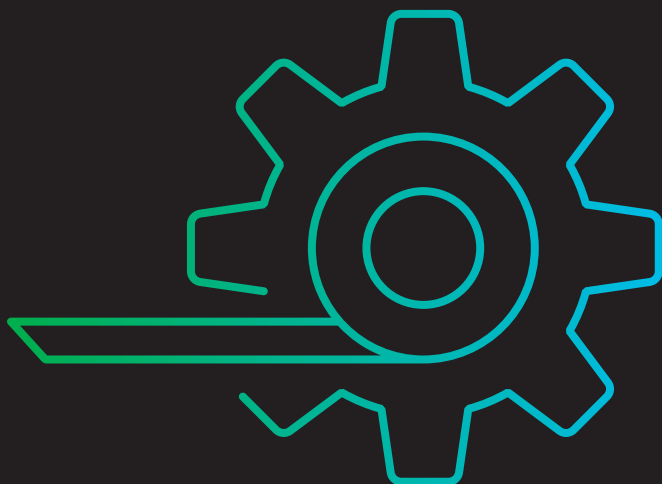


Bonding Automation Handbook





Introduction

3M created this handbook to give you a basic understanding of automating your tape and liquid adhesive processes. There are many benefits to automating, including optimizing the use of labor, decreasing costs and increasing production, worker safety, and quality.

This handbook will cover the following:

- ▶ Tape and adhesive bonding
- ▶ When is automation right for you
- ▶ Ways to improve your process
- ▶ Getting started with automation
- ▶ How 3M can support you
- ▶ 3M tape and liquid adhesive automation
- ▶ Resources available

For more in-depth knowledge and answers to questions about specific processes and automation needs, reach out to your 3M sales professional or connect with one of our automation experts.



**Automated Manufacturing
with 3M Adhesives and Tapes**
Click or Scan

What is adhesive bonding?

Adhesive bonding is one of the basic joining process between two or more parts. Different challenges lead to different solutions. Depending on your needs, adhesive bonds can keep seams and joints secure, maintain rigidity or flexibility and provide a barrier to keep substances in or out while also making production easier.

Disadvantages of traditional joining methods.



Welding is the industry standard for heavy-duty assembly but requires expertise and may not work if the substrates are different (e.g. aluminum to steel).



Bolts allow precise torque control and are removable or replaceable; however, they also require holes to be drilled in the substrate.



Rivets are another popular option but require access from both sides to complete the assembly, and they work best with similar substrates.



Solder is used for electrical conductivity but generally provides a weak mechanical bond.

Benefits of adhesives and tapes over traditional joining methods.

Industrial adhesives and tapes provide key benefits over other industrial assembly methods. For example, liquid adhesives can flow and conform to the shape of the bond area to fill gaps. They typically provide strong bonds. Tapes provide a consistent bond thickness and size. They offer immediate handling strength to enable easy assembly. Both come in multiple formats providing design and production flexibility. In addition to formats, tapes and adhesives come in a variety of strengths to match a wide range of substrate and design needs.



