame development, and there are non-flame-retardant adhesives designed to keep the seal closed as long as possible and thus protect the insulation from flame exposure. Low adhesive coat weights have a lower calorific value, which reduces the fuel available to a fire load.

As a mounting aid, tapes are part of a two-step process: temporary application (by the tape), which takes care of initial bonding and spacing, followed by permanent fixing with mechanical or liquid fasteners. In other words, tapes can have sufficient “holding power” to keep certain substrates who also need a mechanical anchorage. Simply align the substrate in its correct place or position by using the tape, then apply the mechanical anchoring.

What can tapes do, other than stick?

When you're talking about adhesives, the general purpose of bonding obviously sticks out. Sticking, in fact, is the very goal of adhesives. But that's hardly all our PSAs can do.

They offer a variety of benefits compared to other alternatives, especially when it comes to efficiency gains in construction. Our dry adhesives require no activation with water, solvent or heat, and firmly adhere to many surfaces with minimal pressure without the use of brushes, glue guns or tools of any kind. Professional contractors can return commercial spaces to service right away—a big plus for facilities that cannot afford downtime. It also allows contractors to schedule and complete more jobs in a shorter period.

Adding a tape to a construction can offer a variety of other mechanical properties as well;

- Scrim reinforcements – A glass fiber or polyester scrim is essentially a reinforcement net inside the adhesive layer, which can enhance dimensional properties. A scrim can for instance be very useful when laminated to a foam. The scrim will prevent the foam from being stretched when applied, so that it will not suffer from a risk of debonding when the material is returning to its original, not-stretched state.
- Carrier properties – In the case of double coated tapes, there is always a central carrier material. The choice of carrier material can influence properties like the thickness of the tape in the case spacing is required, or to match a substrate to allow for recycling, or to act as a layer with certain properties (strength, shielding, etc).
- Barrier properties – Barrier material for gas and moisture tight constructions: thin metalized self-adhesive films can provide a very low moisture-vapor transmission rate (MVTR) and a great gas barrier, for instance in double- and triple glazing.
- Additive properties – Additives can provide unique properties, including:
  - biocides to reduce mold growth;
  - fire retardants to meet flammability requirements;
  - glass fibers to improve slitting.

