SUPPLIERS' TIPS

When selecting a feeder, how can I determine whether volumetric or gravimetric control is best for my application?

There are four main differences between volumetric and gravimetric feeders that will influence your equipment selection:

1. Volumetric feeders are open-loop devices while gravimetric feeders are closed-loop. A volumetric feeder is a set-speed device that's dependent on a constant, choke-fed, or flooded infeed of a particulate solid, and it feeds by volume only. The feed material must also have consistent material properties, including bulk density. Volumetric feeder types include screw (helix), rotary vane, belt, vibratory, *en masse*, and table feeders. The term *open-loop feeder* applies only to a volumetric feeder since there's no feedback information between the feeder output and the drive control system.

   In contrast, a gravimetric feeder feeds material by weight and provides closed-loop feedback information about the actual weight being discharged over time. The system makes the necessary speed corrections to maintain the controller's setpoint rate. The most common gravimetric feeders include belt, screw, vibratory, and other feeder types. All require controls where at least two precisely measured variables are monitored: mass or weight and velocity or time rate of mass differential. A gravimetric control system should be able to take a primary feed element output in the range of ±1 to 3 percent accuracy and make necessary corrections so that the output is within the ± 0.5 to 1 percent accuracy range.

2. Feed accuracy requirements are different with volumetric and gravimetric control. A volumetric device requires a uniform, consistent, and reliable material supply to provide feed accuracies in the 1 to 5 percent range without process feedback. If the material feed is inconsistent, feed accuracy will suffer proportionally. On the other hand, a gravimetric device will make operating adjustments using process feedback to correct for inconsistent material properties or poor material supply and typically provides accuracy within a 0.5 to 1 percent range. (It should be noted that the process requirements determine what the solids feed accuracy needs to be.)

3. In-house maintenance differs between simple volumetric and more complex gravimetric feeders. Volumetric feeders require basic mechanical and electrical skills and diagnostic equipment found in most maintenance departments, whereas gravimetric feeders involve more complex diagnostics and familiarity with PLCs and system programming. Costs associated with in-house operational spares will be different as well.

4. Volumetric and gravimetric feeders have a major cost difference primarily because of the more complex controls required for the gravimetric feeder that may not be necessary for the volumetric feeder. A basic gravimetric feeder is two to three times more expensive than a similarly sized volumetric unit, depending upon the operating requirements of each. And don't forget operating costs: If your raw materials are expensive, over- or underfeeding may have a significant impact. Also, closely regulated industries are required by law to have records of influent and effluent flows, so a closed-loop feedback system would be necessary.

Bob Kolotac, new business development manager, Metalfab, 973-764-2000

To determine whether volumetric or gravimetric control is best for your application, you must fully define your process requirements. The accuracy level your process requires is the determining factor when choosing volumetric or gravimetric feeding. Specifically, when you need precise dry solids metering or dosing, say an accuracy of ±1 percent or better, to produce your end product. Sometimes this type of accuracy can be achieved with volumetric control if you have a dry solids material that has a constant density and is unaffected by ambient conditions like moisture and temperature. If your process doesn't require such precision but merely a reliable, uninterrupted flow of material (such as a feeder discharging to a mill), volumetric control is adequate. Also there are cases when environmental conditions, such as high air pressure or temperature negate the use of a gravimetric system. In these more extreme cases, a volumetric system is the only option.

A gravimetric control system provides a great deal of feedback in the way of alarms, documentation, and inventory control. For example, if a manufacturer is required to provide ongoing process documentation or validation to customers, then gravimetric control is the only option.

While there are a many optional devices, such as a level probe or flow–no-flow devices, that can be added to a volumetric system to help improve process control, they all have certain limitations and can't replicate the results achieved with gravimetric control.

Paul Matarazzo, senior mechanical engineer and customer test facilities manager, Acrison, 201-440-8300

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