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The Industrial Manufacturer's Guide to VHB Tape

How Boyd converts VHB tape with efficiency to add value to industrial technology applications



VHB tape adds significant value and provides unique characteristics for industrial technology applications. With an acronym that stands for “very high bond,” VHB tape is used for permanent bonding applications and commonly replaces mechanical fasteners like screws or rivets, or in rugged applications that require extreme durability. VHB tapes are used to bond panels to frames, attach decorative materials and trim, adhere displays and display lens windows to a housing, and other applications.

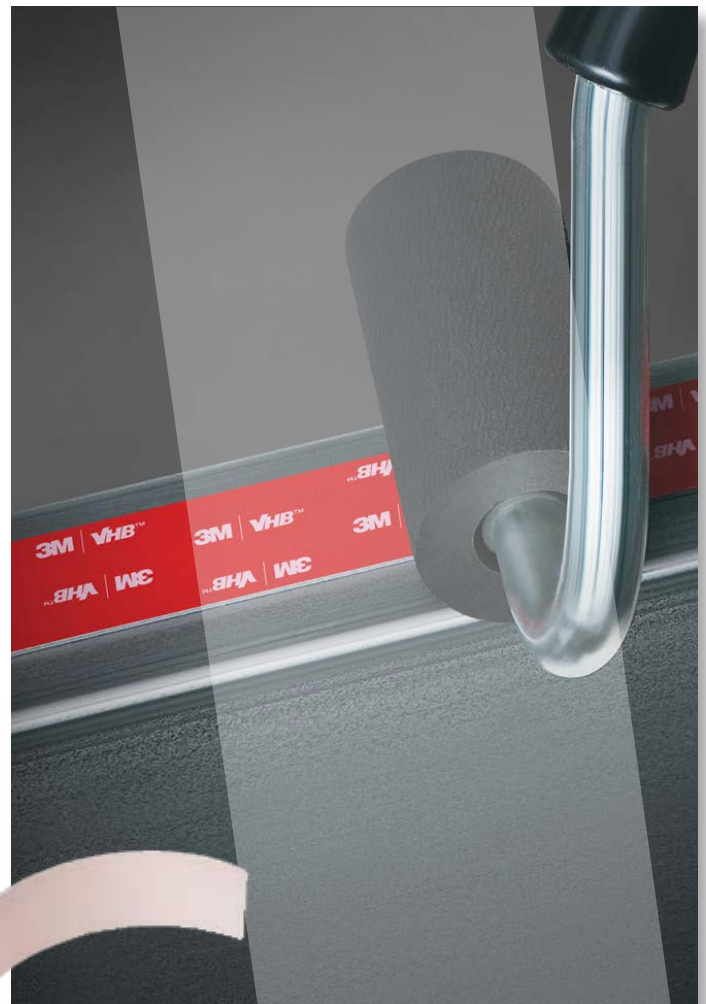
VHB tape is an extremely aggressive tape with instant tack. It's also flexible and most configurations are compressible and stretchy. Due to these characteristics, VHB tape can be challenging to handle and manufacture, and extremely difficult to meet tight tolerance requirements during fabrication and assembly. To maximize efficiency, industrial technology OEMs and component suppliers need a partner to source and convert VHB tape with expert guidance on leveraging the material's strengths in real-world applications.

Boyd has deep experience converting VHB tape into difficult designs and at tight tolerance specifications, allowing industrial technology leaders to benefit from VHB's excellent performance characteristics while minimizing its characteristics that make it difficult to handle and manufacture. As a global [3M™ Preferred Converter](#), we have unique insights and early access to these materials and have completed countless challenging VHB tape projects. This whitepaper explores why VHB tape adds value for industrial technologists, important design and manufacturing considerations, and how Boyd uses our [converting heritage](#) and materials science expertise to maximize the value of VHB tape in industrial technology applications.

VHB tape characteristics

“VHB tape” is the umbrella term for a family of tape products from 3M™. In general, VHB tapes are double-sided acrylic foam tapes that are compatible with a variety of substrates including aluminum, steel, glass, plastics, and painted and powder-coated surfaces. These tapes provide resilient, durable bonding with extremely thin bond lines. VHB tape bonds instantly and provides handling strength immediately after application while bond strength increases over time.

There are a few VHB tapes that are not made with [foam materials](#), but provide the same adhesive strength in a different formulation. 3M™ manufactures a number of VHB tape formulations, including tapes specifically designed for low surface energy substrates, high surface energy, painted or irregular surfaces, electronics, flame retardant applications, and general use.



