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Case history

Feeders satisfy plant's hunger for expansion

Speed and quality were important factors in a project that almost doubled GE Plastics' annual production rates.

by Frank Spaeth

As the world's number one producer of acrylonitrile butadiene styrene (ABS) plastics, General Electric Plastics is by no means a small manufacturing facility. The Ottawa, Ill., plant supplies the plastics needs for a wide variety of General Electric products. But its plastics don't fulfill just GE's needs. The plant also produces plastics for other companies around the world, in applications ranging from bathtub surrounds and auto parts to telephones and computer equipment.

In 1998, GE Plastics decided to expand its Ottawa, Ill., plant. "This was a major expansion," says Darrell Williams, GE Plastics engineering operations specialist. "We wanted to take our production level from 350 million pounds to 500 million pounds of plastics annually."

The plant decided to install three mega extruders, relatively small machines with a high production rate and high extruder torque. These extruders (one 70-millimeter extruder and two 92-millimeter extruders) would press melted plastic through dies to extrude half a million pounds of final product per day.

The GE Plastics engineering team set out to find feeders that could supply materials to the extruders at the high rates they required. Considering how the equipment was expected to measure up, this was not an easy task.

"Six sigma" quality assurance

While the sheer volume of what GE Plastics produces is impressive, it pales in comparison to the company's quest for quality. "GE Plastics, and GE as a whole, have had a major initiative for the past three or four years called the 'six sigma' initiative that we expect our equipment to measure up against," Williams explains. "It means

Weight-loss-differential weigh feeders are hard at work on one of the new GE Plastics production lines.

that in one million opportunities you have no more than 3.4 failures."

It was a prerequisite for any supplier whose feeders were going to be considered for the expansion project that its equipment and systems be capable of delivering GE Plastics materials up to the 6 sigma standards. And GE Plastics challenged suppliers to prove their feeders could pass these rigorous standards.

Past history

Although the company had prior experience with several brands of loss-in-weight feeders, GE Plastics decided to narrow the field to three suppliers whose feeders the company felt were most capable of meeting GE's needs. One of those finalists was Acrison, Inc., a New Jersey-based manufacturer of dry solids handling equipment. This supplier had worked with GE Plastics extensively on a previous project. "Our initial ties go back to late 1993," Williams says, "when the plant was getting ready to install a 133-millimeter extruder."

The feeders needed to feed many different types of materials to this unit. The materials included two base materials (resin and san), as well as various additives (antioxidants, metal-release agents, and others) and color pigments.

At that time, the plant was also looking to take a different approach toward their production process. GE Plastics wanted to feed each of the materials separately. In the past, all materials had been fed into the extruder together.

That 1993 project had entailed 11 different feeders with control mechanisms on the feeder mezzanines. The controls directed when the materials were sent to the extruder and at what rate. The feeders, as well as three continuous blenders, metered the materials to a conveying device that fed them into the extruder.

"We ended up with eleven loss-in-weight feeders, and each of those feeders had a volumetric feeder above it for refill purposes," says Williams. "We fed our resin through one major feeder and our san through another. The other nine feeders were smaller and moved the various additives and pigments used in our plastics materials."

The setup worked this way: Besides the extruder and the feeders, two Acrison inline continuous blenders were also involved. Three of the feed-

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The GE Plastics Ottawa, Ill., facility underwent a major expansion, requiring new, ultraefficient feeders for its processing line.

ers fed their raw materials into one of the continuous blenders, which then emptied its contents into the extruder feed throat. The second blender had six other feeders sending raw materials to it, which, in turn, fed the extruder. The two other feeders fed materials directly into the feed throat. A total of four inlets fed materials to the extruder feed throat — one from each of the two continuous blenders, one big feeder supplying the extruder with san, and one smaller feeder feeding a color pigment. GE Plastics was pleased with the results of that project, and the equipment met or exceeded all expectations at that time.

Challengers brought in

Past success didn't necessarily guarantee that GE Plastics would automatically crown the same feeder supplier as the supplier of choice for the new project. "Acrison was definitely in competition with other major players," says Williams. That competition played out in a series of tests that GE Plastics set up to prove which equipment could best stand up to the company's many demands. Naturally, chief among those demands was the 6 sigma quality assurance standard.

"We were testing different bulk densities and different particle sizes, because these produce unique handling characteristics for the various raw materials."

The plastics producer needed equipment that would perform in a harsh environment. Williams says the plant operates 24 hours a day, 7 days a week, 360 days a year. During the summer months, temperatures inside the plant can reach more than 130°F. The company needed feeders that operate virtually flawlessly — with an uptime factor of 99.8 percent — under these demanding conditions.

This line, one of the original Acrison lines at the GE Plastics Ottawa, Ill., plant, has been operating continually since it was installed 8 years ago.

