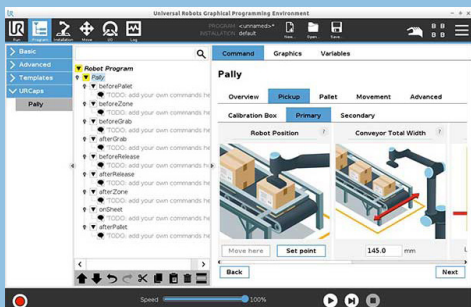


Optimize palletizing applications with cobots.

Factors for maximizing productivity, efficiency, and safety.

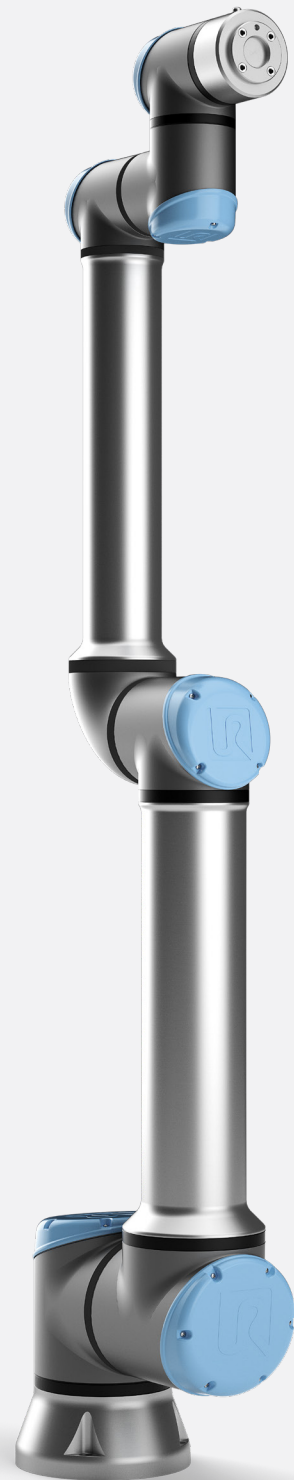
Palletizing Guide

Published June 2021



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Painless palletizing with Universal Robots.

Universal Robots' collaborative robots (or 'cobots') are ideally suited to palletizing applications due to their flexibility, ease of use and attractive total installed cost.

Enhanced by insights from our partners at Robotiq and Vention, The Universal Robots (UR) Palletizing Application Guide explores the palletizing problems that cobots can solve, shares palletizing case studies from UR customers, and delves into the basic considerations to keep in mind when considering a cobot palletizing deployment. Finally, the Guide looks at the pros and cons of three of the most common palletizing configurations.



RNB Cosméticos in Spain has integrated six Universal Robots UR10 robot arms in end-of-line palletizing tasks.

Palletizing's pain points.

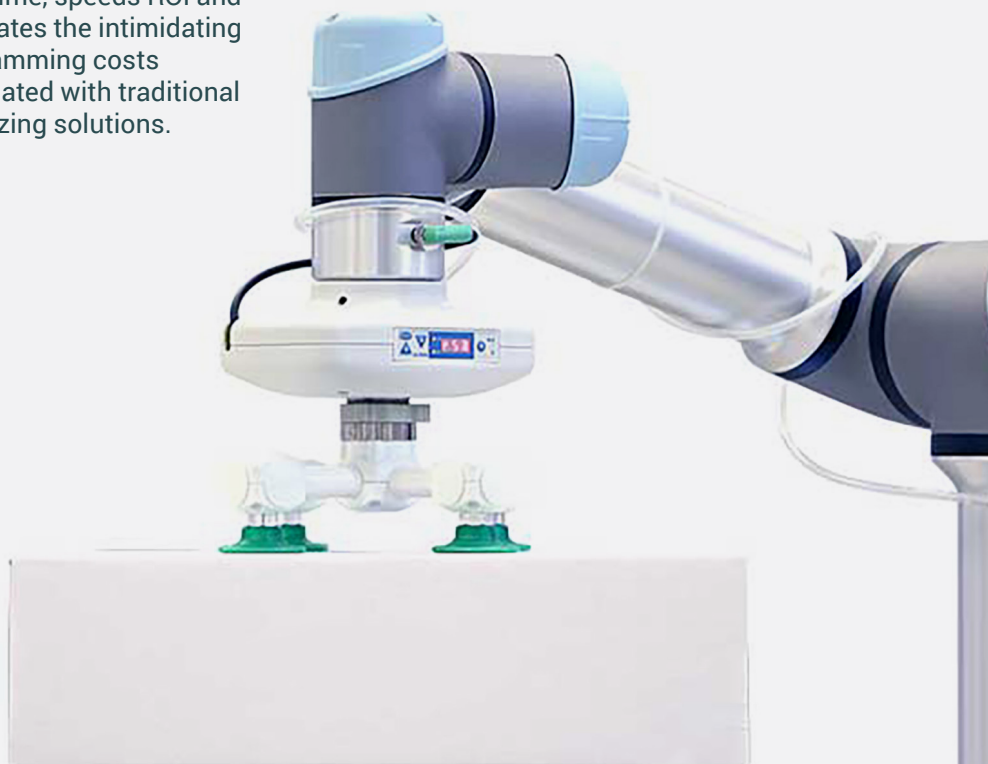
Manual palletizing requires workers to bend, lift and twist for hours on end. Over time, this unergonomic task can cause repetitive strain injuries and musculoskeletal disorders, endangering worker health and driving up labor costs. With manufacturers already facing challenges around hiring and retaining skilled labor, the case for freeing workers from palletizing tasks through the use of cobots is compelling. Some of our customers have found that cobot-powered palletizing can act as an effective tool for attracting new workers, due to the ergonomic enhancements it brings and the 'Wow' factor associated with UR's safe and flexible collaborative robots.

