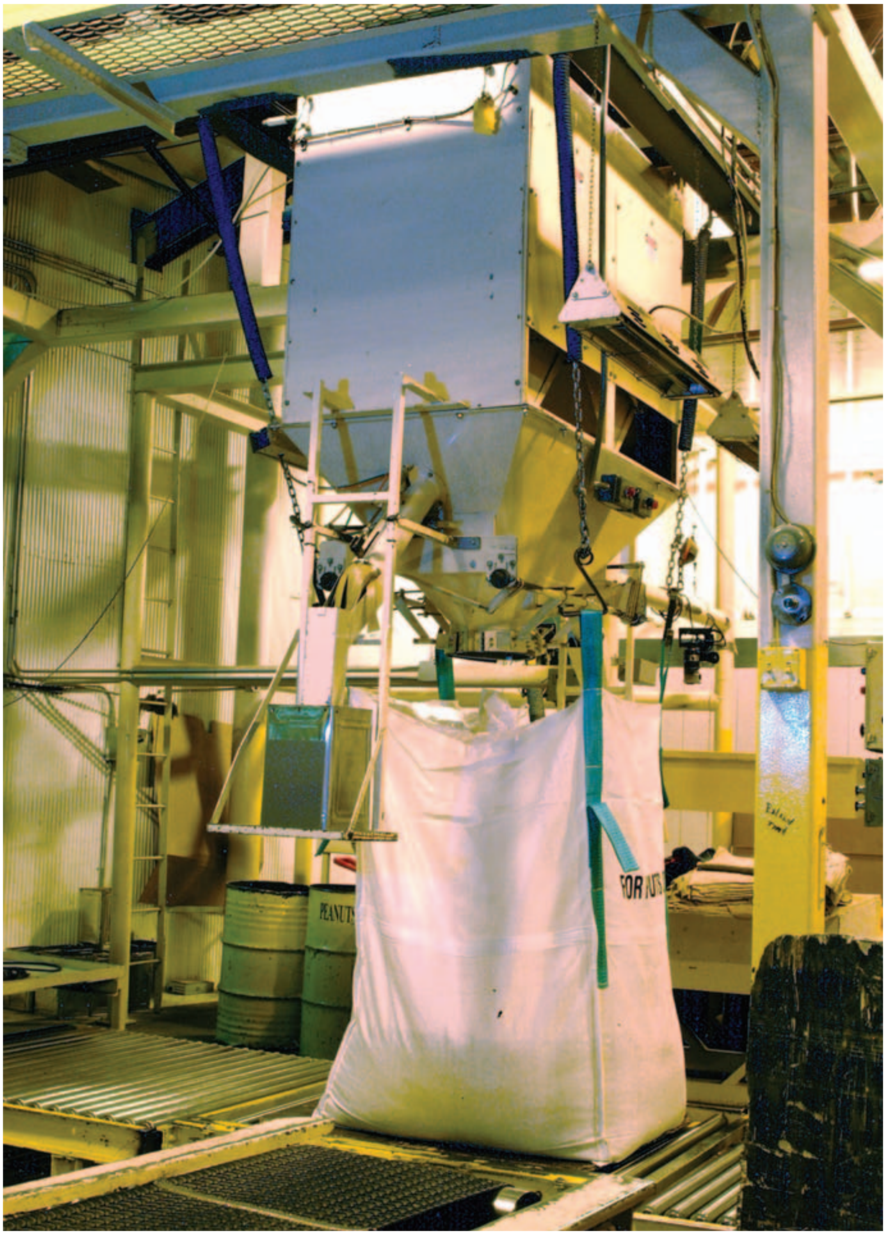
There's nothing nutty about these scales

A company installs two new gravity net-weigh scales in its packaging operation to improve container-filling accuracy and efficiency.

