*The latest, cutting-edge tape solutions for carpeting untangled by industry experts.*

# **Threading the needle:** The future of industry-leading flooring tapes routed in material science

AVERY DENNISON

# Introduction

Avery Dennison Performance Tapes specializes in the development and production of high-quality pressure-sensitive adhesives and tapes for a wide range of applications in the automotive, appliance, electronics, building and construction, general industrial and personal care segments. Our top-of-class expertise and global scale enable us to deliver innovative, sustainable, and intelligent solutions to customers around the world.

## Avery Dennison Performance Tapes

The advantages of Avery Dennison flooring tapes are virtually endless. From sustainable assembly, ease of use, installation (and de-installation) to its low-waste liners, recyclability and – perhaps most importantly – its effect on a healthy indoor air climate. But don't just take our word for it. We'll take you through some must-know subjects on these next pages.

## Indoor Air Quality

## Ease of installation and de-installation

## Recyclability & Sustainability

## Alternative Assembly

# Don’t let flooring put a ceiling on your health

It is easy to overlook air as a potential risk factor to our health and well-being; we can’t really see it. But, as a vast number of studies over the past 50 years have demonstrated, the quality of the air we breathe is something to really consider. *We know we do*.

## Indoor Air Quality

We’re all spending an increasing amount of our time indoors – about 90 percent[1] of every day. Meanwhile, the concentration of pollutants indoors is up to five times higher than outdoors[2], due to volatile organic compounds (VOCs), chemicals, biologicals and all kinds of particles. That’s why Indoor Air Quality (IAQ) remains a very topical issue, subject to more and more stringent regulations as well. It’s also why Avery Dennison performance tapes are low VOC certified, offering a clear advantage over liquid adhesives based on solvents (or containing certain additives), reflecting our commitment to the improvement of health and safety wherever our products are used. *Let’s talk IAQ and VOC.*

## Air pollution

Indoor air quality is the relative measure of harmful pollutants that can be found in the air of any indoor environment[3]. Now, air quality is mostly invisible. That’s why it’s easy not to think about it. However, air pollution is the single biggest environmental threat to our health according to the World Health Organization (WHO).

Nine out of ten people worldwide breathe polluted air by simply living and working in places where pollution levels exceed WHO guideline limits[4].

Exposure to air pollution is the cause of over seven million premature deaths every year[5]. That’s double the number of people dying from HIV, malaria and tick-borne encephalitis combined[6]. Moreover, it can lead to increased mortality from stroke, heart disease, chronic obstructive pulmonary disease, lung cancer and acute respiratory infections[7].

## IAQ and health

Especially children, pregnant women and the elderly are highly susceptible to negative effects from air pollution. Prolonged exposure to high levels of air pollution can affect human respiratory and inflammatory systems. Poor IAQ not only causes headaches and dizziness, it can also exacerbate allergies and asthma – the most common disease in childhood. In most cases asthmatic symptoms subside during young adulthood, but one in three relapses during adulthood, strongly linked to poor IAQ in the workplace environment[8].

The distribution of the disease suggests a strong association and link with our ‘Western’ environment, possibly reflective of urbanization and our tendency to spend ever more time indoors. Which is where flooring can affect the quality of air through VOCs.

1. https://www.epa.gov/report-environment/indoor-air-quality
2. https://www.epa.gov/report-environment/indoor-air-quality
3. https://www.tarkettsportsindoor.com/en/sports-flooring-guide/indoor-air-quality
4. https://www.who.int/data/gho/data/themes/air-pollution
5. https://www.who.int/data/gho/data/themes/air-pollution
6. https://www.ft.com/content/dc088e34-1577-11e8-9376-4a6390addb44
7. https://www.tarkettsportsindoor.com/en/sports-flooring-guide/indoor-air-quality
8. https://www.erswhitebook.org/chapters/adult-asthma/

# VOCs – Volatile Organic Compounds

## Sick Building Syndrome

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 term Sick Building Syndrome (SBS) is used to describe situations where people experience negative health effects from spending time in a home or building[9]. The syndrome was first described and reported during the 1970s among employees working in brand-new office buildings. The affliction was officially acknowledged in 1984, when the WHO published the first report mentioning SBS as a real and valid disease caused by well-determined and clear causes, namely poor IAQ[10].

## SBS and IAQ

Research into SBS has demonstrated a clear and unambiguous link with poor IAQ. The most effective remedy against SBS consists of reducing or eliminating the risk factors.

