

## Case History

# Feeders' support frames do more than just hang around

A plastics company installs five suspended feeders with rolling and rotating support frames that allow easy access for maintenance, cleaning, and calibration.

Being able to make a wide range of custom plastic products in a short time with minimal lead time is essential for a North American custom compounder of thermoplastic polyolefin compounds. To fill a customer's order, the company must be able to quickly change to the new recipe, clean the production equipment to prevent cross-contamination, recalibrate the equipment to handle the new recipe's parameters, and accurately feed the ingredients into a continuous mixer at precise feedrates. To accomplish this, the company recently worked with a feeder supplier to install one weighbelt feeder and four loss-in-weight feeders in a new production line.

The company operates four processing plants in the Eastern US, annually producing more than 400 million pounds of plastic pellets with a range of hardness, strength, flexibility, color, and other properties for national and international manufacturers who process them into appliance and auto-

mobile parts, packaging, and many other consumer goods. To produce the various custom products, the company feeds plastic resin and other ingredients at controlled feedrates into a continuous mixer, where they're melted and mixed together. The extra ingredients include materials such as ground calcium carbonate, talc, and other minerals, copolymers or rubbers, and various colorants and chemical additives. When mixed with the plastic resin, the combination of the various ingredients creates a finished product's physical properties. After passing through the mixer, the product discharges to the production line's downstream equipment for further processing, packaging, and shipping.

### Company needs a new production line

Because of an increased demand for its products, in 2002 the company decided to design and install a new production line in an existing facility. The company needed to install five



*The two U-trough loss-in-weight feeders' support frames roll forward and backward and horizontally rotate 180 degrees so that the feeder's front can be easily accessed for maintenance, cleaning, and calibration.*



feeders in the line to accurately feed the resin and other ingredients into a new continuous mixer. The company required that the feeders discharge the resin and ingredients as close to the mixer's inlet as possible to prevent powders free-falling long distances and becoming aerated, which reduces the mixer's effectiveness and the overall production rate. The company also required that the feeders be easy to access for maintenance, cleaning, and calibration.

The company was already using Thayer Scale's weighbelt feeders and loss-in-weight feeders in other production lines in its facilities. Being familiar with the Pembroke, Mass., continuous weighing and feeding equipment supplier's equipment capabilities, the company contacted the supplier about its new production line.

The supplier had the company send samples of the resin and other ingredients to its test facility. There, engineers determined each material's particle size, air index, bulk density, and angle of repose. The results led the supplier to recommend that the company purchase one weighbelt feeder, four loss-in-weight feeders, and five hanging support frames. The

supplier also specified the loss-in-weight feeder screw sizes and discharge speeds for each ingredient, the weighbelt feeder belt size and discharge speed for the resin, and each feeder's hopper-wall angles for optimum mass flow.

### **The weighbelt and loss-in-weight feeders**

The company hired an installation contractor to install one MWF weighbelt feeder with a variable-speed belt, two PF-SC-S loss-in-weight feeders with U-trough discharge hoppers and variable-speed screws, and two PFM-SC-S loss-in-weight feeders with mini U-trough discharge hoppers and variable-speed screws. The weighbelt feeder's features include a head-pulley drive that decreases measurement errors, a rigid scale-support system that provides stability and ensures accurate weight measurements without recalibration, a flared-skirt design that prevents material spillage and ensures proper feed control, and a self-cleaning tail pulley that prevents material buildup and belt-tracking problems.

Each loss-in-weight feeder has an independently driven, transversely rotating agitator above the screw that

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***The U-trough loss-in-weight feeder's extended screw length allows the feeder to discharge the material close to the mixer inlet.***



conditions the material in the hopper to ensure uniform material density and consistent screw-flight filling. The company has multiple screws for each feeder that are capable of handling a range of materials, and each screw comes with its own set of easily replaceable seals. To maintain a constant feedrate to the mixer, a loss-in-weight feeder's screw speed automatically adjusts to meet the feedrate setpoint. The loss-in-weight feeders can be disassembled without tools in less than 2 minutes, and their polished surfaces lack inaccessible nooks or crannies where material can hide.

