



# Stretch Release Characteristics of 3M™ VHB™ Extrudable Tape

Technical Bulletin

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## Background

3M™ VHB™ Extrudable Tape has been developed for use worldwide in a variety of industrial applications. As national, regional, and local regulations and standards change, many manufacturers are looking to adapt to regulatory and consumer demands for environmental responsibility to meet their company's sustainability goals. 3M™ VHB™ Extrudable Tape possesses a performance characteristic referred to as "stretch release" (Figure 1). After the adhesive is dispensed onto a substrate and allowed to cool, it can be removed. It offers less waste, faster rework, and easier component recycling.



Figure 1. Stretch release demonstration

## How is stretch release performed?

- Stretch as close to a zero-degree, parallel motion in relation to the substrate. Figure 2 demonstrates a zero-degree, parallel stretch direction.
- While it is possible to automate, a slow, manual, hand over hand approach is best.
- It is recommended to secure the substrate or assembly from which the adhesive is being removed.



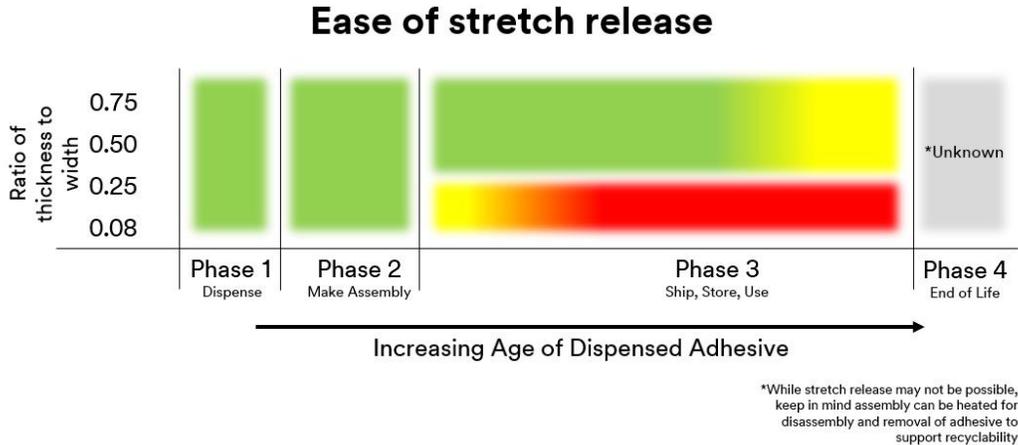
Figure 2. Zero-degree, parallel stretch motion

## How much later after dispensing will stretch release be successful?

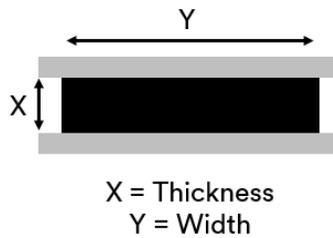
To help define when stretch release can be successful, it is necessary to highlight assembly construction. This can be broken down into 4 phases. Phase 1 is the dispensing phase. 3M™ VHB™ Extrudable Tape is dispensed onto a substrate and allowed to cool. Phase 2 is the assembly phase. The second substrate is placed onto the adhesive and pressure is applied to close the bond. Phase 3 is the shipping/storing/using phase. The assembly now potentially can be exposed to elements such as cold, heat and humidity. Phase 4 is the end-of-life phase. This refers to the assembly reaching the end of its utility. Figure 3 highlights ease of stretch release as it relates to each phase.

**Phases 1 and 2:** It is easiest to stretch release after Phase 1 is complete. When the adhesive cools on the substrate it regains its elongation of 1500% and can be removed from the substrate. After Phase 2 and the adhesive is allowed to cool it also is fairly easy to stretch release. At this stage it is more important to incorporate stretch release tips above to achieve success.

**Phases 3 and 4:** As the adhesive moves into Phase 3 it becomes important to highlight and consider the ratio of thickness to width of the adhesive bead. Figure 4 helps define these measurements. To calculate the ratio, thickness is divided by the width. An internal study was performed examining the affect of prolonged heat on the ability to stretch release between two substrates. Substrate coupons were bonded together in a sandwich construction using a variety of different substrates and adhesive ratios. These coupons were placed in an accelerated aging condition of 90°C for 30 days and, upon cooling, stretch release testing was performed. It was determined that stretch release was still possible on samples with adhesive ratios greater than or equal to 0.25. For test coupons using an adhesive ratio less than 0.25, only glass as a substrate still offered stretch release. Since 3M™ VHB™ Extrudable Tape was recently launched as a completely new form factor adhesive in Q3 2022, there currently is no way to correlate this accelerated aging to true Phase 3 conditions. There are simply too many variables at play. However, as guidance to aide in defining an adhesive ratio that affords stretch release after some time in Phase 3, greater than or equal to 0.25 is recommended. In conjunction with the unknown variables of Phase 3, there is also no prediction that can be made for Phase 4 at this time. Lastly, if the adhesive does not stretch release the assembly may be heated to 150C. This will soften the adhesive and allow for disassembly and recycling.



**Figure 3.** Ease of stretch release as a function of thickness to width ratio of adhesive and time past after dispensing



**Figure 4.** Thickness to width ratio of adhesive used to hold two substrates together.

#### How should a part be designed for successful stretch release?

- Include an exposed, unbonded amount of adhesive at the beginning or end of the adhesive bead. This creates a “tail” that allows for a starting point for stretch release.
- Use radiused edges on inner substrate surfaces that are bonded. This helps avoid potential adhesive breakage during the stretch release process.
- Set a larger gap between the substrates. This equates to a thicker bead of adhesive and a greater ratio of thickness to width.
- Substrate material choice will affect stretch release especially after accelerated aging.

#### Conclusion:

3M™ VHB™ Extrudable Tape has 1500% elongation and as such, it can be stretch released from substrates. This capability supports customers sustainability goals as it offers less waste, faster rework, and easier component recycling. Stretch release is successful with any thickness to width ratio for Phase 1 or Phase 2 assembly construction. However, at a ratio of less than 0.25, stretch release can fail in Phase 3.

It is recommended to use an adhesive thickness to width ratio of greater than or equal to 0.25. 3M will continue to better define guidance for successful stretch release in Phase 3 and Phase 4 of assembly construction. As data is generated and analyzed, 3M will update the Stretch Release Technical Bulletin.

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