Whether you call them goobers, goober peas, pindars, ground nuts, earth nuts, monkey nuts, grass nuts, or just plain peanuts, these popular legumes are a valuable food commodity, containing about 28 percent protein, 50 percent oil, and 18 percent carbohydrates. Annually, the US produces about 1.5 million tons of peanuts, with Georgia producing almost half of this total. More than half of the peanuts produced in the US are used to make peanut butter, while the other half are used to make peanut oil, candies, and other products. To get the peanuts from the field to the consumer, peanut processors package in-shell and shelled peanuts for delivery to companies that turn them into finished products. Recently, one peanut processor in the Eastern US needed to replace two old gravity net-weigh scales used to weigh the peanuts for



The duplex scale dumps one weigh bucket after another of shelled peanuts into a bulk bag until it's filled.

packaging to improve the packaging operation's container-filling accuracy and efficiency.

Packaging the peanuts

After receiving the peanuts in bulk directly from regional farmers, the company cleans them to remove dirt, rocks, and other foreign materials. The company then either packages the in-shell peanuts for delivery to other companies that make in-shell peanut products or removes the shells and packages the shelled peanuts for delivery to companies that make peanut butter or various snack products.

The company packages the peanuts in various-sized containers, depending on its customers' requirements. "Our customers are set up to receive specific-sized containers, and we package the peanuts in whatever they specify — bulk bags, bulk boxes, fifty-kilogram bags, twenty-five-pound mesh bags, and others," says the company's maintenance superin-

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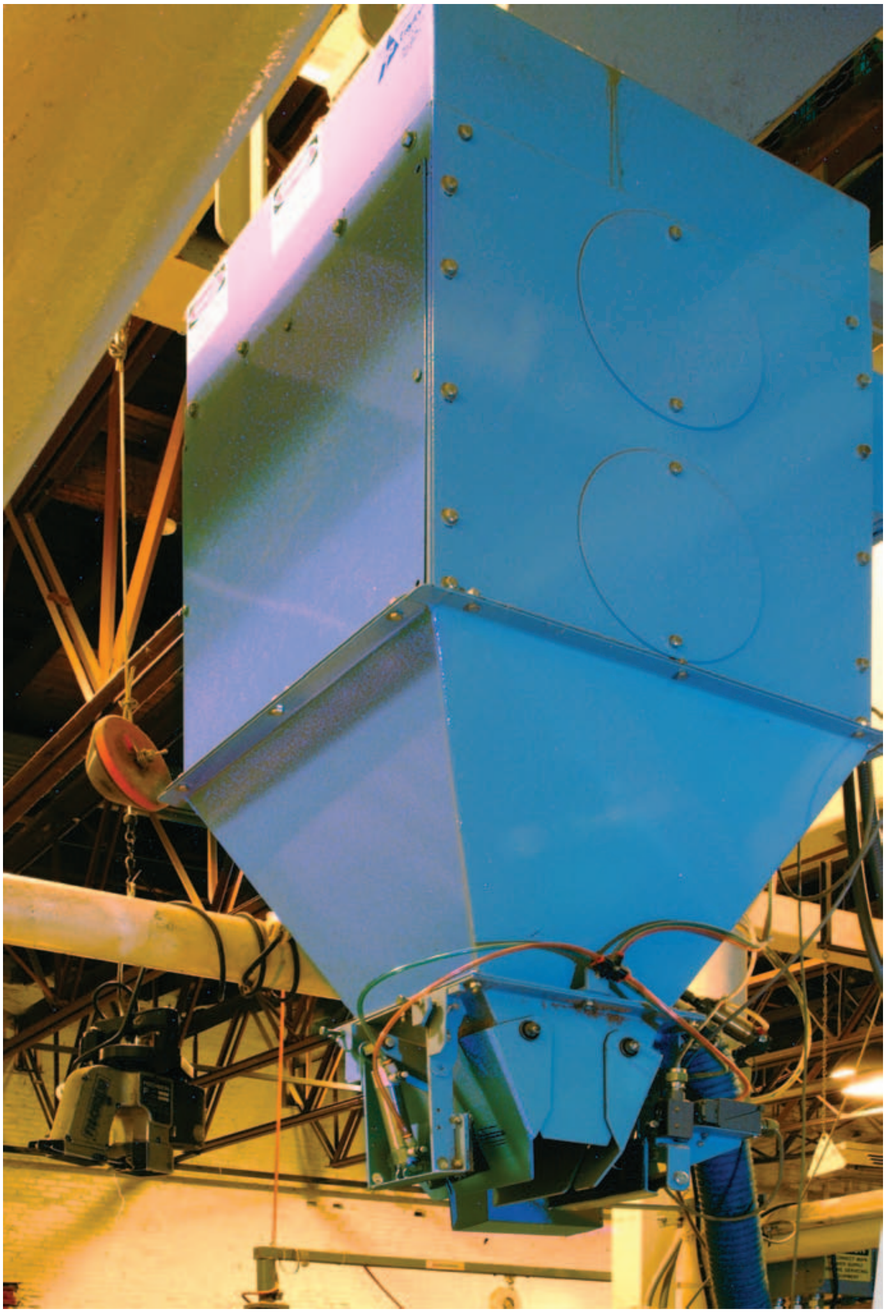

