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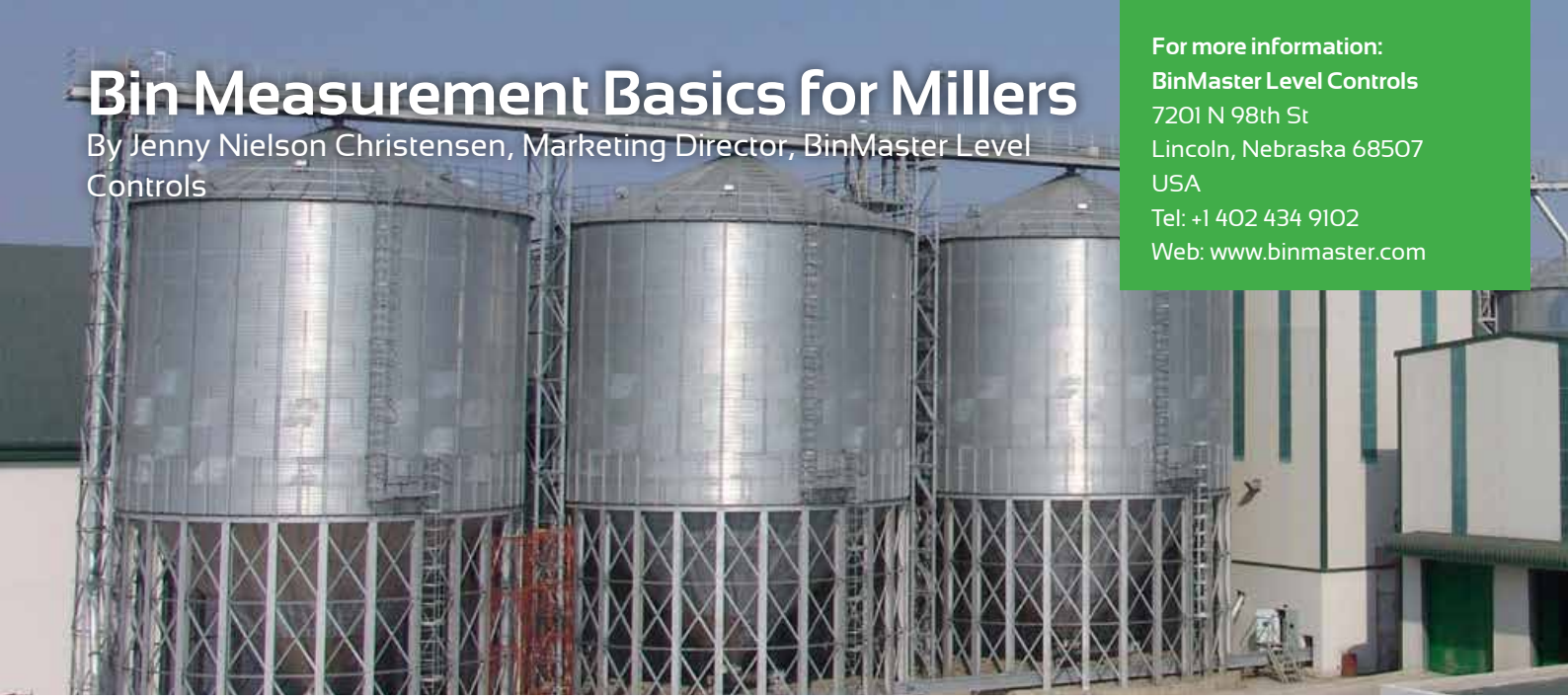

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Milling operations have many challenges at hand when it comes to measuring the level in bins. It's likely that a single operation is home to bins of various construction (concrete or steel), an assortment of sizes, and a variety of materials to measure some granular, some powder, some free-flowing and some prone to dust and buildup. To select the device that is best for a particular bin, it is helpful to consider the material being measured, whether the material surface tends to be even or irregular, the regulatory environment (such as with food), the size of the tank, and whether you need to know when inventory has reached a certain level in the bin which calls for a point level device or you need continuous level measurement.

What can you expect from a bin level detection device?

- It will help you manage your inventory.
- It will eliminate the need to climb tanks to check levels.
- It will enhance safety for employees.
- It will alert you when material reaches a particular level in the bin.
- It will provide a single measurement that is repeatable when there hasn't been any activity in the bin.
- It will provide an accurate distance to product within a few inches.
- It will measure headroom in the tank or the distance to the material, so you know how much space is left in the tank.

What can't you expect?

It's a common fallacy that a bin levels will convert to mass or volume and then to pounds accurately. The nature of powders, granular materials or pellets is that they will settle, shift and compact in the tank. It's true that some advanced devices can and do incorporate compaction calculations into their software, which will compensate somewhat for the behavior of the material. However, a level measurement device is not a scale. Let's explore some of the best level sensor options for millers and considerations when selecting a device, starting with simple, economical sensors building toward the more complex, accurate continuous level technologies.

Rotary Level Indicators

Rotaries are a familiar and common device used for high or low level point level indication in bins, tanks, and silos. A rotary sends an alert via a horn, light or to an alarm panel when material reaches (for high level detection) or falls away

from (for low level detection) the rotary paddle. The principle of operation for rotaries is quite simple. When the rotary is used to alert that material has reached a high level while the bin is filling, the paddle rotates continually until material reaches the paddle. When the paddle meets resistance due to the presence of material, it stops rotating and sends an alert. Conversely, as a low level indicator, the paddle will begin turning when material drops below the level of the paddle and will send an alert or can be wired to start up a process system.

