

# Drive & Control profile

## Modularity and Flexibility Move Conveying Systems Up the List of Packaging Line Priorities



Modular conveyors form a “highway” system to coordinate product flow and balance production in high-speed packaging operations, and are the foundation of an adaptable packaging operations strategy.

Whether referring to beverages or pharmaceuticals, most sectors of the packaging world are heavily influenced by ever-changing customer, market and industry demands. From multi-pack or variety packs for retail club stores to special packaging and labeling requirements, manufacturing engineers are called upon to design packaging lines for maximum

efficiency and flexibility, allowing the line to respond to these demands and adapt to take advantage of new opportunities.

For many manufacturers, conveying systems are one of the last considerations in the packaging line and are treated as though they had little value to add to the process. It is still

### Challenge:

Manufacturing engineers must design packaging lines for maximum efficiency and flexibility to satisfy an increasing share of the marketplace, improve profitability, and adapt to new products, packaging formats and materials.

### Benefits of Modular Chain Conveyors:

- Modularity and flexibility protect uptime and productivity
- Tightly integrated components relieve product bottlenecks and product flow challenges
- Easy adaptation to frequent changes in creative marketing formats, such as new product sizes and labels
- Improved ergonomics and condensed conveyor footprint for operator safety and comfort
- Easy expansion and reconfiguration possibilities, including curves and inclines of up to 90-degrees

relatively common to find that design and layout of packaging lines focus mainly on packaging machinery and little on the supporting conveying systems transporting products between them. But is the task of conveying products from one machine to the next any less critical than the packaging operations performed at the machines? If a conveyor system fails to perform efficiently and effectively, how does that failure affect the productivity of the packaging machinery, which represents a significantly larger investment?

A recent study of productivity and profitability trends in the packaging industry conducted by the Packaging Machinery Manufacturers Institute (PMMI Productivity Study) produced key findings with significant, if not fully appreciated, implications for packaging conveyors. Fully 67%

of the companies participating in the PMMI Productivity Study indicated that in the prior two years they had redesigned packaging line layout for the express purpose of increasing productivity. Moreover, 65% of the companies participating in the study confirmed that they had systematically analyzed process constraints, such as material flow bottlenecks, in the course of planning their changes to packaging line layout. With such demonstrated emphasis on packaging line layout, it seems only logical that conveyor systems—literally the lifeline of the packaging operation—should receive no less attention than packaging machinery.

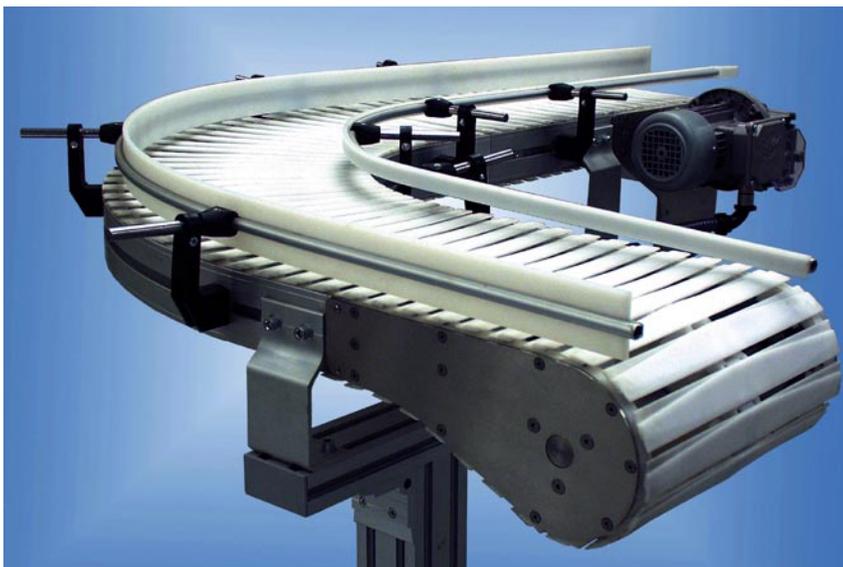
Today's generation of modular chain conveyor systems could go a long way toward changing the way the packaging industry thinks about conveying systems. Designed

for transporting small- to medium-sized products in packaging, assembly and material handling applications, today's sophisticated conveyor systems are built upon the principle that a successful packaging line is about more than moving products from point A to point B. Instead, they are engineered for their critical role as an important link in the packaging line chain. Just like their upstream and downstream machine neighbors, modular chain conveyor systems function to protect uptime and productivity and to maximize the return on capital investments in the entire line.

Leading conveyor suppliers can call upon considerable experience and expertise in assembly applications and process flow optimization to reliably address a comprehensive range of conveying needs. The best conveyors resulting from this experience not only bring new and greater levels of capability and productivity to the packaging line, but also add a level of flexibility that allows packaging operations to adapt quickly and easily to market changes. Using a modular system of chains, curves, curve wheels, lateral guides and conveyor profiles, complemented by variable speed drives, a well-designed conveyor system is capable of satisfying nearly any conveying need and adapting to evolving needs without spending valuable time and money on costly alterations.