Traditional industrial palletizing systems have been around for decades, but they are inflexible and difficult to reconfigure, making them a poor fit for high mix/low volume and seasonal manufacturing. Traditional systems also require fencing, have a large footprint, are time consuming to operate and require outsourced expertise for programming and maintenance.

By contrast, cobot-powered palletizers provide faster cycle times, faster ROI, lower TCO (Total Cost of Ownership), greater flexibility and come with a small footprint. Additionally, after a risk assessment, cobots can be deployed in close proximity to humans without the need for safety fencing. Thanks to different flavors of intuitive palletizing control software, cobots are also easy to deploy, regardless of your company's level of prior robotics experience. This reduces downtime, speeds ROI and eliminates the intimidating programming costs associated with traditional palletizing solutions.

Manual palletizing requires workers to bend, lift and twist for hours on end.

Traditional industrial palletizing systems are inflexible and difficult to reconfigure.



Stacking profits with collaborative automation.

The business case for UR cobots is compelling, especially when comparing our cobots to traditional industrial robot-based palletizing systems. Firstly, the TCO for cobots is much lower than the TCO for traditional robot palletizers. This is because cobot based systems require a much smaller capital investment. Additionally, cobots are easy to deploy and program, which greatly reduces downtime and deployment costs, and in many cases, virtually eliminates the programming and engineering costs associated with traditional automation.

With labor shortages hitting virtually all manufacturing operations, cobots offer an affordable way to tackle the problem. Further, UR cobots are much more flexible than


traditional automation, which means they can be easily deployed and redeployed on a wide range of applications, bringing extra value to palletizing operations. Finally, UR cobots are available through [Universal Robots' Finance and Leasing programs](#), which eliminates any financial risk associated with a cobot purchase. As a result of all these factors combined, Universal Robots' cobots typically provide Return on Investment (ROI) within just 6-12 months.

“The advantage of cobots in general and in palletizing specifically, is their flexibility.”

Nicolas Lauzier
Senior Product Manager
Robotiq



UR cobots typically provide Return on Investment (ROI) within just 6-12 months.



Being able to adapt production to specific customers and to seasonal products gives cobot-based palletizing solutions a significant edge over traditional robot palletizing setups, says Nicolas Lauzier, Senior Product Manager at UR partner Robotiq.

“The advantage of cobots in general and in palletizing specifically, is their flexibility. This is especially important in today’s manufacturing world, where products are always changing and there is increasing demand for more customizations, more options, more colors, more flavors and so on. Automation has to be flexible in order to support these changes in global manufacturing practices,” explains Lauzier.

In practice, UR cobot-powered palletizing systems deliver a wide range of additional business benefits, such as increased capacity and throughput, reduced labor and insurance costs, and better utilization of manufacturing floorspace. Let’s explore three scenarios that showcase some of UR’s proven palletizing results.



→ UR cobot-powered palletizing systems deliver business benefits such as increased capacity and throughput, reduced labor and insurance costs and better floor space utilization.



Proven palletizing prowess.

UR cobots make palletizing automation accessible to companies of all sizes, from global brands to small, family-owned manufacturers and even contract packaging businesses. In the decade plus since our cobots were first deployed on palletizing applications, our technology has provided manufacturers with tangible results and, along the way, UR cobots have gained a reputation for high quality performance and reliability.

At L'Oréal India's Pune plant, for example, manual end-of-the-line operations involved operators lifting approximately 18,700 lbs of product per 8-hour shift. Concerned about the ergonomic risk, L'Oréal India deployed two UR10s on palletizing tasks, enabling the cosmetics giant to improve worker health and safety and improving overall equipment effectiveness in the plant by 5%, thanks to the time saved in pallet replacement.



↑ A Universal Robots UR10 cobot palletizing product at L'Oréal India.
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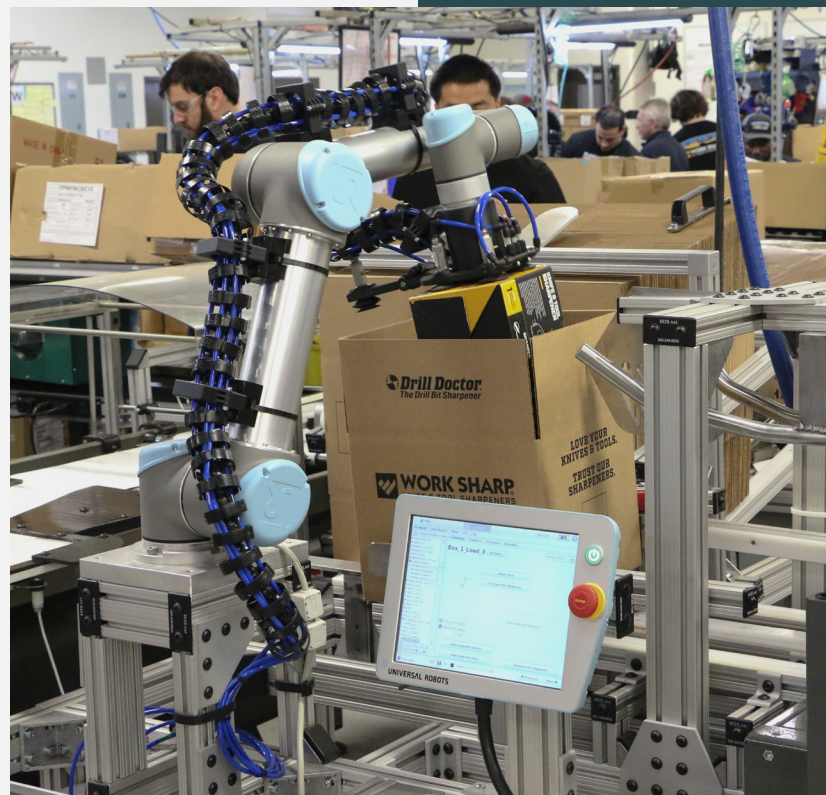


← Unilever has deployed UR10 cobots to handle palletizing tasks at the company's Katowice, Poland facility.