Reducing risks can be done by increasing ventilation, regular and thorough cleaning of floors and furniture, and keeping the ambient temperature low. However, eliminating risks requires a more structural approach – by avoiding building materials that emit harmful chemical components. Which finally brings us to the now-oft used abbreviation VOCs.

9. https://www.e-gezondheid.be/het-sick-building-syndrome/actueel/1165
10. https://mens-en-gezondheid.infonu.nl/aandoeningen/101550-oorzaken-en-symptomen-sick-building-syndrome.html

## VOC & low VOC

The main culprits of poor IAQ are VOCs; organic substances that evaporate at ordinary room temperature, thus 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[11].

Low VOC refers to volatile organic compounds that are not harmful to the environment or to humans. It mostly refers to paints and other products that have a very low or zero VOC, including cleaners, sealants and of course adhesives. Low VOC helps to reduce the emission of smog-forming compounds when used in construction and remodeling projects[12].

Low VOC is, in other words, hugely beneficial to the quality of air indoors.

## Dedication across the board

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 an excellent alternative to the more traditional solutions – most notably for their unique suitability for indoor use as it relates to air quality. That goes for carpet and tile pads, but our portfolio covers everything from resilient flooring and underlayment to skirting boards, profiles, trims and even sports flooring as well.

‘However, Avery Dennison Performance Tapes are preferred over liquid adhesives in a growing number of applications, as they have proven to be an excellent alternative to the more traditional solutions.’

11. https://www.epa.gov/indoor-air-quality-iaq/volatile-organic-compounds-impact-indoor-air-quality
12. https://www.corrosionpedia.com/definition/1891/low-voc

# VOC & Carpet

## Carpet

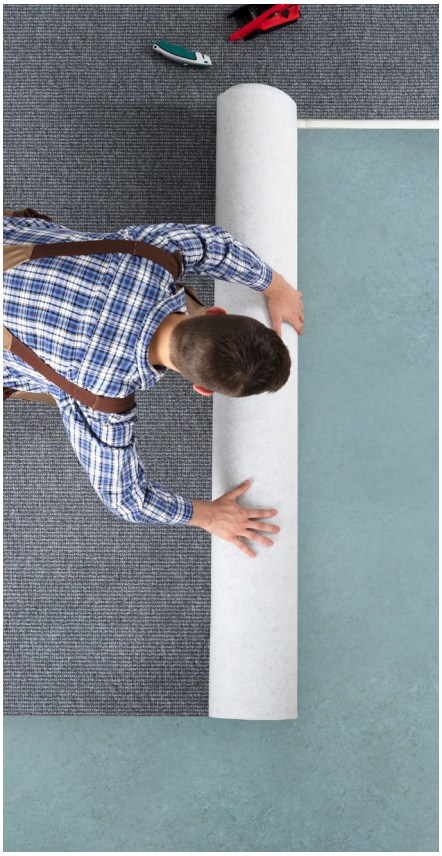
Carpet offers acoustical and comfort benefits that are generally not available with other floor coverings. However, the way a new carpet smells is usually an indication of VOC emission, released most notably right after installation. Luckily, the days of complex sets of materials are behind us, as recyclability asked for a different approach to carpets. At any rate, a low VOC carpet has been specifically manufactured to reduce the emission of VOCs from any of its components, whatever the fabric, the backing and the adhesives.

## What to look for

If carpet is your choice of flooring material, be sure to select carpet that:

- has been tested and is compliant with country-bound regulations and eco labels with regards to VOC emissions;
- can be easily cleaned and maintained;
- is specifically manufactured to prevent liquids from penetrating the backing layer;
- can be installed with low VOC adhesive or by way of an adhesive-free free-floating system;
- can be easily removed without the use of toxic chemicals;
- is unrolled and aired out by the supplier in a clean, dry warehouse before installing it.

‘Luckily, the days of complex sets of materials are behind us, as recyclability asked for a different approach to carpets.’



# VOC & Resilient flooring

## Resilient flooring

The second most commonly used floor type for general use is resilient flooring.

Resilient flooring is commonly used for high-traffic areas. While there are advantages and disadvantages to any flooring choice, regular and effective cleaning and maintenance is essential in keeping floors dry and clean, thus avoiding soil, pollutants, and moisture from accumulating and subsequently spreading throughout the building.

## What to look for

If resilient flooring is your choice of flooring, select a floor that:

- has been tested and is compliant with country-bound
- regulations and eco labels with regards to VOC emissions;
- can be easily cleaned and maintained with low VOC cleaners and finishes;
- can be installed with an adhesive-free click-and-lock system or is self-adhesive (pressure-sensitive adhesive on the back of the flooring panels).;
- uses high-performance coatings to reduce
- maintenance costs and use of cleaners and floor finishes.