The simplex scale has a 150-pound-capacity weigh bucket and uses a bulk gravity-feed gate and a dribble vibratory feeder to feed in-shell peanuts.

tendent. "We're set up to handle twenty-five-pound- to twenty-two-hundred-pound-capacity containers."

The company operates two packaging lines — one for in-shell peanuts and one for shelled peanuts. Each packaging line consists of a product conveyor, surge hopper, packaging scale, and container conveyor.

To package in-shell peanuts, the product conveyor moves a large amount of peanuts to the surge hopper. The surge hopper then gravity-discharges the peanuts to the packaging scale's weigh bucket. When the correct amount of peanuts has filled the weigh bucket, the surge hopper stops discharging. The packaging scale then gravity-discharges the peanuts in the weigh bucket to an empty container on the container conveyor. The container conveyor moves the full container away and positions an empty container beneath the weigh bucket, and the filling process repeats. The same procedure is used for the shelled peanuts.

The company's maintenance supervisor says, "We do lot sizes of four hundred to eight hundred bags, depending on the bag size, and up to twenty bulk boxes or bulk bags at a time. One lot typically equals the amount, by weight, that a tractor trailer can carry."

Packaging scale problems

In the past, the company used a single-bucket mechanical gravity net-weigh scale to weigh the in-shell peanuts and a double-bucket mechanical gravity net-weigh scale to weigh the shelled peanuts. The single-bucket scale had one weigh beam and one 150-pound-capacity weigh bucket. With this scale, the weigh bucket had to completely discharge the in-shell peanuts before it could be filled again. The double-bucket scale had two independent weigh beams and two 150-pound-capacity weigh buckets. With this scale, one weigh bucket was always being filled with shelled peanuts as the other weigh bucket was discharging shelled peanuts into a container. Both scales could fill containers as small as 25-pound-capacity bags and as large as 2,200-pound-capacity bulk boxes.

"When we filled containers that held more material than a scale's weigh bucket, such as bulk boxes, both scales could be programmed to dump one bucket after another into the container until it was filled," says the company's maintenance supervisor. "For example, if we were filling twenty-two-hundred-pound-capacity bulk boxes, we'd program the scale to fill a bucket with one hundred pounds of material and do twenty-two dumps. After completing the twenty-two dumps, the container conveyor would move the full box away and position an empty box under the scale."

One problem the company experienced was that an operator would have to manually recalibrate a scale's weigh beam when switching container sizes. "If a customer wanted twenty-five-pound bags of shelled peanuts," says the company's maintenance supervisor, "an operator would have to manually move the weights on the double-bucket scale's weigh beams, which took time and reduced the packaging operation's efficiency."

Another problem concerned each scale's controller. "The controllers used old circuit boards with chips and electronics that weren't made any longer, so replacement parts were virtually unobtainable through the original scale manufacturer," says the company's maintenance supervisor. "In addition, the software we used to program the scales was on an eight-inch floppy disk, which had little memory and made programming the scales operator-intensive."

The controllers could only be programmed to handle one lot run at a time. "So, for example," says the company's maintenance supervisor, "after we ran a lot of fifty-kilogram bags, if the next lot was going to be bulk boxes, an operator had to manually reprogram the scales and change the target weights and the bulk and dribble speeds to fill the bulk boxes."

