

Case history

Almond company chooses gentle, clean conveying

A California company revamps its almond processing line, including installing tubular drag conveyors to ensure gentle, dust-free nut handling.

Hilltop Ranch Inc., Ballico, Calif., is a family-owned almond processing corporation that processes 50 million pounds of almonds each year. Recently, industry changes made it necessary for owners David and Christine Long to modify their processing operation. While planning plant modifications, they decided to replace open belt conveyors with dust-free equipment.

California, the only US state with a commercial almond industry, produces 1.33 billion pounds of almonds annually. In 2001 and again in 2004, the almond industry was stunned when isolated incidents of salmonella poisoning were traced back to a California almond ranch. Although the incidents were extremely limited, the Almond Board of California, representing almond growers and processors, took proactive action to ensure that this wouldn't happen again. The Board drafted a voluntary food safety plan that in Fall 2007 became a federal marketing order. It mandated that all almonds sold to US consumers be pasteurized. (It exempts nuts exported to other countries or sold to certain processors who will be further treat-

ing them with heat — for example, oil roasting them for snack products.) Primary pasteurization requirements include killing any potentially harmful bacteria and not affecting the almonds' appearance or taste.

As active members of the Almond Board, the Longs determined to make their plant a model that would demonstrate effective and efficient almond handling and incorporate pasteurization into the process. The Longs chose to revamp their production process using one of the newer pasteurization methods — brief exposure to hot steam.

David Long and the company's quality manager, Charlie Jahn, consulted with various equipment suppliers, studied equipment capabilities, and developed an innovative processing line with lots of custom equipment, including specially designed pasteurizing and cooling equipment. In November 2007, Hilltop Ranch opened its facility to other nut processors to show its completed processing line and demonstrate what can be done with ingenuity and planning. *Powder*



Almonds are discharging from a holding tank into an inlet near the tension turn around unit on one of the tubular drag conveyors.

and *Bulk Engineering* was pleased to be able to attend this plant tour.

Preventing almond attrition

Top-quality nuts with no imperfections are key to the company's success, and one of the challenges Long and Jahn faced when planning the revamped processing line was how to transfer the almonds between various points in the plant while keeping them intact. This task became more complex when the pasteurization process was added because the almonds now had to endure more handling: They had to be conveyed to more places in the plant, picked up and dropped off several times, and conveyed around equipment that didn't formerly exist. Gentle handling was a must.

In the past, open belt conveyors carried the almonds from bins, elevators, and cleaning and sorting stations to the final boxing area. These conveyors handled the nuts adequately, but because they were open, almond dust escaped the belts, leaving a coating of dust on the floor and equipment. This resulted in significant housekeeping time and effort. So when Long and Jahn began planning the new process, they wanted to use an enclosed conveying system that would be able to make several pickups and drop-offs

and be virtually dust-free. In addition, the system would have to fit the plant's fairly limited space, which was now complicated by the addition of the pasteurization equipment.

Long and Jahn experimented with aeromechanical and pneumatic conveyors, but both damaged the nuts unacceptably. Jahn did more research and saw an ad for a tubular drag conveyor in *Powder and Bulk Engineering*. At first glance, the system resembled an aeromechanical conveyor, but the ad promised gentle handling, so Jahn called the supplier, Cablevey Conveyors, Oskaloosa, Iowa. The supplier told Jahn that unlike an aeromechanical conveyor, the tubular drag conveyor uses no air to move material through the conveying tube, which helps minimize attrition and dust.

Intrigued, Jahn sent a 100-pound sample of almonds to the supplier to test in the tubular drag conveyor. The closed-loop test system is 33 feet long, including 20 horizontal feet and 13 vertical feet.

The supplier first ran the nuts through the test system three times, taking samples at the end of each run. The vertical drop had the potential to abuse the nuts significantly. How-

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The ultrahigh-molecular-weight plastic discs gently pull the almonds through the conveying tubes.

ever, the samples showed “no noticeable change,” says Jahn. “There were no chips or even scratches on the nuts’ fragile skin.”

Then the supplier ran the nuts through the system several times, “something we would never do in actual production,” says Jahn. Again the results were outstanding. Jahn says there was breakage but no sign of buildup on the discs inside the tube or in the drive mechanisms: “These were the results I was looking for.”

The supplier sent a detailed report of the tests to Jahn, and also returned the almonds that had gone through the testing procedure. Jahn analyzed the nuts and found that their perfect condition supported the results reported by the supplier’s engineers. Jahn and Long decided the tubular drag conveyors would be right for the company’s operation and began working closely with the supplier to plan the facility’s conveying system layout.

