Test center

Put it to the test

A binder and refractory manufacturer hits the road (again and again) on a quest for the ideal mixer upgrade.

It was November 2000 when a rental truck filled with the ingredients to make specialty binders and refractories for the investment casting industry embarked on its first journey to find the ideal mixer. The binder and refrac-

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tory manufacturer prides itself on strict process controls to guarantee that its materials are consistent from package to package. So when the company's drum tumbler used to mix its ingredients became a challenge to operate, the company decided to upgrade its mixing process. To do so, the company ended up earning frequent driver miles as it hauled its ingredients back and forth to a Wisconsin-based test center, to ensure that it selected a mixer that could meet its rigid mixing requirements.

Drum tumbler mixing

Before 2001, the binder and refractory manufacturer used a 4,000-pound-capacity drum tumbler to mix its materials. The drum tumbler was only one component in the process, which required separate steps for compounding, mixing, and packaging, and a forklift to move the rigid intermediate bulk containers to and from each station. The company's formulas incorporate various modifiers that are typically 0.0017 to 0.0077 percent of the total batch weight. These additions, which can amount to 28 to 140 grams, must uniformly mix into the 4,000-pound batch. Each batch the company mixes is sampled and tested for pour time, set time, and slump before being approved for packaging. More often than not, an adjustment had to be made to the formula, followed by additional mixing in the drum tumbler.

The main problem the company experienced with the drum tumbler was that its mixing time was slow — it took a half-hour to merely mix the ingredients. The mixer also had maintenance problems during the summer when its hydraulic motors would overheat.

The company's plant manager decided that something could be done to speed up the mixing process and reduce maintenance problems. But, he says, "My first and foremost concern was improving quality. It's crucial in this industry to produce a consistent product. If we couldn't find a mixer that could do better than what we were currently doing, it would be an exercise in futility. The new mixer would have to maintain the quality of the drum tumbler or improve upon it."

He sent material samples to various rotary-drum mixer manufacturers, but wasn't satisfied with the mixer designs or analytical results. In May 2000, at the Powder & Bulk Solids Show in Chicago, the plant manager discovered Continental Products Corp., Milwaukee, manufacturers of mixing, blending, and coating machinery. The plant manager and the supplier began discussing mixing options that would improve the company's mixing quality, increase batch sizes, and reduce blending time.

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The company's plant manager and plant engineer rented a truck, loaded up about 1 ton of ingredients, and headed to Wisconsin to see what the mixer supplier's test center could do to improve the company's blend.

Test center basics

The supplier uses its "ROLLO-MIXER"® Mark VI horizontal rotary-drum batch mixer to test its customers' materials. The test center has eight different sizes and styles of the mixer, ranging from 5- to 50-cubic-foot capacities. The supplier's testing personnel will set up additional testing equipment based on a material safety data sheet that a prospective customer fills out before material testing. The supplier encourages customers to attend the testing. By being there, they're able to watch the loading, mixing, coating, and discharging of materials from the back, top, and front of the mixer, which has windows and a light set up inside it. Customers are also able to observe the mixer's ability to completely clean out.

The supplier can receive the test materials in bags, drums, gaylords, or bulk bags. The raw materials are loaded onto a platform and charged into the mixer's top with the mixer stopped. Samples are typically taken in 3-, 5-, and 7-minute intervals and materials are usually mixed in 2 to 3 minutes. Once the supplier establishes sample mixing times, an operator turns on the mixer, which usually runs at approximately 3 rpm.

The mixer's rotating drum is suspended from a solid, cold-finished shaft fixed between two self-aligning pillow block bearings, which are supported by a frame, making up one self-contained unit. A chain drive is mounted around the drum section, so the mixer doesn't require trunnions to rotate the drum vessel or adjustments to maintain concentricity. For safety, screens guard the entire drive system and access ports, and control panels have electronic safety lockout switches. To mix materials, the rotating drum's internal flights divide and combine the ingredients — material is lifted at the mixer's front end and free-falls in a cascading flow to achieve uniform particle distribution throughout the batch. The mixer creates more than 25 divisions per revolution. Upon completion of the mixing cycle, the discharge chute opens and the mixed material discharges as the drum rotates.

