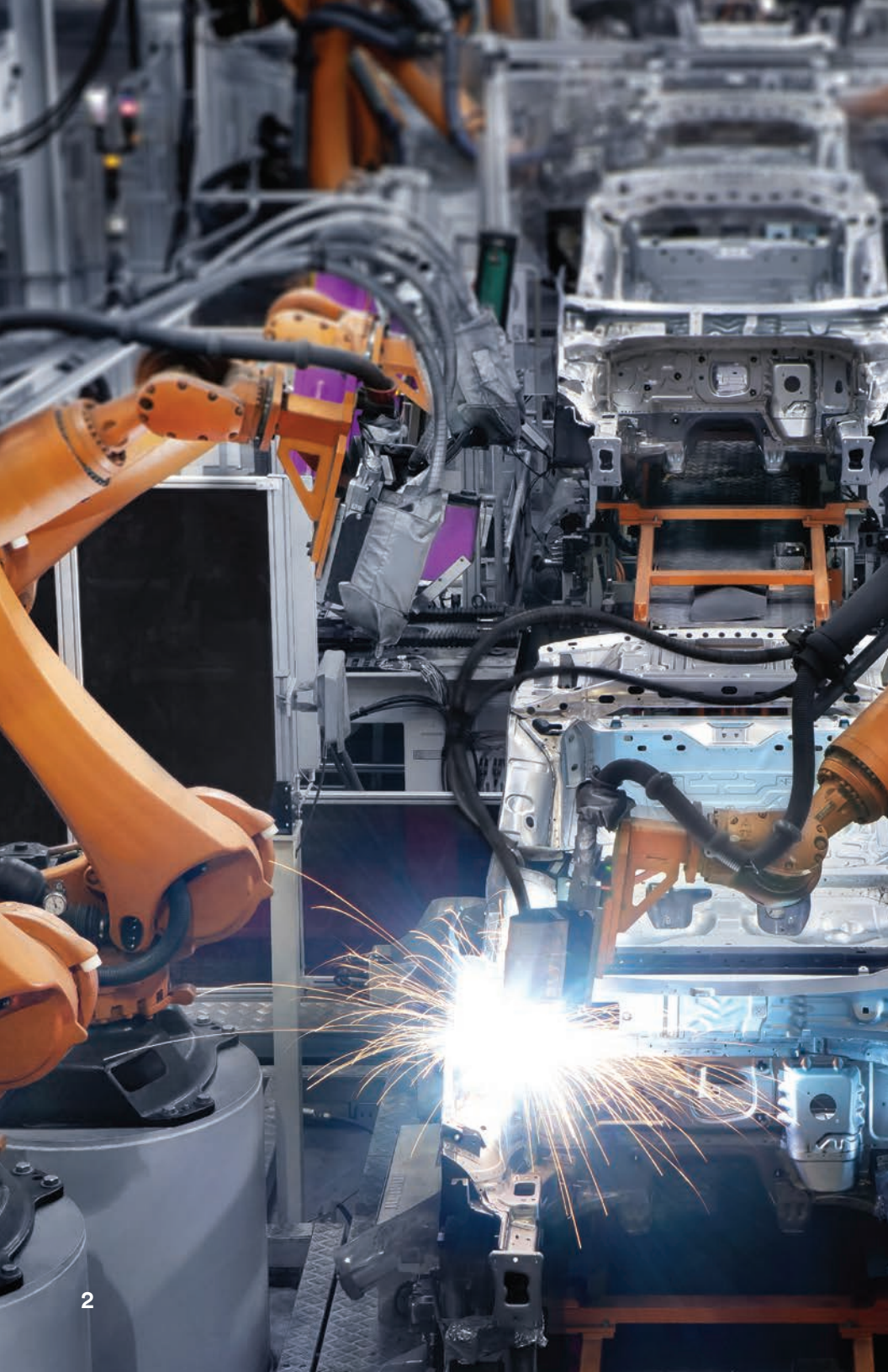


# Automation Customer Handbook





# Introduction

3M created this handbook to give you a basic understanding of automating your abrasive processes. There are many benefits to automating, including helping to decrease costs over time and increase part production, worker safety, and quality.

