



White Paper

The Conveyors that Matter Most on Potato Processing Lines

Vibratory conveying involves much more than transporting product. When a conveyor feeds a digital sorter, cutter, blancher, dryer, freezer or packaging machine, its ability to present product in the ideal manner by aligning, singulating, spreading and/or controlling the flow for that particular operation can improve the equipment's performance by as much as 50 percent. Collecting product after these machines often involves product trajectories and deceleration as well as gentle handling. Mechanical grading and designing efficient packaging distribution systems present other conveying challenges.

To design ideal conveyors for every application, it's necessary to understand the nature of the product and how it slides, rolls and flies, as well as how to present product at each step in the process to optimize each machine's performance. The art and science of designing conveyors incorporates the perfect combination of chutes, lanes, diverters, gates, geometry, speed and stroke in order to feed, collect, grade and distribute.

This white paper will highlight what's needed at various points along potato processing lines where conveyors have the most dramatic effect on equipment performance. We'll start with whole potatoes and then cover potato strip processing and potato chip processing. We'll wrap up with the packaging distribution system, where conveying strips and chips have much in common.

Conveying Whole Potatoes

After being washed and mechanically size graded, whole potatoes are fed to a whole potato sorter (WPS) either before or after peeling, depending on the processor's objectives. While every conveyor at this point in the line needs to feature rigid, heavy-duty structures to withstand the weight of whole potatoes for the throughput required, feeding a digital sorter requires extra consideration.

To maximize the whole potato sorter's performance, the cameras, laser scanners or hyperspectral sensors must get a good 'look' at each object so product defects and foreign material (FM) can be identified.

It is also critical that the product trajectory between inspection and rejection is consistent and predictable so defects and FM can be accurately targeted and removed without ejecting good product. The success of these objectives is largely dependent on an infeed conveyor's ability to separate and singulate the mass flow of potatoes into discrete objects and to stabilize them for presentation to the sorter at the ideal velocity. Well-designed vibratory conveyors with corrugated lanes help the WPS to optimize product quality and maximize yield.



Conveying Potato Strips

Once potatoes have been cut into strips by water knives, a dewatering shaker is required. To remove as much water as possible, a vibratory conveyor's speed and stroke is critical. A mesh bed allows water to pass through the conveyor for recirculation. A sliver sizer remover follows, removing slivers typically 2-3 mm and smaller from the line. This is generally followed by a length sizing grader to remove shorts that will be transferred to a co-product line.

Next, a system of conveyors with a series of diverters and gates distributes the product flow to match the capacity of downstream equipment, which is either a strip sorter or automatic defect removal (ADR) system, depending on the philosophy and line configuration adopted by the processor.

It is critical to the optimal performance of a strip sorter that the infeed conveyor separates, singulates and stabilizes product for presentation to the sorter's inspection system and reject system. Optimal performance is achieved when strips are not touching or clumped reducing the amount of good product in the reject stream when defects are ejected. Operating at a high stroke and high speed, this shaker accelerates strips to high speeds before dropping them onto the sorter's high-speed belt.



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The infeed to an ADR (Automatic Defect Remover or strip defect cutter) is similar to the infeed to a strip sorter with one major exception – strips must also be aligned for an ADR. This is accomplished with a unique shaker that has changes in corrugation. It starts with large corrugations then graduates to narrow corrugations.

At the discharge of the strip sorter, the conveyor handling the 'pass stream' must not damage good product, which is flying in the air at a high speed. This conveyor maximizes gentle handling by following the product trajectory to create a soft landing and easing product deceleration by operating at a reduced speed and stroke.

The discharge of the ADR is a nubbin grader to remove the small defects cut off the strips by the ADR. This is sometimes followed by a rotary size grader to remove short strips that may have been created.

The infeed conveyors leading to the blancher, as well as the downstream dryer and freezer, are all crucial to that machines' performance and have a dramatic impact on the quality of the strips. These three pieces of equipment require that their infeeds spread product evenly across the width of the conveyor at a consistent depth with no gaps in the flow of the strips. This maintains uniform transfer of energy to blanch, dry or freeze each strip evenly while simultaneously conserving energy. These infeeds can feature a corrugated bias feed vibratory shaker that keeps strips in lanes as they drop into the blancher, dryer or freezer.

