Suppliers' Tips

What steps should I take to maintain batch accuracy with a non-free-flowing material?

Achieving the best accuracy with any batching system, regardless of ingredient flow properties, means that the flowrate into and through the metering device must be as consistent as possible during each batch and from batch to batch. Dealing with a non-free-flowing ingredient requires a focus on overcoming flow problems at each step of the ingredient transfer process.

If the ingredient originates in a hopper, silo, bin, bulk bag, or tote, some or all traditional flow-inducement methods can be used to ensure constant flow through the vessel outlet. Possible solutions are vibration, air pads or air sweeps, bin activators, and bin agitators. The vessel design itself may require attention to ensure the outlet is sized to minimize bridging and ratholing. The angle of the vessel conical section must be at least 60 degrees from horizontal and may require a 65- or even 70-degree angle, depending on the ingredient. There are also proprietary hopper outlet designs that can promote mass flow.

If the ingredient flows from the source vessel into a positive-displacement feed device such as a screw feeder, a flexible screw conveyor, a rigid screw conveyor, or a rotary airlock, the goal is to consistently fill the screw flight or rotary airlock pocket with material. At this point, additional vibration, air injection, mechanical agitation, or rotating agitation immediately above the screw inlet or rotary airlock may be required. If these devices are applicable, they should be located within a hopper or inlet transition integral to the metering device.

Once the ingredient is within the metering device, you can ensure that cohesive ingredients that can adhere to the screw tube or rotor housing don't cause flow inconsistency or rate fluctuations. To address this issue, you can specify that the feeder-conveyor screw flights and rotor vane tips have beveled edges to minimize ingredient compaction between the screw flights' edges and the feeding tube or the rotary airlock's rotor tips and the airlock's housing.

If a screw-type feeder-conveyor is used as the metering device, a pneumatically actuated 'plunger' can be fitted that pushes a cover against the end of the screw tube to stop material flow quickly to minimize the probability of an agglomerated piece of ingredient falling out of the tube after the screw has stopped turning.

When the ingredient leaves the metering device, as with the other transition points noted above, flow aids may be required to ensure that all of the ingredient enters the destination vessel or container.

If the appropriate measures are properly applied to the batching system, the ingredient flowrate into and through the metering device should be consistent from batch to batch and throughout the dispensing of each batch. That will help achieve the best possible weighing accuracy when batching a non-free-flowing ingredient.

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When batch weighing accuracy doesn't meet your process requirements, understanding the problem should the first thing on the to-do list. Accuracy issues usually stem from equipment design issues or maintenance issues. If your process worked before, you're lucky! That means you only have a maintenance issue. If your system has trouble maintaining itself within tolerance, you may not be so lucky after all.

In a closed-loop-control system, every component (batch controls, sensors, and actuators) all affect system performance. Other important factors that affect performance are scale accuracy, the control system's response time to sense the weight change accurately, and the system's response time in controlling the material flow to the scale.

If your weighbatching system's net weights vary, then try the following troubleshooting steps:

1. Check for varying feedrates and minimize them.
2. Check that the system scale holds zero rate before and after weighing material.
3. Check batch control and actuator system sensitivity and adjust for best performance.
4. Check for feed and discharge gate leakage.
5. Check for consistent controlling device activation and deactivation. Often, a loose linkage is the problem. Operate the system in manual mode because this puts your problem in slow motion, which makes it easier to understand.
6. Check that all weighed material is being captured in the container being filled.
7. Check a reference scale for consistency.
8. Develop your best operating procedure, taking all trade-offs into consideration.
9. Train your operator to use the operating procedure consistently.

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