



YASKAWA

Application Report High Speed Depalletizer

With lightweight, empty PET containers, bottlers have always had to live with a Faustian trade-off in performance in exchange for ever-higher speeds: the line may move fast, but downtime may be significant due to fallen containers. This was the problem faced by a Toronto-based beverage bottler. Its 2-14-L bottling line, pushed to run 320 bottles/min, was laboring under a maxed-out semi-automatic depalletizer and inefficient combiner. If a bottle fell or the depalletizer was down due to a jam, the filler would be starved; unnecessary stops and starts were all too frequent. "The depalletizer was maxed out, and had a hard time running at even 300 bottles per minute," says the engineering manager. Plus, the combiner, designed for straight-wall containers, had a tough time handling the trademark contour bottles.

Today, the filler is kept humming at a brisk 320/min pace and downtime at the depalletizing end is virtually eliminated. In October '94, the bottler removed its old depalletizer and installed a new Busse Turbo T3000 series depalletizer feeding into a new Descon Genius 100 power rail combiner (instead of feeding at a right angle), which provides a constant flow of single-file 2 and 2-14-L straightwall and contour bottles to the filling operation. "We're running at about the same speed, but a lot more consistently than before".

Downtime Neutralizer

The depalletizer and combiner are designed to significantly reduce jams related to fallen containers; if downtime does occur, both units can work overtime to provide burst speeds of up to 350 bpm to make up for any gaps in the bottle supply, providing a seamless supply of bottles to the filler. "Some people are going faster, but they're using two depalletizers to do the job," says the maintenance manager for the plant. Descon claims that its combiner can single-file containers at speeds to 650 bpm.

To make the project work, Descon, in its role as systems integrator for the project, had to reconfigure the entire beginning of the line. One of the keys to improving container handling was getting rid of the right-angle discharge associated with the previous depalletizer. Descon integrated its own 24-ft-L power rail combiner directly into the Busse conveyor bed in a straightline fashion. This way, bottles travel straight from the depalletizer's sweep area into the combiner, which reduces or combines the 4-ft-W en masse flow down into a single file. Bottles are discharged into an air conveyor which leads to the filler. Aside from increasing efficiency, the straightline flow eliminates a deadplate that stranded bottles at the end of a run, requiring someone to manually remove them.



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The combiner itself is remarkable for the way it single-files the large PET bottles without jams, long a challenge in high-speed PET bottle handling. The old combiner was simply two angled rails that forced containers into one lane. A major problem was bridging—if a group of them were forced through at the exact same moment, they would seize up together, forming a bridge and causing bottles behind them to back up. An operator would have to loosen the jam by hand to get the flow moving again. With a powered rail combiner, a powered side belt keeps a forward pressure on bottles, eliminating bridging. However, the pressure that many powered rail combiners put on bottles can result in crushed containers, especially at higher speeds. Descon remedies this with a patent-pending split power rail design to ease the pressure, instead of the common drive found on most power rail combiners. By splitting the drive, the combiner can match the progressively higher bottle speeds in each section of the combiner. The combiner self-adjusts for line conditions, maintaining suitable accumulation for the filler. “This is one of the first trouble-free combiners on the market in terms of bottles jamming or falling—especially at relatively high speeds.”

For its part, the depalletizer contributes to uptime with the design of the high-efficiency sweep area that reduces incidence of fallen containers. On a conventional depalletizer, after a tier of bottles is swept onto the beds the front retainer bar, or front part of the 4-sided sweep frame, typically remains raised as a new layer of containers is elevated, due to a bulky compression sponge affixed to the inside of the front retainer bar. The problem has always been that any bottles that have been jumbled onto a tilt during handling can tumble forward where the fourth wall should be, causing a glitch in the bottle handling operation.

Smooth Sweep

Busse eliminated the problem by removing the sponge and keeping the front retainer wall down during container elevation. As a result, the layer of potentially unstable contour bottles is brought up into a true 4-wall chamber. The layer is then squared from the rear and sides, as opposed to the front. Since the sweep carriage is driven from both sides via a shaft that goes across the bed, there’s no cocking of the sweep. “It’s a smoother sweep with less damage and fewer fallen bottles”.

Also contributing to smooth operation is the ultra-low-friction belting. While many conventional bottle lines require a soap-based lubricant to ease bottle handling, the lubricant has been known to cause stress fracturing of PET bottles around the base. Although the chain is designed to be lubricant-free, “we find it does need some wetting to improve the mobility of the containers.” Containers are sprayed with water at the infeed of the combiner.

In operation, a fork truck periodically feeds pallets of empty bottles into the conveyor’s infeed. As the depalletizer is a reverse-flow or C-flow configuration, pallets enter one direction, move up through the hoist, and bottles exit in the reverse direction. Once a pallet moves into the hoist, cylinders on the back of the sweep carriage grip the wooden top frame and a series of five suction cups remove the top slipsheet. The sweep carriage moves to the right, depositing both the slipsheet and top frame onto a secondary carriage. The slipsheet falls directly into its own bin, while the secondary carriage takes the top frame and moves it further to the right and deposits it into the top frame bin. By offloading this motion onto a secondary carriage, the sweep carriage is free to move containers, thereby increasing throughput.



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After a tier of containers is elevated, it is squared with the help of the rear pusher bar and the sides. The carriage sweeps the containers onto the conveyor bed, with grippers holding onto the slipsheet so it won't travel with the containers. The front retainer lifts, and containers exit into the combiner. With the sweep carriage positioned over the conveyor, the suction cups attached to the back end of the carriage are positioned over the hoist, and proceed to grip the slipsheet on top of the next tier. With the slipsheet in place, the sweep carriage swings back to the right, positioning the sweep frame over the hoist and the slipsheet over its respective bin. This cycle continues until the pallet is empty, whereupon the empty pallet descends, is discharged from the hoist and upstacked into the pallet stacking bin from the bottom. The bottler gets a cycle time of about 15 seconds per layer or 4 layers/min.

Pushbutton Bottle Changeover

One feature that enhances the depalletizer's operation is the use of a flux vector control drive in the hoist instead of maintenance intensive brakes. The drive, supplied by Yaskawa, is able to stop at each layer and hold the remaining pallet load at 100 percent torque at zero speed. Certainly not a difficult feat with lightweight PET containers, but put up to 4,000 lb of glass bottles on the hoist and it becomes an impressive feature. (Although the company doesn't run glass on this line, it specified glass-handling capability as a back-up.) Another feature that speeds operation is pushbutton bottle size changeover, thanks to an encoder feedback built into the machine. There's no need for someone to physically go into the hoist and adjust sensors. And the bottler specified the ability to handle U.S. and Canadian pallet sizes, although this feature currently isn't used.

With the new combiner and depalletizer in place, Coca-Cola Bottling gets its high speeds and high performance - escaping for now, the Faustian PET bottle handling performance trade-off.