Conveying Potato Chips

In a potato chip plant, the next two steps for conveyors after the whole potato sorter (covered above) is feeding the peelers and cutters. Feeding the peeler utilizes diverters and gates to distribute the product flow to match the capacity of the peelers. Next, the cutter's effectiveness requires potatoes to be oriented length-wise and fed at a constant rate to minimize off-cuts and maximize throughput. Ideally, this is a vibratory conveyor that features U-shape channels that orient the product and a slide that guides potatoes into the cutter.

Between the cutter and the fryer, where chips are dewatered, vibratory shakers can replace



traditional belt conveyors to improve sanitation. This shaker features a wire mesh bottom and air knives overhead to remove the water and starch. Operating at a high speed and stroke, this system singulates chips and blows excess water off then feeds the fryer.

After frying, potato chips require very gentle handling, which adds to the challenge of feeding the digital sorter where product accelerates to a high speed. Gentle handling while accelerating the chips is accomplished by an infeed conveyor



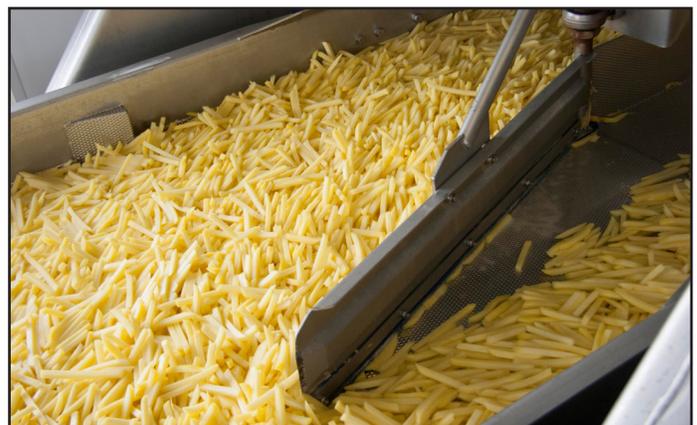
Sanitation is of paramount importance throughout the process, so special attention must be exercised in equipment design, equipment transfers, proper speeds, proper strokes and proper arm angles. Also, equipment type must be appropriate for the application including various lofting vibratory conveyance systems, horizontal motion conveyance and elevating belt conveyor systems.

that separates and singulates the chips and a specialized chute that accelerates and stabilizes the chips on the belt for presentation to the sorter's inspection system so the cameras can get a good 'look' at each object. Creating a predictable trajectory allows the sorter to accurately target and remove defects without rejecting good product. The performance of the sorter depends to a large extent on this infeed.

The discharge conveyor that collects good product from the sorter's 'pass stream' must be extremely gentle to minimize product breakage. This is achieved by decreasing drops and reducing product contact. The profile of the collection shaker matches the product's natural trajectory as it exits.

Conveying Strips and Chips to Packaging

The system of conveyors that take product from the processing line to packaging often begins with belt conveyors to elevate product. These are followed by the appropriate vibratory shakers with gates – slide gates, flip gates, pivot gates and/or proportional-control gates – and/or diverters that lead to multiple scale feed shakers, which feed



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the downstream weighing and packaging machines. The primary objective of this integrated system is to optimize the distribution of product to maximize the output of each weighing and packaging machine, since every on-weight saleable package goes straight to the bottom line. Other objectives include maintaining the product mix, providing an even flow if feeding a seasoning drum and, of course, maximizing sanitation.

A typical conveyor for feeding scales is an electromagnetic vibratory shaker.

It spreads the product uniformly across the pan and it offers infinite control to go faster and slower or to stop and start dependent on the control logic used by the processor.



Conclusion

To optimize the performance of all processing equipment including digital sorters, peelers, cutters, blanchers, dryers, fryers, freezers and weighing and packaging machines, the conveyors that feed these systems must be in perfect harmony with that equipment in order to present product in an ideal manner. These infeed conveyors, along with those that collect, grade and distribute, are essential elements in a potato processor's efforts to improve product quality, increase yields and enhance overall equipment effectiveness (OEE). To get the most from these integrated systems, a deep processing knowledge and application expertise must come together with exceptional conveyor selection and equipment design engineering.

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