This handbook will cover the following:

- ▶ Automation options for abrasives processes
- ▶ Why automate?
- ▶ Things to consider
- ▶ Tips to remember
- ▶ Industry terms
- ▶ 3M abrasives solutions

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: **[3M.com/robotics](https://www.3m.com/robotics)**.

# What is material removal?

Material removal is a term used to cover the modification of part geometry and the modification of a surface.

Examples of removing material from a surface include: cutting, grinding, deburring, cleaning, satin finishing, orbital sanding, and polishing.



Removing gates  
on metal



Grinding wooden  
block into shape



Polishing of a  
painted surface



Abrasive



Speed



Your Part



Control



Force

## Why is the abrasive process so important?

Automating abrasives is not as easy as it may seem. It takes a long time to accumulate the experience to improve abrasive efficiency because of the many variables present in an abrasive process.

It is crucial to engineer the right abrasive solution at the beginning of your project because it will impact what equipment and capability is designed into the process.

Consequently, you will need an expert to help reduce your cycle time and process design time. That's where the knowledge of a 3M Application Engineer comes in.

# What can automating your material removal help you do?



## Reduce labor challenges

Manual material removal is dirty, dusty and can be dangerous. Hiring, training and keeping skilled and unskilled labor can be a challenge.

Automation allows workers to move to higher skilled positions to grow business, can reduce turnover, and still incorporates skilled workers into the process.



## Enable consistent quality

Provide more consistent output and quality with minimal down time required. Operate with fewer employees, run night shifts, and design for tighter tolerances.



## **Increase efficiency**

Increase output of parts per minute, which in turn can help reduce scheduling issues and reduce waste.



## **Savings**

Potentially significant savings through helping to increase production speed, reduce scrap, increase quality, and increase manufacturing flexibility.



## **Increased worker safety**

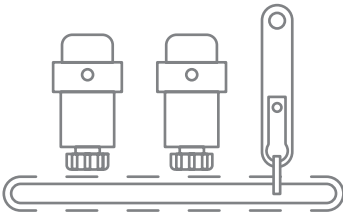
Having less manual processes helps to reduce fatigue, increase social distancing, and reduce workplace injuries.

# What is automation for abrasives?

At its highest level, automation is the act of using machinery to help manufacture a part. There are two primary categories for automation.

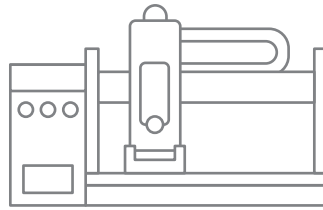
## Fixed automation

Used for high volume production in order to create low mix products of simple and consistent geometry.



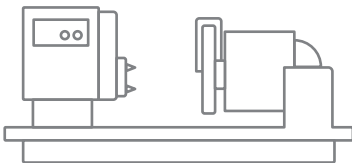
### Feed through

High volume and for simple geometric parts



### CNC machine

Highly accurate and requires precision geometry



### Cylindrical grinding and finishing

For rounded part

Parts created from fixed automation can range from:



Round



Flat

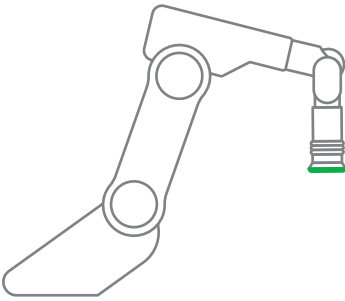


Simple geometric

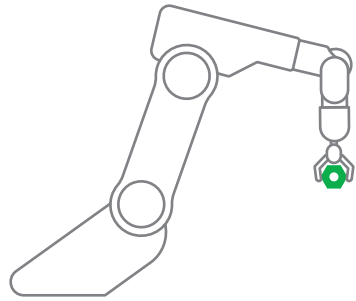
While 3M has deep expertise in both fixed and flexible automation, this booklet is focused on flexible automation. Please contact [3MCAMCenter@mmm.com](mailto:3MCAMCenter@mmm.com) or visit [3M.com/abrasives](http://3M.com/abrasives) for additional information about fixed automation solutions from 3M.