An operator in the control room can view the packaging operation's current status using the central PC.

In addition, the controllers only kept records of the lot that was in progress. At the end of a run, the operator would receive a printout detailing only that current lot number, container size, number of containers filled, number of weighments, amount of each weighment, and start and stop times and dates; none of the information was stored in an electronic database.

Weighing the pros and cons

The company had previously replaced an older mechanical weigh-beam scale with a new scale manufactured by Taylor Products, a division of Magnum Systems, Parsons, Kans., a supplier of dry bulk solids metering, filling, weighing, packaging, and container-handling equipment. Because the company was happy with the new scale's performance, it immediately thought of the supplier when it decided to replace its old single- and double-bucket scales.

Because the supplier was familiar with the company's operation, it was able to immediately recommend scales to replace the company's existing ones. The company sent about 1,000 pounds of in-shell peanuts and 2,000 pounds of shelled peanuts to the supplier's test center so that the supplier could verify that the scales it recommended would meet the company's fill- and dump-speed requirements. After the tests proved successful, the company provided a list of automated tasks the scales needed to be able to do.

For example, the scales would have to automatically take small quality control samples during lot runs. “With the old scales, we had to stop in the middle of a lot run, take a sample, and do a bunch of manual entries,” says the company’s maintenance supervisor. “We wanted the new scales to be programmed to automatically take a quality control sample from the material stream between the weigh bucket and container without missing a beat.”

The company also wanted the new scales to be able to be programmed with several lot run parameters. This would allow an operator to easily change each of the scales’ parameters by simply calling up the correct lot run when switching container sizes. In addition, the scales would have to maintain an electronic database of every lot run, including lot number, container size, individual container fill weight, number of containers filled, quality control sample info, and start and stop times.

The new packaging scales

With the company’s requirements met, the supplier delivered one TEGN gravity-fill simplex (single-bucket) net-weigh bagging scale for the in-shell peanut packaging line and one TEGN gravity-fill duplex (double-bucket) net-weigh bagging scale for the shelled peanut packaging line to the company’s facility and helped the company install them.

The TEGN simplex bagging scale has one 150-pound-capacity weigh bucket and uses a bulk gravity feed gate and a dribble vibratory feeder to feed in-shell peanuts from the surge hopper to the weigh bucket. The bulk gravity feed gate is a clamshell-style gate that, when open, feeds material in bulk to the weigh bucket to a predetermined dribble point. At this point, the bulk gate closes and the dribble vibratory feeder uses vibration to slowly finish filling the weigh bucket to the set point. The dribble point is selectable and depends on the material’s bulk density — the heavier the material, the farther away from the set point the dribble begins, and the lighter the material, the closer to the set point the dribble begins.

The TEGN duplex bagging scale has two 150-pound-capacity weigh buckets and uses a bulk gravity feed gate and dribble gravity feed gate to feed shelled peanuts from the surge hopper to the weigh buckets. Both the bulk and dribble gravity feed gates are clamshell-style gates, with the bulk gate being larger than the dribble gate. When filling a weigh bucket, both gates open and material fills into the weigh bucket in bulk to a predetermined dribble point. At this point, the bulk gate closes and the dribble gate remains open, allowing material to slowly finish filling the weigh bucket by gravity to the set point.

Each of the weigh buckets discharges material to the containers through a double-acting bomb-bay-style gate. The simplex scale can fill up to nine 100-pound-capacity containers a minute and the duplex scale can fill up to 18 100-pound-capacity containers a minute — the speed at which a container is filled depends on how much material is being packaged, the material characteristics, and the weigh-bucket size.

Both scales can accurately fill a weigh bucket to within ±0.2 pounds of the set point. Both scales also have built-in quality control samplers that automatically take a small amount of material from the material stream between the weigh bucket and container. The company uses this feature to guarantee the quality of the products being shipped to its customers and to adhere to government regulations concerning food quality requirements.

