DistributionDigest
Distribution Center and Materials Handling Management
A Supply Chain Digest Publication

Date: Jan. 11, 2010
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Category: Trends and Developments
No. 100

Materials Handling Tech Note:

Advances in Conveyor Technology increasing System Flexibility

Most material handling vendors had a very difficult year in 2009. Somewhat lost in that environment was good news for companies that may invest in new or additional conveyor technology in 2010 and beyond: over the past 2 -3 years, manufacturers of material handling automation (MHA) equipment have made substantial improvements in engineering and system design that provide users much improved flexibility in initial system layout and over the lifecycle of that equipment.

This is important because one barrier to adoption of materials handling automation has always been concerns about flexibility – companies legitimately worry that once they have "bolted equipment to the floor" it will become prohibitively expensive or difficult to make changes need to adapt to business needs.

While that is often a legitimate concern, our research has found that conveyor manufacturers have made improvements in several key areas that will make systems more flexible in design, implementation, and ability to adapt over time.

In this Tech Note, we look at key developments, based on independent research and technology briefings from three of the industry's largest providers: **Dematic**, **HK Systems**, and **Intelligrated** (which recently acquired FKI Logistex).

Below, we organize advances in system flexibility into key areas of advancement.

MDR Provides More Equipment and Layout Options

In a later Tech Note, we will delve more into the subject of "Motor-Driven Roller" (MDR) conveyor technology in more detail. In summary, MDR involves providing power to turn conveyor rollers through DC motors inside the rollers themselves, rather than through large AC motors and long belts to drive the rollers.

In many applications, MDR can have significant advantages, especially in short runs, curves, transfers and related applications.

Though MDR technology has been around for years, it is only recently that most conveyor manufacturers have begun to fully productize them into their offerings. The result is that users now have a whole new set of options to consider when selecting equipment in a given design – options that in many cases can offer better performance and/or can achieve the same result in a smaller physical footprint.

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Summary of Recent Conveyor Technology Improvements		
Development Area	Recent Advances	Flexibility Benefits
Equipment Options	Motor-Driven Roller (MDR) technology can be intermixed with traditional conveyors in a given design	More equipment/layout options; potential to reduce system "footprint"
Physical Conveyor Design	Wires, tubing, etc. increasingly built directly into conveyor frame	Can enable equipment to be repositioned more easily
Physical Conveyor Design	Equipment designed with common base components that allow a "Lego-like" approach to implementation	Much more easy to make changes to layout after initial systems implementation
Sensing and Controls	Switch to electronic versus mechanical sensors and related advances in control software	"Dynamic" accumulation zones are now possible, improving conveyor utilization
Controls	Automated speed control that adjusts conveyor speeds based on volumes	Enables companies to have more control about flowing product through the system and smooth those volumes across different areas of the DC and/or throughout a shift.

"Hidden" Componentry

Increasingly, leading US conveyor equipment providers are mounting wiring, drives, controls and pneumatics behind or within the conveyor frame, and/or (depending on customer preference) hiding this gear behind shrouds or plastic windows.

This approach not only provides a much cleaner look, but also reduces noise and fluid leaks. Perhaps more importantly, it also adds to system flexibility, as the hidden nature of the gear makes it easier to move pieces equipment as needs or thinking changes after installation.

It is worth noting that this is the approach many European conveyor manufacturers have been taking for years, in a market that has different values and customer expectations regarding equipment pricing, as such this approach comes with a cost. It has lately come to market in the US part as a result of a natural evolution of equipment engineering, and also because a few large retail customers began to demand this approach from their system providers.

That customer clout drove the engineering and production changes that could deliver this cleaner approach to conveyor design – and which now will benefit additional customers at basically no additional cost for the equipment versus before.

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It is worth noting that even with this "hidden" approach to wires and other gear within the frame, in general, this will not make it harder to access the gear for repair and maintenance purposes.

LEGO-like Building Block Approach

At long last, conveyor manufacturers have developed "component" pieces of equipment that can rather easily be moved, repositioned, and replaced by "snapping in" the new piece of equipment.

At Dematic, for example, this is accomplished by establishing one side channel design and a series of common parts for all conveyor modules from inclines, declines, accumulation, transportation, curves, etc. This approach allows modules, such as a right angle transfer, steerable wheel diverter, or a segmented belt section to be moved and remounted in the common side channel to a new location in the system with ease and speed.

New MDR-based components also now enable the ability to mix and match AC driven conveyor with DC motor driven rollers. For example, a DC-powered roller curve could be implemented with motorized rollers while connecting to a straight section of AC powered accumulation conveyor. This might be done because it cost less to run one AC driven conveyor in a long straight section versus many zones of DC motorized rollers.

Modular design, in short, means that may no longer be necessary to tear out the conveyors when requirements change. Technicians can simply rearrange the modules in a different path.

Thus, conveyors are becoming more reusable assets. Modular "plug and convey" designs allow conveyor sections to be moved and reconfigured to another location or building and into a different application.

