Vacuum conveying system completes the package

The Association for the Blind and Visually Impaired (ABVI), Rochester, N.Y., is a not-for-profit organization that provides employment opportunities for people who are blind and visually impaired. ABVI’s manufacturing and fulfillment division has 60 employees who convert, assemble, package, and distribute a wide range of high-quality products for federal and state government use. When the federal government wanted to switch to a bio-based laundry detergent for the military and other government entities, ABVI decided to bid on the contract to package the detergent for distribution. To secure the contract, ABVI had to develop a cost-efficient, user-friendly production line that included a vacuum conveying system to transfer the detergent from a bulk bag to a box-filling machine.

Planning the new production line

ABVI first worked with a co-manufacturer to formulate a bio-based detergent that met the government’s specifications. ABVI then had to design a production line to remove the detergent from a 2,000-pound palleted bulk bag and package it in 13-pound boxes. According to Leon France, ABVI industrial engineer and quality manager, the new line had to be economical to ensure the lowest bid, easy to use for operators who are blind and visually impaired, and installable in an area with limited head room.

France worked with a New-Jersey-based manufacturer that specializes in auger filling machines for accurately dispensing materials into containers. To transfer the detergent to the filling machine’s hopper, the manufacturer recommended that France contact a vacuum conveying system supplier it had successfully worked with in the past. This supplier, Vac-U-Max, Belleville, N.J., designs and builds custom and semicustom pneumatic conveying systems and support equipment for conveying, batching, and weighing dry materials.

France contacted the conveying system supplier and sent material samples to the supplier’s facility for testing to ensure that the detergent’s...
particle size distribution didn’t change during conveyance. The supplier conducted conveying and particle analysis tests to determine several system configurations and operating parameters for transferring the detergent. France then traveled to the test facility and watched the supplier demonstrate the various conveying systems.

“The supplier showed us several ways that we could convey the detergent and then discussed with us the advantages and disadvantages of each option,” says France. “After witnessing the tests, we selected a custom-designed vacuum conveying system that uses a pickup wand that an operator inserts into a palleted bulk bag’s top opening. Since the packaging room doesn’t have enough height to accommodate a bulk bag discharging stand, we felt this was the best option because it allows us to do everything in one room at the same level. It also kept the project’s costs down because we didn’t incur the extra expense of special equipment for lifting the bulk bags.”

When the government awarded ABVI the contract, France began constructing a ventilated packaging room and purchased the auger filling machine, vacuum conveying system, and ancillary equipment needed to fill the detergent into the boxes. “We only had about six months to get the production line set up, tested, and started,” says France. “So to ensure that it would be fully functional when we installed it in our packaging room, we worked with the filling machine manufacturer and

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After an operator places an empty detergent box in the box-filling machine’s filling zone, optical sensors signal the machine’s controller to discharge the detergent from the hopper.
The vacuum conveying system

In January 2012, ABVI installed the production line in the new packaging room. The line’s vacuum conveying system consists of a MDL107150 5-horsepower positive-displacement vacuum pump, a MDL105017T vacuum receiver with a MDL106043 filter, a 25-foot-long flex hose, and an adjustable air-bleed pickup wand. The vacuum pump is installed in the packaging room near the filling machine, the Type 316 stainless steel vacuum receiver is installed directly above the filling machine’s conical hopper, and the 2-inch-diameter flex hose connects the pickup wand to the receiver. To aid with cleaning and maintenance, the supplier mounted the vacuum receiver on a mobile frame with castors and a hand crank. This allows an operator to roll the frame away from the filling machine and lower the vacuum receiver to waist level for easy access to the receiver’s interior.

To package the detergent, an operator first uses an electric pallet truck to move a palleted bulk bag from the storage area into the packaging room. The operator then inserts the pickup wand into the bulk bag and activates the production line at the filling machine’s controller. The conveying system pulls the detergent for a predetermined time about 10 feet horizontally and about 15 feet vertically from the bag to the receiver. When the conveying cycle stops, a vibrator mounted on the receiver activates and the receiver’s bottom dump gate opens to gravity-discharge the detergent into the filling machine’s hopper.

After the detergent has vacated the receiver, the dump gate closes and the conveying system pulls more detergent to the receiver.

This process repeats until the detergent reaches the hopper’s high-level sensor, at which time the conveying system goes into stand-by mode. As the operator fills the detergent into the boxes, the material level in the filling machine’s hopper decreases. When the material level in the hopper reaches a low-level sensor, the sensor signals the conveying system to begin pulling detergent from the bulk bag to the vacuum receiver again.

The supplier and filling machine manufacturer worked together to program the conveying system’s conveying cycle to maintain an appropriate material level in the hopper. This ensures that the detergent’s density above the auger filler head stays constant, leading to consistent weights within the established tolerance parameters. If necessary, the operator can adjust the pickup wand to increase or decrease the incoming airflow — the more air, the more detergent gets pulled to the vacuum receiver, and vice versa.

Special care was taken when designing the production line to ensure that people with vision loss can easily operate all of the equipment. Since the pickup wand stays in the bulk bag, if a void forms in the bag or a blockage occurs in the tube that prevents material from being pulled to the receiver, the system sounds an alarm to alert the operator to move the wand or check the tube.

France says that the vacuum pump operates at a low noise level. “The Department of Labor did a noise audit to make sure that the sound level didn’t exceed OSHA’s requirements, and it didn’t,” he says. “In fact, it was well below it, so the operators aren’t required to wear hearing protection.”

Conveying system is the perfect fit

ABVI operates the production line 8 hours a day, 5 days a week, and transfers about 5,200 pounds of material per day to meet current customer demand. “Overall, we’re impressed with the vacuum conveying system and the expertise that the supplier provided during the process,” says France. “We really appreciated their willingness to work with us when designing the system. They custom-designed a system that fits our production needs, is easy for our operators to use, and fits in a tight space.”

When France was looking for the conveying system, he talked with several other manufacturers for information and comparison quotes to ensure that the most economical and efficient system was selected. “However, I found that the other manufacturers weren’t as customer-focused as this supplier,” he says. “They invited us to their test facility, which allowed us to see that their conveying system could transfer the detergent at the required rates without changing its homogeneous particle distribution. Most important, they were willing to work with the filling machine manufacturer to set up and integrate the equipment before the whole system was delivered to our facility. Because of this, we were able to start packaging the detergent right away after installing the production line.”

Note: Find more information on this topic in articles listed under “Pneumatic conveying” in Powder and Bulk Engineering’s comprehensive Article Index in the December 2011 issue and at PBE’s website, www.powderbulk.com, and in books available through the website in the PBE Bookstore. You can also purchase copies of past PBE articles at www.powderbulk.com.

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