**Faster Assembly
Time**



**Design
Flexibility**



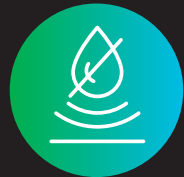
**Immediate Handling
Strength**



**Bond Dissimilar
Materials and
LSE Materials**



**Clean Aesthetics
and Reduced
Product Bulk**



**Prevent Moisture
Intrusion**

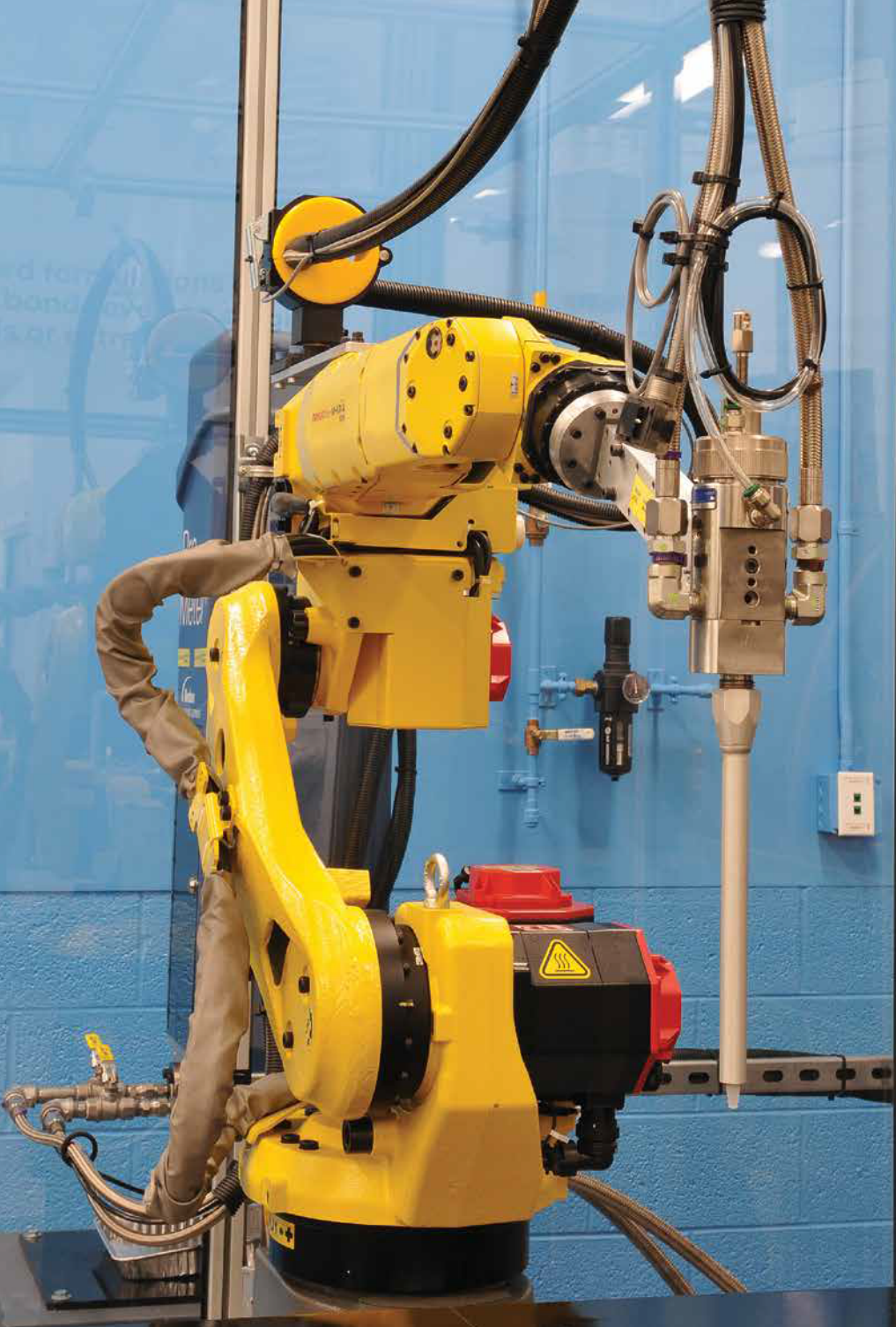
When is automation the right solution?

Typical reasons to automate liquid adhesive or tape applications.

The following diagram shows key reasons why you may value automation.

■ Assembly ■ Process ■ Cost

Increase quality	Improve traceability	Decrease takt time	Reduce high-cost labor rate
Improve aesthetics	Decrease operator fatigue	Increase throughput	Reduce work in process inventory
Increase consistency and accuracy of placement	Difficult to find labor/ Labor shortage	Complexity of operation	Reduce waste, re-work and scrap
Increase repeatability of their process	Increase safety	Improve operator efficiency	Reduce cost



Are you ready for automation?

Automation may benefit your process; however, some factors may influence your readiness to move to automated solutions. It's helpful to know where you fall on the spectrum for each of these factors. You may look at these factors individually or in combination.

Readiness factors to consider.

▶ **Assembly Volume**

Automated solutions may be more beneficial if your volume is high.

▶ **Cost of Poor Quality**

Automated solutions help to consistently and accurately apply tape and adhesive.

▶ **Labor**

If labor costs are high or it is difficult to hire employees, a switch to an automated solution may be easier than if labor cost is low or it is easy to hire employees.