↓ Darex in Oregon, USA, deployed a UR5 cobot from Universal Robots to handle packaging and palletizing tasks.

Unilever's Katowice, Poland facility, which specializes in tea packing processes, deployed six UR10 robots to handle palletizing tasks. Prior to the implementation, operators spent around 70% of their time packaging and 30% palletizing. With cobots palletizing around 1,100 boxes during an eight-hour shift, throughput and productivity at the facility improved and operators are now free to focus on more ergonomic tasks.

Meanwhile, Darex, a family-owned USA-based manufacturer of drill and knife sharpeners, successfully deployed UR5 cobots on screwdriving, box erecting and palletizing tasks in its Oregon facility. Two employees with no previous robotics experience took UR's free online training course and were able to program the entire solution themselves. The deployment resulted in a 30% optimization of Darex's packaging & palletizing processes.

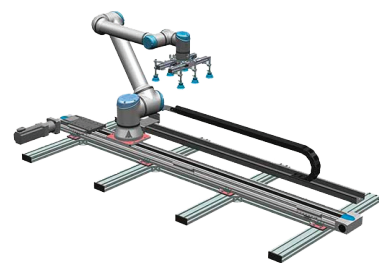
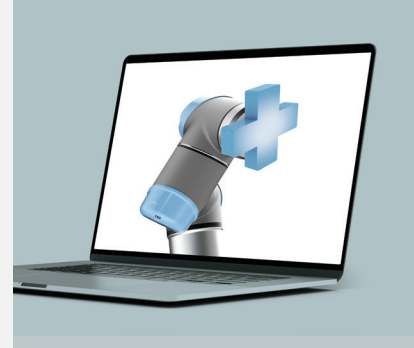


Complete palletizing via UR+.

Building on Universal Robots experience as the world's most successful cobot maker and spurred by customer demand, Universal Robots and our partners have developed a range of easy to deploy palletizing-focused Application Kits designed to provide with users with all the hardware and software required to get started on palletizing applications. Available through the UR+ platform, Universal Robots' palletizing Application Kits provide manufacturers with a wide variety of ways to get cobot-powered palletizing tasks up and running quickly, easily and at a fraction of the cost associated with traditional, competing palletizing systems.

UR+ is the industry's largest and most comprehensive ecosystem of certified peripherals – including software, vision systems and

accessories such as grippers – designed to integrate seamlessly with UR robots. UR+ Certified Application Kits are hardware and software packages focused on a specific application, such as palletizing, assembly and inspection. Our palletizing Application Kits include all the software and hardware you need to quickly deploy palletizing automation. This is a big deal, especially for smaller companies that would find it difficult and time-consuming to source and integrate all these different elements into a cohesive palletizing system.



Palletizers powered by cobots.

Powered by a UR10e cobot, the Cross Palletron 3000 Application Kit is a fully collaborative palletizing system with user friendly software that eliminates need for complex robotic programming. Developed by seasoned robot integration specialists Cross Automation, the Kit is extremely mobile (it is easily moved using a dolly), can handle payloads of up to 18lbs and can pick eight boxes a minute. This Kit comes with Rocketfarm's remarkable 'Pally' palletizing software, which provides UR cobot users with an easy-to-use interface for creating palletizing patterns and programs.

Developed by Columbia/Okura, a company with decades of traditional palletizing automation

experience, the miniPAL Application Kit is a UR cobot-powered palletizing solution that can handle a payload of up to 22 lbs and can palletize up to twenty boxes per minute depending on pattern, product and payload. The miniPAL Application Kit comes with Pally software, safety area scanners, safety mats and infeed conveyors, all of which are designed to speed palletizing automation deployments while ensuring safe operations.



↑ The miniPAL's compact design includes a lifting column for all tall loads, dual stacking locations for continuous load building and built-in fork pockets for easy mobility.



→ The Cross Palletron 300 Application Kit comes with a 7th axis, which increases the cobot's work envelope compared to 6-axis systems.

One of the downsides of traditional palletizing automation is the length of time it takes to program every part of the process, including stack patterns. With e-commerce on the rise and driving increased demand for customized, smaller pallets destined for retail and warehouse facilities, the ability to easily program and reprogram palletizing automation is becoming a must have feature.

The UR+ ecosystem is home to specialist palletizing software packages designed to help you control and optimize your end-of-line automation quickly and easily.

