design Engineering

The Virtue of Not Stacking Up

Ontario-based Almac Industrial Systems' Automated Lift Platform provides a flexible and cost-effective alternative to robots for process lines.

By Murali Shivamuthulingam | July 15, 2008

As in many automation challenges, seemingly simple tasks turn out to be the most difficult to solve efficiently. In such cases, it's all too easy to create overly complex, expensive and inflexible solutions that get a job done but ultimately reduce productivity and negatively impact the bottom line.

Take, for example, de-stacking variable-sized sheets of fibre cement board from a pallet, moving them individually a short distance and placing them on a strand chain conveyor belt. On the surface, it would seem like a fairly simple pick-and-place operation. That is until the handled material is taken into account, says Robert Austin, senior designer for Aurora, Ont.'s Almac Industrial Systems, an automation company that specializes in conveyor systems and material handling applications.

"Due to the nature of the fibre boards, they have to be handled with care," he says. "They can't be dropped hard from a height, and you can't pick them up using clamps because then you end up damaging the edges of the boards. They are also heavy, so you need a certain amount of grip to hold it. If you hold it too lightly, the board might fall off; hold it too strong, it might get damaged."

In addition, he says the board's weight has to be evenly distributed to prevent buckling during transport. And since fibre cement board comes in a number of standard widths and lengths, the system has to be flexible enough to accommodate different-sized material equally well without any time-consuming configuration required.

In place of conventional pads, the vacuum box on Almac's Automated Lift Platform incorporates a perforated aluminum sheet that doesn't clog when handling "dusty" materials such as dry wall or cement board.

Enter the ALP

That's the challenge Almac faced when one of its customers, a major U.S.-based supplier of building materials, was looking to expand and needed new handling machines. Initially, Austin says, Almac's first machine emulated the vacuum-based systems the customer already had, which used conventional vacuum pads. This approach, however, had one major flaw.

"Fibre cement board gives off a fine grain powder that can create a very dusty environment," Austin explains. "The suction pads get clogged up and need constant replacement—one per machine, every other week. The customer we were working for had pallets full of suction pads, and they aren't exactly cheap. So because of its high maintenance cost, we came up with a new idea, and we have had no problems with it over the last four years."

That new idea is what the company calls its Automated Lift Platform (ALP), a vacuum-based de-stacking system distinguished by its simplicity, efficiency and flexibility, Austin says.

For example, the ALP is simple in that it need only provide easily programmed X- and Y-axis movement. A multi-strand conveyor delivers pallets of cement board to a conveyor mounted on a scissor lift table, which indexes the load up incrementally as individual boards are separated from the stack by an aluminium vacuum box. In this way, the box doesn't need to vary the distance travelled through each cycle but always descends to a set and reliably repeatable height.

The vacuum box is similarly straightforward and virtually maintenance free. To solve the clogging problem, the Almac team replaced the vacuum pads with a perforated aluminium sheet. In essence, the suction system works like an air hockey table with the airflow reversed. A New York Blower—mounted on top of the ALP—draws air through the holes at a constant and controllable rate to handle different board weights. While the perforations are large enough not to clog, they are also distributed across the face of the sheet in proportion to the density of the boards being handled.

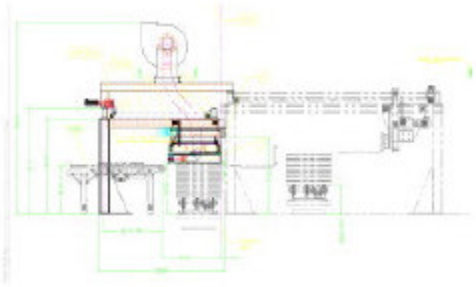
To control the exposure area of the aluminium sheet, and thereby maintain suction strength, the vacuum box features a manual control that allows operators to adjust the box's effective operating width.

"To accommodate different lengths, the box is divided into separate cells that can be quickly turned on or off as needed," Austin says. "So, for example, when a batch of 96-inch boards needs to be handled, one cell can be shut down."

After a board has been transported to the end of its travel, all the cells turn off allowing the board to drop on to a second conveyor. For lighter boards or materials that might remain attached after suction is turned off, the box also incorporates thumper devices to fool proof the operation.

Similar to the thumpers, a fork transfer system enhances the ALP's automation by optimizing the material reloading process. When the each pallet gets down to the final few boards, sensors in the scissor lift table signal the machine's integrated fork lift blades to engage the pallet and hold it at the required height. This gives the scissor lift table enough time to descend, acquire a new pallet of boards and rise to the proper height so that de-stacking can continue without pausing to reload.

"When the fork conveyor retracts, it puts the empty pallet on another chain conveyor which carries it by shuttle car to the outfield section," Austin says. "This way, the same pallet used to de-stack is used again to re-stack after the boards have been processed."



Measuring 374 in. long and 200 in. wide, Almac's ALP is self-contained, takes up little shop-floor space and is easily integrated into an existing process line.

Simplicity and flexibility

According to Victor Lourenco, Almac's electrical project leader, automation and controls, other process lines commonly use less-efficient methods, such as part-specific machines, which are more expensive and limit manufacturing flexibility.

"You could also use robotic arms for doing the same job, but they are PC-controlled and would need to have a different set of programs for each board size and weight," he says. "Robotic arms can also be comparatively expensive to source and time-consuming to program."

In contrast, the entire ALP, including X- and Y-axis motion and up to a six-celled vacuum box, is controlled by one Allan-Bradley MicroLogix 1500 PLC. Not only does this reduce costs but it also makes setup and configuration much simpler.

"As a PLC-controlled system, the ALP is very easy to program," he says. "And once it is programmed, it only takes the flick of a switch to reconfigure the PLC to handle different-sized and weighted boards."

Another advantage the ALP has over other systems, Lourenco says, is that it consists of modular automation components. In addition to the small form factor PLC, the ALP incorporates an Allan-Bradley servo motor for the X-axis motion and a variable frequency gear motor from SEW Eurodrive to handle the up and down motion of the vacuum box.

"Our original ALP machines went to a U.S. customer who typically prefers Allan-Bradley because of their reputation for controls, but the system doesn't need to be that," he says. "Those components could be any name brand; we can make our systems with any equipment a customer is comfortable with."

Measuring 374 in. long and 200 in. wide, the ALP takes up relatively little shop-floor space and, Robert says, the system is a self-contained turnkey solution that can be easily integrated into an existing process line.

"Although we developed the automated lift platform for handling fibre board, it can be used in many different types of applications as long as there are flat sheets," Austin says. "It can be modified for wood panels, sheet metal or the roll forming industry. As long as there is enough surface area to hold it up, the vacuum box can be designed to lift the product."
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