## Flexible automation

Enables production of a variety of different complex geometry part types in small batches.



Robot with abrasive in hand



Robot with part in hand

Parts created from flexible automation can range from:



Manipulable



Reprogrammable



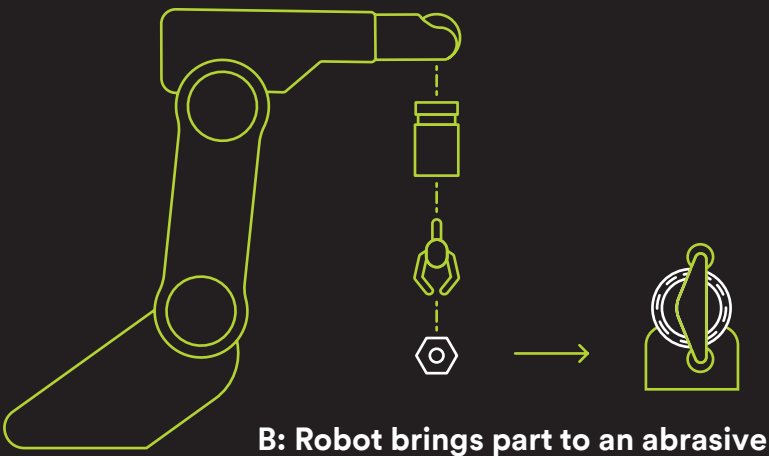
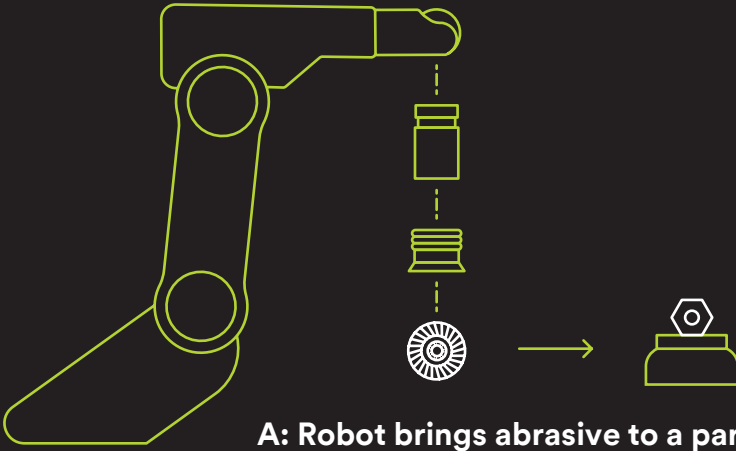
Repeatable



High and low  
volume

# What does a typical material removal cell look like?

There are 2 options



Depending on the type of material removal you are performing, there are 4 main abrasive forms.