# VOC & Adhesives

## VOC's in Adhesives

VOCs in adhesives and sealants are a necessary component to make them fluid and workable. That's one of the reasons pressure-sensitive adhesives have our preference, as they are significantly lower in VOC emission compared to liquid adhesives.

Pressure-sensitive adhesives (PSAs) are used in a wide array of applications, ranging from floors and construction materials, to labeling and packaging, mounting graphics displays, and assembling electronic devices[13] . PSAs hold two surfaces together solely by surface contact, which is achieved by firm initial external pressure.
These dry adhesives require no activation with water, solvent or heat, and firmly adhere to many dissimilar surfaces with minimal pressure. PSAs can be used for bonding materials such as plastic, paper, metal, glass, and wood, including some of the low surface energy type materials like Polyethylene and Polypropylene.

As far as choices for adhesives go, PSAs offer a variety of benefits compared to other alternatives, be it glue-down, click-and-lock, or free-floating installation methods. They are easy to install by way of peel-and-stick installation and are very DIY-friendly, making specific skills and tool sets redundant. What's more, their lower VOC emission results in significantly less exposure to harmful substances throughout the value chain. Thanks to sustainable raw material usage, PSAs reduce waste for landfills as well.

'PSAs can be used for bonding materials such as plastic, paper, metal, glass, and wood, including some of the low surface energy type materials like Polyethylene and Polypropylene.'

13. https://www.adhesivesmag.com/articles/88511-pressure-sensitive-adhesives-101

# Low VOC Certified

## Certification

Various obligatory and voluntary national and international measurement standards have been developed for IAQ because of the vast importance of tackling these health issues

These standards set out minimum and maximum values that need to be met by relevant product manufacturers, which in turn are tested and monitored by accredited third-party laboratories. In the case of Avery Dennison's PSA portfolio, we have selected Eurofins. Eurofins BioPharma Product Testing is a provider of laboratory testing and manufacturing services to the international life sciences market.

## Stay safe

We're spending more time indoors than ever. At home, at the office, in school, in the gym, in public transportation systems – we are constantly exposed to much higher concentrations of pollutants and biological contaminants than would be the case outdoors, where these harmful substances evaporate and disperse much faster.

Our modern, indoor lifestyle has created worsening health issues, ranging from short-term illnesses to long-term medical conditions, and even fatalities. These negative effects are encountered across the board, from the general population to particular, vulnerable groups such as children, pregnant women and elderly people.

There are temporary, reactive measures, such as proper ventilation, thorough cleaning and a low and constant ambient temperature. However, to properly protect the air quality of any indoor environment, one should first and foremost seek to eliminate any and all potential sources of contamination that originate from flooring and other building materials.

Make sure to always opt for low or no VOC options when selecting materials such as flooring, wall and ceiling materials, adhesives, paints, coatings, and sealants. Trusting independently developed, tested, controlled, and issued standards and accreditations are your best bet at installing the safest and healthiest options.

Don't let poor IAQ ruin your quality of life. Choose quality flooring and building materials.

# Performance Tapes - Ease Of Installation

The latest, cutting-edge tape solutions for carpeting and other flooring, untangled by industry experts. A brief overview of the advantages of performance tapes over the more traditional solutions for permanent, removable and repositionable flooring options.

## Introduction

In a world of ever-evolving needs of customers and consumers, Avery Dennison is delighted to share significant leaps regarding reliable, sustainable and forward-thinking tape solutions.

Conventional installation methods for flooring and the more traditional solutions such as liquid adhesives have well-known drawbacks. Glue-down systems raise air quality concerns for users and require hours of curing, for one. Click-in-place floors dispense with glue but are free-floating, noisy and can be damaged by sunlight and heat – which can also lead to surface irregularities. In addition, loose-lay-systems have less qualitative acoustic properties. Here, we focus on the ease of installation and de-installation of performance tapes and their many other advantages over the aforementioned traditional approach.

In this section, we'll be discussing tape solutions for carpet flooring and tile pads (for modular flooring) in particular, but the performance tapes portfolio covers everything from resilient flooring and underlayment to skirting boards, profiles, trims and sports flooring.

