Plant upgrade

New plant incorporates tried-and-true feeders

When upgrading to a new plant, a plastics compounder chooses scale-based loss-in-weight feeders like those that have contributed to the company's top-quality products for more than 20 years.

We manufacture highly engineered resins — the more sophisticated the application, the better," says Craig Lucas, executive vice president of B&M Plastics Inc., Evansville, Ind. "And for us to keep turning out top-quality engineered resins, we need to have highly accurate and rugged feeders."

B&M Plastics manufactures engineered resins for the injection molding industry. Owner Bill Gillenwater formerly worked for GE Plastics, Mount Vernon, Ind. He left GE Plastics in 1983 and started his own toll-compounding business, recompounding GE's off-spec materials into usable products. Within a few years, the company launched its own product line of custom-engineered materials while continuing to toll-process for various companies. The company produces polycarbonate resins (PCs), acrylonitrile-butadiene-styrenes (ABSs), polybutylene terephthalate (PBTs), and various polycarbonate alloys. These products, most of them proprietary compounds, are used in various applications in the automotive, consumer, aerospace, HVAC, electrical, and lawn and garden industries.

In early 2004, the growing company moved into a brand-new, 293,000-square-foot facility in Evansville. The company built three new extrusion lines in the new plant, then, to minimize customer disruption, gradually moved the five lines from the old plant to the new one after the new lines were running. The company is currently operating seven lines 24 hours a day, 5 days a week, and expects to be running nine lines by the end of this year.

Ingredients are gravity-discharged from portable drop-bottom bins on the second-level mezzanine to gravimetric loss-in-weight feeders on the first-level mezzanine.

The engineered materials

Making engineered materials is a challenging task and one that's welcomed by B&M. The job starts in the company's lab, where engineers test, analyze, and refine recipes until they have the correct formula for the job at hand. The engineers may design a new material to meet a customer's requirements, or they may match a material a customer has already developed. In either case, ingredient accuracy is essential. "Our niche," says Lucas, "is creating tight color matches on specific resins that demand enhanced characteristics such as flame resistance, UV stabilization, impact modification, and fiberglass reinforcement. Our ability to meet these challenges gives our customers a superior edge in the marketplace."

B&M uses various mixtures of certified prime (certified to meet specifications) and wide-spec materials (for example, the color, melt flow, or impact strength may vary slightly from prime specifications) plus various additives such as color, fiberglass, and flame retardants. Some of these ingredients are poor-flowing powders, some are free-flowing pellets, and some (such as the fiberglass) are chopped fibrous pieces that tend to interlock.

Operators preblend some ingredients in one of the company's 11 ribbon blenders that have capacities ranging from about 1,000 to 38,000 pounds. The individual and preblended ingredients are then put into separate portable drop-bottom bins and raised by forklift to a second-level mezzanine. Each portable bin's bottom opens and the ingredients gravity-discharge to a feeder's hopper on the first-level mezzanine. Each extrusion line has three or four feeders of various sizes, depending on the recipe being used on the line at the time.

The feeders feed the ingredients to an extruder, which sits on the plant floor. The extruder is a long cylinder, or *barrel,* with an internal auger (also called a *feed screw*) and eight to 10

"If we put too much of one of these ingredients into the resin, it costs us more than we want to spend. If we put in too little, it doesn't pass the certification tests."

An operator stands among one extrusion line's various-sized gravimetric loss-in-weight feeders on the first-level mezzanine.

heating zones. Each heating zone can be set to a different temperature as needed to process the ingredients. The auger pushes the ingredients through the heated barrel. The ingredients blend together, forming the desired engineered resin.

When the molten resin reaches the end of the auger, it passes through a die that squeezes the resin out in spaghetti-like strands. The strands are pulled through a water bath, which immediately hardens the resin. The hardened strands are sent to a pelletizer that chops them into approximately ⅛-inch-long pellets. These are classified (fines and oversize pellets are removed), and the onsize pellets are passed through a metal detection device. The accepted pellets are then boxed or sent to a bulk truck or storage silo. They're delivered to the customer in 1,000-pound boxes or bulk loads.

The need for accuracy

"Many different ingredients may go into an engineered resin," says Lucas. "For example, we make a PBT glass-filled flame-retardant product that's used to produce drain pans for furnaces. We make 100,000 pounds of that product a week. We combine PBT, fiberglass, and flame retardant in exact amounts. If we put too much of one of these ingredients into the resin, it costs us more than we want to spend. If we put in too little, it doesn't pass the certification tests. The material tolerances, product standards, and measurement accuracy are all critical to our business."

