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WHITE **PAPER**

Is now the time to consider a **robot palletizer?**

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As small startup manufacturing businesses grow and increase production, they will inevitably look for ways to improve their operation. Physical labor has advantages of flexibility, human insight, and a relatively low up-front cost. Mechanical automation also has advantages – ergonomics, repeatability, and stamina to name a few. Each business must weigh the trade-offs between manual and automatic operations.

Many core industries: mineral, food, chemical, petfood, feed, seed, agriculture, and others use bags or sacks as a means of storing and transporting their products. Most operations start out stacking bags manually and then eventually end up with some form of automatic palletizing. When does a company make this shift to automation? What must be considered before making this change? This paper attempts to discuss these questions in light of the recent boom in robotic palletizing.

Many of the concerns of automatic stacking deal with the robots limitations regarding judgment. Though a human operator may begin by making poor stacks, he will quickly learn how to improve the appearance and functionality of the stack. This process is not so simple when automation is used.

Color teach pendant used as main interface on standard palletizing cell

In many operations, human operators overlap bags to keep a stack within the confines of a pallet. This overlapping seems relatively intuitive and simple for humans, but it can be a little trickier and require more attention with robots. Automation seems to work best when the task is consistent and repeated. Some products and bag types are more predisposed than others to overlapping, and sometimes, for some products and bag types, overlapping should be avoided. In these specific cases, overlapping can typically be eliminated by resorting to one or more of the following methods:

- Conditioning – use bag flatteners (compression) or settlers (vibration) to make the bag as consistent in shape as possible. For some products, the shape of a bag can change dramatically with basic conditioning.
- Adjusting Bag Volume or Weight – consider increasing or decreasing the overall size of the bag to allow it to be efficiently stacked on a pallet. For example, if a 50 pound bag will not fit in a 5-bag pattern on a standard GMA pallet, consider a 20 kg (44 lb) bag.
- Bag Sizing – Change the proportions of the bag such that a flat, consistent bag can be stacked without overlapping

in a standard pattern on a standard pallet. Often, a bag can be made a little thicker to reduce its length or width.
- Pallet Size – In some cases it is even practical to change the pallet size. Though a 48 x 40" pallet is widely used, some find it practical to use larger or smaller pallets. One mineral manufacturer found that a 36 x 54" pallet worked well with his large bags; the result was an effective 3 bag interlocking pattern.

Tightness of the pallet and its overall appearance can be affected by an operator. Motivation can play a large role here! A robot stacking bags of consistent shape and size will make a pallet of consistent shape and size. The speed of the operation, the style of the bag gripping tool, and the programming of the robot can all affect the look and function of the automatically palletized stack.


Finger gripper


Lateral gripper


Pallet of bags

A traditional clamshell-style tool (finger gripper) can be very fast and effective for rates of up to 27 bags per minute. The lateral gripper, for its part, works best with bags that are square and thick, carefully placing the bags in a tight pattern. Such a tool may be equipped with horizontal bottom fingers which retract to leave the bag in a precise position. It will, however, run much slower (perhaps up to 15 bags per minute). To overcome this speed restriction, multiple bags can be grouped and moved with a similar tool, larger in size, for rates of up to 40 bags per minute.

Like humans, robots can be flexible in their operation. Planning and programming are essential. If required rates are slow, it may be possible to use the robot to perform other functions as follows:

- Moving empty pallets into position for stacking bags
- Positioning slipsheets, tiesheets, or topsheets
- Hanging empty bags
- Positioning bags for sealing or closing
- Positioning bags for printing
- Positioning bags for checkweighing
- Spraying glue to tie layers together

It can very safely be said that the more you expect the robot to do, the slower the overall rate will be! The advantage, of course, is that a single robot can eliminate the need for auxiliary equipment if the overall rate will allow. Similar to a human operator, a robot can make various stacking patterns and even accommodate specific bag positions. These include butts out, tags out, or printed side out. Again, planning and programming are essential here.

Safety and injury avoidance are a driving factor for many robot purchases. Robots with their high speed movements create risks that must be attended to. The proper design of a safety cell around a robot is a key to mitigating the risk. Safety components such as light curtains can greatly enhance the usability of the robot and its surrounding components.

Likewise, robot manufacturers have developed software solutions to help with collision avoidance and safety. Today's robotic palletizing systems are both safe and functional.

Benefits of Bag Palletizing Automation

- Safer for workers
- Higher production rates
- Optimization of warehouse space
- Greater quality and stability of full pallet loads
- Quick payback on investment (savings on labor)
- Minimal downtimes (maintenance, changeovers, repairs)
- Greater competitiveness for your product in the marketplace
- More consistent production rates

If your operation currently includes manual stacking of bags, you will eventually consider the option of robotic palletizing. Robotic palletizers continue to prove themselves as valuable enhancements to many bagging operations. Regardless of the motivating factors leading to your consideration of automated bag stacking, a review of the factors affecting reliability, stack appearance and functionality will be key to a successful implementation of this technology.

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