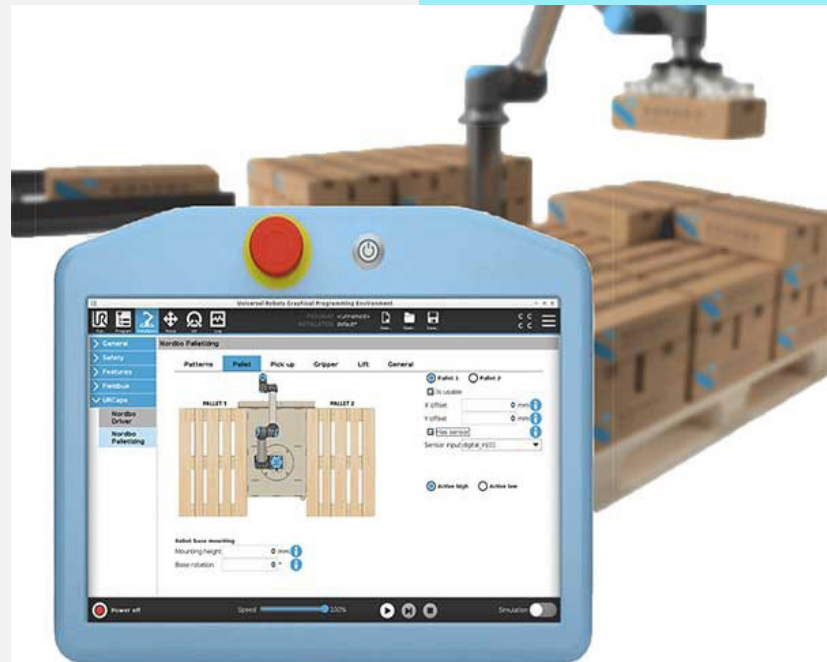
PackMate, for example, is palletizing software that provides you with full control of the pattern creation process via its online pallet pattern generator. With no programming experience required, users can create and change patterns online within minutes. Next, they download the selected pattern to a USB drive, pop the USB drive in the cobot controller and the system can start palletizing according to user-defined parameters.

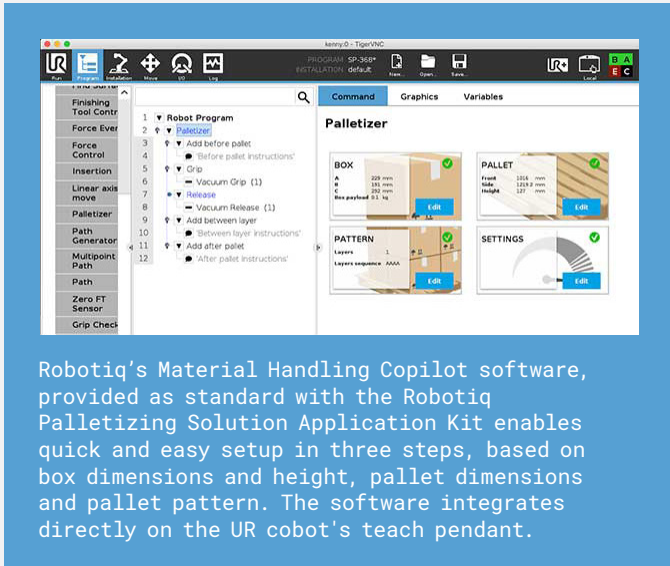
Vention's Cobot Palletizer is based on an ingenious CAD platform that allows you to design your entire palletizing system online. Users can choose from a library of turnkey designs or design a palletizing cell from scratch using different types of box feeders and grippers. The kit includes a choice of vertical actuators, a choice of box feeders and grippers, Pally palletizing software and a choice of safety equipment. The ability to design your system online provides extra flexibility and assurance that the final deployment will be a good fit for your facility – this is an especially important consideration for companies where floorspace is at a premium.



↑ The Vention Cobot Palletizer Application Kit allows users to design palletizing configurations online.

↓ Palletizing software solutions like PackMate reduce downtime by greatly simplifying the programming process.





Robotiq's Material Handling Copilot software, provided as standard with the Robotiq Palletizing Solution Application Kit enables quick and easy setup in three steps, based on box dimensions and height, pallet dimensions and pallet pattern. The software integrates directly on the UR robot's teach pendant.

Robotiq collaborated with UR on the development of the [Robotiq Palletizing Solution](#). This Application Kit comes with Robotiq's unique Material Handling Copilot software, which enables synchronized motion between the Kit's 7th axis and the cobot so they can both move at the same time. This easy to use software allows users to reduce cycle times.

Meet the CoBo-Stack.

Powered by the [enhanced UR10e](#) with its 12.5kg (27.55lbs) payload, [MBO's CoBo-Stack](#) is a collaborative palletizing solution specially designed to handle stacks of folded paper sheets such as those found in intermediary stages of brochure and book production. Traditional palletizing robots push human workers to their limits – a problem that CoBo Stack solves by taking over the heavy duty, repetitive lifting. In turn, this frees humans to focus on higher value tasks such as quality control.

The CoBo-Stack system allows one operator to control two CoBo-Stacks via easy-to-use software. Compatible with all leading folding machine

brands, CoBo-Stack combines high-tech features – such as optical and acoustic sensors that provide updates on operating status – with powerful lifting capabilities.

"The enhanced UR10e makes our MBO CoBo-Stack much more profitable for our customers by expanding their application possibilities to include larger packages and heavier products, such as catalogues and adhesive bindings," says Sebastian König, Head of Research & Development at MBO Postpress Solutions GmbH.

↓ CoBo-Stack is designed to relieve human workers from repetitive, unergonomic palletizing and stacking tasks.



Palletizing principles.

