Grippers for Collaborative Robots

HANDY GUIDE FOR COLLABORATIVE ROBOT APPLICATIONS

Grippers for Collaborative Robots

LEAN ROBOTICS

robotiq.com | leanrobotics.org

Contents

Lean Robotics: Simplify Robot Cell Deployments

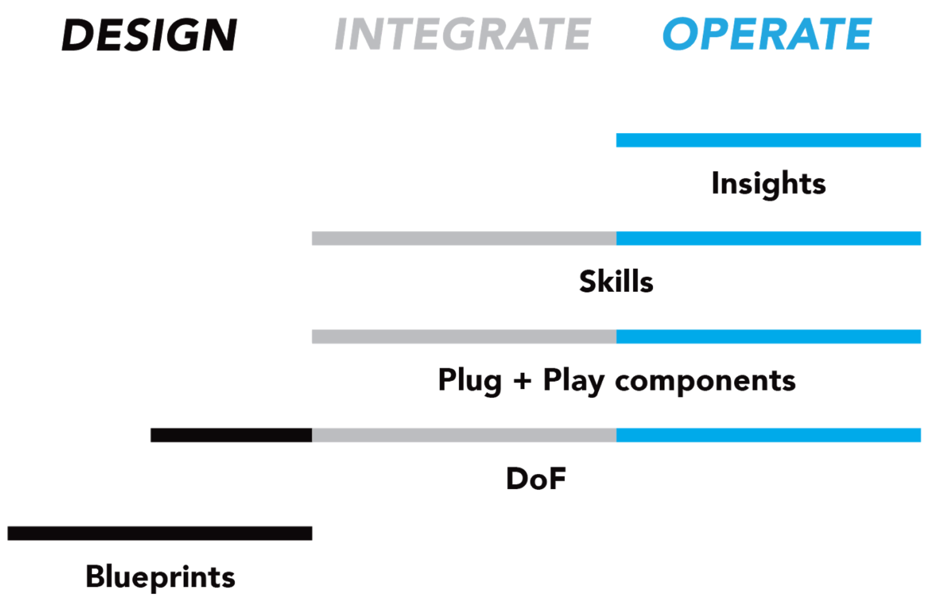
Whenever you ask if robots could work in your factory, the answer you receive is always a hesitant “It depends.” It depends on your factory, your team, which robot you choose, what you want it to do… and a whole lot more.

If you're a first-time robot user, how can you get started? How do you get from your initial idea to a productive, working robot? And if you’ve already got a few robotic deployments under your belt, how can you scale up your robotics efforts throughout your factory—or across multiple factories?

The answers can be found in **lean robotics: a methodology for simplifying robotic cell deployments**.

Lean robotics is a systematic way to complete the robotic cell deployment cycle, from design to integration and operation. It will empower your team to deploy robots quicker and more efficiently than ever before.

Lean robotics divides robotic cell deployments into three phases: Design, Integrate and Operate.



Robotiq’s library of eBooks covers the different phases of the robot cell deployment to ensure that you have access to tips from robotics experts all along.

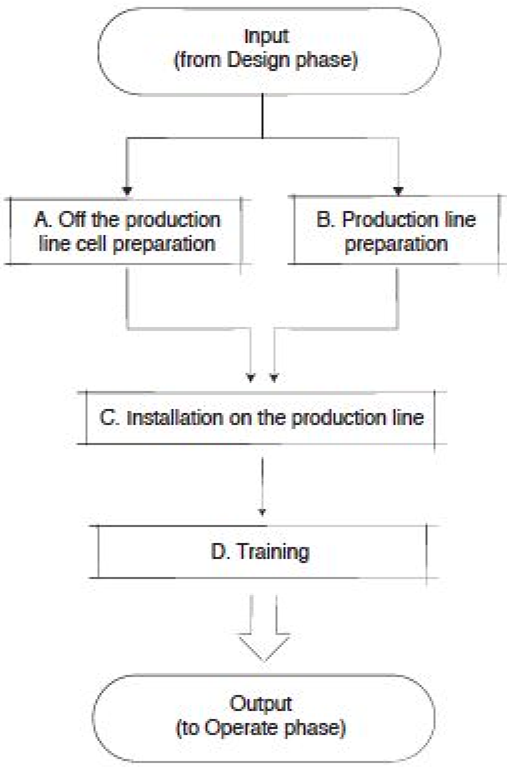
Learn more about Lean Robotics on **leanrobotics.org**.

This Ebook Covers the Integrate Phase

The integrate phase consists of putting the pieces of the robotic cell together, programming it, and installing the cell on the production line.

INTEGRATE

You start the integrate phase with the cell design in hand and the equipment ready to be assembled. At the end of the integrate phase, you'll have a working robotic cell on your production line, ready to start creating value for its customer.



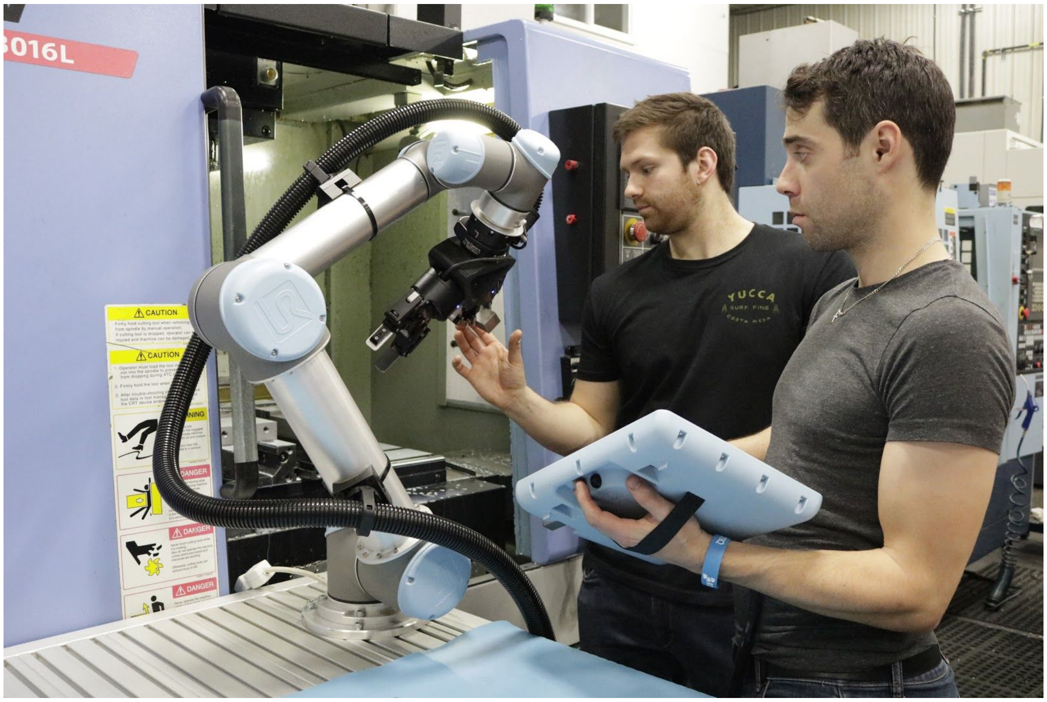
Introduction

When thinking about industrial robots, the image that comes to mind is often an automobile assembly line with lots of robots lined up along it. These robots weld parts together, install components, and assemble products at speeds no human could match. The payload they handle make it unsafe for workers to be around such robots, and they often require fencing to ensure safety.

