Picking the Best Robotic Tooling for Palletizing

By asking the right questions, companies can design robotic systems that maximize end-of-line efficiency and ROI

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Today's manufacturers have started looking downstream more and more for automation opportunities. And when they do, more are choosing robotic systems. According to PMMI's 2007 Packaging Machinery Shipments & Outlook Study, shipments of robotic palletizers rose by more than 16 percent in 2006 — and shipments of packaging machinery are projected to increase from $469 to $530 million by 2009.

Designing a robotic palletizing cell has become more complicated as companies invest more in environmentally friendly and sustainable packaging. To reduce dunnage, standard corrugated cardboard cartons are being replaced with thinner-walled pressboard, shrink-wrapped bundles of product on corrugated pads, and even loose product in trays. Add increased demand from club stores and marketing changes to the mix, and manufacturers need to account for an even wider range of packaging sizes, shapes and materials.

Choosing the correct end-of-arm tooling helps ensure that a new robotic palletizing or depalletizing system can effectively handle a company's full range of packaging types. End-of-arm tooling is a highly project-specific component that represents a large percentage of the overall cost of the system.

Tooling types for palletizing include vacuum, side clamp, fork style and layer handling (see "Tooling Overview" section on page 2 for details on each tooling type). Asking the following questions and understanding the specifications of each type is essential to designing a system that will maximize performance, speed, uptime and return on investment.

Five Questions to Ask Before Specifying Robotic Tooling

Today's manufacturers need to account for a wide range of packaging sizes, shapes and materials when designing robotic palletizing systems.

1. What kinds of product(s) are you handling?

The first step in choosing robotic tooling is analyzing the full range of products and packaging types running on your line. Take some time to determine how each item should be handled. For example, can the packaging support its own weight during transfer? Or, will it need to be supported from underneath? Here are some important factors to consider:

- Size, shape and weight
- Stability and construction
- Sealing, wrapping and/or taping
- Secondary packaging

2. What rates do you require on your packaging line?

The throughput capabilities of your robotic system can vary greatly depending on which tool you use and the product you are palletizing. A good starting point is to determine an acceptable range of line speeds (cases per minute), which can help you better evaluate your tooling options.

End-of-arm tooling is highly project-specific and represents a large percentage of the overall cost of a robotic palletizing system.

3. How important are the aesthetics of your packaging?

Certain tooling types enable more pallet configurations than others. This flexibility may be needed to orient graphics for full-pallet displays and to meet the demands of club stores. Some tools can cause dimpling in shrink wrap or marking on packaging, which may be unacceptable for items ending up on display.

4. Will your robot be handling slip/tier sheets or pallets?

Don't forget to take into account tooling for robots that handle tier sheets or pallets. Also keep in mind that peripheral tooling may be required, and that handling tier sheets or pallets will reduce line palletizing rates. Reduction in secondary packaging around the product may necessitate sheets between layers to keep the palletized load stable.

5. Will your system be able to adapt to future packaging changes?

Whenever possible, design flexibility into your system to handle changes in your current product line and the addition of new packaging types in the future. Partner with an experienced palletizing integrator to help you make informed choices and specify the equipment that is best suited for your application.

Tooling Overview

Ideal for traditional packaging such as sealed corrugate cases, vacuum tooling uses pneumatically actuated foam or cups (shown here) to lift products.

Vacuum

Vacuum tooling is the most popular — yet most misapplied — tooling type. It uses pneumatically actuated cups or foam to lift products, depending on the availability of the surface. As only the top surface of the case comes in contact with the tooling, the vacuum option enables a large range of pallet patterns and is the most prevalent type used for depalletizing.

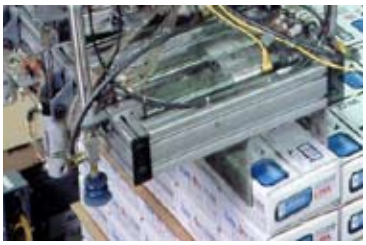
Vacuum tooling is ideal for sturdy, traditional packaging, such as sealed corrugate cases that can bear the total weight of the product during transfer. This method is not recommended for many types of packaging, including tall cases with a low center of gravity. As the robot accelerates, inertia can cause the cases to "peel away" from the vacuum carrying surface. If not planned for during the design phase, this issue can cause a lot of trouble when it is time to run production.

Fork style tooling is useful for handling irregularly shaped cases and bags and any packaging that cannot support its own product weight.

Fork style

Fork style tooling uses a row of forks that comb through conveyor rollers to lift product from the bottom. Fork style tooling is useful for handling irregularly shaped cases and bags, cases with lids, fan-fold cartons and any packaging that cannot support its own product weight.

On the downside, fork style requires additional space for pattern formation. A large amount of mechanical motion makes this the slowest method, and it is not suitable for depalletizing.



Side clamp tooling works well with thinner-walled sustainable packaging, and offers flexibility for packaging lines that run a variety of products.

Side clamp

Side clamp tooling is often used for packages that cannot be handled with a vacuum tool. A robotic palletizer equipped with side clamp tooling permits shrink-wrapped product in trays or on pads, for example, to be manipulated efficiently. It also enables higher robotic arm speeds than vacuum tooling, and provides greater control and confidence in holding onto and transferring product.

Side clamp tooling works well with thinner-walled sustainable packaging, and can offer flexibility for packaging lines that run a variety of products. For example, a small beverage line is able to clamp a six-pack differently than a three-pound box of syrup. However, this type may not be suitable for palletizing fragile items or for packaging materials with less tear strength than breach strength (think of a bowling ball in a plastic bag).

Layer handling is ideal for cases without sealed tops.

Layer handling

Some operations may require complete layer handling for palletizing, which is expensive due to the ancillary material handling equipment needed to form each layer. This application is ideal for cases without sealed tops.

Hybrid Tooling

Sometimes, a combination of two separate robotic tooling types is used to help constrain motion along both the x and y axes during motion, or peripheral tooling is added to handle pallets or tier sheets.

The multi-function side clamp tool shown here provides gentle clamping of cases, transfer of empty pallets and handling of slip sheets.

Vacuum-assisted clamping or layer handling

When clamps cannot transfer force to the center of the layer due to overpopulation of product or varying patterns, vacuum tooling can be used to hold the layer in place vertically. Vacuum-assisted layer handling is ideal for patterns that include voids for cooling purposes in pasteurization or heat-curing operations.

Vacuum-assisted fork style

Forks support the packages from underneath, while vacuum tooling along the back row of the cases keeps them in place.

Clamping-assisted vacuum

Used for tall and light packages, the vacuum tool is used to lift and move the product, while the clamps keep it from moving horizontally and peeling away from the vacuum.

Handling tier sheets or pallets

Cylinder-mounted vacuum cups can be used as a peripheral device to pick up tier sheets. A set of pick arms swings into position to pick the pallet and then swings back out of the way during the palletizing operation.

Source: 13th Annual Packaging Machinery Shipments & Outlook Study;
Packaging Machinery Manufacturers Institute (PMMI), August 2007, Arlington, Va.