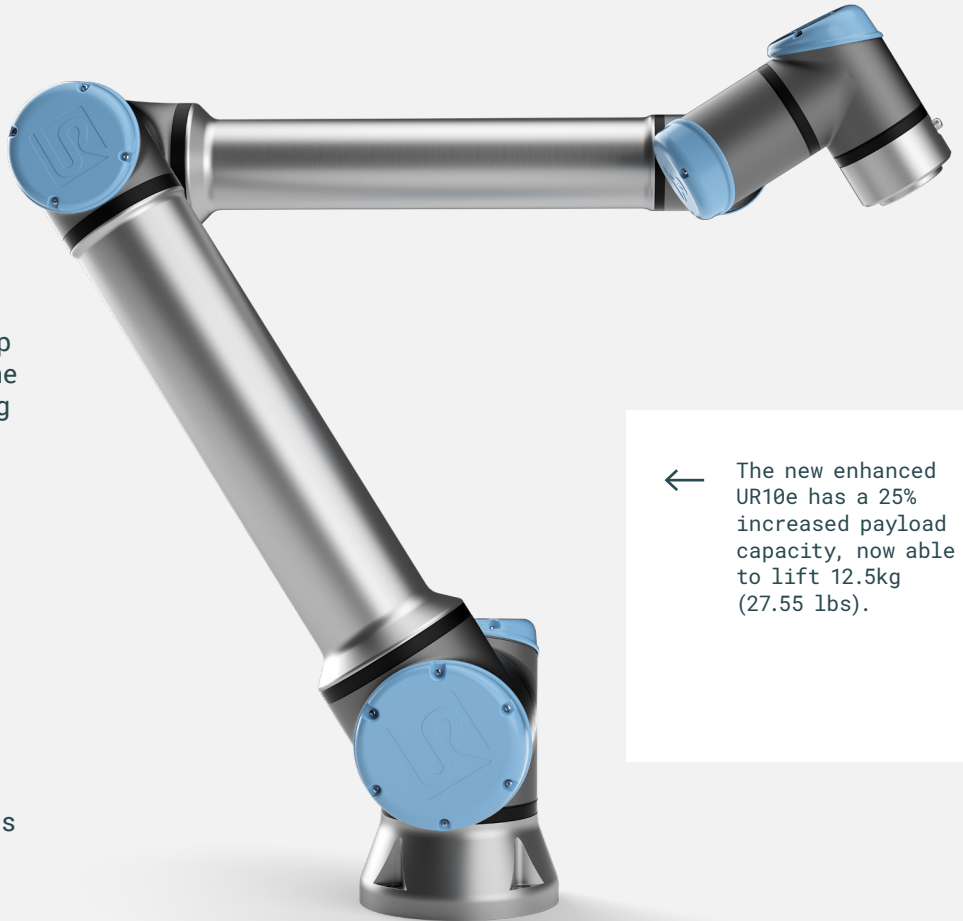
01. Payload.

The two most important factors to keep in mind regarding payload are firstly, the weight of the cases and products being moved and secondly, depending on the application and the throughput of the conveyor, whether your palletizing application is set up to handle multiple boxes at the same time.

“A product that is designed to be handled by a human – perhaps not at the palletizing point but later on when it gets to a shelf and a human picks it – necessarily comes with its own ergonomic constraints, regardless of cobot payload considerations,” explains Robotiq’s Lauzier.

Remember to factor in the weight of the gripper you plan to use too, Lauzier advises, as these will add to the overall payload of the system.

UR’s new UR10e, with its 12.5kg (27.5lbs) payload, is a powerful addition to our range of cobots, making it a great fit for palletizing applications. With greater reach than the UR16e and enhanced payload capabilities over the original UR10, the new UR10e brings extra power and possibilities to palletizing operations.



← The new enhanced UR10e has a 25% increased payload capacity, now able to lift 12.5kg (27.55 lbs).

“ A product that is designed to be handled by a human – perhaps not at the palletizing point but later on when it gets to a shelf and a human picks it – necessarily comes with its own ergonomic constraints, regardless of cobot payload considerations.”

Nicolas Lauzier
Senior Product Manager
Robotiq

02. Choosing a gripper.

End-of-arm tooling tooling is a fraction of the cost of a palletizing application, but it's typically where a lot of the engineering time and effort is spent, says Patrick Tawagi, Director of Applications Management at UR+ partner Vention.

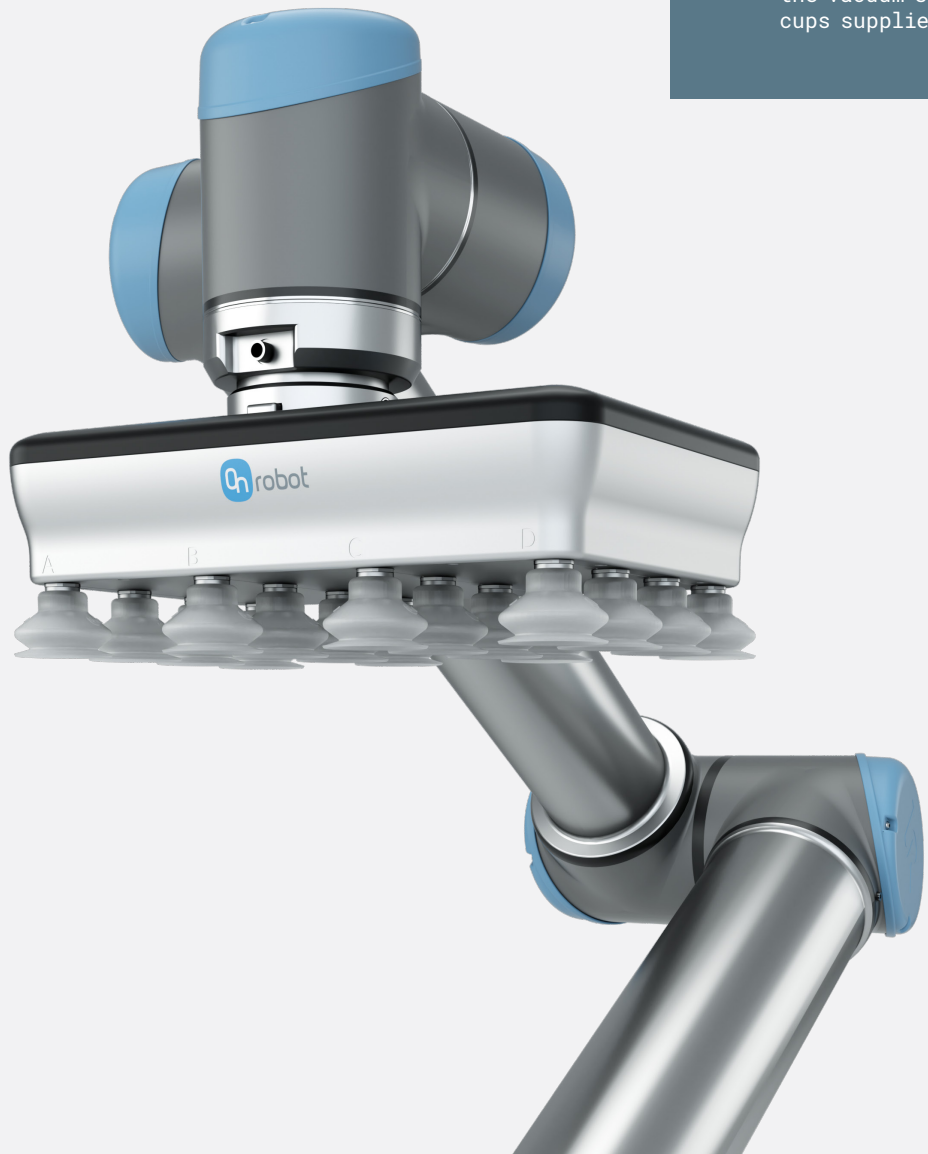
The UR+ ecosystem is home to numerous grippers for palletizing applications, including pneumatic grippers that use external air and powerful, all-electric vacuum grippers.