Industrial robots on an assembly line.

Today, a new kind of robot is taking on more and more roles in factories. Although collaborative robots have been around for over 30 years, they have only recently become affordable and practical for factories. In part due to their lighter payloads and slower speeds, collaborative robots also feature better safety systems and easier programming interfaces than traditional industrial robots.

Many robot providers are now coming up with collaborative robots, which are often called "cobots." Their main benefit is the fact that they can share the same work environment as human workers. Moreover, they can work in collaboration with workers, handing them parts, for instance.



Collaborative robot cell.

When we say “cobots,” we often refer to the robot arm. Of course, the robot arm is not able to pick parts, sense force, or detect objects on a work plane all by itself — it needs a helping “hand” to perform its tasks. We call these the end-of-arm tooling, with the most common one being the gripper.

Grippers give the robot arm the ability to pick up parts to perform various tasks, including insertion and pick-and-place as well as machine tending. Grippers are as much part of the robot cell as the robot arm is. In collaborative applications, the gripper is responsible for handling parts in a safe and secure manner.

Many elements should be considered when integrating a collaborative robot cell that includes a gripper. When it comes to choosing a gripper, the number of options can be overwhelming. Several factors should be considered when making that decision. Once a gripper has been chosen, there are a few basic points that should be covered in order to integrate and program the collaborative gripping application.

Grippers in Collaborative Cells

What Is a Cobot?

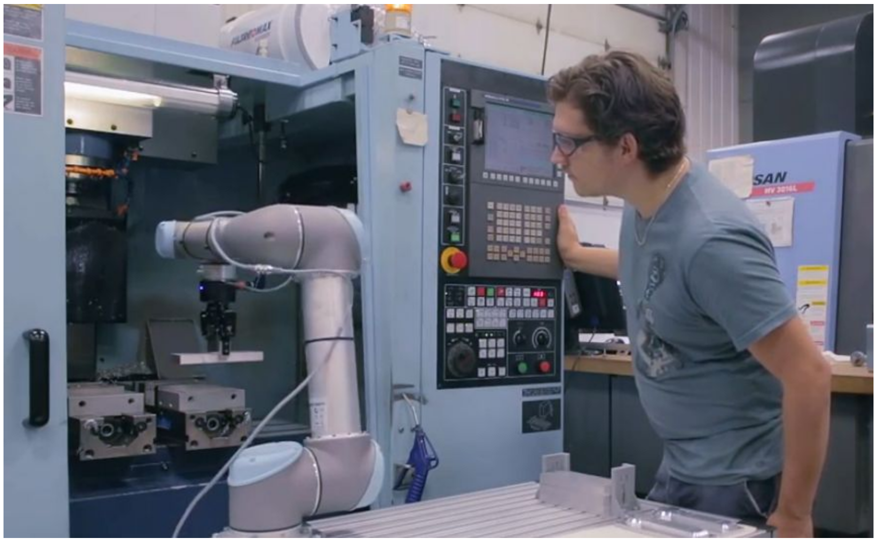
Since they don't necessarily need a whole fencing system, and they're easier to integrate than traditional robots, collaborative robots are best seen as tools. A process engineer or technician should be able to learn how to use and program this type of robot cell.

A cobot can also be simply moved around a plant and adapted to different applications. Their flexibility is one of their main strengths. A collaborative robot cell is not designed solely for one application with one specific part; it can be re-programmed rapidly to perform a different task.

The term "collaborative robot" is often misused and mistaken for "collaborative application."

- A collaborative **robot** refers to robotic arms that are force limited and that can be used within a collaborative application.
- A collaborative **application** is where the robot performs its task in collaboration with a worker in the same workspace.

Thus, a power and force limited robot may be required to perform a non-collaborative application. If there is no operator working within its workspace or in collaboration with it, then it is not a collaborative application. Force limited robots can be used for both collaborative and non-collaborative applications. The difference between the two scenarios is a matter of how it is integrated, assessed and programmed, as well as its application. A collaborative robot cell can also have different operation modes, depending on whether workers are present in its surroundings.

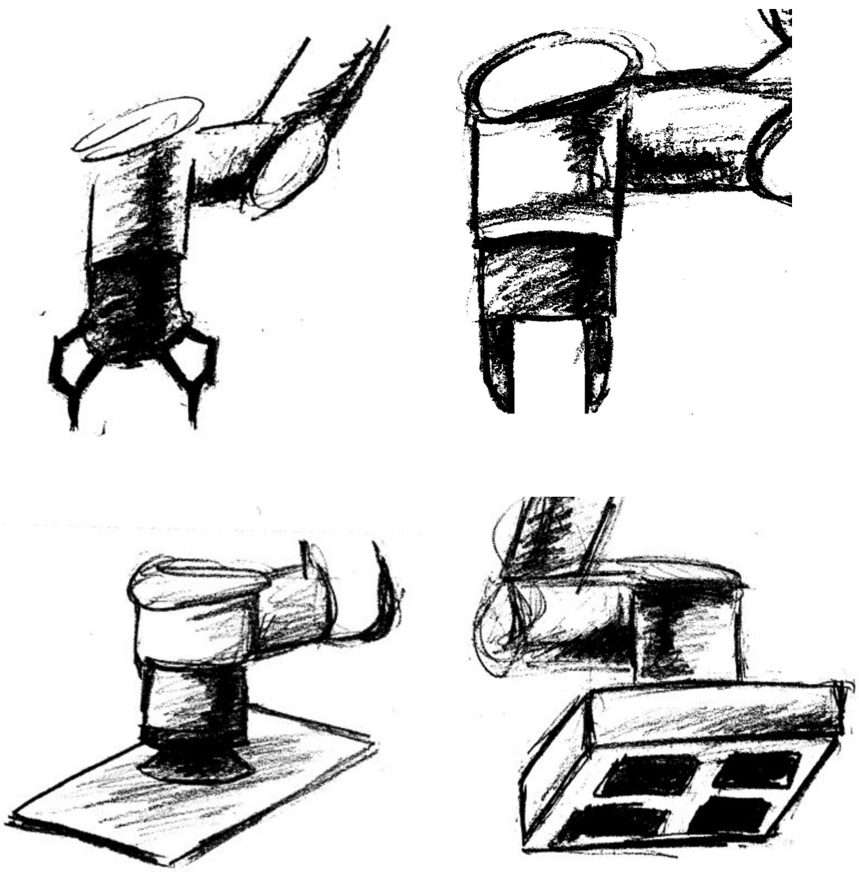


Collaborative application.

The requirements for a robot cell to be used in collaborative applications have been described in various documents, and global standards have been set. Such documents provide guidelines and best practices regarding the integration of these robot cells.

When implementing such a cell, it is best practice to perform a risk assessment first and design the cell accordingly. Since workers are going to be in the same workspace, the risk of injury and damage has to be considered when performing the risk assessment.

In a robot cell, the robot arm is often the first component to be chosen. After selecting one, you need to define what your robot cell needs in terms of end-of-arm tooling. Obviously, grippers are commonly used to pick up and handle objects. Throughout this document, "gripper" refers to a robotic device mounted on a robot arm that performs object handling. It allows the robot to pick objects and perform tasks with them.



Types of grippers. Top row (left to right): electrical, pneumatic and hydraulic. Bottom row: suction cup, magnetic.

