

By Christian Dager

Smart conveyors streamline wet wipes packaging challenges

Smart conveying solutions enable high-speed throughput of delicate wet wipes

High-speed automation for folding, wetting, cutting and piling wet wipes presents throughput challenges when fragile stacks of newly produced wipes are transferred to downstream primary and secondary packaging machinery operating at lower throughput speeds.

There is little worse on an automated production line than an interruption or cessation of throughput because of equipment failure, product spillage or product jam ups. The costs of machine repair, product damage and clean up, and added labor are marginal compared to the loss of revenue from slowed or stopped throughput. In high-volume manufacturing facilities, throughput interruption can exceed tens-of-thousands of dollars of revenue lost per hour because of slowdowns, shutdowns and jam ups.

Consequently, manufacturers closely manage their product line operations to maximize uptime. Technology plays a critical role. As new and improved technology becomes available, operational performance, safety and maintenance are streamlined for better output, optimized equipment utilization and system longevity.

Smart conveying solutions enable high-speed end-of-line throughput of delicate wet wipes while maximizing uptime, minimizing product damage and maintaining industry standards for cleanliness.

Wet wipes production bottleneck

An industry sector where automation has made a significant improvement in throughput uptime is the primary and secondary packaging of wet wipes. Wet wipe consumption has nearly tripled in the past decade, according to Smithers Pira (formally Pira International), the worldwide authority on the packaging, paper and print industry supply chains. The appeal of sanitizing wipes, baby wipes, diaper liners, feminine hygiene and cosmetic wipes, and cleaning cloth products comes from the advantages they offer consumers in effectiveness, cleanliness, convenience and ease of use. Adding to this tremendous growth, the demand for sanitizing wet wipes has exploded with COVID-19, pushing manufacturers' wet wipe production demands beyond previous expectations.

Wet wipe manufacturing automation can produce up to 500 stacks of wipes per minute, in counts ranging from 20 to 100 single-ply sheets per stack. At these high throughput levels, downstream systems for primary and secondary packaging like shrink wrappers and case packers cannot handle the volume of product flow unless it is split into multiple packaging machinery lines.

Whether one packaging line or multiple lines are employed, the need to handle the fragile wet wipe stacks gently to minimize damage or deformation is a key concern. Transporting the stacks of wipes carefully from manufacturing through primary packaging with high throughput and near-zero product damage is of critical importance. But many wet wipe manufacturers are plagued with conveying systems that are inadequate for moving these fragile stacks through the packaging processes.

When positioning stacks of wipes for infeed into primary packaging machinery like shrink wrappers as well as handling containers of packaged wipes for infeed into secondary packaging systems like case

Figure 1: The demand for sanitizing wet wipes has exploded with COVID-19. Courtesy: Shuttleworth



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Figure 2:
High-speed automation for wet wipes folding, wetting, cutting and piling presents throughput challenges. Courtesy: Shuttleworth

packers, too often the conveyors handling these wipes are not designed to adequately stage the products for precise registration for infeed. The same can be said for labeling, and particularly date stamping, where the products may have to be rotated on the conveyor to a precise location for stamping.

No matter how efficient shrink wrappers, labelers and case packers may be, if the wet wipes packaging line does not use conveyors adequately designed for the handling of fragile products like wet wipes, and precisely stage these products for infeed, the product quality, throughput speed and cost-efficiency of the entire production and packaging line will be compromised.

Having the right conveyor systems that adequately address these conditions minimizes line stoppages, and significantly decreases opportunities for product jams and damage. Designing the wet wipes packaging conveyor system to function as an uninterrupted and smooth-running operation increases efficiency, throughput and profitability for the entire primary and secondary packaging line.

Smarter conveyor technology

Three technology developments have contributed to enhancing high-performance conveying for wet wipes packaging: Slip-Torque roller technology, dynamic accumulation and SmartFeed. These were developed by Shuttleworth, a designer, manufacturer and integrator of conveyor solutions to solve material handling challenges — specifically, conveyor systems that accumulate, flip, stack, rotate, push, divert, combine or index products for manufacturing or packaging processes.