Discs



Belts



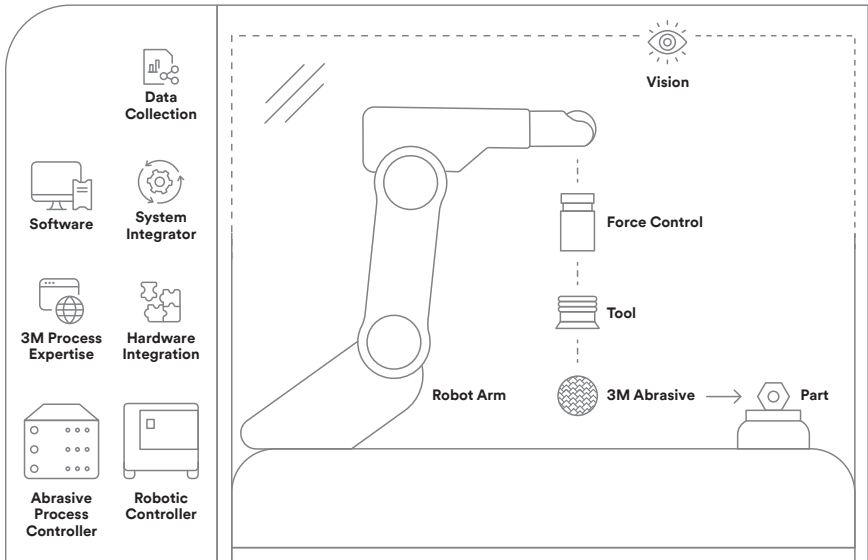
Wheels



Brushes

## General view of a typical cell.

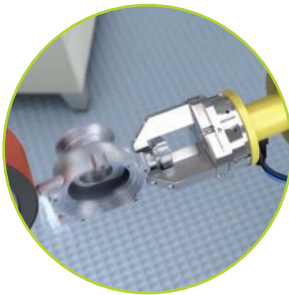
Cells are conformable to work to solve your specific needs.



This is a general view of a typical cell. Each cell type looks slightly different.

# Most common abrasive processes to automate

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



**De-gating**



**Deburring**



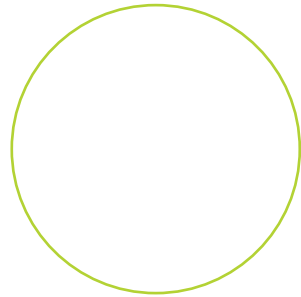
**Weld grinding**



**Blending/  
finishing**



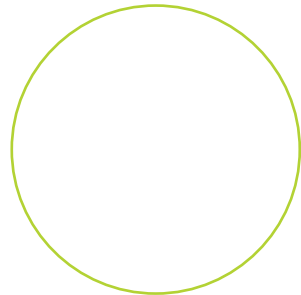
**Laser-braze  
finishing**



**Coatings  
removal**

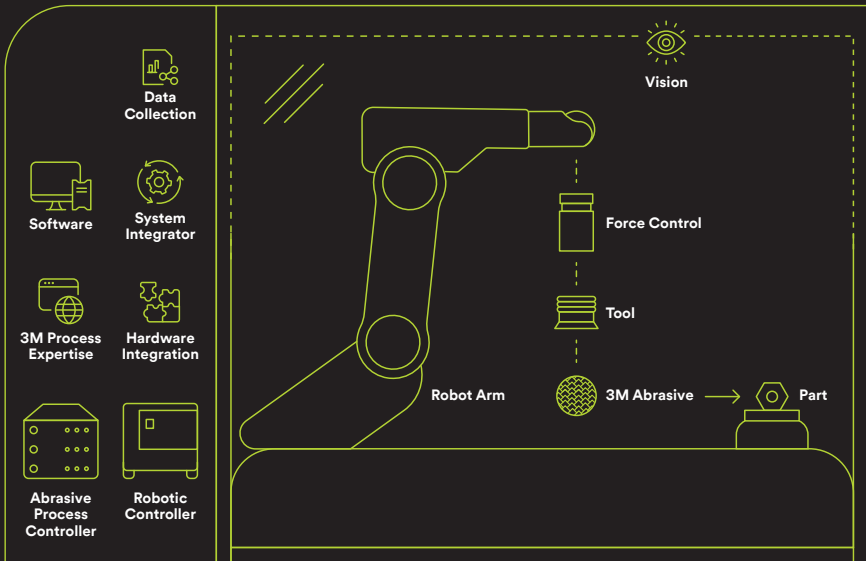


**Cleaning**



**Preparing for  
coating**

# Building a robotic cell



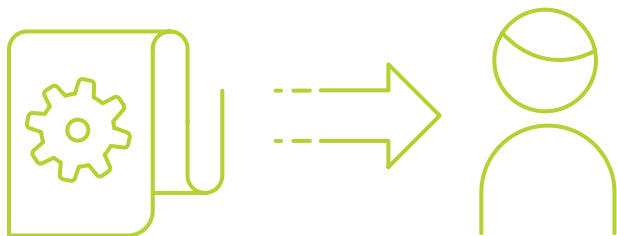
## What does 3M do?