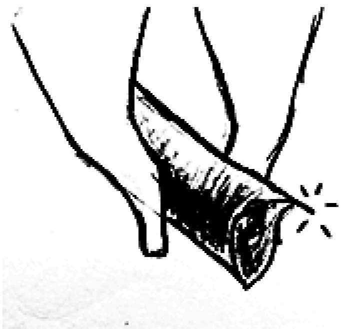
Grippers within the collaborative cell should be treated as part of the whole collaborative cell. They are as important to operator safety as the robot arm. Therefore, they should be seamlessly integrated with the cell in regards to its safety, flexibility, and ease of use. They should enhance gripping abilities, not create disadvantages. All in all, the gripper must not be the limiting factor when it comes to the robot cell being collaborative.

Safety with Grippers and Cobots

When choosing a gripper for a collaborative application, a range of elements must be considered. The gripper has to be assessed on its own in addition to as a part of the whole collaborative application.

First, you should avoid grippers with sharp edges and pinch points. If moving parts are accessible by operators, do they represent a hazard? Smooth edges are better than sharp ones, due to the reduced risk of injury.

You should also assess the object that is to be picked by the gripper during the application. Does it have sharp edges? Does the grip contain pinch points? If so, consider this set of elements when designing the robot cell and make sure to prevent the risk of injury as much as possible.



Part with sharp edges.

The part's temperature should also be considered when assessing the risks of the collaborative cell. If objects with high temperatures are picked up, the gripper should be able to withstand the heat without representing a risk of burning the operators.

Other potential hazards to consider are collisions with the work plane, the environment, fixtures, parts and workers. The robot arm should be set up and controlled in a manner that avoids and reduces the risk of those hazards. Consider not only the collision hazard of the gripper on the robot, but also of the part being picked up.

Another important factor to consider regarding the safety of the collaborative cell is the potential loss of power to the gripper. Whatever the type of gripper — whether suction cup or hydraulic, pneumatic, electrical or magnetic gripper — the event of a power supply loss or pressure drop has to be considered and managed. This kind of event should not result in the robot dropping the part, especially during a sudden motion stop. A failed grasp also presents the risk of a part being ejected at an unwanted moment. Safe gripping strategies should be considered carefully.

If a tool changer has to be used, the robot cell should verify that the proper tool has been picked up. It should also be verified that the tool is securely fixed to the robot arm.

As of this e-book's date of publication, ISO/TS 15066 is the technical specifications to consult regarding grippers for collaborative applications. It focuses on collaborative robots and collaborative robot cells, so it should be read and applied according to your collaborative application. As mentioned, it is also recommended to perform a thorough risk assessment of the robot cell (as described earlier), for which this is the core documentation containing all the information you will need on your robot cell's safety hazards.

What to Consider when Choosing a Gripping Technology

While keeping in mind the technical standards for collaborative robots, you need to define your needs for the gripper. The key to choosing a gripping technology for a robot cell is understanding the application. What task will the robot actually be doing?

The gripper will of course have to pick up a part at some point, but then, what action will be taken?

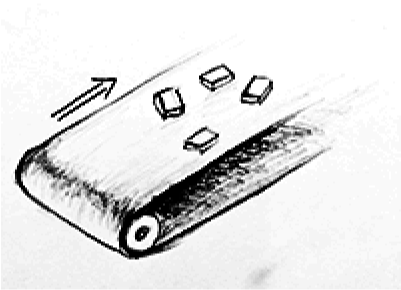
- How will the gripper pick up the part?
- What will the gripper do with the part?

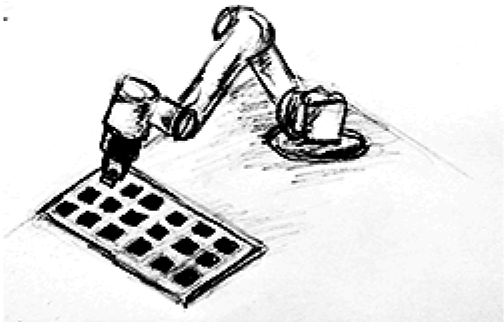
In addition, there are many technical specifications and other aspects that will influence the choice of gripper for a collaborative robot cell.

Gripping Strategy

The choice of gripper is strongly influenced by the type of part to be picked and the gripping strategy to be used.

First, the way the parts are presented to the robot will influence the gripping strategy. Whether it is a conveyor with randomly disposed parts or a pallet with perfectly aligned parts, the right gripping strategy needs to be chosen.

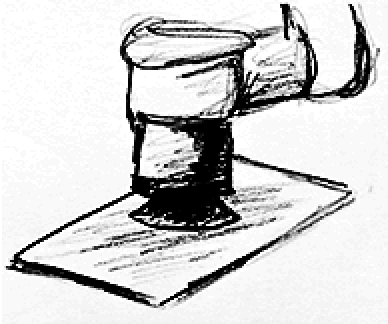




Part presentation: randomly presented on a conveyor belt (left) and aligned on a tray (right).

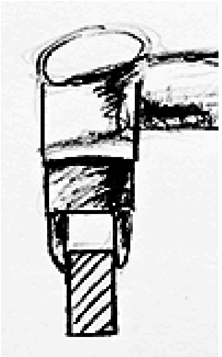
The part's geometry will help you decide which gripping technology to use.

A broad, flat part that is not high may require an adhesive grip from the top (such as a suction cup).



Tubular parts can be picked up with an internal grip.

A part with parallel faces means the gripper's fingers can close onto them in order to perform the grasp.



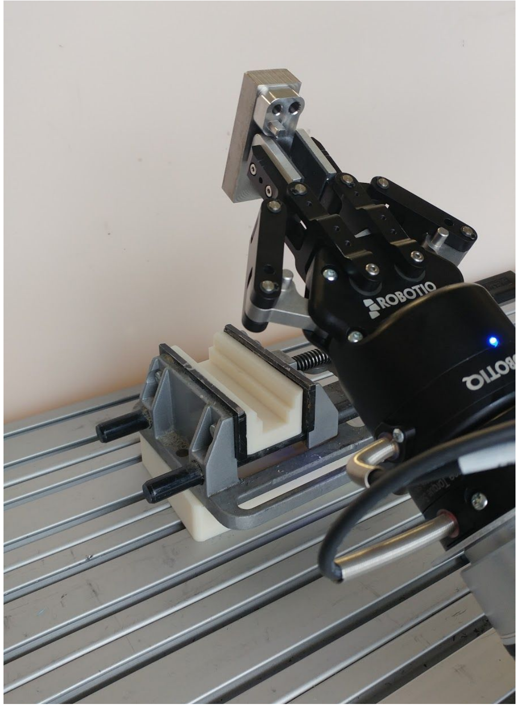
In any case, it can help to look at how the part is presented to the robot and think about how you would pick it up by hand. Since it is a collaborative robot cell, it is very likely the task and application are on a human scale. While performing this exercise, be aware of how you would pick it up. Where and how were the forces applied? How else would it be possible to perform this task? Would it be possible using only two fingers? Three fingers? Or would it need a pulling force? This basic exercise can help answer how a robot gripper could pick the part up.

Task Performed

Beyond how the part is presented, you should consider the task to be performed after the part is picked up.