This is an area where the conveyor industry has made great strides, but still has a ways to go. For example, while MDR-based sections are truly plug and play, AC-powered sections are hard wiring mean some electrical work has to be done when moving and re-arranging them (some of this required by building codes for electric systems). The industry, however, is getting very close now.

Electronic Sensing and Controls

Among the most significant changes in conveyor technology is the move from mechanical sensors to electronic sensors. This change has been driven by the conflicting demands for higher speed with increased sensitivity for handling smaller, lighter weight cartons.

Electronic sensing has many advantages. It allows for higher speeds, reduces noise and lessens the need for maintenance because there are no moving parts to wear out. It also extends the range of items that can be handled via conveyor. With most mechanical sensors, cartons need to weigh several pounds to trigger a sensor. The new electronic sensors, by contrast, can be tripped by the cartons physical presents alone thus eliminating the weight factor.

Now, a combination of the sensors and more advanced conveyor control software can dynamically set those zones, moving the shorter cartons up to the longer ones, freeing up space on the conveyor and perhaps even reducing the amount of accumulation length needed, depending on carton mix.

Buyers need to be careful here because while some manufacturers have incorporated electronic sensors into their standard product line, others still offer them as optional to mechanical sensors. Buyers need to make sure you know what is being provided in a vendor's quote.

An important ramification of this change is related to zero-pressure accumulation conveyor. Traditionally, accumulation zone lengths were based on how far apart the sensors are; in an important change, zone length can now be determined by the size of the cartons conveyed.

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Before, for example, if the longest carton to be handled on the system was three feet, zones would be created on the conveyor at a length of three feet. That means that shorter cartons – perhaps just 12 inches long – would also use a three-foot zone, effectively wasting space.

Now, a combination of the sensors and more advanced conveyor control software can dynamically set those zones, moving the shorter cartons up to the longer ones, freeing up space on the conveyor and perhaps even reducing the amount of accumulation length needed, depending on carton mix.

Intelligrated, for example, has developed what is calls "crowder functionality" that allows for very small gaps between cartons, further increasing carton accumulation density per lineal foot of conveyor while also increasing system throughput. Some vendors have similar technology.

Automatic Speed Control

Conveyor speeds have been steadily increasing. Some conveyors are approaching speeds of 500 plus feet per minute, with sorters actually attaining blazing-fast speeds up to 700 feet per minute. At these speeds the system would be handling and sorting cartons in the 200 to 250 per minute range. Of course, that's not an advantage if the rest of the operation is unable to keep up. If you can't pick, pack and load at those rates, ultra-fast conveying and sortation may create bottlenecks that offset any gains achieved through greater velocity.

In reality, relatively few companies (mostly in retail) have requirements for ultra high rates above 150 cases per minute, but in general most companies are attracted to increased sorter and conveyor speeds.

The problem is that in the typical DC logistics system operation, there are times of slow or no volume followed by dramatic surges that require substantial throughput. In response to these highly fluctuating volume patterns, conveyor manufacturers are being pressured by their customers to better accommodate this operational reality.

As a result, today's conveyor systems can be equipped with automatic speed control through innovative solutions such as more responsive servo and VFD (variable frequency drive) control.

For example, at the beginning of a work shift an operations manager might enter the expected case volume into the Warehouse Control System (WCS). This then allows the conveyor system to automatically slow down or speed up to more closely match volume demand within system design parameters and constraints.

But, there is still room for improvement. Therefore, a highly competitive, industry-wide design initiative is underway to reduce the gap between cartons as they are being merged and inducted onto sorters. Smaller gaps serve to increase the population of cartons on the conveyor, producing higher throughput volume while at the same time reducing speed. Additional benefits are in lower noise level, lower maintenance cost, and improved system performance.

To a large degree these speed control and gap initiatives have been made possible due to the continued increase in relatively cheap computing power and faster processing capability. Thus allowing software engineers to develop more sophisticated logic based programs that optimize conveyor speed while minimizing carton gaps at critical merge and sorter induction points. Also, equipment like high capacity cross-belt sorters are now available that can sort at right angles, which further reduces gap and speed requirements.

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Summary

We believe that MHA vendors are smart to focus on increasing system flexibility, not only because flexibility concerns have always been a barrier to adoption of more automated DC systems, but because the world is in fact becoming more dynamic, not less.

This puts an additional premium on flexibility, and/or raises concerns in this area to even higher levels than before.

The improvements we've noted here that MHA providers have brought to market in the way of increased modularity and more advanced controls are ones that potential adopters of conveyor and sortation systems need to get up to speed on, as they can significantly impact how a project might be considered versus even a few years ago.

Vendors have implemented these features differently, or in some cases not at all, and as such they should serve as key areas of comparison between vendor candidates.

Suggested Reading/Viewing:

- **Automated Case Picking 2009: The Next Frontier in Distribution Center Management**
- **Logistics News: After Tough 2009, Signs of Uptick in Investment in Material Handling Automation Going Into 2010**

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