Each feeder hangs in an independently mounted support frame. The loss-in-weight feeder support frames each have a built-in scale that measures hopper weight loss using a high-output, electronic force-measurement sensor, while the weighbelt's scale is located under the belt and measures the material weight as it passes over it. Each support frame's force measurement suspension system consists of stainless steel aircraft cables and torque-transfer tubes, which counterbalance the weigh hopper, motor, speed reducer, and other equipment weight so that the scale only measures the material's net weight regardless of the load position. The scales self-align to gravity, are immune to support structure deflections and process vibrations, and don't require recalibration if the feeder is moved frequently. In addition, the support frames' design allowed the installation contractor to install the support frames on rollers that allow an operator to roll a feeder forward and backward and horizontally rotate it 180 degrees so that the feeder's front can be easily accessed for maintenance, cleaning, and calibration during product changeover.

The continuous-mixer supplier provided a central PC and PLC to control the mixer and feeders and worked with the feeder supplier to integrate them with the feeders' controls. The feeders' scales and controls are connected to the mixer's PLC via an Ethernet connection. The PLC is connected to the

central PC, which stores various product recipes with preset set points for the feeders and mixer. The PC records the feeders' feedrates and the material amount fed to the mixer as well as the mixer's temperature and mixing speed, collecting and storing the data for bookkeeping purposes.

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To make a product, the operator goes to the central PC, calls up a product's recipe, and verifies the feeders' feedrate set points and the mixer's mixing temperature and speed. The PC communicates the information to the PLC, which sets the feeders' feedrates and the mixer's temperature and mixing speed and continuously monitors them to maintain the set points.

### **Producing a custom product**

When producing a customer's custom product, the weighbelt feeder handles the main resin, while the two U-trough loss-in-weight feeders handle the primary fillers, such as titanium dioxide, calcium carbonate, talc, or flame retardants, and the two mini U-trough loss-in-weight feeders handle the colorant and other minor chemical additives. Each feeder only handles one ingredient at a time, limiting the production line to 5 ingredients. However, depending on the product being made, one ingredient may consist of several materials.

During operation, material continuously discharges from the weighbelt feeder's hopper onto the belt. The weighbelt feeder's scale continuously

compares the material weight on the belt, adjusting the belt speed to maintain the feedrate setpoint. A loss-in-weight feeder's screw turns and feeds material from the feeder hopper, and the scale continuously monitors the amount of material that discharges from the feeder hopper, adjusting the screw speed to maintain the feedrate setpoint. When the feeder hopper reaches the low level, a refill hopper located above the loss-in-weight feeder discharges material to the feeder hopper, refilling it on the fly.

"We feed ingredients into the mixer based on pounds-per-hour set points," says the company's project manager, "and because the bulk density of powdered materials can change from a full hopper to an empty hopper, the feeder controller automatically adjusts a feeder's belt or screw speed to keep feeding the same amount of material to the mixer, providing a constant feedrate regardless of the material's bulk density."

The weighbelt feeder and two mini U-trough loss-in-weight feeders discharge material onto a conveyor belt that moves it to the mixer's inlet. The other two U-trough loss-in-weight feeders discharge material directly into the inlet. The supplier extended the screw length of each U-trough loss-in-weight feeder so their discharges are as close as possible to the inlet.

The mixer produces about 30 million pounds of product a year, ranging between 5,000 and 8,000 pounds an hour, depending on the product. Because the company ships in truckload or railcar quantities, the production line operates until enough product has been produced to fill the appropriate number of trucks or railcars.

### **Feeders meet company's requirements**

"We handle a lot of powders and we didn't want them to fall a long distance to the mixer inlet when they left the feeders," says the company's project manager. "But because of how the supplier's feeders hang, we were

able to get the feeders' discharges as close as possible to the inlet to minimize the distance, so we have less dusting, fluidization, and aeration. This improved the production line's mixing efficiency and production rate and capacity, while maintaining product quality.

"In addition, an operator doesn't need tools to change a screw. Some suppliers' equipment has a screw that threads on, and it can get very tight, but this supplier uses a quick-release device that doesn't require tools to remove or install a screw. And being able to roll a feeder out and rotate it horizontally one hundred eighty degrees allows an operator to easily clean the feeder between product runs so there's no cross-contamination."

**PBE**

**Note:** To find other articles on this topic, go to [www.powderbulk.com](http://www.powderbulk.com), click on "Article Index," and look under the subject heading "Feeders" and "Mechanical conveying," or see *Powder and Bulk Engineering's* comprehensive "Index to articles" in this issue.

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