If your palletizing application pushes your cobot to the limit in terms of payload, look for safe, light grippers. If your facility already has clean compressed air, you could consider deploying a pneumatic gripper. Some grippers require an external power supply too, which should be factored into your plans.

When it comes to gripper selection, the type of cardboard your product is packed into also makes a difference, Tawagi adds. Wrinkled and lightweight cardboard is beyond the capabilities of some grippers, so be sure to check that the gripper you select can easily handle the required cardboard type.



↑ Schmalz's Robot Set RECB comes with a built-in pneumatic vacuum generator, which functions as a ready-to-connect gripping system with the vacuum suction cups supplied.



→ OnRobot's VGP20 is a powerful electric vacuum gripper that can handle heavy duty payloads of up to 20kg (44.1 lbs).

03. Footprint.

With space at a premium in most production facilities, footprint is a key consideration for your palletizing application. In a well-designed palletizing application, the item taking up the most space is not the cobot palletizing system, but the pallet, says Tawagi.

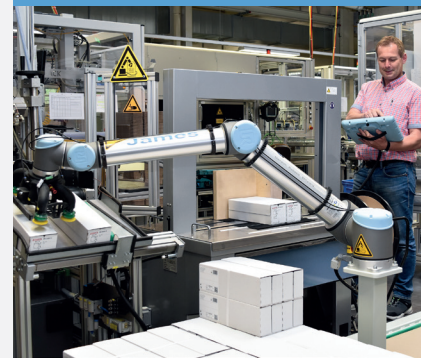
And with the majority of palletizing applications incorporating dual-pallet setups — so that the cobot can continue palletizing on a second pallet, while it waits for its first completed pallet to be collected — as a general rule, you should aim for a footprint that’s as little over two pallets in size as possible.

“The basic constraint on footprint is pallet size. After that, you want a palletizing system that’s as slim as possible. You don’t want a very large palletizing cell with a very large enclosure around it, nor do you want something that is not very accessible for an operator to get at. That’s why UR cobots are so great: since they are collaborative, you can add an area scanner and operate the cobot at a slower speed whenever an operator enters the workspace,” explains Tawagi.

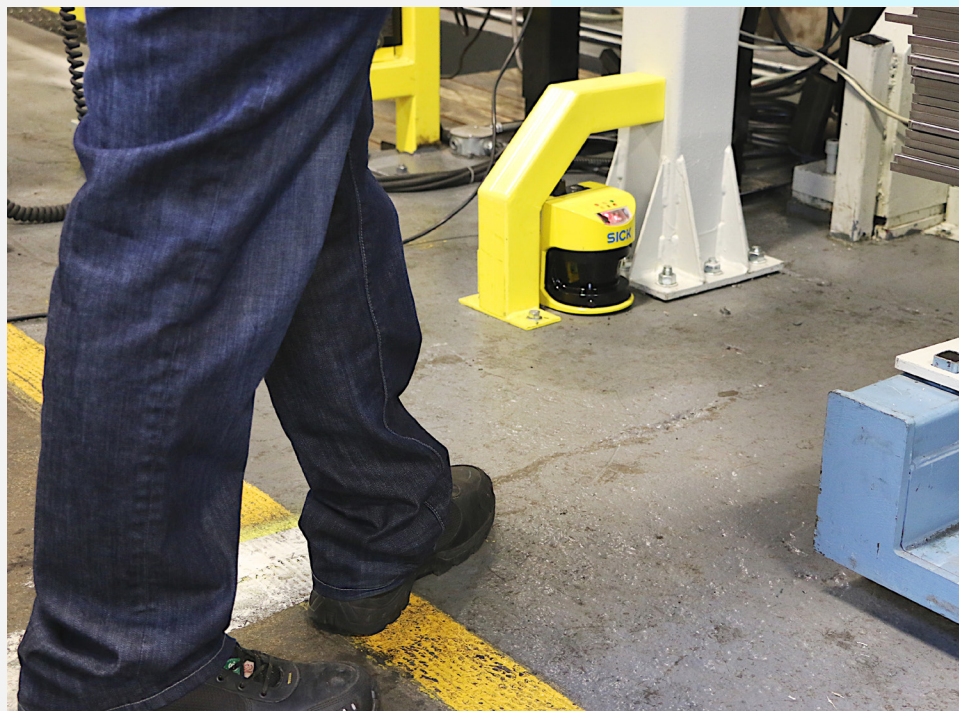
Cobots are an excellent way to automate palletizing in existing facilities without changing the routing and layout of existing conveyors and other machinery, says Robotiq’s Lauzier.

