

## Test center

# Customer-friendly test lab provides conclusive results

A new test lab improves a pneumatic conveying equipment company's demonstration and material-testing capabilities.

Our old pneumatic conveying test lab wasn't laid out very well and used equipment that required a lot of time, energy, and effort to clean to prevent cross-contamination," says Brad Schultz, pneumatic systems product manager for Smoot Co., Kansas City, Kans. "This meant that we weren't able to run as many tests per week as we could have had things been easier to clean between runs. To improve our situation, we recently designed and built a new test lab and upgraded the equipment."

### The previous test lab

The company's old test lab was housed in a corner of the plant's machine shop. The fully functional lab, which had no walls and was open to the rest of the machine shop, used one 3-inch-diameter conveying line for both pressure and vacuum dilute- and dense-phase conveying tests.

"The lab was great if you were an engineer wanting to use our conveying system to test materials or for re-

search and development," says Schultz. "However, because the lab's layout wasn't very practical, it was absolutely terrible if you were a customer wanting to see a conveying system demonstration or witness a material test. A customer could always watch the equipment work, but they really couldn't see the material move through the conveying line because the closest sight glass was located about thirty feet up in the air. This was because the conveying line had to run above overhead cranes and other equipment."

Another issue the company had with the test lab concerned the potential for cross-contamination. "A customer running particle breakage tests on granola doesn't want to see the granola discharge from the conveying system covered in fly ash that was left in the conveying line from earlier tests," says Schultz. "Even though it's only a test and the granola is never consumed, the customer is left with the impression that something isn't quite right with the conveying sys-



**Test lab technicians talk with a customer about a dense-phase pressure conveyor's operating principle before conducting a test with a highly abrasive material.**

tem. And since the customer is testing the granola for particle breakage, they don't want any fly ash dust in the granola sample because the dust will show up as breakage during the particle analysis tests, which completely skews the results."

To prevent such cross-contamination, lab technicians cleaned the conveying system before testing each customer's material. However, because cleaning the conveying line and other equipment took so much time, the test lab was limited to running tests for just one customer per week.

Schultz realized that to improve the lab's testing capabilities the company needed to build a new lab with a more customer-friendly layout and upgrade the conveying system and other equipment. "The new test lab needed to be more accessible to the customers, allowing them easy access to all of the equipment and the ability to see their materials move through the conveying line," he says. "And the lab's equipment had to be easy to clean in a short time, which would enable us to increase the number of tests performed each week and give us the ability to test a more diverse range of

materials without having to worry about cross-contamination issues."

### The new test lab

Completed in January 2008, the company's new test lab is located inside the plant in its own dedicated space that's twice the area of the previous lab. A 100-by-300-foot mezzanine with a concrete floor separates the lab into two floors and allows easy access to the uppermost conveying system components. The lab now has two separate conveying lines — one of 3-inch-diameter pipe used only for dense-phase conveying and one of 3-inch-diameter tube used only for dilute-phase conveying. The two conveying lines, which loop around the lab one on top of the other, each have 150- and 230-foot-closed-loop sections. The conveying lines also have more sight glasses and are installed so that a customer standing on the floor can easily view the material moving through a conveying line only a few feet away.

The dilute-phase system's positive-displacement blower has a variable-frequency drive, allowing the test lab to vary the airflow rate through the conveying line. The dilute-phase sys-

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***Test lab technicians analyze the data collected during a test run to provide a customer with a performance report showing the conveying system operating in steady-state conveying conditions***

tem can operate at a maximum pressure of 15 psi or a maximum vacuum of 15 inches mercury. The dense-phase system can operate at a maximum pressure of 110 psi. According to Schultz, the test lab can perform vacuum dense-phase tests, but rarely does so, and then only with a specialized material because it's such a small part of the market. The company doesn't use any air-assist devices in the conveying lines.

"The advantages of having both a dilute- and dense-phase system right next to each other are twofold," says Schultz. "Not only can we test a material in both systems to determine which system works best, we can also get a very good apples-to-apples comparison between the two systems because their conveying lines have the exact same geometry and are installed within inches of each other."

Along with the pneumatic conveying equipment that the company manufactures, the lab also demonstrates some equipment that its sister company manufactures for getting materials into and out of the lab equipment. Schultz says, "It works best for us to get the material samples shipped to us in bulk bags because we have both a Taylor Products bulk bag unloader and bulk bag filler as integral parts of our test lab."