VHB tape benefits

In addition to providing high bond strength, there are many reasons technologists choose VHB tape for industrial technology applications. Some of the advantages of VHB tape include:

Instant bonding – VHB tape bonds mating substrates on contact so manufacturers don't have to wait for adhesives to cure before moving on to downstream processes.

Shock absorption – One of the best things about using VHB tape compared to other bonding technologies is that it dissipates energy. VHB tape absorbs and dissipates energy to enhance impact protection. This helps protect components from things like drop shock. For example, if someone dropped their smartphone and the glass lens was bonded with VHB foam tape, the shock absorption of the VHB tape would likely prevent the display from cracking or popping off.

Stress distribution – VHB tape spreads and dissipates energy over its entire bonding surface, which allows for movement in the underlying substrates and a more consistent and cohesive surface aesthetic. This is an important differentiator from using a mechanical fastener like a screw or rivet, which is considered a stress concentrator because any stress on the component goes to that limited bonding area. This negatively impacts aesthetics (such as stressed metal near rivets on trailer panels) and may compromise the bond over the life of the product.

Expansion and contraction – VHB tape allows for differing expansion and contraction rates of dissimilar substrates, like when plastics are bonded to metal materials. This provides additional design flexibility for industrial technology leaders and improves the performance of industrial products, especially those that experience high temperature fluctuations.



Waterproofing – VHB tape is used to achieve ingress protection ratings (IP waterproof or water resistant ratings) or to meet other requirements for water resistance. It is used frequently in industrial technology to both [bond and seal](#) for reliable waterproof applications.

Conformability – VHB tape is flexible and available in different thicknesses and various firmness levels, providing greater conformability for complex geometries and irregular substrates.

Design flexibility – VHB tape offers design and assembly flexibility in that permanent bonds do not have to be made simultaneously like with epoxy or mechanical fasteners. Boyd can convert VHB tape to a custom geometry, laminate it to a first surface, and send this subassembly to a customer where they remove a release liner and create a second bond to an additional substrate. VHB parts are supplied in rolls, on sheets or in other configurations, and can be optimized with registration control to enable various levels of customer assembly automation.

Invisible appearance – Boyd specifies and fabricates VHB foam tapes in several colors including white, gray, black and clear to meet a variety of design requirements. Bond lines are generally very thin (around 6 mils) to create a sleek appearance in end products.



Surface preparation

Most adhesive failures happen because a substrate was not prepared appropriately. All [adhesives](#) — not just VHB tape — stick to whatever is on the surface of a substrate. That could be a sealant, a coating, the substrate itself, or contaminants like dirt, dust or other debris. Cleanliness and proper surface preparation are important to assure tapes adhere to the base substrate. Techniques to improve adhesion in VHB tape applications include:

Heavy oils — Clean the surface and remove oil or grease using a degreaser or solvent-based cleaner.

Abrasion — Abrading the surface can help remove heavy dirt or oxidation and create more surface area for VHB tape to bond to.

Surface primers — Prime surfaces using a specialty priming solution from 3M™ to increase adhesion, especially for paint or plastic surfaces.

Porous surfaces — Seal porous surfaces such as wood, particle board or concrete prior to VHB tape application.

Glass — For applications involving glass, use a silane treatment to improve adhesion.

Other materials — Consider the potential for special surface preparation for all materials, including metal, copper, plastics, rubber and more.

The importance of pressure

Bond strength — and the ultimate success of any bonding application using VHB tape — is dependent on the amount of adhesive-to-surface contact developed. Like any other type of pressure-sensitive adhesive, firm application pressure helps VHB develop better adhesive contact with the substrate and improves bond strength. Typically, adequate surface contact can be attained by applying enough pressure to ensure the tape experiences approximately 15 psi (100 kPa) pressure. It's also important to note that the bond strength of VHB tape increases over time due to cold flow, which is when the applied adhesive slowly grabs more surface area and generates extra bond strength.



Converting VHB tape

Part of what makes VHB tape a challenging, yet valuable, material is the fact that it provides immediate adhesion to surfaces with a very strong bond. This can cause problems in fabrication, converting and manufacturing, or if not handled appropriately during material preparation, manual assembly or in an automated system. You cut VHB tape, it sticks to your tool. You handle VHB tape, it sticks to your hands and material preparation surfaces. You automate VHB tape in assembly processes, it sticks to your pick-and-place machines.