▶ **Level of Precision Required**

Automation may be more beneficial when quality standards require extreme precision and accuracy. You may still have some lower-level automation tools even if quality can be achieved manually (such as basic tools or process assists).

▶ **Experience with Automation**

If you have automation knowledge and have already used automated solutions, you may be more ready.

▶ **Budget**

One of the largest factors that influence readiness to move to an automated solution is your budget. Automation is easier to adopt if you have a budget set aside for it. The most important budget barrier is the cost of the equipment.

▶ **Production**

Uncertain economic situations may lead to hesitation of adopting automation. If you're not sure how long you will be producing the part you are more likely to avoid automation if it is not designed to be flexible.

Check the box to see where you fall on the spectrum.
A combination of factors shows that automation is
beneficial, but you may use a single factor as a good
enough reason to automate.

**More likely to use basic
tools or process assists**

**More likely to use fixed
or flexible automation**

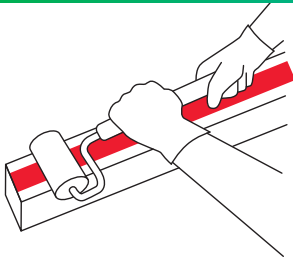


Is bonding automation right for you? Let's explore options together.

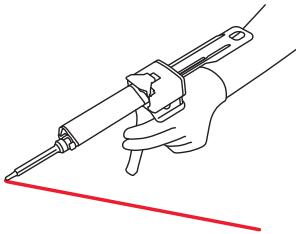
There are many ways to improve your bonding process.

Manufacturers don't always go immediately from manual processing to full automation. An intermediate step in this journey often involves using Basic Tools and Process Assists to achieve production goals.

Tape



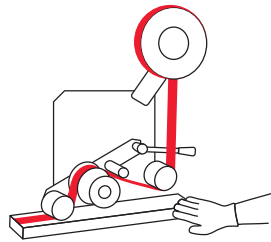
Liquid Adhesive



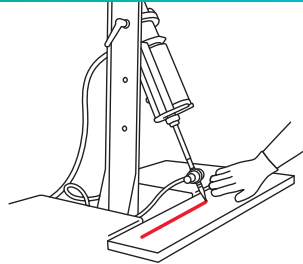
Basic Tools

Simple basic tools to improve the application process, without automation.

Tape



Liquid Adhesive

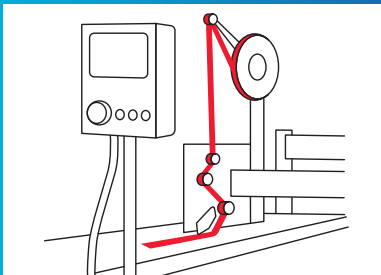


Process Assist

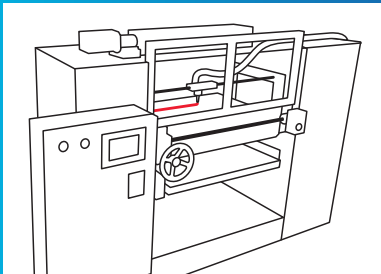
Simple mechanical or electrical tools to increase productivity of manual application.

3M is able to support you wherever you are in your automation journey. Whether you need Basic Tools or Process Assists to get started, or are looking for more complex Fixed and Flexible Automation solutions, we have the knowledge and resources to support you.

Tape



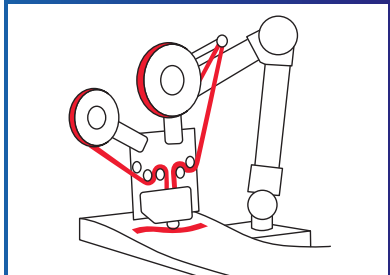
Liquid Adhesive



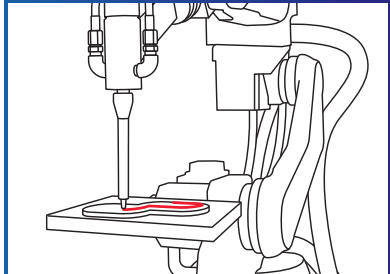
Fixed Automation

Mostly automated operation designed to perform one specific assembly process with the goal of improving accuracy, speed, or labor reduction.