Material testing begins

The plant manager and plant engineer decided they wanted to run tests with the supplier's 50-cubic-foot-capacity mixer, its largest test model, because they were concerned about potential issues involved in scaling up the results. The company's intention, if the mixer proved successful, was to purchase a 200-cubic-foot-capacity production-sized unit for the company's line. The supplier set up the 50-cubic-foot-capacity mixer and mounted a bag-dump station to the mixer's top to handle the company's bags of raw materials. The supplier also equipped the mixer's discharge chute extension with a 12-inch-diameter iris valve to discharge the blended materials directly into the company's 50-pound-capacity boxes. This was an essential step, because the company needed to know not only that the individual samples taken from the mixer fit its specifications, but that every package filled from a batch also met those specifications.

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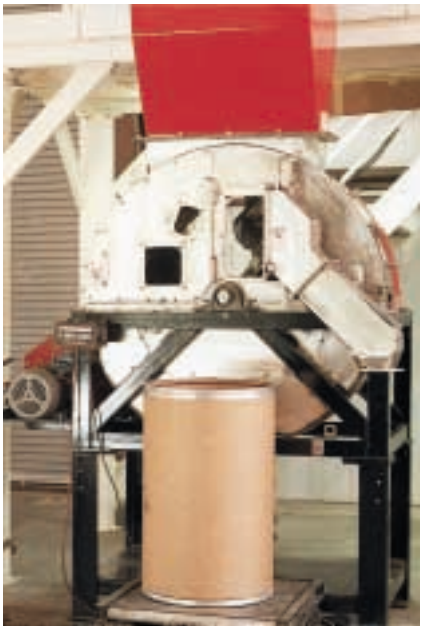
The supplier's personnel loaded 1,200 pounds of raw materials into the mixer. Once the mixer was filled, an operator turned it on and mixed the ingredients. When mixing was completed, the mixer discharged the material into the boxes. The plant manager and plant engineer then loaded the boxes onto the rental truck and made their way back to their own plant to assess the results.



The plant manager and plant engineer decided to run tests in the supplier's 50-cubic-foot mixer, its largest test model, because they were concerned about scaling up.

"When we got back, we tested every single box," says the plant manager. "We wanted to make sure the mix was consistent and homogeneous from the first to the last box." Unfortunately, the mixer's first run didn't provide the results they were looking for.

On the road again

The plant manager and plant engineer traveled to another mixer supplier's test center to test other mixer options. This trip didn't prove successful either, so they decided to head back to Wisconsin.

The supplier, the plant manager, and the plant engineer had a hunch that on the first run, they were overloading the mixer. They also believed that the product formula needed to be adjusted. Because the product is a very

fine, castable powder, it's crucial that the ingredient amounts are exact each time. To test the effect of formula adjustment, the company decided to run three batches. They ran the first batch with the usual ingredient amounts. For the second batch they added 90 more grams of a raw material additive that increases the amount of time it takes the finished product to set up. For the third batch they added 90 more grams of another additive that slowed down the set time. Once again, the mixer discharged the product into boxes, and the plant manager and plant engineer loaded up the rental truck and returned to their plant for testing. This time the samples showed that the additional 90 grams corrected the pour time, set time, and slump and provided the consistency the company was looking for.

One last time

The plant manager was pleased to see that the 50-cubic-foot-capacity test mixer was a success, but how well would the mixer work when scaled up to a production-size unit? The plant manager's concern led him to load up the rental truck one last time and head for Wisconsin. It just so happened that the supplier had a 200-cubic-foot-capacity mixer available to test the materials. The results showed that there wasn't a measurable difference in the bigger mixer's performance — the material's quality was consistent.

The company purchased a 200-cubic-foot-capacity mixer for its manufacturing plant and installed it in January 2001. The supplier set the mixer on electronic load cells so batch ingredients can be weighed automatically as they enter the mixing drum. The mixer allows the company to run 1,000- to 10,000-pound batches.

The company was pleased with the mixer's compact design, which saved valuable production space. The company also liked that they could perform all aspects of the compounding, mixing, and filling cycles with one piece of equipment, significantly reducing energy and maintenance requirements. The plant manager says, "This mixer's blending time is much quicker than our original drum tumbler. We went from mixing 4,000 pounds every half-hour to mixing 10,000 pounds every 15 minutes. And, by increasing our batch size, we decreased our testing time."

The plant manager is also pleased with the mixer's minimal maintenance. He says, "There really isn't any maintenance at all because there are no moving parts, and the mixer also rotates extremely slowly. We've only had to replace two solenoid valves, and because it's a chain-driven machine, all we have to do is lube the chain. It does a great job." As a result of the great job and proven success, the company purchased an identical mixer for its other production plant.

Mixer success, consistently blended product, increased batch size, quick blending times, *and* frequent driver miles, what more could a binder and refractory manufacturing company ask for? **PBE**

Continental Products, Milwaukee, WI