Slip-torque and dynamic accumulation. Slip-Torque roller technology uses individually powered, stationary rotating roller shafts covered with loose, segmented rollers, which become the conveyor

surface. It is powered by a continuous chain to control the drive force of the conveyed wipes. When the wet wipes stop on the conveyor surface, the segmented rollers beneath also stop, generating low back-pressure accumulation, and minimizing product damage. It is the weight of the wet wipes being conveyed, combined with the coefficient of friction between the shafts and the inside diameter of the rollers, that provide the driving force. As the weight of the conveyed products increases, there is a corresponding increase in the driving force supplied.

Slip-Torque's low line pressure provided throughout the conveyor, and its continuous-motion dynamic accumulation allows precise product placement on the conveyor while it continues to take product flow from an upstream line for a period of time, where other conveyors would have stopped well before. A low back-pressure accumulation buffer absorbs irregularities in the production flow and provides a smooth, even flow on the line. A servo-controlled guide provides efficient lane changing of incoming wet wipes, eliminating product backlog at the point of entry.

The system allows the same conveyor to be split into multiple, independently operating lanes if desired. For example, the middle lane can accumulate, while the right lane and the left lane can both convey, or even operate in opposite directions. Each lane can act independently, if needed, but is powered by only one common motor, which also reduces energy usage.

Conveyors with Slip-Torque have the ability to modulate the speed of different sections of the conveyor via a centrally controlled programmable logic controller (PLC) and human-machine interface (HMI). As wipes are moving down the line, the rollers at the back end of the conveyor can be moving faster than the ones at the front end. The products can be moving at variable speeds on different sections of the conveyor as dictated by throughput requirements. This controls the wet wipes spacing on the conveyor, keeping these delicate products separated and equally spaced from each other to minimize product contact and facilitate infeed into packaging equipment such as shrink wrappers.

The Slip-Torque surface also can be used to minimize product contact while steering products into desired locations such as employing rollers with herringbone patterns to orient products without the use of guardrails or setting up a series of sequentially smaller roller heights to direct food products into the center of the conveyor for packaging induction without touching any other conveyor parts. Slip-fit rollers with tapered corners can be used to maintain product orientation as it is transported through 45-degree and 90-degree conveyor turns.

Because of the unique features of Slip-Torque rollers, the conveyor system is a safe environment for workers who work near and interact with the wipes being carried on the conveyor system. The roller contact surface is designed to stop immediately if a hand is placed on it, thus maintaining a safe working environment.

SmartFeed. Nowhere in the wet wipes packaging process is the handling of these products more susceptible to damage than with infeed into the primary and secondary packaging machinery. Inaccurate infeed contributes to high defect rates, lessened throughput and increased production costs. This is common particularly with shrink wrapping where mis-wraps can easily occur, jamming the line. When shrink coverage does not completely cover the product, it can go unnoticed until later when the product has become contaminated due to exposure. Improper sealing is caused primarily by poor infeed and mis-registration.

To achieve a consistent level of infeed registration, Shuttleworth developed a series of automatic wrapper and case packer infeeds. Working in combination with Slip-Torque conveyors, SmartFeed links machine infeed to upstream product flow. It is designed to dynamically accumulate and synchronize the release of products for infeed without stopping the production flow.

The infeeds operate by timing the release of product into the flighted infeed with a pneumatic/electric gate, or a servo-controlled variable-speed surface. With a speed-up zone near the discharge end of the infeed, one product at a time is placed onto the infeed of the packaging machine. The spacing is precise, with a tolerance of 0.25 inch to 0.5 inch. The infeed is in synchronization with the machine using encoder feedback. A sensor identifies each product's location, and the conveyor will either accelerate or decelerate the product to place it into position on the machine's flighted infeed.

The system operates in four speed-registration zones to manage the infeed of products:

1. The first zone accepts the product from upstream wet wipe manufacturing or upstream packaging systems, or a staging point, then conveys it downstream.
2. The second zone closes the gaps between the wet wipes, running the products back-to-back.
3. The third zone increases the spacing between the products equal to the pitch flight on the packaging machine.