The project posed other difficulties as well. The feeders would need to handle a wide range of materials and feedrates. "Because of the rules of the expansion project, even as capable as the extruders were, we still have to deliver materials to them on a consistent basis, every time we want them," says Williams.

These new feeders would be handling the same bases, additives, and pigments as the feeders used in the 1993 project. The feeders would need great flexibility to ensure that all needed materials would be delivered to the line at the rates required.

The coupling of the feeders to the plant's high-speed extruders was another challenge because of the rates the extruders are capable of working at. "The normal 92-millimeter extruder may be able to run our product at a rate of 3,300 or 3,400 pounds per hour," Williams explains. "These mega machines are capable of producing 11,000 or 12,000 pounds per hour." The feeders GE Plastics selected would have to deliver tremendous amounts of material in a consistent manner — time after time.

The testing begins

Engineers from the Ottawa, Ill., plant worked with global sourcing leaders from GE Plastics corporate headquarters to set rigid, fixed test parameters. By doing so they provided for head-to-head performance comparisons between the participating suppliers' feeders. The feeders would be tested at actual production rates. A predetermined maximum number of refills for the feeders was set. GE Plastics felt that limiting the number of refills to sound engineering practice was critical to successfully attaining the set goals.

Continuous sampling of data would be required at 5-second intervals, and a minimum of 250 samples would be taken for each feedrate tested. Those feed samples would be taken from a scale independent of the feeders.

Once the parameters were set, the testing started. Each of the suppliers was asked to perform three separate series of tests. Each series lasted 2 days and involved feeding several materials used at the GE Plastics plant at several feedrates. The testing was done for many reasons. First, GE Plastics wanted to see which feeders could supply the materials to 6 sigma standards. Second, the plant engineers needed to know what kind of feed auger designs and what feeder sizes they needed.

The testing took place at the suppliers' labs, using full-size feeders as opposed to lab-scale feeders. "To test performance, we fed the materials through the feeders into a container sitting on a scale," Williams says. "Then we took the output to a computer, which took readings every five seconds."

The first and third series of tests were witnessed by plant personnel, while the second series was not. Although the testing method for each series was the same, materials and feeders varied. "We were testing different bulk densities and different particle sizes," Williams explains, "because these produce unique handling characteristics for the various raw materials."

A supplier is selected

When all the tests were completed, GE Plastics chose Acrison to again supply them with feeders and mixing equipment. "Their products were at least equal to — but in most cases much better than — any of the other

Refill devices are an important part of the GE Plastics setup. They help keep the loss-in-weight feeders running smoothly.

products we trialed," Williams says. This supplier's test results, as well as what its initial line of equipment had demonstrated during the plant's 1993 project, gave the supplier GE Plastics' business.

The plant purchased three lines of weight-loss-differential weigh-feeder systems, along with a multiple-feeder controller for each line. The feeders are able to self-empty while feeding, thus supplying the highest possible product yield. Each feeder consists of a supply hopper located above the inlet to a feed chamber; an auger is located at the supply hopper's outlet. The circular, flat-bottom feed chamber has a nonrestrictive, nonconvergent product inlet located over the extruder. The horizontal, slow-speed, rotating auger conditions the material and ensures its positive flow from the supply hopper into the feed chamber and from the chamber to the extruder.

GE Plastics also purchased some simple, economical Acrison refill devices. Each refill device has a storage hopper with a slide gate at the outlet located below the hopper. In operation, the refill unit's bottom slide gate opens so the entire hopper and chamber contents are emptied completely in seconds. GE Plastics bought in-line conveyor-blenders from Acrison for the expansion project as well. Using the inline units gave the plant many options for process line layout because of the units' size and setup. Space issues had to be considered because GE Plastics was placing the expansion into an existing building.

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The resulting process differed slightly from that in the 1993 project. While the feeders still feed blenders, which in turn deliver materials to the extruders, the amount of equipment and its placement differ slightly. One larger blender mixes most of the materials, which are then dropped into a feeder and sent to an extruder.

"With the design we're using this time we mix earlier in the process," Williams says. "This process cuts down on the number of feeders needed." It also cuts down on the space needed for the process.

Satisfied customers

GE Plastics has benefited in many ways from its new equipment. "Feeder flexibility and reliability have been the two primary benefits," Williams says. "And the supplier continues to provide support as far as problem-solving and troubleshooting with new additives."

Williams is also impressed with the data the feeder supplier provides on the range of feedrates for a particular auger size and what each feeder is capable of handling. "The supplier can even tell us when we need to change to the next auger size up or the next size down," says Williams. The plant's been impressed with the range of feedrates all the new feeders can handle as well.

The real success of the GE Plastics plant expansion can be seen in the statistics. Since the new feeders were installed, the plant has regularly broken records for consistently meeting the 6 sigma quality goals, production capacity, and profit levels. And the plant has done it all while maintaining competitive pricing for its customers. Says Williams, "The feeders have met or exceeded our expectations."

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