“The ROI is really attractive when you are able to install everything on an existing floor plan. One of the main advantages of cobot palletizing is that it’s possible to complete these projects with limited cost and limited changes to factory layout and this is usually what the customer prefers,” adds Lauzier.

↓ Gustav Hensel GMBH & Co needed constant direct access to the palletizing cell. The company opted for a UR10 cobot as a traditional industrial robot with safety guarding was not an option.



↓ UR+ partner SICK has developed area scanner technology that ensures safe deployment of collaborative automation, following a risk assessment.



04. Stack patterns.

Most facilities want to stack their pallets to the maximum height allowed in freight trucks and containers. This is where stack patterns should be considered, because they will impact on the overall stability of your completed pallet.

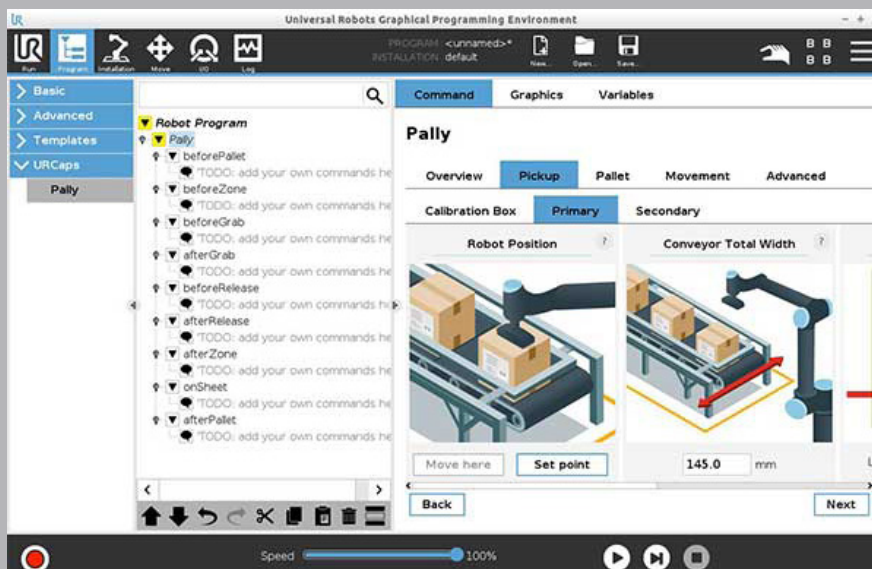
“Choosing the right stack pattern is not the hardest thing to do, but it can be a bit of a puzzle, especially when translating the pattern into coordinates for a robot. Software solutions available through UR+ let you do all this extremely easily, by creating stack patterns via an intuitive graphical user interface. And you don’t have to write a single line of code,” says Tawagi.

Software such as Rocketfarm’s Pally Palletizing Software, for example, which is bundled with several of the palletizing Kits available through UR+, enables easy stack pattern selection. Pally also provides features such as optimized path planning, generic support for any gripper, and the ability to define different layers in your pallet — all of which are designed to eliminate the technical headaches associated with traditional palletizing deployments.

05. Safety.

Palletizing applications require a risk assessment because they often involve moving heavy products at eye level and because palletizing is a process that usually requires some speed to complete effectively, says Robotiq’s Lauzier.

“Due to the potential risk involved, some type of guarding will likely be required around your palletizing cell,” notes Lauzier. “However, cobots are flexible, easy to install, and easy to program, so it makes sense to deploy a cobot instead of a traditional robot, even if safeguarding is required.”



← Pally Palletizing Software is designed to enable quick and easy collaborative palletizing automation deployments.

Common palletizing configurations.

There are numerous ways to set up your palletizing application, depending on the type of product being handled and the throughput of your palletizing operations. As noted above, dual pallet setups are commonly deployed because they allow for maximization of your cobot's palletizing capabilities – when one pallet is filled, the cobot can immediately start work on a second. But there are other factors and features worth considering when it comes to designing your palletizing cell. In this section, we will explore the pros and cons of three popular palletizing configurations.



Fixed pedestal setups, such as the one shown here, offer a low-cost way to deploy collaborative palletizing automation. Source: Vention

01. Fixed pedestal.

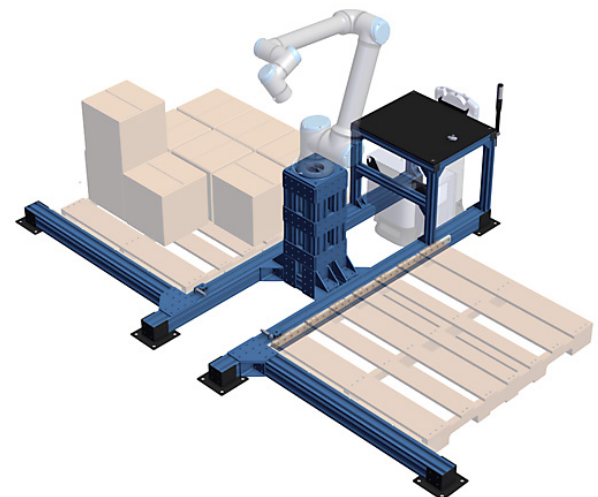
Fixed pedestal configurations (sometimes known as fixed column configurations), in which the base of your UR cobot is fixed in place on a pedestal, is the low-cost way to configure a palletizing application.