A central PC located in a control room controls and monitors both scales’ operations. The PC is connected to the simplex scale via an Allen-Bradley SLC500 processor and one TGE weighscale. The PC is connected to the duplex scale via another Allen-Bradley SLC500 processor and two TGE weighscales. Each TGE weighscale monitors a weigh bucket’s weight via load cells and is responsible for directing the scale to start filling the weigh bucket, start the dribble feed mode, stop filling, discharge the weigh bucket, and take quality control samples.

The company uses the PC to store the various lot run parameters. The company makes three different in-shell products and nine different shelled products. For each product, the company can program 10 different lot run parameters (or recipes) into the PC, totaling 120 different recipes. A recipe consists of a lot number, weighment amount per weigh bucket, number of weighments per container, quality control sample frequency, and number of containers to be filled.

To start a lot run using the simplex scale, for example, an operator places the correct containers on the container conveyor and then uses the PC to call up the correct recipe. The PC then communicates with the SLC 500, which communicates with the TGE weighscale. The TGE weighscale resets the set point for the weigh bucket and releases material from the surge hopper. The TGE weighscale then verifies that the correct weight is in the weigh bucket and signals the scale to discharge the weigh bucket into the container.

For each lot run, the PC uses an Excel database to keep track of the number of weigh buckets dumped, the number and type of containers filled, the number of containers rejected, the individual weighment for each container, the number of quality control samples taken, and the lot run start and stop times. This information is also printed at the end of the day in a report that the operator files. And to aid in maintaining the scales, the PC is connected to a modem and phone so that the supplier can access the company’s system through a dial-up modem to troubleshoot the scales off-site.

The new scales have several selectable functions that help maintain their filling accuracy. The auto-zero function tares the TGE weighscale (resets it to zero) after each weigh-bucket discharge so that any residual material in the weigh bucket doesn't affect the weight of the next weighment.

The Weigh-trac function is a program that automatically adjusts the TGE weighscale to maintain the set point. An operator specifies an over-under range from the set point, such as ±3 pounds. Just before discharge, the TGE weighscale communicates the material weight in the weigh bucket to the Weigh-trac function. If the material's weight is over or under the set point and still within the over-under range, the Weigh-trac function automatically adjusts the TGE weighscale so that either less or more material fills into the weigh bucket for the next weighment, bringing it closer to the set point until it's within the accuracy range of ±0.2 pounds.

The over-under reject function works in conjunction with the Weigh-trac function. Again, the operator specifies an over-under range from the set point, such as ±3 pounds. Just before discharge, the TGE weighscale communicates the material weight in the weigh bucket to the over-under reject function. If the material's weight in the weigh bucket falls outside the over-under range, the over-under reject function sounds an alarm and stops the scale from dumping the weigh bucket. The operator then manually empties the weigh bucket and checks to make sure that nothing is wrong with the scale. If the over-under reject function is activated, the Weigh-trac function doesn't automatically compensate for the weight differential, because the error may have been caused by a temporary change in the material's bulk density, material surge, or lack of material in the surge hopper.

Improving the packaging operation

Since installing the new scales, the company's production rates have increased and its packaging operation has become more accurate and versatile. It also takes the company less time to switch between lot runs, increasing the packaging operation's efficiency. "Now, when we change from fifty-kilogram bags to twenty-two-hundred-pound bulk boxes, the operator just has to access and download the correct recipe on the PC and make sure that the correct containers are on the container conveyor," says the company's maintenance supervisor. "In the past, the operator had to manually recalibrate everything."

The new scales are very similar to the old scales in how they look and operate. However, whereas the old scales used mechanical weighbeams and a low-memory 8-inch floppy disk, the new scales use load cells and a central PC that holds all of the packaging operation's production information. "We used the old scales for twelve years, so it took the operator a little while to get used to the new scales and computer system," says the company's maintenance engineer. "But now she definitely likes the new packaging operation better than the old one." **PBE**

Note: To find other articles on this topic, go to www.powderbulk.com, click on "Article Index," and look under the subject heading "Weighing and batching," or see *Powder and Bulk Engineering*'s comprehensive "Index to articles" in the December 2002 issue.

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