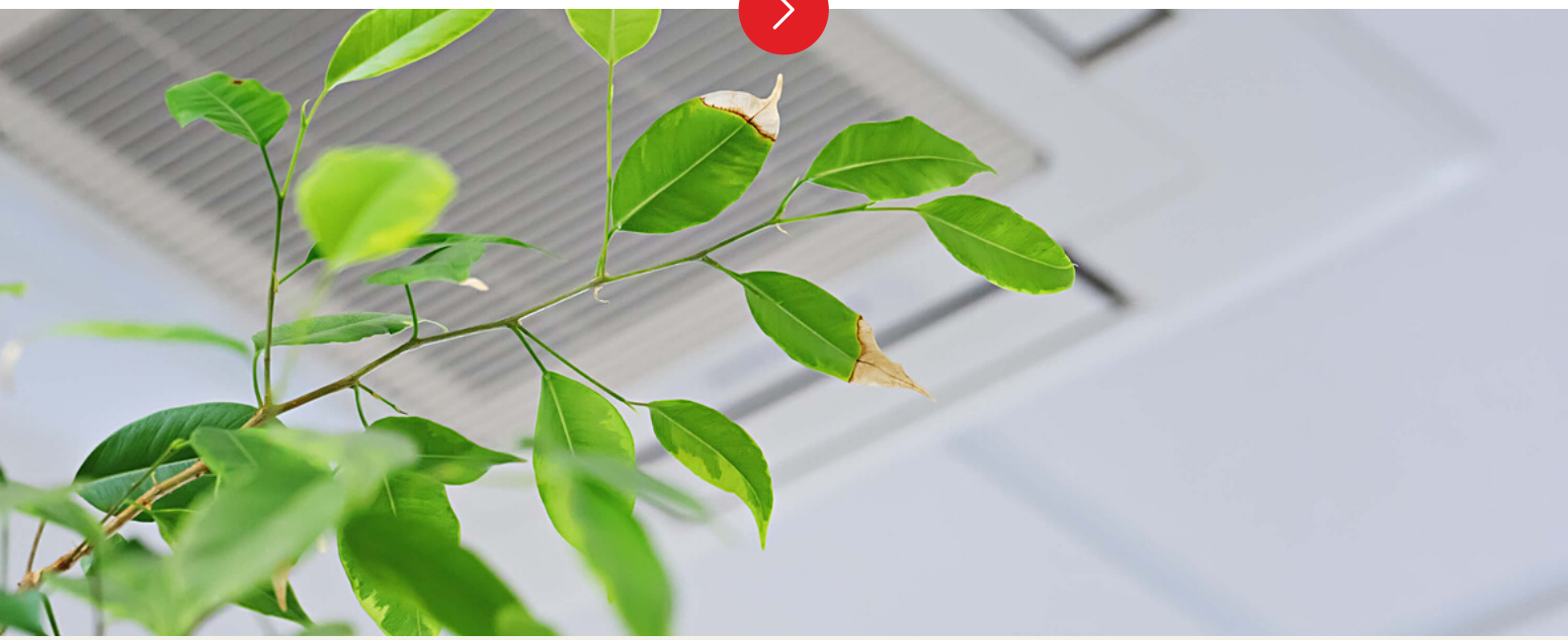
Indoor Air Quality

Indoor Air Quality is affected by a variety of factors, from climate and outdoor environment, ventilation, cleaning conditions and products used in households. However, building materials, particularly in flooring and walls, play their part as well. They can emit airborne particulates and volatile organic compounds that may be harmful.

The main culprits of poor indoor air quality are volatile organic compounds, VOCs – organic substances that evaporate at ordinary room temperature, easily dispersing throughout buildings and accumulating to much higher concentrations than outdoors. They include a variety of chemicals, some of which may have short- and long-term adverse health effects.

Concentrations of many VOCs are consistently higher indoors (up to ten times higher) than outdoors. Avery Dennison PSA tapes are low-VOC solutions, referring to levels that are not harmful to the environment or to humans. Low VOC helps to reduce the emission of smog-forming compounds when used in construction and remodeling projects. It is, in other words, hugely beneficial to the quality of air indoors.

Producing low-VOC building materials – and having the certifications to back that up – is not a unique approach, as they have become more widely available. However, Avery Dennison performance tapes are preferred over liquid adhesives in a growing number of applications, as they have proven to be the better alternative to the more traditional solutions.



Sustainability

To come full circle on the EU directive towards 2050, we will conclude with some of the many advantages of PSA tapes over the more traditional approaches when it comes to sustainability. It's not just governments and legislators that are seeking sustainable solutions. Due to increased awareness from both consumers and businesses, brand owners, end users and converters are all looking for solutions that convey a sustainable reputation, strengthen customer service and meet sustainability goals as well as recycling targets.

Avery Dennison is delighted to share significant leaps regarding reliable, sustainable and forward-thinking tape solutions. Across our company, we're looking at new ways to apply our materials expertise to invent and engineer solutions that advance the circular economy. However, liner waste is a big problem, even if it is the sole waste product.

Our materials are used in a wide range of industries – including building & construction, but also automotive, appliances, electronics, specialty industrial, medical and personal care segments. When you're applying thousands or even millions of adhesive tapes, it adds up – while recycling can be difficult and expensive. That's why our AD Circular Program stems the tide of liner waste and increases the supply of recycled liner material.

AD Circular in a nutshell

- Easy, transparent, cost-effective
- It works with any liner from any company
- It can move you closer to your sustainability goals and requirements
- It tracks the amount of waste you recycle and the amount of CO2 you avoid
- It supports a circular economy

Watch our Circular AD movie

Overview of practical B&C tape applications

Vapour & gas barrier – Warm-edge spacer

A functional self-adhesive film is a component within flexible warm edge spacer construction in double and triple glazing units. Film and tape have several functions, including acting as a moisture barrier, gas barrier and an adhesion promoter to the sealant. Warm Edge Spacers are used in Insulating Glass Units (IGU's), more commonly known as double glazing/triple glazing sealed combinations of double or triple glass window panes separated by an air/gas space to reduce heat transfer across part of the building envelope.

Weather strips

Weather strips or seals are EPDM foams applied to seal gaps around window and door frames. They stop the airflow through these gaps, preventing drafts and keeping conditioned air inside. They are used at installation or during maintenance. Avery Dennison Performance Tapes offers a full line of specially formulated high-performance pressure-sensitive tapes for the installation of peel and stick weather stripping. Our double coated, rubber based adhesive scrim tapes, with excellent weather and plasticizer resistance, offer a versatile solution for weather strips and other applications based on EPDM foams.