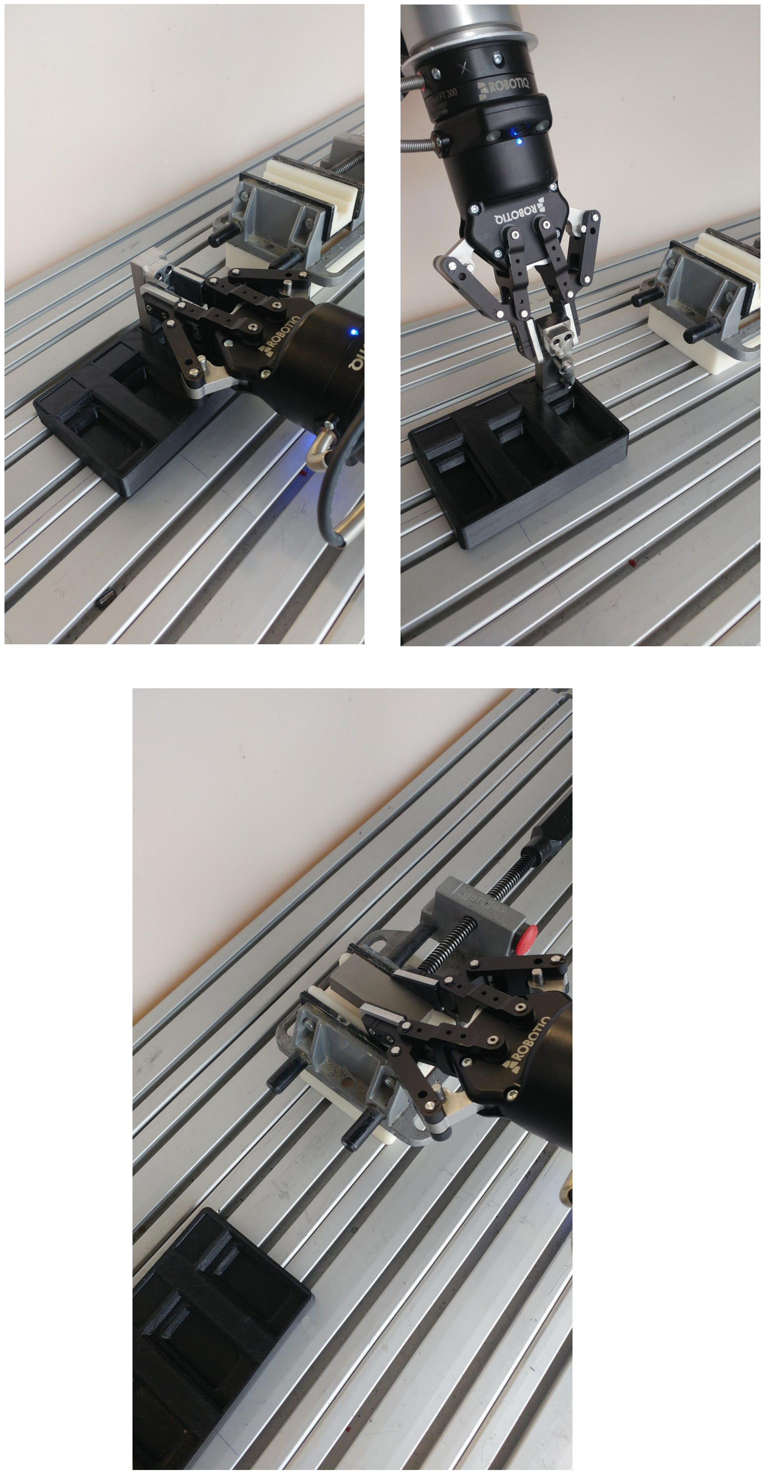
You can continue with the exercise and imagine how you would handle the part and perform the task. In doing so, analyze your movements and what they imply. This will help with comprehending the motions that the robot arm, wrist and gripper have to execute.

Some complex tasks will require the help of an external device or fixture to reposition the part within the gripper. For instance, if a part has to be flipped and placed on a tray, then it can hardly be done if the gripper grips the part from the top, because it would not be able to rotate the part and place it upside down.



Gripper unable to flip a part.

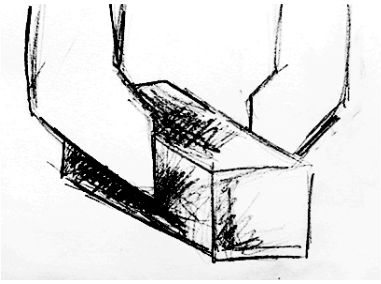
An external fixture or secondary station may have to be used. This represents the limit in the robot arm and gripper's abilities to perform complex motions.

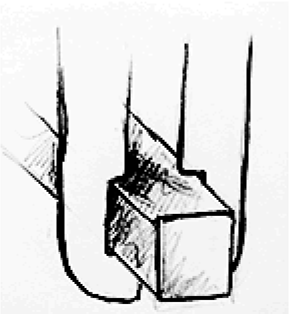


Use of a fixture to flip the part.

Grip Types

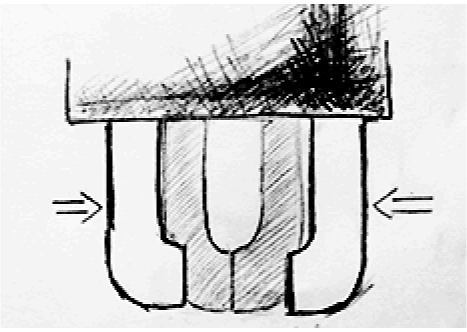
Some types of grip use the form of the object or custom fingertips to get a secure grasp. Other grips rely on friction and normal force to hold onto the part. When feasible given the application and the object, you may utilize the object's shape during grasping in order to ensure a more secure grip. However, this will reduce the gripper's flexibility and make it harder to change the robot cell's application.

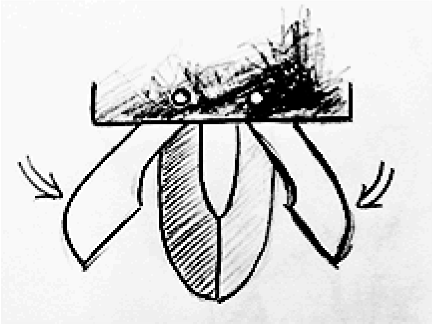




Grip relying on force (left) and on the object's shape (right).

Some grippers close their fingers in a parallel motion, whereas others use rotation to close them together. These two different motions offer various grip types and solutions. Consider each of them when assessing the type of grip you wish to perform. They have their own pros and cons, but they should be chosen for the type of grip they perform in regards to the object you wish to have picked.

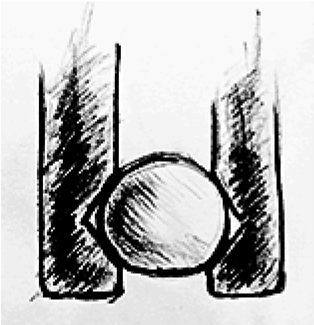




Gripper's finger closure motion: parallel (left) and rotational (right).

Fingers & Fingertips

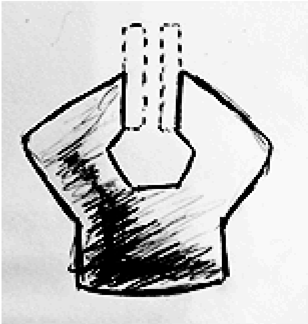
Fingertips can be chosen or designed to fit your part. For instance, when grasping round or cylindrical parts, it is wise to use grooved fingers. This feature allows a more secure grip and helps center the part within the fingers. It also means the same fingers can grasp round parts of different diameters.



Grooved fingertips for grasping round parts.

The gripper in itself may have most of the features required to pick up an object, but in some grippers, parts are customizable. The fingers and fingertips may be changed to fit the object's shape and the application.