## Advantages of flooring tapes

Innovative pressure-sensitive adhesive (PSA) solutions are the new generation for any type of flooring situation. They are fitted with an adhesive, but not comparable to a generic liquid adhesive. The adhesive in our tapes is pressure-sensitive, bonding primarily based on pressing – which is hugely advantageous for installation. Our portfolio consists of PSAs of different coat weights and strengths pre-applied to carriers, then covered with a special release liner. They are used for their myriad of advantages, as they offer a variety of benefits compared to other alternatives, be it glue-down, click-and-lock, or free-floating.

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. The release liner protects the adhesive before it is removed.

## Matching solutions

Our general purpose tapes add value in a variety of ways, helping converters solve their issues. Solving a variety of flooring challenges has always been at the heart of our solutions. We understand that different questions ask for different answers. Carpet, whether it be rolls or tiles, has a different purpose in each unique situation, both in terms of application and usage period – from removable and repositionable to permanent.

Broadloom for instance, also known as room-wide (under)carpet, is usually installed with a bond at the perimeter of the carpet: carpet backing to subfloor. Various subfloors and carpet backings are out there and determine tape construction and adhesive selection. From double coated scrim tapes to transfer tapes with high coat weights of acrylic and rubber adhesives – there is an Avery Dennison solution for every purpose.

# Ease of installation

## The new generation

Innovative PSA solutions offer an improved bonding option. They consist of a dry adhesive laminated to the flooring product during production and covered with a release liner. The liner is removed during installation. Resilient and carpet floors attached with pressure-sensitive adhesives are highly stable and perform better acoustically than most click systems. Plus, floors can be easily removed for renovations without damaging the subfloor.

Tape solutions qualify for permanent and temporary bonding, from tile pads and carpet floors to underlayment applications, and from PSA for the fixation and installation of floor substrates, skirting boards, profiles and trims to multilayer production.

## Sustainable and eco-friendly

The newest PSAs meet the highest standards for sustainability and Indoor Air Quality (IAQ) performance. Manufacturers and distributors of glue-down flooring products face daunting IAQ regulations in Europe and the U.S., and even stricter rules are on the horizon. Further, some flooring manufacturers employ liquid adhesives in their production processes that create excessive scrap and increase exposure risks for workers as well.
New varieties of PSA tapes can achieve full compliance with current as well as projected regulations. Replacing liquid adhesives with PSA solutions helps manufacturers meet these rules, while limiting employees and end users' exposure to volatile organic compounds (VOCs) that are typically associated with liquid adhesives. Moreover, they install easily even by do-it-yourself standards and leave the floor immediately ready to use.

## Ease and convenience

There are benefits for everyone involved here — from flooring manufacturers and distributors to professional contractors, installers and homeowners. Compared with both glue-down and click-in-place flooring, self-adhesive floors are easier to install, making them especially appealing to homeowners and DIYers.
Homeowners and DIYers often find conventional floor bonding methods difficult and unforgiving. But they can tackle PSA flooring projects with ease. Primers or underlayment are usually not needed. Just peel-off the liner from the flooring plank or tile and press it down. Once the floor is laid, it's ready for immediate use. By adding PSA peel-and-stick products to their existing offerings, flooring manufacturers can broaden their product portfolios, reach new customers and target the growing DIY market.

## Critical advantage

Flooring contractors and installers contending with a shortage of skilled labor will find simplified installation a critical advantage. With easy-to-install PSA solutions, they can assign workers with moderate training and experience to floor installation tasks, lessening the need for highly skilled workers or the need for any kind of additional tools.

Unlike glue-down flooring which can take 48 hours to completely cure, PSAs are set by pressure and require no cure time. Professional contractors can return commercial spaces to service right away—a big plus for facilities like hospitals that cannot afford downtime. This also allows contractors to schedule and complete more jobs in a shorter period.

Durable and multifunctional [ca. 80]
Tape solutions qualify for permanent and temporary bonding with various materials, subfloors and underlayment. Anything PVC, vinyl and rubber to cement or wooden subflooring is compatible. Moreover, cleanly removable solutions are a key element to consider in the afterlife of flooring and subfloor.

Tapes have excellent aging performance, both in application as well as in terms of storage. Shelf-life of liquid adhesives, on the other hand, is different. Any liquid adhesive solution in stock will have to be put to use within the year, whereas tape will remain ready for application for much longer than that. Two years is the standard, but five is hardly unusual.

## Ease of use, time-saving, waste-avoiding

From DIY installers and professional contractors to flooring manufacturers and distributors, the irrefutable advantages of tape solutions are catching on. It's not hard to see why. The easily tearable peel & stick approach, installed simply by adding pressure and without the use of tools, is completely unique to tapes. Avoiding costly wait times with immediately walkable floors and the obvious recyclability benefits are a nice – but important – upside.