4. The fourth zone positions each wet wipes stack, canister, tub or flexible package into the gaps between the flights.

The packaging machine and smart infeed are always talking to each other and reacting to whatever products are moving through the line. When there is a delay with an item, SmartFeed tells the machine that no item is in position, and to slow down or stop. When the next item is in position, it tells the machine to start, providing there is accurate product indexing. System controls installed upstream regulate the line speed throughout directed by input from infeed. In this way, it creates an integrated system monitoring the flow of product up to and into each primary packaging and secondary packaging machine on the wet wipes line.

Several versions of the system can be integrated for handling both primary and secondary packaging of wipes:

- Gated SmartFeed and high-speed gated SmartFeed use a product stop to synchronize the release of the stacks of wipes and containers or wipes to the flighted infeed of the wrapper or case packer. The combination of the low-pressure queue area, speed change and the product stop provides jam-free operation. Gated infeeds operate at rates of 20 to 80 wet wipe stacks or packaged wipe containers per minute. The high-speed infeed can reach rates of 120 units per minute.
- Multi-Packer SmartFeed is designed to release a pattern of multiple wet wipes stacks or containers

Figure 3: Wet Wipes can be moving at variable speeds on different sections of the conveyor as dictated by throughput requirements. Courtesy: Shuttleworth



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Figure 4: Wet wipes can be moved from one conveyor traffic lane to another traveling in the same or the opposite direction. Courtesy: Shuttleworth

in time with a flighted or belted infeed. A product stop, combined with an adjustable overhead brake, controls the number of products released.

- Servo SmartFeed combines buffering and indexing into a single-source solution for infeed of wet wipes stacks and containers without the use of devices. This system monitors production flow and delivers this information to the wrapper and case packer for speed modulation. Servo SmartFeed automatically synchronizes to the packaging machine so that the wipes are precisely and consistently placed on the infeed of the wrapper or cartoner.

Flexible product control devices

Many conveyors used in manufacturing enable the adaptation of product control devices such as product stops, pushers and clamps that can be used to modify the flow of conveyed products. Most conveyors bring these devices in from the side or even over the top such as would be found on belt conveyors, plastic link conveyors or table-top chain conveyors. Side-mounted devices are limited in their flexibility to control product flow because of their side-only mounting locations, and top-mounted devices are considered even less desirable by manufacturers because of safety and product contamination concerns.

Conveyors equipped with Slip-Torque roller technology function differently with product control devices. These conveyors use the space between rollers to allow these devices to be mounted below the surface, reaching up between the rollers to affect more precise and flexible product motion control without interfering with the line flow.

Product control devices can be more specifically located on conveyors equipped with Slip-Torque compared to conventional systems and bring a much

higher level of positioning accuracy with more positive product handling. The product control devices include:

- Blade stops and brakes that enable on-demand stops and starts of production flow
- Lift-and-transfer, lift-and-rotate, side transfer and turntable devices that are used to provide a smooth and accurate product transfer at a 90-degree angle to the original transport direction, or to change the orientation of products on the conveyor
- Product positioners that accurately position or rotate products for a particular process such as for scanning bar codes in labeling
- Pushers to push products perpendicular from one conveyor traffic lane to another traveling in the same or the opposite direction, into or out of operator workstations or off of the conveyor system completely
- Single-row combiners that combine wet wipes in multiple lanes into one single row
- High-speed telescoping and custom product diverters and laners can direct the product flow to a particular lane for efficient buffering or line balancing.

Inadequate product control on packaging conveyors will cause product defects. Material handling systems not designed specifically for handling wet wipes can cause product marring, defects and misalignment of wet wipes stacks by not providing adequate product control while on the conveyor system. Conveyor designs that allow the wet wipes to come into contact with side rails or fail to adjust adequately to velocity changes around curves will inevitably introduce unnecessary random product movement on the conveyor, increasing the possibility of wet wipes damage.

Efficient conveyor technology for wet wipes packaging lines

Wet wipes manufacturers now have smarter conveyor systems specifically designed for the precision and flexible needs of their primary and secondary packaging lines. These systems incorporate the necessary automation and product handling devices that enable manufacturers to achieve more productivity, increased versatility, decreased product damage and realize a more profitable bottom line. 

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