3M does not make robots.

We help you (or your system integrator) make the process decisions to get the best results out of your end product and automation goals, using 3M abrasives.

The abrasive is one of the most important pieces: it touches your part, and designing an optimal abrasive process takes years of experience and skill.

We can help connect you with industry leaders that make robots and build integrated robotic systems.



## What does a “system integrator” do?

A system integrator can help you manage the design and implementation of your robotic cell and integrates it with your existing processing equipment.

Think of a system integrator as the general contractor for your automation project:

- ▶ You tell them your automation goals and it is their job to design the process and find the best pieces (e.g., robotic arm, force control unit, tools, abrasives, gating) to meet your goals.
- ▶ This includes set-up, installation and integration of all hardware, software, and equipment as well as teaching your team how to use the robotic system.

Putting together a robotic system can be a complicated project. It takes years of skill and experience to become a great system integrator for abrasives automation.

That’s why 3M has started a System Integrator Network to help connect you with the best in the business. For more information visit: **[3M.com/robotics](https://www.3m.com/robotics)**.

# How to sell automation to your management

## 1. Set expectations

Make sure to set the correct expectations when selling automation to your management team.



Investment in automation takes time and is an iterative process to find the best solution for your needs.



It might take more than one solution to solve all your production goals. But it isn't all or nothing.



Robots can be problem solvers, but they aren't magic.



## 2. Reference case studies

See how these case studies measure up to advantages that match your team's expectations.



### **Help increase quality and safety concerns, and decrease re-work.**

In testing trials, a leading motorcycle manufacturer looking to (1) reduce their fuel tank production rework, and (2) increase quality by moving from a manual to an automated process, achieved the following:

- ▶ Went from a 5-step to 3-step process
- ▶ 50% reduction in processing time
- ▶ 40% reduction in required labor
- ▶ The test manufacturer plans to install 8 additional robotic cells due to success



### **Help decrease production time and cost.**

An electrical box manufacturer moved their weld grinding operation from manual to automated and accomplished the following:

- ▶ 286% increase in cut speed
- ▶ 50% increase in through-put
- ▶ 48% reduction in cost of abrasives per year
- ▶ 75% reduction in overall labor costs
- ▶ Annual savings of \$900K (not including business benefit of increased production)



### **Help decrease production time and increase quality.**

A prominent engine manufacturing company invested in moving their finishing process to a robotic process and accomplished the following:

- ▶ 75% reduction in process time (from 8hrs to 2hrs)
- ▶ Helped meet tighter specs
- ▶ Helped reduce scrap
- ▶ Bonus: Resulted in significant reduction in downstream processing time



### **Help decrease production time.**

An automotive manufacturer moved their door and hood sanding operation from manual to robotic and to 3M abrasives and accomplished the following:

- ▶ 58% decrease in production time
- ▶ 2x longer lasting abrasive
- ▶ Bonus: Resulted in significant reduction in downstream processing time

### **Automation is worth the investment.**

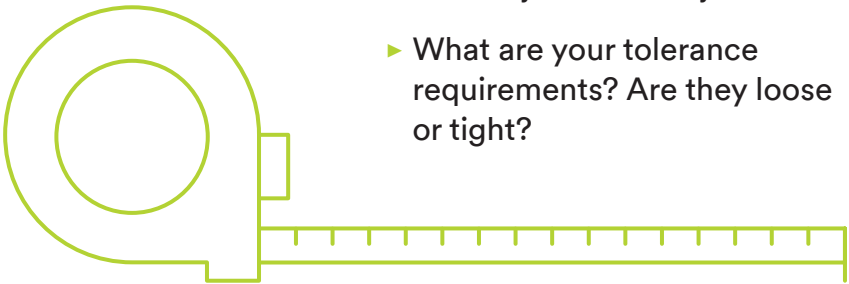
But remember, it takes the skills of a 3M Automation Expert Application Engineer to help you achieve your automation goals. Connect with one of our automation experts here: [3M.com/robotics](https://www.3m.com/robotics).