Tape



Liquid Adhesive



Flexible Automation

Mostly automated operation designed to perform more than one assembly process or, to be re-purposed later. Often incorporates robotics.

Most common bonding processes to automate.

These are the most common bonding process types to automate. But remember, even if you don't see your process here, there may still be an opportunity to automate.



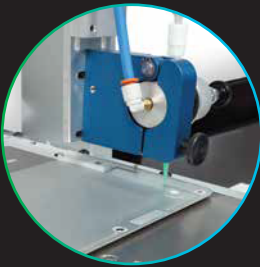
Stiffener to Panel



Gasketing



Mounting and Trim Attachment



Panel To Frame



Small Joint Assembly



Potting



Getting started with automation.

What does 3M do?

3M does not make robots.

We help you (along with a dispensing partner and/or system integrator) make the process decisions to get the best results out of your end product and automation goals, using 3M tape and liquid adhesives.

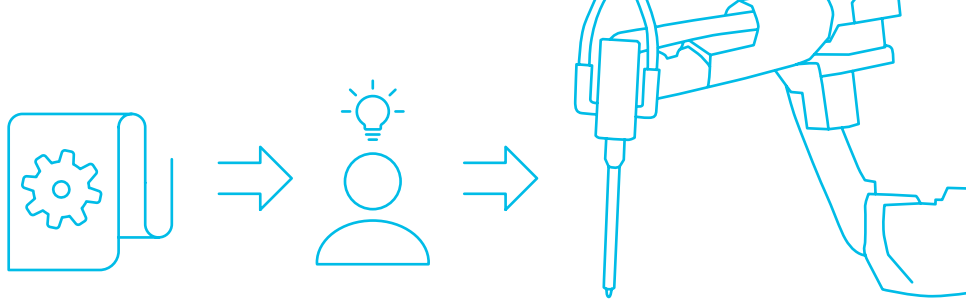
Our goal is to help you effectively use and process tape and adhesives to achieve your goals. We utilize our deep bonding expertise and combine that with ecosystem partners to help you achieve better outcomes. We can help connect you with industry leaders that support bonding process automation.

3M Bonding Automation Network



Get support for your automation projects from leading suppliers.

The 3M Bonding Automation Network brings together leading suppliers of automation equipment and integration services to help make the process of automating your application easier. The network has been trained on the 3M product portfolio and the suppliers work closely with 3M on automation projects.



What does a “system integrator” do?

A system integrator can help you manage the design and implementation of your tape and liquid adhesive automation system and integrate it with your existing processing equipment.

What do tape and liquid adhesive dispensing or automation companies do?

- ▶ Dispensing companies help determine the right equipment for the application and production goals
- ▶ Automation companies provide robotics, software and often integration services



Things to know before meeting with a system integrator.

Before you can automate a bonding process, you must be able to communicate your outcome requirements to a system integrator. Below is a checklist that will help you prepare for a conversation with a system integrator. If you want advice on any of these items, contact a 3M bonding automation expert.



I know which part I want to automate.

Before you consider automation you need to identify which part to prioritize for automation. Incoming part shape, weight and complexity are among the most important parameters a system integrator accounts for when designing an automated cell.



I know what application needs to be performed.

A system integrator will create an automated cell tailored to the application being performed. Just like in a manual operation, automated bonding will leverage different adhesives and techniques.



I know the full set of process steps for my part.

Automation is good for performing simple tasks. Work with your operator to determine which bonding steps have a lot of variability and which are simple and repeatable.



I know what a good outcome looks like.

A system integrator will need a clear, objective target for the automation process to meet. You and your operators will need to have the same measurable definition of a good outcome.



I know my current cycle times.

Increased production is one of the main benefits of automation. By knowing your current cycle time per part, a system integrator can set a target for improvement and help ensure that you realize the benefits of automation.

Preparing for automation.



Questions to ask your system integrator:

- ▶ Have they automated a similar process in the past?
- ▶ Are they willing to understand your current process and improve it with automation?
- ▶ Are they willing to come to your facility?
- ▶ What is the estimated timeline for project completion?
- ▶ Are your contract and payment terms clear?