### **Maximizing Modularity**

A separate study commissioned by the Packaging Machinery



Pre-engineered modules—like this 90°curve assembly—fit into tight spaces and can be redeployed easily in alternate configurations, saving time and money.



Small-radius turns, high-efficiency motor and drive systems, and high tensile strength chains combine to produce flexible conveyor systems that lower acquisition cost and minimize costs of ownership through operational flexibility and protection of investments in productivity.

Manufacturers Institute, titled “Vision 2010: A Look at the Packaging Machinery industry in 2010” (“Vision Project”), provides a view of the packaging industry’s long-term future and establishes a basis for developing effective short and long-term objectives and strategies for machinery manufacturers. The Vision Project finds that manufacturers of packaged goods are under unrelenting pressure to attract and satisfy an increasing share of the marketplace through product and process innovation and differentiation, while reducing costs and capital expenditures to maintain competitiveness and improve profitability. New products, new packaging formats, and new packaging materials all play a role in their competitive strategies. Accordingly, packaging machinery—and the conveyor

systems that link machines in the packaging value chain—must be designed to enable and help sustain these strategies. Today—and going forward—equipment and conveyor systems must be increasingly flexible, versatile, maintainable, and simple in design and operation, while using a minimal footprint within the production facility.

One of the key benefits a thoughtfully-conceived conveyor system brings to the packaging line is its modularity. Each component is tightly integrated within the larger system to create designs that can readily address a variety of challenges such as product tipping, product jamming and special handling of unusual or delicate packaging dimensions.

In addition to linking primary and secondary packaging processes for maximum production efficiency, modular chain conveyors can relieve bottlenecks and other product flow challenges via line buffering and accumulators. They can also adapt to different process speeds, infeed/outfeed demands, production disturbances, labeler changeovers and line stoppages. Good conveyor systems also improve the operator’s work experience, by allowing configurations that make packaging processes accessible to manual operations. Indeed, no well-planned conveyor layout should ever impede operator movement around the labeler, checkweigher, case packer, palletizer or other manually-operated equipment.

In fact, a smart layout will also improve the ergonomic qualities of a packaging process by condensing conveyor footprints for less operator movement and greater productivity.

For more complex conveying tasks, such as elevation with an aggressive incline to allow for personnel and other traffic to pass underneath or product presentation at vision inspection stations, packaging system engineers should look for a conveyor that offers different types of chains based on the type of product the line is handling. For example, a cleated chain can elevate products 90 degrees straight up without damaging the product and without the product falling from the chain. This is especially important when products need special care to protect elaborate packaging, as it reduces product waste and lowers packaging costs.

Each pre-engineered component, from turns and guide rail structures to motor and drive systems, can be easily combined for customized layouts and functions. Variable configurations can accommodate different product heights, climbs and descent rates, inclining or declining at up to 90 degrees. The basics of good chain design play a key role, too, and should not be overlooked. A stable chain that can handle high tensile forces (today’s leading chain conveyors offer up to 1,250 N) at high speed—up to 300 feet per minute in many applications—can save money by allowing fewer powered drives over a given conveyor length. Also, a tightly

designed chain surface minimizes gaps between links and allows even small components to be conveyed without complication. Thus, packaging and pharmaceutical lines can use conveyors to transport goods directly on the transport chain.

Compared to steel, the extruded aluminum conveyor frame and plastic chains used by leading conveyor companies have the flexibility to adapt to frequent changes in creative marketing formats, such as new product sizes and labels, whereas purpose-built, welded steel designs are normally dedicated to one specific task. This distinction can be crucial in the world of consumer products, in which a useful and clever package design may be fundamental to both product functionality and brand differentiation.

Spiral buffers made from steel, for example, are difficult to weld, not easily expanded, and typically do not survive beyond their original design and deployment. Conversely, using a comprehensive system of product transport chains (flat, cleated, steel-plated, ESD, static friction, accumulation roller, roller cleated and universal), curves (horizontal and vertical), curve wheels, lateral guides, profiles and variable speed drives to enable speed modulation for maximum line efficiency, a system built using today's modular conveyor technology is easily configured and expanded. Consider elevation changes, which are often necessary to open space on the plant floor, improve access to packaging



Maximum density, maximum efficiency: buffering conveyor systems—like this vertical inline spiral accumulation system—offer ultra-compact accumulation to minimize floor space and keep production going.

process steps, or accommodate packaging machinery infeed characteristics. Standard vertical curve modules—typically ranging from 5 degrees to 90 degrees—can be used in combination with static friction or cleated chain for angled transport of products without the need for additional transfer points or secondary equipment. This means minimal additional investment, faster implementation, conformance to constrained process footprints, and lower risk of conveyor-related product damage.