# Elements of automation — things to consider



## The work that needs to be done

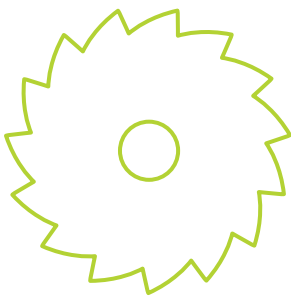
- ▶ What do incoming parts look like, and what do they need to look like afterwards?
- ▶ What is the purpose of the abrasive step in your process? Is it dimensional, functional or aesthetic?
- ▶ How do you measure “good”? Is it subjective or objective?
- ▶ What are your tolerance requirements? Are they loose or tight?





## Automation goals

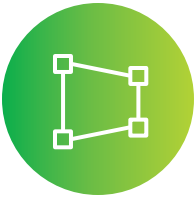
- ▶ Are you automating to increase production? If so, to how many parts per unit of time?
- ▶ Are you automating to increase quality? If so, to what measure of quality or tolerances? How will those measures be judged?



## Product type and form

- ▶ What type of abrasive product do you need to use to achieve your goals on your specific part?
- ▶ What form does that abrasive type need to come in to achieve your goal?

# Elements of automation — things to consider



## Abrasive process parameters

How much conformability do you need?

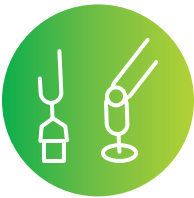
What life span is required?

What level of consistent output is needed over the life span?



## Force/pressure

How much force/pressure needs to be applied, at what speed, and at which angles, to achieve the correct consistency?



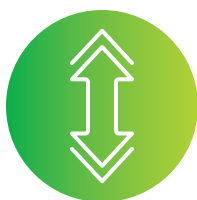
## Design choice

Do you want the robot to carry the part to the abrasive, or do you want the robot to carry and apply the abrasive to the part?



## Tool choice

What tool is needed to achieve the correct abrasive parameters, at the angles you require, and within your design choice and floor space?



## Compliance

“Compliance” tools allow the robotic system to account for part variation in order to maintain consistent contact.

1. **Passive Compliance:** Similar to a “spring” or “air shock” that maintains contact without feedback from sensors.
2. **Active Compliance:** Characterized by sensors in robot arm or end of arm tool that assesses force and adjusts accordingly.

*Compliance may be on the robot arm or on a backstand.*



## Robot path

What is the optimal path for your robot to take to achieve your automation goals?

*This is most likely different than your current manual process. Your goals and capabilities have changed, so the design of your process should change too.*



## Location

Where on the factory floor will this robotic system be installed?

*Consider environmental limitations, safety, electricity, upstream and downstream process steps, fixturing required, and hold time between steps.*

# Automation parameters to consider



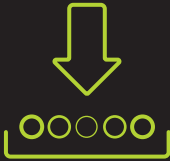
General abrasive process parameters



Benefits of premium abrasive products



Adjust for abrasive wear



Input part variability



Input part complexity



Finished part requirements



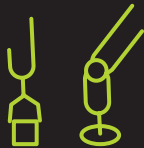
Tool path



Fixturing capability



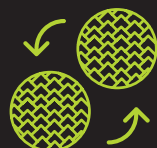
Input part mix/volume



Design choice



Robot sizing



How to change abrasive media

# **Why is the abrasive so important in the process?**

Once the design of the cell is fixed, it could be too late for us to help. You do not want to simply copy the current manual process to an automated process. You instead want to achieve your new automation goals, whether they be around efficiency, productivity, ROI or something else by leveraging the advantages of a robotic process. There are several things to consider in order to meet both your new automation goals and your product quality goals. That's why there are experts like us to help get it done right before it's too late.