And have we mentioned it's the definitive solution to avoiding the stress related to the short window of applying liquid adhesives as soon as the lid comes off the bucket?

# Examples of easy installation

## High tack tile pads

For a practical example of the ease of installation, let's look at these self-adhesive high tack tile pads for a user-friendly and glue-free installation of modular flooring substrates. Tile tabs are used to install modular floor systems as a free-floating system without connecting the modular floor to the subfloor, whilst creating a connection between the floor tiles. This adhesive holds the tile in its position, while it remains possible to lift up the tile without leaving adhesive residue behind, thus leaving the subfloor unimpacted.

## Tear, place, compile

Tape is a preferable alternative to the installation method where carpet tiles are installed with a liquid adhesive applied to the subfloor. Our engineered performance adhesive has excellent resistance to plasticizers, chemicals, moisture and temperature. There is a strong connection to the floor substrate over time.

Just tear off the tile pad from the roll, place the tile pad below the modular floor substrate and simply compile and press down for bonding. There is a high initial bond to a variety of carpet tile backing materials, with no protective liner and no waste.

## Integrated modular floor tape solution

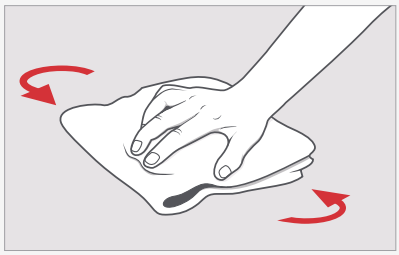
Here, a double coated tape on a thin polyester carrier is applied, fitted on one side with a permanent adhesive that is laminated to the backing of the tile. The other side holds a removable adhesive which is placed in contact with the subfloor when tiles are installed, after the liner is removed. The high strength adhesive holds the tile in its position with excellent adhesion regardless of the type of backing, while it remains possible to lift up the tile without leaving adhesive residue behind, thus leaving the subfloor unimpacted.

## Peel, position, push, remove

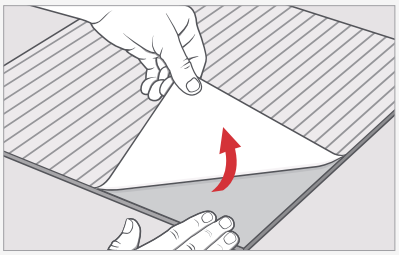
The tape is applied with remarkable convenience whatever the backing may be – from recycled vinyl composite, PU foam, rubber foam, felt and jute to woven and NW fabrics, latex, bitumen, et cetera. Just prepare the subfloor by removing dirt, oily surfaces and remains of old adhesives, remove the tape liner, position the tile and gently push down on the surface (or use a roller). When needed, simply remove by lifting the tile. The adhesive can even be reapplied several times depending on the type of subfloor.

**Installation**

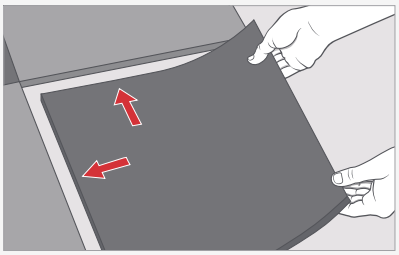
1. Prepare subfloor, removing dirt, oily surfaces, remains of old adhesives.



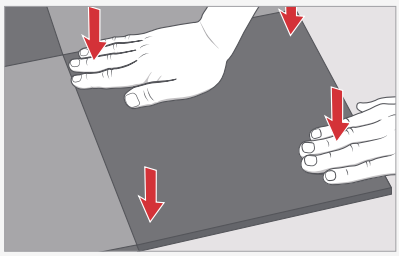
2. Remove liner.

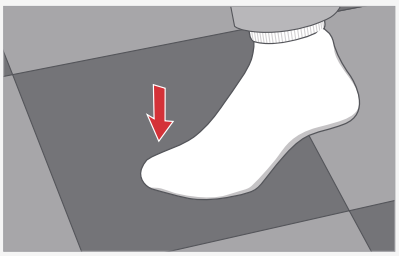


3. Position the tile.

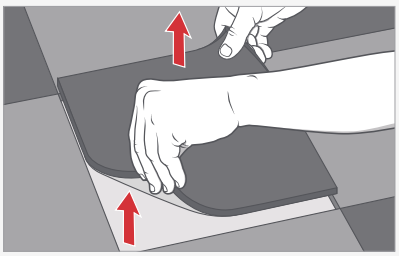


4. Gently push the whole surface of each tile down on the surface, or use a roller.





5. When needed simply remove by lifting the tile. The adhesive can be reapplied several times depending on the type of subfloor.