Modifying the fingers or fingertips requires design and fabrication. This implies additional cost and delays in the process of integrating the gripper. Depending on the application and your situation, it may or may not bring advantages. If you do decide to go with custom fingertips, now is the time to be inventive and make this gripper as efficient as possible for your specific application.



Custom fingers or fingertips.

Custom fingertips are suited for robot cells that will perform rather similar tasks over a long period of time. These factors justify the time and energy spent designing and integrating the custom components. Regardless of the situation, the time invested has to be assessed regarding whether or not it is a good investment compared to off-the-shelf fingers. For quicker application changes or small batch sizes, a flexible and adaptive gripper might be the way to go. These grippers can also be suited to non-changing applications or larger batch sizes. It all comes down to which solution best suits your needs in regards to the investment and resources required.

Robot Cell Flexibility

Even though it is difficult to predict exactly how the collaborative robot cell will be used in the future, it's likely to have many different applications over time. A machine tending application for a robot may have different parts to produce depending on the ongoing project and batch sizes. Also, the entire cell might be moved to a different part of the factory floor to serve a different task or because of plant reorganization.

When choosing a gripper for a robot cell, you must assess its required adaptability. Is the robot going to always tend to the same machine or perform the same task? Are there other robots in the plant?

Also, the type of production should be taken into account. If the same products and the same parts are manufactured over a long period of time as opposed to smaller batch sizes, this can affect the type of gripper you should choose.

Power Supply: Electrical, Pneumatic or Hydraulic?

Another key factor is the setup required to supply power to the gripper.

Electrical grippers are fairly simple: only a power supply is required, and there is often one within the robot controller. You must verify the voltage and current necessary to power the gripper, as well as the maximum voltage and overcurrent protections.

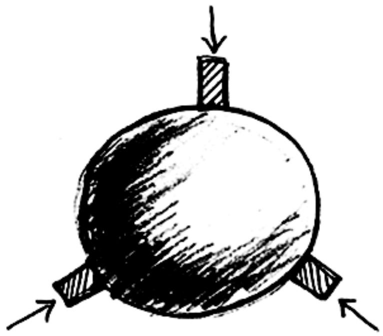
Pneumatic and hydraulic grippers require an air or hydraulic line. If one of these has already been installed on the factory floor, this makes hydraulic and pneumatic grippers a good contender. Those types of grippers, along with suction cups, have to be hooked up to the main air or hydraulic line. Assess how you would perform this before making a decision about gripping technology. As mentioned previously, the robot cell may change location within the plant and perform a different application. It all depends the factory's requirements, but the gripper should not limit this ability to adapt.

Power Supply and Picking Options
Magnetic grippers and suction cups can only pick up a part by sticking to one of its surfaces and pulling it. Your part must have a flat surface in order for these grippers to work.

Electrical, pneumatic, and hydraulic grippers can come with different transmission mechanisms. This allows for many finger-closing motions. They can be either linear, angular, or adaptive — the latter of which is a mix of both using underactuated fingers.

Underactuated adaptive fingers allow for a parallel or encompassing grip.

They can also come with more than two fingers. Grippers with three fingers provide a third contact point on the object and can therefore ensure a more secure grip. For instance, these grippers are particularly suitable in the case of picking cylinders from the top.



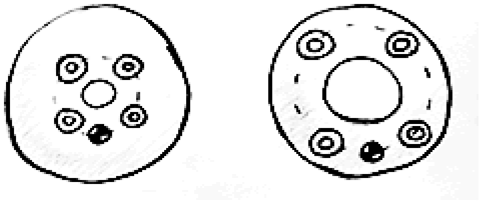
Three finger gripper.

Ease of Integration

It often feels like there are almost as many communication protocols as there are robot manufacturers. When looking at grippers for a robot cell, check the communication protocol used to control the gripper. Can the gripper be connected and controlled directly by your controller or PC/PLC? Or do you need a gateway between the two? Does it communicate via digital or analog inputs and outputs (I/O)? Communication is one of the factors that determine ease of integration of a robot cell.

Furthermore, when gathering information on potential grippers, check whether they have software packages or software development kits available for the selected robot controller. If there are some available, this can save significantly on setup time, leaving you with more time for the actual programming.

Another element that is sometimes overlooked is the mechanical installation. The robot arm may already be in place or it may have just been chosen. With this information, compare both the robot tool flange and the gripper's bolt pattern.

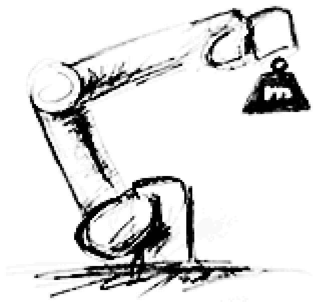


Robot bolt patterns.

Do they fit? Chances are they don't. In that case, an adapter plate will have to be designed and fabricated. It is also possible to contact the manufacturer or distributor to find out if they sell one.

Payload and Gripping Force

A crucial factor to consider when choosing a gripper for a collaborative cell is the payload the gripper is able to handle. While the robot's payload calculation includes the gripper as well as the part that has to be picked, the gripper's payload is only the object it picks.



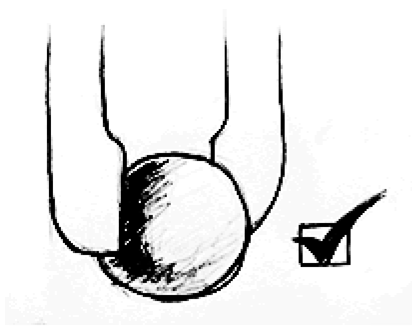
Robot arm payload.

$$\textit{Robot arm payload} = \textit{Gripper weight (and other tooling)} + \textit{object to pick}$$

Also, once the gripper is mounted on the robot, the gripper should be able to hold as much of the remaining payload as the arm can withstand. That way, regardless of the application, the gripper will not be the limiting factor in the robot's payload capacity. The robot may also have been chosen for its reach rather than its payload. In that case, the gripper's payload should fit the objects you intend to pick. Also keep in mind that this is a collaborative robot cell and its application may change over time. Thus, a robot that has to pick up a light object this quarter may have to handle heavier parts over time.

Gripper Feedback

Some grippers can provide feedback to the controller. The most interesting ones provide information about whether a part has been grasped successfully and the opening position. Making sure an object has really been picked up can make the robot program more robust. If its resolution is suitable, the opening feedback can measure an object's dimension. This can be used in a part-sorting application by checking the dimension on which the gripper closed.



Gripper feedback: object detection.

Sensors can be added to grippers that do not provide such feedback. They can detect if a specific position has been reached or, in the case of parallel fingers, inform on the width of the opening between the fingers. Those are added accessories and their precision, reliability, and robustness must be assessed before they are integrated with the robot cell.

Cost

Last but not least, cost is an important factor to consider. As with any project, at the end of the day, the benefits should justify the cost of the investment. Collaborative robot cells can be moved around the factory to perform different tasks. Their ease of use, integration and programming make that possible.

On top of that, your should take into account other aspects of cost:

- How much time will it take to complete the integration?
- Will custom fingertips and adapter plates need to be designed?
- Is it an electrical, pneumatic or hydraulic gripper?
    - Is the required setup already in place for either one of them?
    - Concerning hydraulic and pneumatic grippers, what will be the cost of implementing them?
- Are any special skills needed to install and program the gripper?
- What about maintenance cost and frequency?