To improve the lab's cleanability, the company removed the filter-receiver from the conveying system and installed two 10-cubic-foot hoppers to collect the material. "The filter-receiver's filters were difficult to clean and had the potential for cross-contamination because we couldn't always get all of the material out of the filter media," says Schultz. "With the hoppers we get a little dust leakage now and then, but they're easy to clean — we just open a hopper lid and sweep it out. Now we can clean the conveying systems and other equipment in a matter of a few hours rather than a few days like in the past. We seem to be doing more of these filterless designs lately in actual applications because we've found that the small amount of

carryover loss offsets the gains in clean-up and changeover time."

Currently, the company can run tests for two or more customers per week because the lab is so much easier to clean between tests. "In the past, if a customer wanted to come here and test two or three different materials, we'd probably tell them that they'd be here two or more days," says Schultz. "Now we can easily test two to three different materials in one day. Also, the tests take less time to run because the equipment is more accessible and easier to work with, which is a big improvement over the previous lab."

### Test lab capabilities

The test lab can handle just about any dry bulk material, including food products, pharmaceuticals, chemicals, fly ash, and plastic resins, but it doesn't handle explosive materials. The material particle sizes can range from very fine up to jelly bean size.

"We recommend dilute- or dense-phase conveying systems mainly on the basis of the material that is to be conveyed," says Schultz. "Our dilute-phase systems handle a large number of materials, such as granola, green coffee beans, potato flakes, carbon black, bone fragments, and wood chips, while our dense-phase systems are typically used to handle highly abrasive or very fragile materials."

According to Schultz, most of the tests the lab performs are geared toward finding out what's going to happen to a customer's material in a conveying system rather than whether a pneumatic conveying system will be able to convey the material. "It seems customers want to know if our system can convey their materials and maintain their desirable qualities, such as final particle size, without excessive breakage occurring," says Schultz. "That's why most of the tests we do now are breakage-type tests in which we try to determine the best system settings to maximize conveying rates and minimize particle degradation."



***The test lab's mezzanine provides easy access to numerous conveying-line sight glasses, allowing customers to watch their material move through a conveying line during a test.***

The test lab also works with customers who need to troubleshoot an existing conveying system. "For example, if a customer has a conveying system that isn't operating correctly, we'll duplicate their system's settings in our lab and run their material through it to find out what needs to be changed to improve their system's operation," says Schultz. "Or if a customer needs to convey a new material in an existing conveying system, they can test that material in our lab to find out what changes they'll need to make to their existing system to properly handle it."

### Conducting a test in the new lab

To use the test lab, a customer typically works directly with the company's test lab manager. At first, the lab manager and the customer will talk over the phone about the lab's capabilities and the procedures for conducting material tests in the lab. The lab manager will want to know about the customer's current conveying system and the material's characteristics, whether there are any special material-handling requirements, how many samples the customer wants from the tests, and any other relevant information that will help to set up and conduct the material tests.

From this initial conversation, the lab manager will determine how much material the customer needs to send to the lab. "The lab normally prefers to receive test materials in bulk bags, be-

cause it's so much easier to hang a bulk bag and pull material out of it as needed for the tests and then put it back into another bulk bag," says Schultz. "This way we're not having to mess around with multiple drums, fifty-pound bags, or other small containers. However, we do have the ability to handle those other containers if we need to."

In most cases, the customer will travel to the company's test lab to witness the tests firsthand. "When a customer comes here for a material test, we'll pick them up at the airport and drive them to our test lab," says Schultz. "We don't charge for material testing if the customer visits the lab to witness the tests because we want to get them here to see the tests and to see the equipment working."

The test lab will provide the customer with detailed performance reports and equipment recommendations based on the test results. "During a test run, a

conveying system's instrumentation and flow meters collect data about every three to five seconds and sends it to a computer that stores it in an Excel spreadsheet," says Schultz. "After the tests, a lab technician reviews the data and trims off the top and bottom portions so that the customer sees the relevant data that shows the conveying system operating in steady-state conveying conditions. This information is given to the customer before they leave the lab."

The test lab has screens and sieves for performing particle analysis tests on a customer's material samples. "However," says Schultz, "every customer has their own method of determining breakage. Some customers count kernels and scuffs, and others run the material through their own process to see which particles are damaged. Since each customer has their own standards, we generally encourage them to do their own analysis because unless we do it exactly the same way they do

we'll get erroneous results. Because of this, we allow customers to bring their test lab people and equipment to our plant to run particle analysis tests after a test run. And if that's not possible, we'll collect all of the samples and send them back to the customer." **PBE**

**Note:** To find other articles on this topic, look under "Pneumatic conveying" in *Powder and Bulk Engineering's* Article Index at [www.powderbulk.com](http://www.powderbulk.com) or in the December 2007 issue.

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