Removable adhesives for protective pads

Pressure-sensitive adhesives provide many benefits in the assembly and application of protective pads – these are an essential packaging material, used for protecting glass sheets, glass units and windscreens during transportation and storage. Windows and doors, due to the amount of glazing they contain, are some of the most fragile building components that need protection during transportation and construction.

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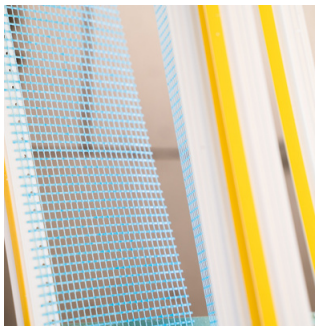


Exterior Building Profiles

Weather resistant and self-adhesive EPDM strips are installed at the edge of facade panels to absorb minor tolerances in the structure. They also seal off the structure from dirt and water, guiding the flow of rain to the outside of the building envelope.

Compribands

A compriband is an impregnated, pre-compressed foam sealing tape, for use around the perimeter of windows and doors, creating an air-, wind- and watertight seal in the process. It can be used for sealing the joint between window frame and surrounding walls or between two concrete structures, but also against insects in shutters, for panels, roof tiles, facades and much more.

Closure of pipe insulation and building envelope materials

Pipe insulation closure tapes are a type of tape used to seal and secure insulation around pipes. These pressure-sensitive adhesives are specifically designed to be compatible with insulation materials and their facing materials, and can help ensure that pipes are properly insulated to prevent heat loss or gain. In addition, the tape helps to protect the insulation from moisture and dust, while it plays a vital role in the fire behavior of the construction.

Airtight membrane splicing

Airtightness is a critical consideration within any structure, and for those building envelopes that aren't properly sealed, many problems can occur. From reduced energy efficiency to the deterioration of insulation, tapes are critical to preventing the adverse effects of poor airtightness. In the case of roof membrane splicing, tapes ensure that diverse surfaces can be connected and joints and leaks comprehensively sealed.

Fixation of cable channels and profiles (cable trunks or gutters)

When it comes to installing cable and wire tidying solutions, high performance adhesive tapes help to avoid the hassle, time and potential damage created by mounting cable ducting solutions with mechanical fastenings such as nails and screws. Avery Dennison's range of tapes perform on any trunking and mounting surface, even low energy substrates.

Intumescent strips

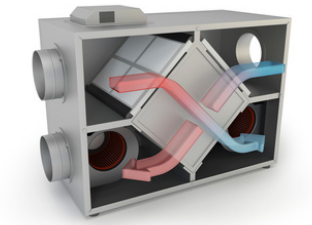
PSA tapes offer a viable option for assembling and securing foam or elastomeric pack seals prior to lid or connector attachment. There are appropriate PSA solutions for polyurethane, elastomeric or silicon seals. Our tapes can also be designed for easier seal opening to facilitate maintenance and recycling. Thermal insulating or intumescent layers can be used.

Sound / acoustic insulation

Various shock and sound absorption pads as well as spacer profiles that are capable of accommodating tolerance differences and damping vibrations. Our pressure-sensitive adhesives are engineered for high performance with a wide range of substrates. This includes the open-cell foams and felts being specified more frequently by OEMs for noise absorption/isolation, both inside and outside. The structure of these foams is often a bonding challenge for more traditional adhesives.

Thermal insulation

Avery Dennison's high-performance insulation glue and adhesive insulation tapes aid the assembly and installation of different insulation applications, from equipment and processes to ductwork and piping. Key applications include noise and thermal foam insulation tapes, gasketing, construction aids, air and water sealing, and more. Our glue for foam insulation is easy to laminate to various types of open- or closed-cell foams, with some containing scrims to reinforce mechanical properties.