These are all questions that you have to ponder when evaluating the cost of a gripping solution. The main question to ask yourself is: What is the cost of putting the gripper on the robot and being able to control it? It is not just about buying a gripper, but about making it work within the robot cell.

A crucial factor when choosing a gripper for a collaborative cell is that it should not be the limiting factor. The gripper must seamlessly integrate and fit with the other components of the robot cell.

Make sure your risk assessment has been correctly performed so you know the technical requirements your gripper must meet. Gather all the information you can from the grippers you are interested in and ponder all of this using the factors listed above.

How to (Seamlessly) Integrate a Gripper

Once you've chosen the gripping technology, it must now be integrated properly into the collaborative cell. Since it is a collaborative cell, it can be tempting to simply hook the gripper up to the controller and just start programming it.

While this may be exciting, there are a few steps you need to go through before you can properly build a program to perform a task. Some of these steps you will go through while programming. Other steps must be completed before writing any lines of code. They will help you make your final application safer and more robust.

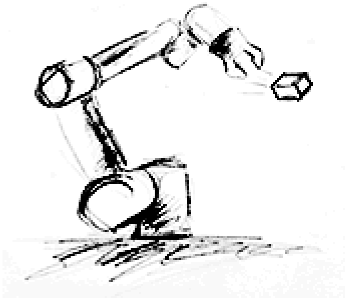
Emergency Stops and Power Failures

Before you power up the gripper and start programming with it, an important question to ask is how you want to manage power failures and emergency stops. These are the cases during which the gripper is most at risk of dropping the part, other than when the part slips due to a poor grip.

Power loss and emergency stops may occur at any time, and all possible cases should be considered in order to prevent material damage and reduce the risk of injuries.

Power loss can also occur with the gripper alone due to an issue with a cable or connector.

In the event of a power failure to the entire cell or an emergency stop, the power supplied to the robot arm is cut, making it come to a quick stop. This can generate high decelerations if the arm was moving fast. The gripper is then at risk of dropping the part or letting go of it with high velocity.



Part ejected due to a sudden stop.

You should think about what should happen to the gripper in case of an emergency stop. Should it lose power completely or simply halt its motion?

This depends on how the gripper behaves during a power loss. If the gripper is self-locking, losing power while a part is grasped will likely not cause it to be dropped. It also depends on the type of part that is gripped. The questions below will help you assess the risks in the event of a power failure.

- What is the part's weight?
- What is the highest speed the robot arm can reach during the application?
- Does the part have sharp edges?
- What is the risk of damage or injury if the part is dropped?

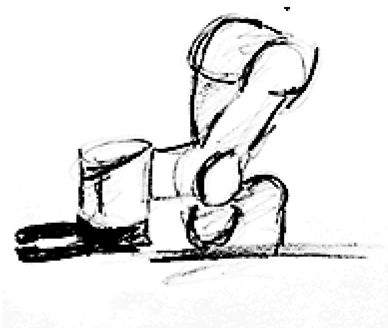
If you want the gripper to lose power when the robot controller's emergency stop button is pressed, there are solutions. First, confirm that the gripper has an emergency stop switch with the manufacturer. If the gripper does not have one, you can configure its power supply to an output (I/O) of the robot controller. You can set it so that the power is cut to the gripper when the emergency stop button is pressed. This procedure may differ depending on your gripper and robot controller type, but it should allow you to manage the emergency stop from only one point: the controller.

It would also be a good practice to have the part's center of gravity located between the fingers, or as close as possible to being between the fingers. This will reduce the moment on the part in the event of a sudden stop of the robot arm, diminishing the risk of the part being ejected from the grasp.

Mechanical Installation

When mounting the gripper on the robot arm, estimate the robot's motion and wrist orientation throughout the application. This will help you predict the best tooling orientation in regards to the robot arm. It can also provide guidance on how the gripper should be mounted on the robot arm. What would be the best wrist orientation for your gripper to perform its task?

The gripper can easily be oriented using the robot's last joint. It is also possible to angle the gripper compared to the robot's tool flange. An adapter plate can be designed to offset the gripper on the tool flange.

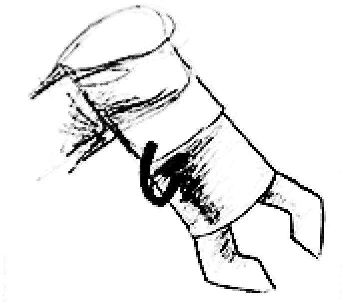


Adapter plate for changing the gripper's orientation or offsetting its position.

This procedure requires care and attention when setting the tool center point (TCP) and center of gravity, but it can facilitate the programming of a given application. It can, for instance, ease the robot's motion if the gripper has to insert a part in a place that is hard for the robot arm to reach.

Cable Management

Once the gripper is mounted on the arm, you will need to wire it to the controller or PC/PLC. You will then have to deal with cable management, a step that is often overlooked. Some collaborative robots are designed to have cables running through them or have a tool output at the wrist or forearm.



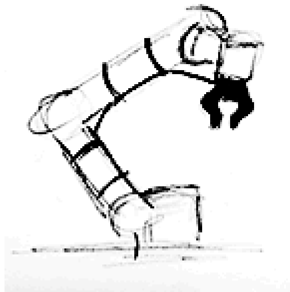
Tool connector at the wrist.

These features are interesting if they fit your gripper's power requirements and communication setup. If they do not fit, cable management will have to be addressed. Keep in mind that there are some products on the market for this purpose, but you can also use a custom one.

Regardless of the solution, when cable management has to be performed, the cables are fixed along the robot arm. Between this fixed section and the end-of-arm tooling, you should leave a section of unsecured cable to allow wrist motion and rotation. This is the portion of cable that will undergo the greatest stress. A wide range of motion can be performed at the wrist because robot arms often have three joints placed close to one another, creating the robot wrist.

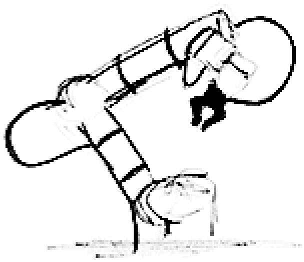
Robot wrist with three joints.

Excess cable should be left in order to allow this motion to take place without pulling and applying stress on the cables. Failing to leave enough excess cable can cause extensive pulling and twisting stress on the cable, which can damage both the cable and the connectors.



Cable management: not enough excess cable.

Too much excess cable may cause it to get tangled in the tooling or even in the robot's environment. Check that you've properly prevented this situation before you start programming the application and double-check during the programming step.

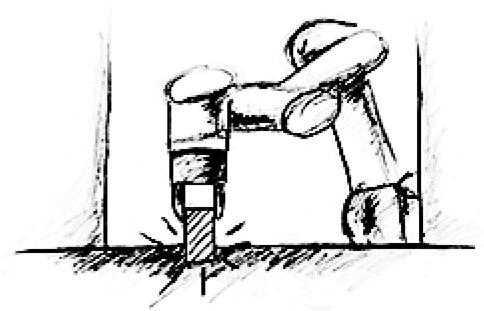


Cable management: too much excess cable.

Tool Center Point

Once the gripper is installed and wired on the robot, it's important to set the tool center point (TCP) and center of gravity correctly. As some robot motion can be performed in regards to the TCP, it must be set properly before you start programming.