Boyd's adhesive specialists are experts in specifying the best VHB tape option to maximize performance in your application. Boyd's industrial manufacturing engineers are experts and best-in-class in optimizing manufacturing processes to improve manufacturability. Boyd's product designers are experts in recommending part design and presentation to maximize effectiveness in your application and assembly processes.

Because VHB tape is aggressively tacky, conformable, and flexible, it can be difficult to maintain tight tolerances when converting complex, precision geometries or manufacturing or assembling at high volume. Boyd's converting experts use creative industrial manufacturing techniques and tooling design to deliver complex, precise geometries with tight tolerance control at high volumes, if you need them. Advanced rotary die cutting, laser

cutting, plotter cutting and waterjet cutting are all fabrication technologies commonly used to convert VHB tape. Fabrication method is tailored based on feature sizes, target tolerances and manufacturing throughput requirements. Boyd can also include tabs for easy liner removal or key registration points for automatic application or assembly, if requested.

Testing and validation

Boyd's material testing services identify optimal materials and help industrial technology manufacturers understand the exact nature of the substrates involved in a given application. For example, Boyd tests powder coatings on metal substrates to determine the actual surface energy of the material to recommend the optimal adhesive for this traditionally low surface energy substrate.

Boyd's application engineers typically work closely with our customers and the 3M™ Technical Support team to identify the right solution for each application. Additionally, Boyd rapid prototypes designs to accelerate comparative performance evaluations using different materials and make design adjustments around manufacturability. We also provide peel testing analysis on different design configurations when appropriate.

Storage and shelf life

All 3M™ VHB tapes have a shelf life of 24 months from the date of manufacture if they are stored at temperatures between 40°F to 100°F (4°C to 38°C) and in a location with 0-95% relative humidity. The optimum storage conditions are 72°F (22°C) and 50% relative humidity. While the performance of VHB tape is not expected to change even after shelf life expires, 3M™ suggests that VHB tapes be used prior to the shelf-life date whenever possible.

Removing VHB tape

Because VHB tape is intended for use in permanent bonding and sealing applications, it isn't formulated to be removed. However, mistakes happen. Components get affixed upside down and sometimes tape is applied to things it shouldn't be. In these cases, there are several techniques for removing VHB tape, including:

Cutting tools – Cutting through the tape at the bond line is the most effective method for separating large assemblies (>20 square inches) bonded with VHB tape.

Low temperatures – Use specialized equipment to lower the temperature of the material to around -80°F which can reduce the bond strength enough to remove the tape.

Abrasion – If surface damage is not an issue, once the majority of the tape is removed, use a porous abrasive disk or wheel to remove residual adhesive.

Solvents – Adhesive residue from VHB tape can be wet with a solvent and then covered with a plastic

film and allowed to soak for 5-15 minutes. This will help the adhesive soften so a scraper can then be used to fully remove the tape.

Boyd is the converting partner industrial technology manufacturers trust

We work with leading industrial technology manufacturers to innovate product performance and manufacturing efficiency with countless installations of all formulations of VHB tape. Leverage our adhesive material science heritage, expertise and installed converting technologies and capacity to execute complex projects with precision and tight tolerance controls. By working with Boyd early in the product development process, we help you specify the best adhesive materials for your application and design features into your tape components to improve manufacturability, enhance product performance and elevate the user experience. We are also a global [3M™ Preferred Converter](#), which gives us priority access to material innovation and valuable resources for VHB-related testing and design.

Ready to start your next industrial technology manufacturing project?

Contact Boyd today today to see how we'll help you maximize the value of VHB tape.

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Boyd is the trusted global innovator of sustainable solutions that make our customers' products better, safer, faster and more reliable. Our innovative engineered materials and thermal solutions advance our customers' technology to maximize performance in 5G infrastructure and the world's most advanced data centers; enhance reliability and extend range for electric and autonomous vehicles; advance the accuracy of cutting-edge personal healthcare and diagnostic systems; enable performance-critical aircraft and defense technologies; and accelerate innovation in next-generation electronics and human machine interface. Core to Boyd's global manufacturing is a deep commitment to protect the environment with sustainable, scalable, lean, strategically located regional operations that reduce waste and minimize carbon footprint. We empower our employees, develop their potential and inspire them to do the right things with integrity and accountability to champion our customers' success.