Capacitance Probes

Capacitance sensors are designed for a wide array of applications and materials and may be used in powders, granulars, pellets and other solid or slurry materials. The sensors may be used for high, mid and low level detection in bins, silos, tanks, hoppers, chutes and other types of vessels where material is stored, processed, flowing or discharged. Capacitance sensors operate by detecting the presence or absence of material in contact with the probe by sensing a change in capacitance caused by the difference between the dielectric constant of the material in the tank and the air. These sensors are able to detect very small changes in capacitance, typically one picofarad.

Vibrating Level Sensors

The vibrating level sensor or vibrating rod is a piezoelectric driven vibration type level switch can be used for level detection in bins, silos, and hoppers filled with powders or dry solid materials. A vibrating level sensor can detect extremely light, fluffy materials as light as 1.25 lb./cu. ft.3, such as powders and flakes or can be used for heavy materials such as grains or pellets. These are rugged sensors that are often constructed of durable stainless steel and are virtually wear and maintenance free. A vibrating level sensor can be utilized as a high, mid or

low level alert and can be mounted on the top of the bin as a high level detector or in the bottom cone of a bin to sense when the tank is nearly empty.

A weight and cable-based sensor is a very economical and accurate continuous level measurement choice. Weight and cable-based or bob-style sensors can be ideal for diverse applications in powdered and granular materials as these sensors are not affected by dust, humidity, temperature, dielectric constant, or fumes that may be present in the bin. Plus, as a stainless steel probe at the end of the cable makes minimal contact with the material, there is minimal risk of contamination. This type of sensor works in virtually any material regardless of particle size or bulk density including very fine powders to heavy, dense materials. If there are multiple tanks containing different types of materials that need to be monitored, "bobs" are a proven technology that have been in existence for over 20 years and are trouble-free, long-lasting and require no calibration.

Bob-style Sensors

A bob-style sensor can be used in bins up to 180 feet tall, but are also often used in smaller, active process bins under 40 feet tall. For the best accuracy, the sensor should be mounted on the roof about 1/6 of the way in from the outer perimeter of the bin, which places it ideally to account for the angle of repose on a center-fill bin. Properly mounted on a center-fill, center-discharge bin, bob-style sensors will consistently provide 5% to 7% accuracy. They work by releasing a cable with a weighted sensor probe that stops and retracts when the probe comes into contact with material. Redundant measurements are taken when the sensor probe is both descending and retracting to guarantee every measurement is precise.

Bob-style sensor networks can be integrated utilizing a wide variety of communication options. Most cost effective and popular is a control console mounted at ground level that can report the data from one up to over 100 bins and provides information such as distance to product (headroom), height of product, and percentage full. If the preference is to have bin data sent to a personal computer, there is software to report detailed data for multiple bins simultaneously and display a visual report of bin levels. Other communications include the ability to send automated email alerts when bins reach a predetermined level.

3D Scanners

// 3D Scanner Bin Software

A 3D scanner is a non-contact, dust-penetrating bin volume measurement system that uses acoustics-based technology to measure bin contents at multiple points within the bin. What makes a 3D scanner different is that unlike ultrasonic or radar devices that are measuring one point and determining a single distance, the 3D Scanner takes measurements from multiple points within the bin and uses these points to help estimate the volume of material in the bin. Sampling measurements from multiple points when the material surface of the bin is uneven enables the 3DLevelScanner to calculate bin volume for powders and solids with greater precision than any single point measurement device.

A 3D scanner is unique because it is able to map the topography of the bin and create a computerized profile of the bin contents. This allows for greater accuracy as it detects cone up, cone down, bridging and sidewall buildup and then accounts for these variations when it provides the volume estimate. The 3D scanner comes equipped with software that displays the tank data in an easy-to-read format. The measurements are sent to a main display screen which includes data such as average, minimum and maximum distances, level, temperature inside the tank, and volume percentage. The 3D mapping software depicts surface irregularities in a visual representation of the bin contents.

Food for Thought

When it comes to managing inventory in any bin in your operation, the first consideration is what type of information you need. Are you seeking level, volume, or are you really looking for weight? If you simply need to know if a bin is empty or full, choose a point level device. If you need to know the level of the bin, such as percentage full, headroom or distance to product on an ongoing basic a continuous inventory management system such as a bob-style or 3D device is the right choice. A non-contact device may be desired if the regulatory environment demands it. Keep in mind that some non-contact devices such as ultrasonic or radar perform inconsistently or unreliably in dusty environments.

Bin size, the number of bins, and whether they need to be networked will also influence the type of system you select. If you are seeking convenience, look for a system that offers wireless installation, plus software or consoles that centralize the location of your data and can generate the types of reports you need. The need for inventory accuracy can vary from one operation or even one bin to the next. Getting an accurate measurement for a single point in the bin can be accomplished easily, but it might not give you the overall volume accuracy you need. For uneven material surfaces, bins with multiple fill and discharge points, or very large bins, expect for the solution to be more complex and more expensive.

And remember, when it comes to bin level controls there is a robust selection of technologies at prices ranging from a few hundred to a few thousand dollars. Bin level measurement is not a one-size-fits-all solution it's a puzzle with many pieces that when put together right will give you a better picture of your inventory.