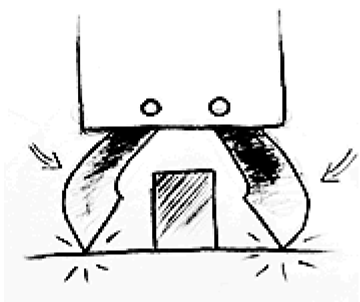
When programming the robot's motion for the application, make sure the end-of-arm tooling does not interfere with the work plane, other machines, fixtures, etc. Also consider these things regarding motions when the gripper picks the part.



Collision of part with the environment.

With some collaborative robots, the center of gravity must be set so that the robot will consider the tool that is attached. This will prevent the robot from mistaking the gripper's weight for the part's weight when applying force. Take the time to get the right data from the supplier or, if it is not available, to calculate it as precisely as possible.

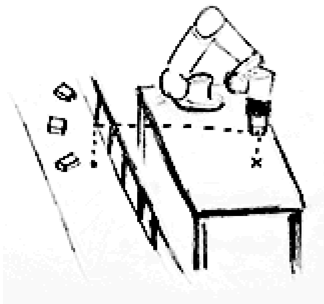
When the gripper closes to pick up an object, make sure the tips of the fingers do not collide with the work plane or other fixtures. This is especially likely to happen with grippers that have angular motion of the fingers.



Fingertip collision with the work plane.

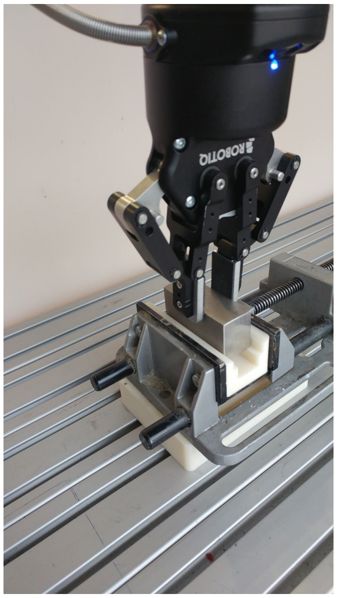
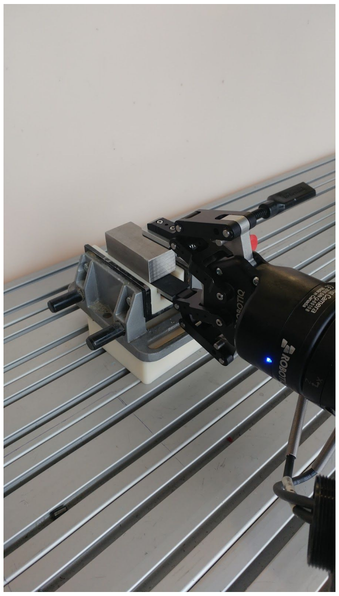
Approach and Retreat Positions

When picking and moving objects with the robot arm, it is good practice to include an approach and retreat position. Those positions can, for instance, be at a certain height above the part to be picked. They ensure that the robot will clear the work plane or table when moving the object from one station to another. These positions should be used wisely to prevent any collisions with the robot's environment, tools, tables, etc.



Approach and retreat positions.

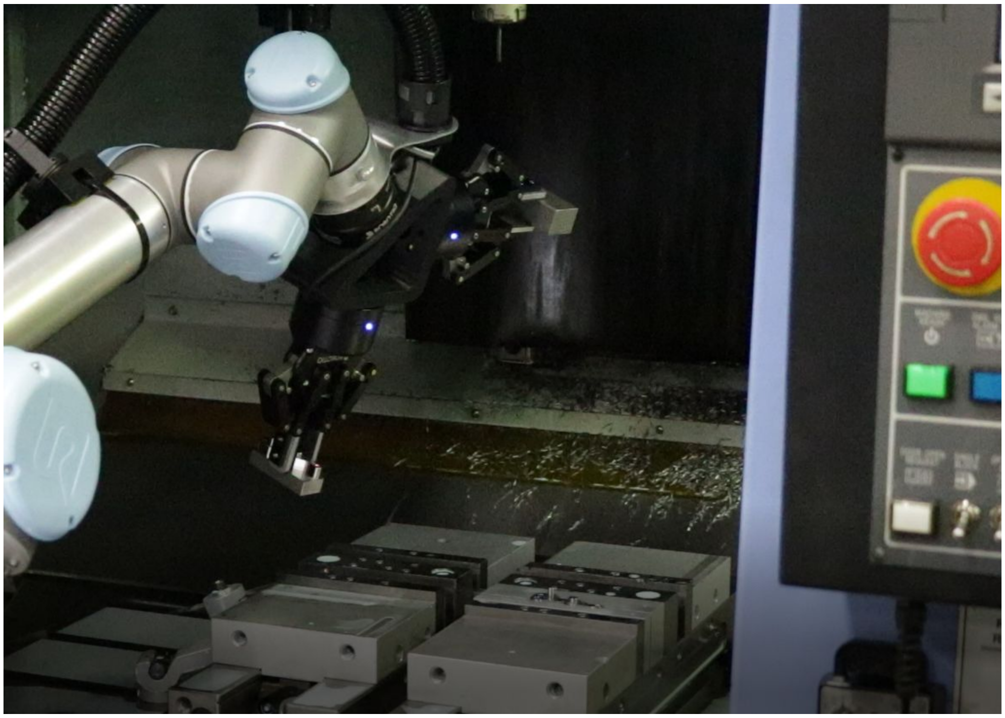
Depending on the object's geometry and the tasks to be performed, a specific position can be used to prepare for object picking. This is part of the gripping strategy and should be considered before designing fingertips and fixtures.

Gripping strategy: top pick (left) and side pick (right).

Multiple Grippers

To reduce the cycle time even more, some robot arms will support having two or more grippers mounted on them. This is mostly seen in machine tending applications where the machine's cycle time is quite short. Having multiple grippers means one gripper can pick up the blank part to be machined, the other gripper can pick the machined part from the machine and the first gripper can place the blank part in. While the machine performs its task, the second gripper can drop the machined part in the desired area and pick up another blank. This speeds up cycle times and can increase productivity.



Dual gripper setup for machine tending application.

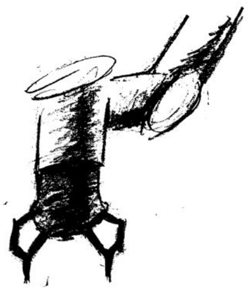
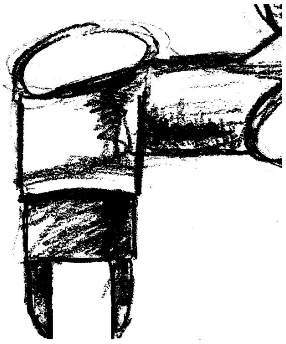
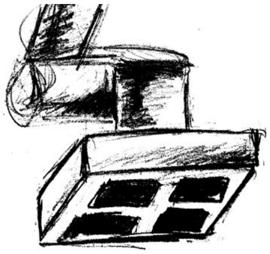
When considering whether to implement multiple grippers, more factors have to be pondered. Verify the way grippers are controlled when two or more of them are connected to the same controller. Also, verify the power supply capacities for such a setup. A key element to take into account is how the grippers will be mounted on the tool flange. Can the supplier provide you with one? Some will offer packages for [multi-gripper](#) [applications](#). If this is not the case, you will have to design and fabricate a mounting plate.

Dual gripper mounting plate examples.

Remember, the weight of both grippers and their mounting plate should fit the robot arm's payload. It must be able to pick up the objects without exceeding its capacity. You should also verify the gripper's own payload in regards to the parts to pick.