The conveying system

Hilltop Ranch’s tubular drag conveying system consists of five Super 6 conveyors that connect to various pieces of equipment and one Super 2 conveyor that’s used for carrying frequent in-line samples to the company’s test lab. Each tubular drag conveyor consists of two stainless steel conveying tubes, a cable-and-disc assembly, a drive unit, a tension turnaround unit, and one (or more) material inlet and outlet.

Depending on a company’s application, each conveying tube is 2, 4, or 6 inches in diameter and may have one (or more) transparent polycarbonate inspection section that allows observers to see what’s happening in the system. The conveying tubes may be straight or curved, of various lengths, and laid out in various configurations, including vertical, horizontal, or angled parallel lines; a loop; or multiple-corner shapes.

The cable-and-disc assembly consists of the supplier’s Ultra-Flex stainless steel cable with ultrahigh-molecular-weight (UHMW) plastic discs sized to fit the conveying tube and attached at regular intervals, generally 2 or 6 inches, depending on the application. This assembly is an endless loop that runs from the turnaround unit, through the conveying tube and the drive unit, then back through the return tube and to the turnaround again. Along the way, material is picked up at one (or more) inlet and discharged through one (or more) outlet.

The drive unit provides power to move the cable-and-disc assembly through the conveying tubes. The tension turnaround unit maintains the proper cable tension. Each tubular drag conveyor may have one (or more) inlet and outlet of various types. System components are connected with compression couplers and gaskets, making the system totally enclosed and dust-free.

The system is customized to suit each customer’s application and includes a 1- to 5-horsepower single- or variable-speed motor that provides material transfer rates of less than 100 to 1,240 ft³/h. The almond processing company’s tubular drag conveying system uses one 5-horsepower variable-speed motor on each tubular drag conveyor. The cable moves at a low maximum speed of 1.6 mph (140 fpm), with each disc gently pulling almonds about 1,000 ft³/h, or up to 40,000 lb/h.

The new production line

At Hilltop Ranch, shelled almonds are filled into large bins outside the plant, then moved inside. A bin dumper elevates a bin and dumps the nuts onto a shaker, which drops them into a laser sorting line for electronic cleaning. This sorts out defective nuts, bits of shell, and other debris. The good nuts discharge to an elevator, which carries them upward to bins above a sorting room. The nuts are then discharged



Almonds are transferred from one tubular drag conveyor (top) to another (bottom).

down chutes to sorting tables, where workers manually grade the nuts by size and other criteria.

The graded nuts discharge to another elevator, passing through a metal detector before moving into a tubular drag conveyor, which takes them to a large twin holding tank that holds 50,000 pounds in each of its two sections. At the proper time, the almonds discharge from the holding tank into another tubular drag conveyor, which transports them to a diverter valve that directs them either to the pasteurization process or a metal detector and boxing area.

The nuts sent to the boxing area travel in a tubular drag conveyor to a spiral elevator which gently allows the nuts to descend by gravity into 50-pound boxes. The boxes will be sent to various customers, including confectioners, mixed-nut purveyors, and others.

The nuts sent to the pasteurization process are moved by another tubular drag conveyor, which takes them to the top of the pasteurization tank. Here, the nuts have a controlled 10- to 12-second fall through 220°F steam. They discharge to a fluid-bed gyratory dryer where excess moisture is removed, then are conveyed by tubular drag conveyor into a cooler. Here, they fall by gravity down a perforated

cone that exposes them to 65°F cool air, which helps cool the inside of the almonds. From the cooler, another tubular drag conveyor carries the nuts upward to the metal detector and box-filling station.

Gentle, dust-free operation

During the new pasteurization line's first 3 months, the plant operated the conveying system for 1,400 hours. "The conveyors are working out very well," says Jahn. "Compared to other systems we tried, they're more dust-free and easier to clean, and they handle the almonds a lot more gently."

He says that the plant's maintenance people did the entire installation themselves. "Assembly is straightforward, and the supplier's support staff was very helpful when we had questions. They're easy to work with," he says.

Dexter Long, the company's vice president of operations, says that there was a slight learning curve when they first installed the conveyors. "The conveyors have limit switches, so if the tension on the cable is too much or too little, the conveyor shuts off. But once we got the hang of that, it's been smooth going ever since. In fact, I wouldn't consider starting a new line with anything other than this supplier's conveyors." **PBE**

Note: To find other articles on tubular drag conveyors, look under "Mechanical conveying" in *Powder and Bulk Engineering's* comprehensive Article Index at www.powderbulk.com and in the December 2007 issue.

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