3M Bonding Process Centers

Take advantage of 3M Expertise around the world.

Automating a process or production line requires expertise. 3M can help.

We have three state-of-the-art Bonding Process Centers located around the world where our scientists and engineers can work with you in person or remotely to address your production challenges. Whether you want to try new innovations in dispensing and automation or are simply looking for a better tape or adhesive to bond your parts together, our experts will work with your team to find customized solutions.

- ▶ One-on-one attention
- ▶ Process development on your specific parts
- ▶ Individualized solutions for your process
- ▶ Optimization of existing dispensing processes
- ▶ Suggestions for process improvements
- ▶ Follow-up support after your visit



**Your
Parts**

Your parts, your design
and production experts



**Our
Technology**

Our science and our
team of adhesive experts



**Complete
Solution**

One complete solution
for your application



**Take a 360° virtual tour of
3M's Bonding Process Centers**
Click or Scan



Remote consultations are also available.

Rather than scheduling an in-person visit, send us your parts and we'll discuss what you'd like us to test and show you, which we can then do remotely.

Do you have parts you want to test? Let's find solutions together.

You have your experts and we have ours. Let's put them together to find a complete solution for your application.

Call: **66-0-2666 3666** (8 a.m. to 5 p.m. Central Time)

Email: **3M-TH-IATD@mmm.com**

Visit: **[https://www.3m.co.th/3M/th_TH/
bonding-and-assembly-th/](https://www.3m.co.th/3M/th_TH/bonding-and-assembly-th/)**

3M Tapes and Liquid Adhesives for Automation

Different challenges lead to different solutions. 3M Tapes and Adhesives are available in multiple formats and strengths to meet your automation process needs. See below for a few examples of our solutions.



Scotch-Weld™
Structural Adhesive

Structural adhesives need to be strong — but that's just the beginning. Depending on your specific process and needs you might be looking for shorter or longer open times, low-odor formulations, better environmental exposure performance, sealing properties, flexibility, adherence to specific substrates or any number of other features. At 3M, we know structural adhesives and the many ways they hold the world together.



VHB™
Tape Since 1980

With 3M™ VHB™ Tapes, you can maintain consistency from sketch to construction, eliminating distracting, visible fasteners, like screws and bolts. These high-strength, double-sided acrylic foam tapes let you quickly and easily create a long-lasting bond that actually builds strength over time. With the ability to join a wide variety of materials, they provide resilient bonding solutions in just about anything you can dream up.



Thin Bonding

3M™ Double Coated Tapes / 3M™ Adhesive Transfer Tapes

Thin bonding lets your design shine without bulky fasteners by using a virtually invisible industrial-strength bond to attach materials. Using a tape rather than a liquid adhesive allows you to customize the tape to the precise shape you need for the final design, as well as giving you production flexibility by leaving the liner in place until the second substrate is ready. Double coated or adhesive transfer tapes provide shear strength, conformability and high initial adhesion and have industrial applications in electronics, auto interiors, signage and graphics, sporting equipment and much more.



How material packaging and forms affect automation choices.