For this reason, the company's choice of feeders is of utmost importance.

When B&M got its start back in 1983, its sole customer — GE Plastics — specified that the company use the same feeders GE was using, feeders manufactured and supplied by Acrison Inc., a Moonachie, N.J., supplier of volumetric and gravimetric feeders, controllers, blenders, and other equipment. GE had been using these feeders for some time and was completely confident in their accuracy. So Bill Gillenwater built his first extrusion line using feeders from this supplier. Over the years, as the company grew, Gillenwater and his engineers added new feeders almost exclusively from this supplier. At times, Gillenwater had his engineers assess feeders from other suppliers, but the reports always came back that the Acrison feeders were the best fit for the company's applications. So when B&M built its new plant, it was natural to once again consider feeders from the New Jersey supplier.

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Another factor in feeder choice was the company's desire to standardize everything in the new plant as much as possible. The equipment would be interchangeable and operators would be able to effectively operate all of the equipment. The new plant would have only one type of feeding system, with each feeder usable on any extrusion line. To select the system, "We involved the operators," says Lucas. "We brought them in and asked them about what was good and what was bad about the equipment they'd been working with. We decided we had to compare and contrast feeding systems and see which system fit our processes the best. We looked at durability and scaleability. It turned out that the system we liked best was the one the company had already been using. Now we have identical equipment working on the various lines.

"We also have spares for the feeders and other equipment, and everything is mounted on wheels. This makes it easy to move things for cleaning and maintenance. If one piece breaks down or shows signs of wear, we can simply pull it offline, put in a spare, and send the failed component to maintenance to be cleaned or fixed. Then we put the fixed piece in the 'spare' box to wait for the next time it's needed."

An operator checks feeder operation via the multifeeder controller on one extrusion line.

The feeders

The feeders are different sizes and different models to meet the company's varied and changing needs, but all are gravimetric loss-in-weight feeders from the supplier's 402, 403, 405, 406, and 407 feeder series, and all operate essentially the same way. Each feeder has a supply hopper and a metering mechanism that are mounted on a platform scale. The metering mechanism is designed with one or more augers, and the scale is counterbalanced so it measures only the material, not the equipment. This provides a higher degree of accuracy than scales without this feature, as well as the ability to handle very small quantities accurately — in this plant, some feeders may measure only 1 pound of material an hour while others measure several thousand. In addition, each extrusion line has a Model MD-II-2000 CTS touchscreen multifeeder controller that monitors and controls the feedrate for each feeder on the line.

In this plant, material is gravity-discharged into a feeder's supply hopper, and the scale measures its weight using a digital weight-sensing system that constantly sends the weight data

to the multifeeder controller. The scale is factory-calibrated and, unlike scales that use load cells, never needs to be adjusted.

The material gravity-feeds from the hopper into the metering mechanism. This mechanism varies depending on the material being fed. For example, a feeder for free-flowing pellets has a single auger, and a feeder for a difficult-flowing material may have multiple augers of various shapes. Some of these supplemental augers move concentrically around the main auger to break up material clumps and help the material feed consistently and evenly. As the feeder feeds material into the next process step (here, the extruder), the scale continues to send weight data to the controller, ensuring that the proper amount of material is being fed at any moment.

An operator can monitor each feeder in an extrusion line from the line's dedicated controller. [From here,] the operator can…adjust any parameter as needed.

An operator can monitor each feeder in an extrusion line from the line's dedicated controller. The operator can look at icons of the line's feeders and read each feeder's parameters, such as its motor speed, setpoint, and actual feedrate. The operator can also view a graph that plots feedrate versus time data and can adjust any parameter as needed.

"We can accumulate data for trending and other analysis," says Lucas. "One day we hope to connect all these controllers to a central computer system for plant-wide data analysis capabilities. These controllers will allow us to do this when we're ready."

The results

B&M's most important requirements for its feeders, says Lucas, are accuracy and durability: "I've worked with feeders from a lot of different companies and these are the most rugged and sturdy. They have to be able to withstand a lot, because the combination of a dusty environment and feed material that ranges from very fine talc to brittle fiberglass is challenging."

Each production line constantly changes materials and colors, and any contamination can throw off the resin properties and make it off-spec, so ease of cleaning and rapid changeovers are also important to the company. These tasks are accomplished easily with the feeders.

Lucas also appreciates the feeders' scaleability: "Using these feeders has been an evolutionary process. We used the feeders in a fairly simple manner in the old plant. We're taking advantage of more features now. The supplier's technology has always stayed in front of our ability to use it. It gives us plenty of room to grow without increasing our capital investment." **PBE**

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