# De-installation

## Removable and clean

All of the aforementioned advantages that make tape solutions unique when it comes to ease of installation apply to de-installation as well. For starters, the removability – on any given subfloor – is a huge upside, especially compared to generic liquid adhesive solutions.

Carpet flooring or tiles for instance, can be removed without any residue at all, as the subfloor is immediately ready for the next removable application – which goes a long way when it comes to event carpeting for conferences, exhibitions and trade fairs as well. There is simply no impact of any kind on subflooring. And that applies to permanent solutions as well. At end-of-life, you just lift up the flooring, tear and remove.

In fact, it's so cleanly removable that it's even possible to isolate the tape from the flooring and recycle both separately. When liquid adhesive is cured, it is no longer removable. Flooring with tapes however comes away clean, separable into different waste streams.

Additionally, many carpet fibers these days are produced from one single material (mostly PP & PET). To be able to completely recycle and reuse it, their mounting tapes can be made with the same carrier material so that both the product and the installation means can be wasted and recycled together, in other words combined in the same waste stream.

***Photo:*** *With the right PSA, no extra cleaning work is required when removing the flooring*

# Recyclability – A key feature of Avery Dennison Tape Solutions

Sustainability isn't a thing we do – it's our focus on how we do everything. At Avery Dennison, we have pledged to deliver innovations that advance the circular economy and reduce environmental impact. Let's talk recyclability.

## Introduction

We take pride in our approach. As a world-class operation focused on developing and manufacturing high performance solutions for a broad range of applications, delivering innovations that advance the circular economy is always top of mind. As a member of the Circular Economy for Labels (CELAB) consortium, we organize collaboration among other companies to bring that economy to life faster. We implement and advance technologies to enable recyclability, extend the lifespan of materials, reduce waste, increase recycled content and integrate opportunities for circular processes across our industries.

## Sustainability

We reduce our environmental footprint by decreasing our greenhouse gas (GHG) emissions, increasing our water efficiency and protecting the forests from which our products are derived. As a leader in our industries, we engage with our suppliers, customers and value chain partners to drive change that protects our climate and ecosystems.

We champion transparency, collaboration, equality, diversity and inclusion. Our business contributes to the economic livelihoods of people and communities across our value chain. We serve as a force for good in our operations by promoting safety and enhancing the employee experience, as well as in our communities by investing in programs that advance women's empowerment, sustainability and education. By collaborating with our customers and suppliers, we can deliver a more sustainable future.

## Recyclability

There are several overarching reasons to campaign for recyclability as well. For starters, our industry is seeing more and more regulation and legislation – and rightfully so.
In the EU, there is the European Green Deal, the Waste Framework Directive, the Single Use Plastic Directive and the Packaging Waste Directive – to name a few. As a corollary, there is an uptake in demand for 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. As this brochure aims to make clear, they need not look any further.

# Avery Dennison circular

## Eliminating liner waste

Avery Dennison is serious about sustainability. We have set clear goals to dramatically improve recyclability and to reduce waste across the whole value chain. Our materials are used in a wide range of industries – not only building and construction, but also automotive, appliances, electronics, specialty industrial, medical and personal care segments.

In a world of ever-evolving needs of customers and consumers, Avery Dennison is delighted to share significant leaps regarding reliable, sustainable and forward-thinking tape solutions.

However, liner waste is a big problem, even if it is the sole waste product of our solutions. When you're applying thousands or even millions of adhesive tapes, it adds up. Recycling can be difficult and expensive. That's why we have developed AD Circular to help out.

## Liner recycling program

Our AD Circular Program stems the tide of liner waste and increases the supply of recycled liner material. It also strengthens your own sustainability story and helps you achieve your goals for recycling, reducing greenhouse gas emissions, and more. It is our latest contribution toward the establishment of a circular economy, and one of the many ways we're enabling recycling and advancing the use of recycled materials.
Because together we can eliminate liner waste.

AD Circular is a very easy 3-step solution. Firstly, you sign up online so that we can provide however many boxes you need for your leftover liners. Then, you schedule a pickup date when you're at capacity. Our helpful website application does all the work for you. The third step is the best one: simply enjoy the results, while we create new materials.

Using our website, you can see how much waste you have recycled, how much emissions you have kept out of the atmosphere, and more. It even provides certificates to show what you have accomplished, making it easier to meet your environmental targets. Do you have liners from another manufacturer? We'll take them too!