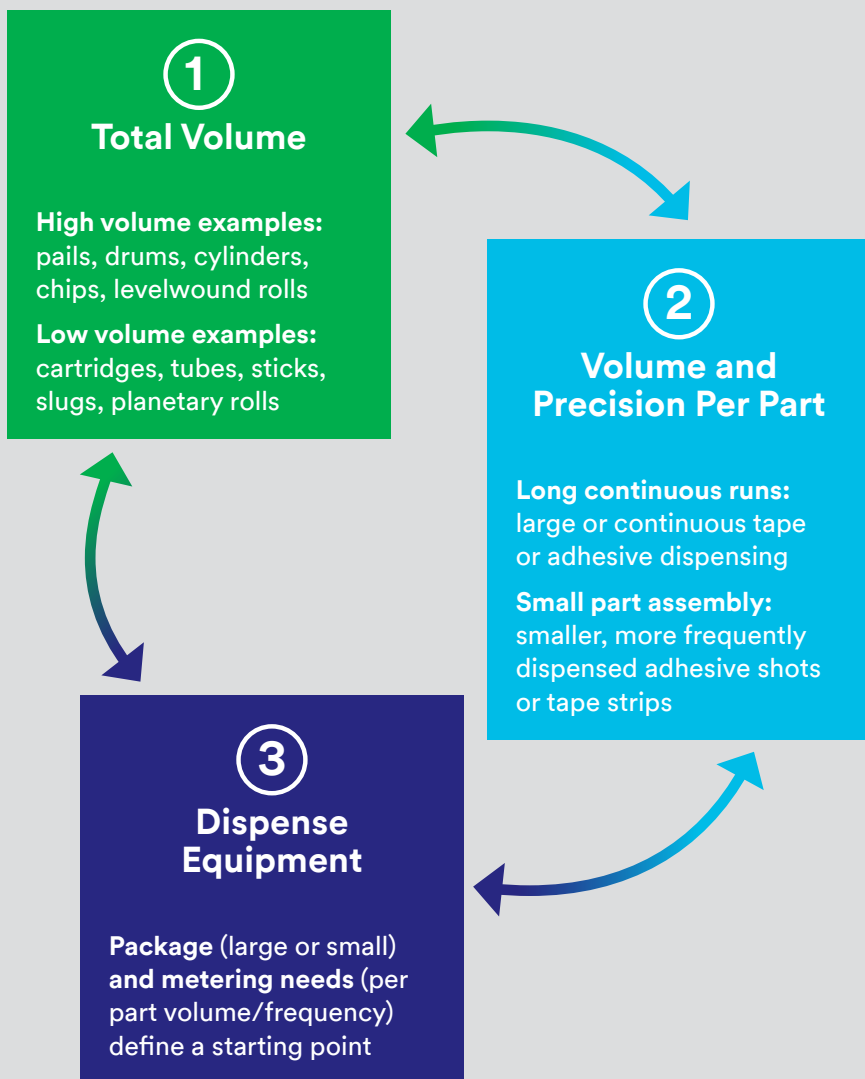
Several variables influence the tape and adhesive form that's right for the application.

The volume of tape or liquid adhesive applied may determine the form factor needed. The form factor and the volume dispensed per part plays a role in determining the equipment to use. Not all dispense equipment can work with all form factors or provide the necessary volume per part. Alternatively, if you have already determined the dispensing equipment, this will define the form factor or packaging choice.

Work with your 3M representative and System Integrator to choose the one that's right for the application.

The diagram shows that each of these variables has influence on the form factor selected:

- 1 Total Volume**
- 2 Volume and Precision Per Part**
- 3 Dispense Equipment**



Tape Form Factors

Not all 3M tape comes in all form factors. The overview below lists the most used form factors and how they relate to the automation of tapes.

Planetary Rolls

The most common planetary rolls are sized for manual application in easy-to-handle diameters.

Longer planetary rolls may be available for process assists, and continuous laminators or tape heads mounted on the end-of-arm effector of a robot.



Levelwound Rolls

Levelwound rolls are often necessary to reduce change-over with high volume, fixed, or flexible automation.



Die-Cut Pieces

Die-cut pieces are available from 3M Preferred Converter Partners. It's important to know whether the die cuts will be applied manually or automatically before the tape is specified and converted.



Liquid Adhesive Form Factors

Not all 3M liquid adhesives come in all packaging types. The overview below lists the two main categories and a few examples of packages within those categories.

Handheld

Common handheld forms of liquid adhesives are:

- ▶ Cartridges
- ▶ Tubes
- ▶ Sausage packs
- ▶ Aerosols
- ▶ Sticks and slugs



Bulk

Common bulk forms of liquid adhesives are:

- ▶ Pails
- ▶ Drums
- ▶ Chips and pellets
- ▶ Cylinders



3M is here to help advance your automation.

Fast and easy assembly with the RoboTape™ System for 3M™ Tape.

3M, a leading expert in tape for assembly, and Innovative Automation, a leader in automation technology, have joined forces to provide a pre-configured tape automation system that offers speed, quality, and efficiency of assembly with 3M tape at scale.

This system is ideal for high-volume tape applications where speed, reliability and consistency are important.

For additional information, contact your 3M sales representative or visit the website at engage.3M.com/RoboTape.