# **Are you a good candidate for automation?**

The easiest way to find out is to give us a call and walk us through your process and future wants. Because remember, solving problems is what we do.

# Why is the abrasive consumable matched with optimum processing conditions so important?

Automating abrasives is not as easy as it may seem, because it is crucial to choose the right kind of abrasive solution at the beginning of your project.

It takes a long time to accumulate the experience to improve abrasive efficiency, which means you need an expert to help reduce your cycle time and process design time. That's where the knowledge of a 3M Application engineer comes in.

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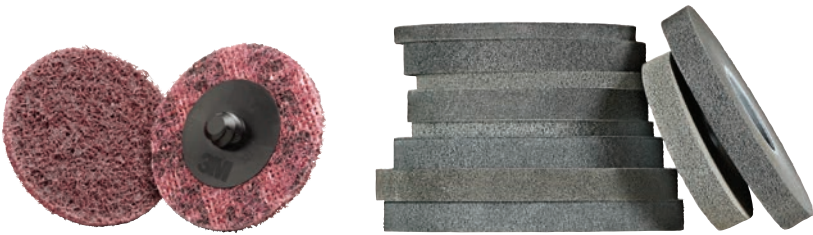
# What abrasive material solutions exist?

## Flexible solutions

Flexible solutions include discs, coated and nonwoven abrasives, and forms such as belts, discs and brushes. Flexible solutions are used for a wide range of applications. They offer flexibility to contours being sanded under different conditions including wet or dry processing.

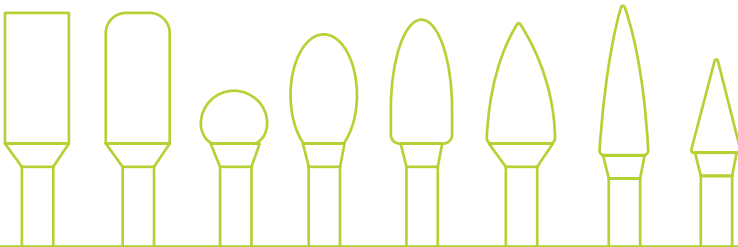


Flexible solutions are available in a variety of conformabilities. 3M can tailor conformabilities to suit your needs.



## Hard tooling

Examples of hard tooling include bonded wheels, diamond saws and carbide bits. Hard tooling is most commonly used for cutting and deburring.



# 3M Abrasives for Robotics

For more information contact your 3M Sales Rep.  
We have the answers and expertise to help you find  
a solution that meets your needs.



Cubitron™ II products, powered by 3M's precision-shaped grain, are available in many grit sizes and product forms to optimize material removal needs from heavy grinding to light sanding.



Trizact™ finishing and polishing products are micro-replicated abrasive constructions which enable continuous exposure of fresh grain as the construction erodes during use, resulting in consistent finishes throughout the product's life.



Scotch-Brite™ products are made of non-woven fabric or flexible bristles which provide inherent conformability, enabling them to follow part contours while deburring, cleaning and finishing.



**3M**

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# Things to know before meeting with a system integrator

Before you can automate an abrasive 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 robotics 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 a robotic cell.



## **I know what application needs to be performed.**

A system integrator will create a robotic cell tailored to the application being performed. Just like in a manual operation, automated deburring will leverage different abrasives and techniques from automated grinding.



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

Robots are good at performing simple tasks. Work with your operator to determine which grinding and finishing 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 robotic 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?
- ▶ Do they seem overly ambitious?
- ▶ What is the estimated timeline for project completion?
- ▶ Are your contract and payment terms clear?



# Why 3M?

## We help make robots work for you.

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

## Process expertise

3M has over 30 years of abrasive automation expertise. Our globally located Application Engineers and facilities are dedicated to developing your ideal robotic abrasive process. Send us parts to try out for you, so we can learn with you the best way to optimize your process.

## Premium abrasives

Our long-lasting, consistently performing and superior quality abrasives are optimal for a variety of robotic applications.

## Global partnerships

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

# Automation Customer Handbook



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