When installing a conveyor system on a new packaging line, packaging system engineers should look for a range of electronic planning tools to simplify system design and layout. The best conveyor suppliers offer a set of tools which

includes a complete parts catalog, menu selection of components and configurations, macro components and functions, 3D solid models and integrated calculation functions—all of which significantly reduce the design effort and shorten implementation timelines. Some companies even offer software which also calculates driving power and chain tensile forces, to ensure the appropriate component selection for the task. Once the design is complete, the modular components facilitate fast, worry-free installation that compresses project timeframes, lowers implementation costs and gets products to market more quickly.

Further complementing its modularity, a conveyor made of an extruded aluminum frame can easily incorporate ancillary process equipment such as vision systems and marking systems, which can be mounted directly to the conveyor body. Drop-on-demand (DOD) ink jet printers, for example, are commonly used for outer case and secondary packaging coding applications to imprint such data as time, date, shift code, and other information for tracking and identification purposes. Basic structural elements and fastening hardware—part of the standard offering of leading conveyor suppliers—can be used to quickly and sturdily mount DOD printers to the conveyor with built-in flexibility to move the printer as circumstances demand. Because of the tight radii and extreme layout flexibility possible with today's conveyors, a well-designed system also boasts the smallest



Changes on-the-fly: Adjustable guide rails provide flexibility to quickly adapt to a wide range of container shapes and sizes, reducing time-to-market cycles.

possible footprint, to save valuable floor space and maximize the use of available area. For example, systems can be configured for vertical accumulation to save floor space and to keep upstream and downstream equipment running during brief stoppages.

In addition to the conveyor layout with vertical and horizontal curves, curve wheels, lateral guides and profiles, drive concepts also should be modular. Variable speed drives have compact designs and are equipped with an overload coupling, while motors with integrated frequency inverters permit infinite speed adjustments.

### **The Flexibility to Seize New Opportunities**

The PMMI Study, referenced above, also examines the challenges and opportunities presented by the growing trend toward running multiple products

and packaging formats on a single packaging line. It found that “slow changeover time” ranked highest among equipment-related factors inhibiting productivity improvements. Moreover, 62% of the companies participating in the study reported an increase over the prior year in the average number of products or size variations run on their lines. This, of course, implies an increase in the frequency of packaging line changeovers and suggests that the limitations inherent in inflexible conveyor systems would likely increase downtime for changeovers, while requiring considerable mechanical work by maintainers or operators to implement a changeover.

Essentially, the smart designs of today’s modular chain conveyor systems can account for nearly any conveying demand, including changes in the product mix, line expansion and special handling of

delicate packaging. Sometimes new opportunities come in the form of expanding capacity, other times they can take production into a whole new direction. The best conveyors today keep both of these scenarios in mind, making the line equally flexible for change by further capitalizing on the benefits of modularity.

Packaging conveyor systems are at the heart of all forward-thinking packaging operations strategies. They enhance process agility, streamline process flow and minimize operations costs. Perhaps more importantly, their flexibility plays an important role in harmonizing marketing priorities and opportunities with production objectives by easily adapting while minimizing investment in new conveyors.

Within the context of modular chain conveyor systems, flexibility means easy expansion and reconfiguration possibilities, including curves and inclines. As mentioned earlier, beverage packaging and pharmaceutical packaging are heavily influenced by retail club store demands for multi-packs and variety packs. This is where the value of modularity lies, because modular conveyors can be configured and reconfigured to run several SKUs on one line by simply adjusting the mechanical side guides. Quick-adjust and positive positioning elements incorporated into side guide systems ensure both speed and repeatability of changeover, enabling the fastest possible return to production of saleable product.

A filling operation with downstream labeling, for example, typically has multiple label changeovers, even for the same product. Changes may include RFID mandates that affect labeling standards and labeling process strategies, labeling for multiple languages and new inspection systems to comply with safety and security standards. The labeling area, which is characterized by scaled, small radius turns, can feature a buffering system in which the product is diverted off the main line while the labeler is changed. Here a typical snaking conveyor in a serpentine design takes up space, whereas a modular chain conveyor can be configured in tiers that spiral upward, saving space.

Bosch Rexroth refers to such flexibility as Adaptive Modularity.™ An adaptively modular conveyor



Multi-flexing plastic chain creates a high-strength transport platform, and specialized surface features adapt to unique packaging formats and transport tasks.

can easily adapt to the changing packaging environment and can redeploy and reconfigure easily for different packages and processes to capitalize on market opportunities. For example, packaging lines often require reconfiguration or relocation in order to remain productive. New packaging media, different sizes and shapes, and additional process steps are just a few of the events that can

affect material flow. Adaptive Modularity enables customers to adjust to new operating parameters quickly and inexpensively, which maximizes the value of their original investment. Moreover, if a packaging line is relocated, Adaptive Modularity allows for quick disassembly and re-assembly, often without the involvement and cost of third party integrators.

Modularity and flexibility are really two sides of the same coin since adapting a packaging line for new products or packaging is just as important as expanding a packaging line for greater production. Ultimately, the ideal conveyor system is both modular and flexible, allowing it to handle the custom application for which it was originally built and accommodate new and evolving applications to seize market opportunities.

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