**Learn about more collaborations
at 3M.com/AssemblySolutions**

Click or Scan



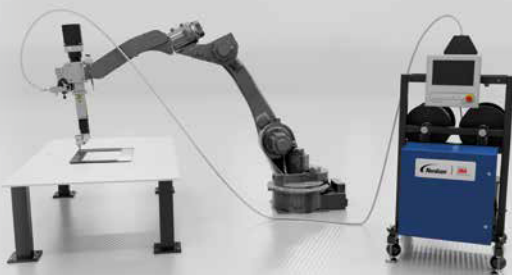
Solve problems with flexible materials and the 3M™ On Demand Bonding System featuring 3M™ VHB™ Extrudable Tape GP.

3M, in collaboration with Nordson Corporation, has reimagined durable bonding with 3M™ VHB™ Extrudable Tape GP and the 3M™ On Demand Bonding System.

Bring your operation the efficiency, versatility, simplicity and sustainability you need to maintain a competitive edge and deliver your customers the next generation of appliance innovation.

engage.3M.com/3MVHBExtrudableTape

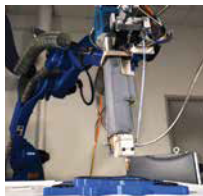
- ▶ Simple, automated solution
- ▶ Easily integrates into your assembly line



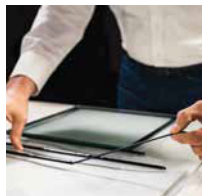
Efficiency



Versatility



Simplicity



Sustainability

Why 3M?

We help make bonding automation work for you.

Automating parts of your operation can be a daunting task. Our experienced automation experts can answer your questions, whether you're fine tuning an existing automation application or just getting started.

Process Expertise

3M has a long history of bonding automation expertise. Our multiple 3M Bonding Process Centers are dedicated to developing your ideal bonding automation process. Send us parts to try out for you, or meet with us virtually or in person so we can learn with you the best way to optimize your process.

Premium Products

Our long-lasting, consistently performing and quality tapes and liquid adhesives are optimal for a variety of automation applications.

Global Partnerships

3M has trusted relationships with system integrators, robot manufacturers and equipment suppliers.





Summary of key steps to take on your automation journey.

Understand your bonding challenges and the 3M products available

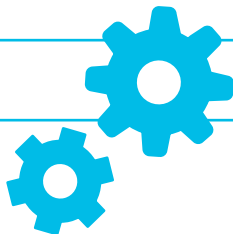
Determine the benefits of automation for your application

Engage 3M to explore options

- ✓ Testing at 3M Bonding Process Centers
- ✓ Engaging 3M Bonding Automation Network partners
- ✓ Select bonding method

Work with integrators/3M/automation partners to identify potential solutions

Implement automation



Ask an expert.

Contact us — we're here to help.

Contact us if you need product, technical or application advice or want to collaborate with a 3M automation expert.

► **3M Technical Specialist**

Call: 66-0-2666 3666 (8 a.m. to 5 p.m. Central Time)

Email: 3M-TH-IATD@mmm.com

Visit: https://www.3m.co.th/3M/th_TH/bonding-and-assembly-th/

► **3M Bonding Process Center**

3M.com/BondingProcessCenter

► **RoboTape™ System for 3M™ Tape**

engage.3M.com/RoboTape

► **3M™ On Demand Bonding System featuring 3M™ VHB™ Extrudable Tape GP**

engage.3M.com/3MVHBExtrudableTape

Bonding Automation Handbook

Warranty and Limited Remedy

3M warrants that each 3M product meets the applicable 3M product specification at the time 3M ships the product. 3M MAKES NO OTHER EXPRESS OR IMPLIED WARRANTIES OR CONDITIONS, INCLUDING ANY IMPLIED WARRANTY OR CONDITION OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. If a 3M product does not conform to this warranty, the sole and exclusive remedy is, at 3M's option, replacement of the 3M product or refund of the purchase price.

Limitation of Liability

Except for the limited remedy above, and except to the extent prohibited by law, 3M will not be liable for any loss or damage arising from or related to the 3M product, whether direct, indirect, special, incidental, or consequential, regardless of the legal or equitable theory asserted.



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