There's no reason to worry about the price either. AD Circular probably costs about the same as what you are already paying for liner disposal. Better yet, it might even help you save some money, as we also handle all the paperwork and regulatory matters.

## 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

# Sustainable solutions

## Regeneration

We're not content to simply reduce our own impact. We're looking at regenerative practices. We're looking at ways that we can apply what we do well to make whole systems better – from the adhesive industry to communities to the environment. AD Circular is an example of how, working together, we can meet the challenge of reducing liner waste.

***But there's more.***

Recyclability of materials has taken a step as well. Materials are now being made with rigorous focus on separability, addressing end-of-life issues. Tape can play a huge part in the approach. One of the major challenges in carpet recycling for instance has always been that carpets can consist of hundreds of components. The process of separation can be rather costly, which has led to the development of mono materials in carpet production.

It's been a while since producers relied solely on synthetic materials – in other words, materials made up of multiple parts – to manufacture carpet. The days of those complex sets of materials, irreversibly glued together, are behind us, as recyclability asked for a different approach. The industry has undergone substantial technological advances, with many producers having switched to using a single material, offering obvious advantages when it comes to end-of-life and recycling. Product circularity has become increasingly important– enabling a circular economy through regenerative products and process design

## Cradle to Cradle

'Cradle to Cradle Certified' or C2C is the global standard for products that are safe, circular and responsibly made. For over a decade, C2C has been helping leading brands, retailers, designers and manufacturers across the value chain to innovate and optimize materials and products according to the world's most advanced science-based measures.

A trend following on from that in the carpet industry has been to use the same material for both carpet face and backing, further avoiding the costly process of separation and purification – taking the recyclability of carpet a long way further. New technologies have offered the freedom to manufacture carpet from fully circular mono-materials such as polyester (PET), polypropylene (PP) and polyamide (PA6, PA66). But that's not all.

## Carpet to Carpet

Mounting tapes can be made with the same carrier material so that product & installation means can be wasted & recycled together, in other words combined in the waste stream.

Again, this is where Avery Dennison comes in. To effectively facilitate a true carpet-to-carpet approach, adhesive layers are summoned to not only bond during assembly, but also debond during recycling. We offer adhesive technologies that allow for temperature-related debonding on demand. Some of our high performance transfer tapes are in fact being used in an alternative carpet assembly process where tape features as mechanical bonding for carpet-backing. We'll tell you all about it.

# Alternative Carpet Assembly – The Weave Of The Future

Sustainability isn't a thing we do – it's our focus on how we do everything. At Avery Dennison, we have pledged to deliver innovations that advance the circular economy and reduce environmental impact. Let's talk about our concept for alternative carpet assembly: manufacturing a true cradle-to-cradle solution.

## Sustainability

The advantages of Avery Dennison performance flooring tapes are virtually endless. From sustainable assembly and ease of installation (and de-installation) to the use of low-waste liners, the effects on a healthy indoor air climate and – perhaps most importantly – the overall degree of recyclability. Because we don't just talk sustainability.

## Circular economy

Sustainability means focusing on the future. It is assessed by criteria that include the eco-friendliness of the production process, the use and durability of materials and the right attention for what comes next – the renewability of those materials at end-of-life.

In this last part, we'll look into several examples of the progress in sustainable solutions on the manufacturing side, including our concept of manufacturing a true cradle-to-cradle carpet assembly solution befitting the circular economy.

# Sustainable solutions

## Carpet recycling

Recycling in the carpet industry is hardly a new thing. Preserving natural resources and contributing to reducing climate change has been part of the agenda for a while now.

It has resulted, for instance, in carpet take-back programs: collecting used flooring to either find a second life for it, or recycling its materials altogether in environmentally, socially and financially responsible ways. Nowadays, it is not uncommon for flooring materials to be reintroduced into supply chains and even become new floors.

In addition to using sustainable materials, the manufacturing process has become eco-friendlier as well – especially when opting for wool or recycled nylon yarn. The most sustainable materials are not only durable, but also renewable and even biodegradable, while the situation is further improved by implementing environmentally friendly production methods. In other words: using recycled water and adopting reusable tools and byproducts – cones, dyes, pallets – in a production process powered by renewable energy.

Recyclability of materials has taken a step as well. One of the major challenges in carpet recycling has always been that carpets can consist of hundreds of components. The process of separation can be rather costly, which has led to the development of mono materials in carpet production. It's been a while since producers relied solely on synthetic materials – in other words, materials made up of multiple parts – to manufacture carpet.