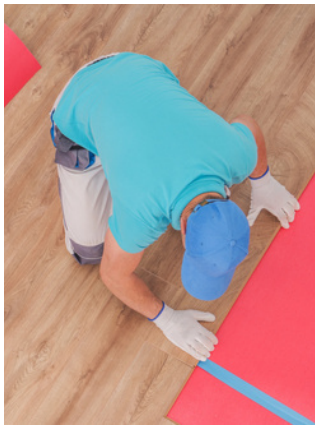


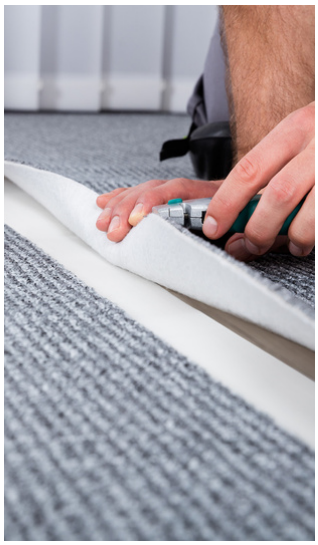
Noise and Vibration damping

Our silicone adhesives provide excellent environmental resistance. They offer a wide temperature application range (-60°C up to 280°C, or -75°F up to 535°F) and excellent vibration damping characteristics. They bond to silicone and other low surface energy materials, including adhesion to ultra-difficult substrates (such as silicone surfaces) with ultra-durable performance. Examples include SIL 1000 (FT 2103), a high shear adhesive and FT 0370 adhesive with increased tack.

Underlayment

Avery Dennison Performance Tapes offers a full line of specially formulated pressure-sensitive tapes for self-adhesive underlayment flooring applications. Our range of tape solutions can be applied across a range of different materials, including PE foam, (recycled) PU foam, XPS foam, rubber, cork, and (recycled) felt, that also come in different forms (rolls, sheets, folded panels). Furthermore, these can be used in combination with a vapor barrier.



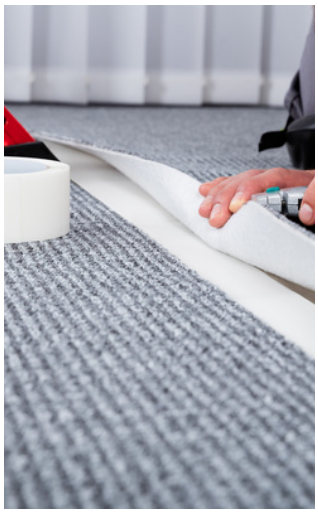


Flexible Flooring Fixation

Tapes offer greater ease of installation for flooring, to be used immediately. They come in the form of transfer tapes or double coated tapes, filmic or reinforced with scrims, and are suitable for various building materials, subfloors and underlayments. Also available are relatively high coating weights that conform to irregular/uneven backings and subfloors, while bespoke removable tapes can be produced when required and offer advantages in any future de-installation need. Our extensive, flexible range of tape solutions enables a sustainable and long-term approach to your future floorings, including carpets and resilient-, sports- and rubber flooring.

Wall or ceiling mounting

From fixing skirting boards and decorative tiles to walls, to applying cornices and other aesthetic fixtures to ceilings, mounting adhesives offer an easy-to-use solution that ensures the removal of mounted products doesn't damage the plaster behind it. PSAs provide many benefits in applications that relate to installations on or in ceilings. From the simple on-ceiling mounting of sensors, decoration, and devices like Wi-Fi access points to air valves and the specialized edge tape that keeps canopies free of weather and exterior influences, Avery Dennison offers a full line of specially formulated high-performance adhesives.



Bonding of EPDM seals

EPDM is a non-toxic, synthetic type of rubber that has gained widespread popularity for its excellent durability, great resistance and chemical compatibility properties in the industry. Besides the fact that EPDM rubber is one of the most waterproof rubbers available in the market, the material is also renowned for its excellent resistance to ozone, weather conditions, UV rays, and aging, making it a prime material for exterior applications.

Temporary fixing of construction material

Avery Dennison provides a range of permanent as well as removable adhesives designed for unique bonding requirements where dissimilar materials are involved. Products in this category include differential tapes with permanent adhesives on the laminating side in combination with removable acrylic adhesives on the mounting side. Temporary solutions are fully removable, leaving no single residue when removed, for instance for application of protection materials, or to prepare for de-installation as a sustainable end-of-life action.

Please refer to Tapes. AveryDennison.com for complete terms and conditions, including warranty terms, relating to this product. You should periodically review the site as terms and conditions are subject to change without notice.

The information contained herein is believed to be reliable but Avery Dennison makes no representations concerning the accuracy or correctness of the data. This product, like any other, should be tested by the customer/user thoroughly using end user conditions to ensure the product meets the particular requirements. Independent results may vary.

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