“Having a fixed pedestal setup is a lot more economical than the alternatives. There is no integration between an extra axis and the cobot. It can be made extremely rigid very easily. And it makes programming a bit easier as well,” says Tawagi.

However, fixed pedestal configurations present some limitations. For example,

compared to 7th vertical axis configurations (see below), fixed pedestals are quite limited in terms of the size of pallet that can be built. Additionally, since the height of the pedestal will be optimized for specific types of box and pallet layouts, fixed pedestal setups restrict the overall area in which your cobot can operate.

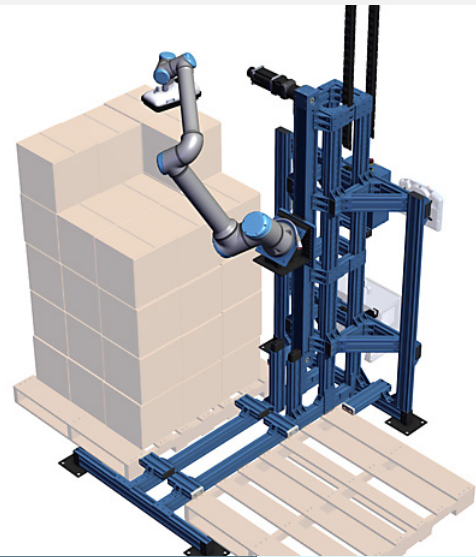
Despite these limitations, fixed pedestal configurations are well-suited to low-volume, low-throughput palletizing applications – and all at an attractive price point.



02. Vertical 7th axis.

In vertical 7th axis palletizing setups, the base of your cobot can move up and down, extending its reach and enabling it to palletize at greater stack heights, resulting in taller pallets. 7th vertical axis setups “open up a wide range of palletizing use cases that you just wouldn’t be able to perform with a fixed robot arm,” says Tawagi, adding that taller pallets can significantly reduce your overall freight costs.

Adding a vertical axis can add to the complexity of your palletizing project, so be sure to look out for systems that provide full integration with UR cobots. Fully integrated vertical 7th axis palletizing systems will simplify the deployment process and reduce downtime, lowering the overall TCO of the solution.



The vertical 7th axis palletizing setup for UR10e cobots shown here extends the cobot's by 1250mm (49.21in). Source: Vention



Adding a horizontal access, like the system shown below, enables you to use a single cobot to stack up to 8 standard pallets. Source: Vention.

03. Horizontal 8th axis.

In this configuration, your cobot is able to move horizontally, which greatly expands its work envelope. This type of solution is typically deployed in larger facilities, says Vention’s Tawagi.

“Using a horizontal access allows you to palletize many pallets at the same time, but is best suited to low throughput operations, so the robot doesn’t have to be everywhere at once. You can have the cobot shuttle

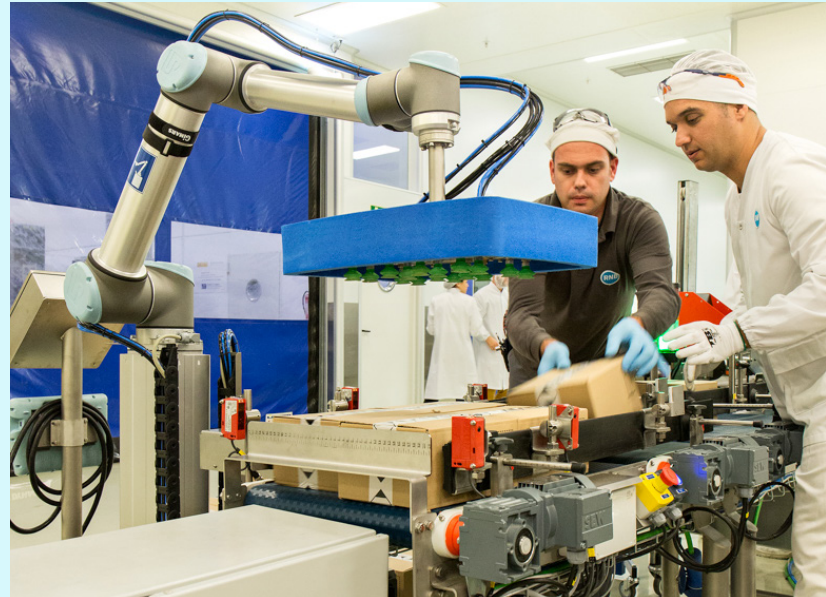
back and forth between each station on the horizontal axis and put it to work on four, five, or more, pallets all in a row.”

Since providing an extra axis (either horizontal or vertical) to your cobot adds to the overall complexity of the system, be sure to look for 8th axes that are fully compatible with UR cobots. Even with that compatibility in hand, expect 8th axis configurations to require some custom integration.



Ready to talk palletizing?

Whether you are looking for a way to improve palletizing quality and throughput, improve worker health and safety, or address labor shortages through the adoption of cobot-powered palletizing solutions – and at a fraction of the cost of traditional robot palletizing systems – we are here to help you.



About Universal Robots

Universal Robots is the market leader in collaborative robots. Since introducing the world's first commercially viable cobot in 2008, UR has developed a product portfolio including the UR3e, UR5e, UR10e, and UR16e, reflecting a range of reaches and payloads. Each model is supported by a host of Plug & Produce end effectors, software, and accessories in the UR+ certification

program, allowing for flexible redeployment of one robot into several diverse applications. Universal Robots has installed over 50,000 cobots worldwide, automating every manufacturing industry.

Headquartered in Odense, Denmark, UR operates out of 21 regional offices in the Americas, Europe, and Asia-Pacific.

Find out more

Click here to learn even more about automation using cobots robots with Universal Robots.



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