The days of those complex sets of materials, irreversibly glued together, are behind us, as recyclability asked for a different approach. The industry has undergone substantial technological advances, with many producers having switched to using a single material, offering obvious advantages when it comes to end-of-life and recycling.

A trend following on from that has been to use the same material for both carpet face and backing, further avoiding the costly process of separation and purification. In this way, the approach of a mono material takes the recyclability of a carpet a long way further. New technologies have offered the freedom to manufacture carpet from fully circular mono-materials such as polyester (PET), polypropylene (PP) and polyamide (PA6, PA66).

When it comes to true recyclability, the industry however is still looking for that silver bullet that offers a true cradle to cradle solution: or rather, carpet to carpet. In all these examples of sustainable solutions, there is one common factor: dependence on recyclable materials

# The Next Step

## Almost full-circle

Sure, when PET of used plastic bottles is converted into plastic flakes and then into soft fibers to form PET-felt backings, they can later on be downcycled into materials for vehicle interiors or noise-absorbing materials. However, if you use PET, or PP, or any of the common solutions out there, it is still necessary to recycle at the carpet's end-of-life.

Moreover, while PET and similar solutions are fully recyclable, additional processing is required in many cases to maintain its properties.

## Carpet to Carpet

In other words, the industry is struggling with which source material to use, which is why we decided to focus on a carpet-to-carpet solution. If you return carpet to carpet, you avoid dependency on the aforementioned recyclables. Which is why adhesive layers are summoned to not only bond during assembly, but also debond during recycling. Avery Dennison offers adhesive technologies that allow for temperature-related debonding on demand. Some of our high-performance transfer tapes are being used in an alternative carpet assembly process where tape features as mechanical bonding for carpet-backing.

'Avery Dennison offers adhesive technologies that allow for temperature-related debonding on demand.'

13. https://www.adhesivesmag.com/articles/88511-pressure-sensitive-adhesives-101

# Alternative assembly

## The power of PSA tapes

Backings applied to carpet fiber for the assembly of carpet tiles and roles are generally different materials bonded or melted together, which makes it hard to separate at end-of-life for recycling purposes. However, assembly with thick synthetic rubber-based transfer tape allows a secure bonding of the fibers with several types of backings. Heating up the assembly sufficiently allows for clean separation. It allows for recycling, full on. Which got us thinking: what if you use transfer tape as a bonding method for the backing material?

Our transfer tapes portfolio consists of pressure-sensitive adhesives (PSAs) of different coat weights and strengths pre-applied to liners, then covered with a special release liner. We use these PSAs for their myriad of advantages, as they offer a variety of benefits compared to other alternatives, be it glue-down, click-and-lock, or free-floating installation methods.

PSAs hold two surfaces together solely by surface contact, which is achieved by firm initial external pressure. These dry adhesives require no activation with water, solvent or heat, and firmly adhere to many dissimilar surfaces with minimal pressure. The release liner protects the adhesive until it is removed. In other words, these general-purpose tapes add value in a variety of ways, helping manufacturers solve their bonding issues.

## Multifunctional

Ideal for mounting, framing, bonding and laminating, transfer tapes offer good conformability and adhesive wet-out. PSA tapes can be used for bonding materials such as plastic, paper, metal, glass, and wood, including some of the low surface energy type materials like Polyethylene, and Polypropylene.

They allow for tremendous ease of use by way of DIY-friendly peel- and stick installation, offering permanent, removable and repositionable options. Specific skills and tool sets are redundant, while fast installation and the absence of cure time reduce downtime. Moreover, there are huge advantages in terms of sustainability and recyclability.

## Sustainable

First of all, PSAs are lower in VOC emission compared to liquid adhesives, resulting in less exposure to harmful substances throughout the value chain – there are no health risks during or after installation. Usage of raw materials for production is sustainable as well, reducing waste. The concept of using PSA tape as backing offers huge potential. Transfer tapes are suitable for many applications – and many application environments.

Now, we're looking to add full recyclability of carpet to that list!

## Avery Dennison Performance Tapes

Avery Dennison Performance Tapes is a world-class operation focused on developing and manufacturing high performance pressure-sensitive adhesives and tapes for a broad range of applications in automotive, appliances, electronics, building and construction, specialty industrial and personal care segments.

The organization has 50 years of experience supplying standard and customized pressure-sensitive materials designed to deliver innovative solutions for customers' needs across the globe. Worldwide manufacturing facilities ensure a global presence supported by local sales, technical and customer service throughout the regions.

Learn more at www.tapes.averydennison.com.

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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