From emergency stops to picking strategies to collision avoidance, there are a lot of factors to think about when integrating the gripper to your robot cell. When you program the robot application, you may be tempted to go with your intuition. You should however keep the above items in mind. They will help you design programs that are robust, effective, safe and truly ingenious. Although you may already have thought of some of those steps when programming, it's worth double-checking. With time, this list will become something you automatically consider when integrating a gripper to a collaborative cell.

Table - Gripping Technologies

Gripper type		How it works	Things to consider
Electrical		An electric motor is powered and its rotational motion is transmitted to the fingers. Depending on the transmission, the finger movement will either be linear or rotational.	Easy setup to the power source. Verify the type of transmission to predict maintenance needs and find out if it is self-blocking.
Pneumatic & hydraulic		Energy is supplied by pressurized fluid or compressed air (requires a whole line setup). A piston is activated by the pressurized fluid or air. Its motion is transmitted to the fingers.	Can generate high forces. Needs to be hooked up to a hydraulic line. There is a risk of leakage or pressure drop in the line. The gripper itself does not contain a motor.
Magnetic		In some models, compressed air is used to move a magnet closer to the object or further away within the gripper in order to pick up and release the part. Other models use an electrically activated magnet.	May be sensitive to surrounding magnetic fields. Typically used to pick flat, ferromagnetic parts. Machining chips may stick to the gripper. Oil on the part's surface may compromise the grip.
Suction cups (vacuum)		Requires a vacuum (negative pressure) to apply suction to the surface of a part. The vacuum can be performed by various mechanisms.	May have a flexible linkage between the cup and the object. Verify that your object's surface will allow for a good grip with the cup. Risk of loss of vacuum.

Conclusion

The gripper is an important part of the robot cell, and one that's as important as the robot arm itself. Its ability to enhance the robot's performance makes it a vital player that should not be overlooked, especially in collaborative robot applications. The gripper has an important task of handling the parts and its actions should not present a higher risk of injuries. In that regard, even if the robot is called a "cobot," a proper risk assessment must be performed.

You should consider not only the robot cell components, but the application as a whole. What motions will be performed? What kind of parts will be picked? Does the part itself present any risks of causing harm? Do the grip, the part and the arm motion present risks when they're combined? These are all important questions to ask yourself when considering a collaborative robot cell that includes a gripper.

Many grippers on the market can be integrated in a collaborative application. The application should be well defined in order to decide which gripper suits it best. The choice of power supply is also a key feature to decide on. Once the gripper is chosen, the integration can begin. At this stage, other elements have to be considered in order to properly integrate the gripper to a collaborative robot cell.

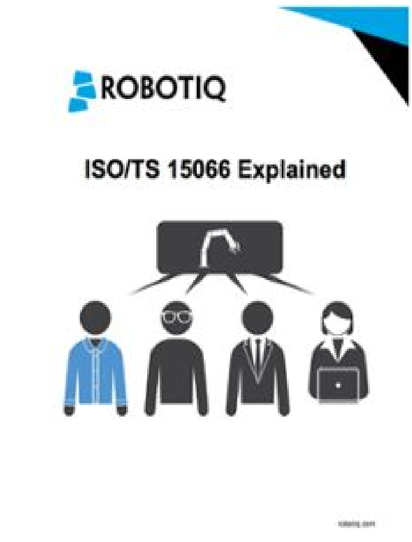
When deciding on a gripper for a collaborative application, the main question to keep in mind is whether the gripper is as flexible as the rest of robot cell. This will ensure a seamless integration of the gripper to a collaborative robot cell.

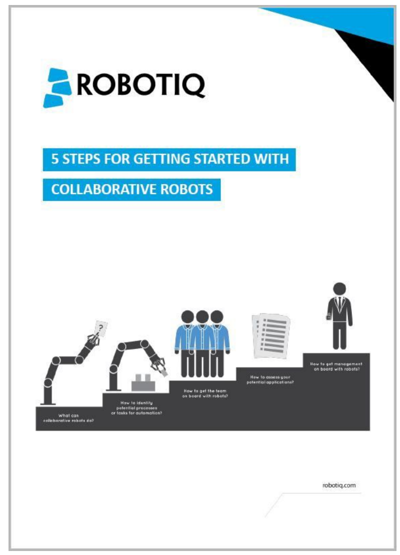
Browse Other Ebooks

Collaborative Robot Ebook

ISO/TS 15066 Explained

Getting Started With Collaborative Robots



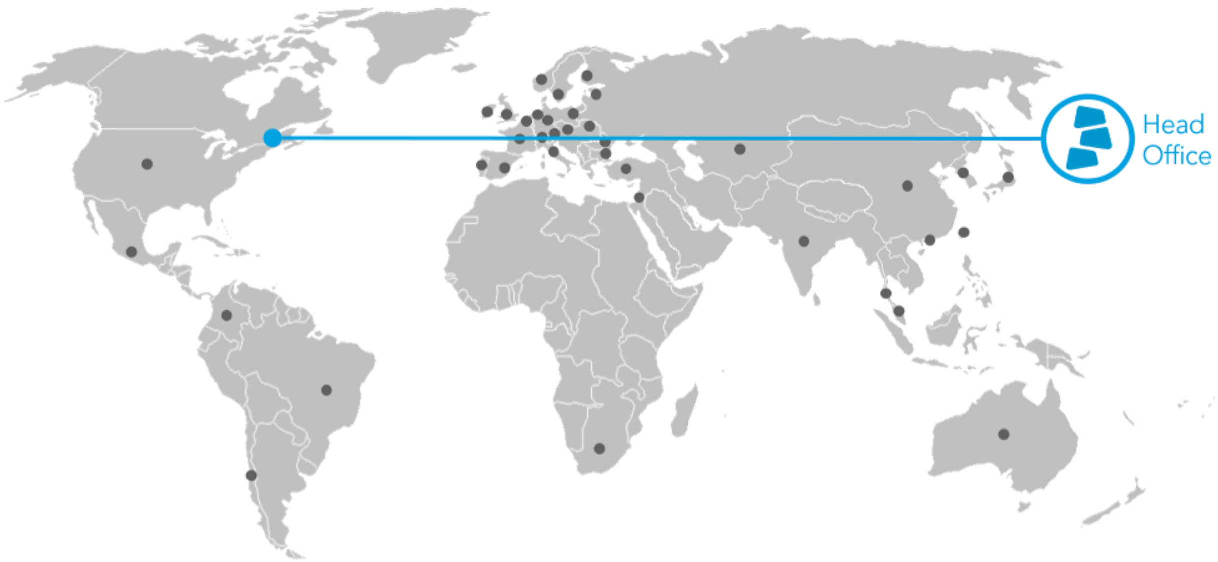


About Robotiq

At Robotiq, we free human hands from repetitive tasks.

We help manufacturers overcome their workforce challenges by enabling them to install robots on their own. They succeed with our robotic plug + play tools and the support of our automation experts community.

Robotiq is the humans behind the robots: an employee-owned business with a passionate team and an international partner network.



Let’s Keep in Touch

For any questions concerning robotic and automated handling or if you want to learn more about the advantages of using flexible electric handling tools, contact us.

Join us on social media:

Robotiq’s Blog	Twitter
Linkedin	Facebook
Youtube	Google+

D o F

Robotiq’s community where industrial **automation Pros** share their **know-how** and **get answers**

Ask Your Question

LEARN MORE

robotiq.com | leanrobotics.org