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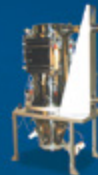
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Indoor Venting Helps Manage Combustible Dust Explosion Risks

Now includes metal dust explosion protection

THE REMBE Q-Rohr-3 family of products is an indoor flameless venting system that eliminates the need for relocating dust collectors or other enclosures outside. The REMBE Q-Rohr-3 consists of a specialized stainless steel mesh construction and a REMBE rupture disc. An integrated signaling unit connects to any audible/visual alarm and shutdown to alert plant personnel, should there be an incident. In an event, flames are extinguished, pressure, noise and dust are reduced to negligible levels. The system is FM and ATEX approved and NFPA compliant.

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Particulate Monitoring

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Prevent Cross Contamination



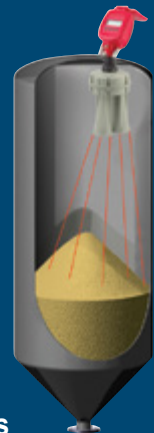
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Product Releases

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Food-Grade Hoses Handle High-Static Applications

Hose design helps dissipate static charges to ground.

KURIYAMA OF America's new line of Tigerflex Voltbuster food-grade material-handling hoses have been designed for high-static applications such as the transfer of powders, pellets and other granular materials.

The hose's design helps dissipate static charges to ground, helping prevent static build-up and reducing the potential for dangerous electrostatic discharges. They have been constructed with static dissipative plastic materials, allowing for the free flow of static to the hose's embedded grounding wire. The light-weight design of the hoses can help reduce injuries related to heavier metal hoses.

The "Volt Series" hose-tube construction includes abrasion-resistant food-grade polyurethane to ensure the purity of transferred materials. In addition, the grounding wire has been encapsulated in a rigid PVC helix on the exterior of the hose, eliminating the risk of contaminating the transferred materials. The VLT-SD Series is constructed the same, but has an FDA polyester fabric reinforcement to handle both suction and higher pressure discharge applications. New 2- and 8-in. ID sizes have been recently added to this product line.





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Round Collectors Suit Vacuum Applications

Integrated self-centering canister eliminates need for a rotary valve

SCHUST STANDARD Products is extending the Liberator series with a line of round collectors. The Schust Round Collectors (SRC) are suitable for vacuum applications and other high pressure conditions. The SRC can operate with pressures low as -70 inches of water column. The Schust Round Collector features an integrated cam-lock canister. This mobile self-centering canister seals directly to the collector housing eliminating the need for a rotary valve. Compact bottom load bag configuration provides space savings for indoor applications. Stainless steel construction available.



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Solve Solids Processing Conundrums

Understanding the unique issues posed by solids is crucial for success

By Tom Blackwood, Contributing Editor

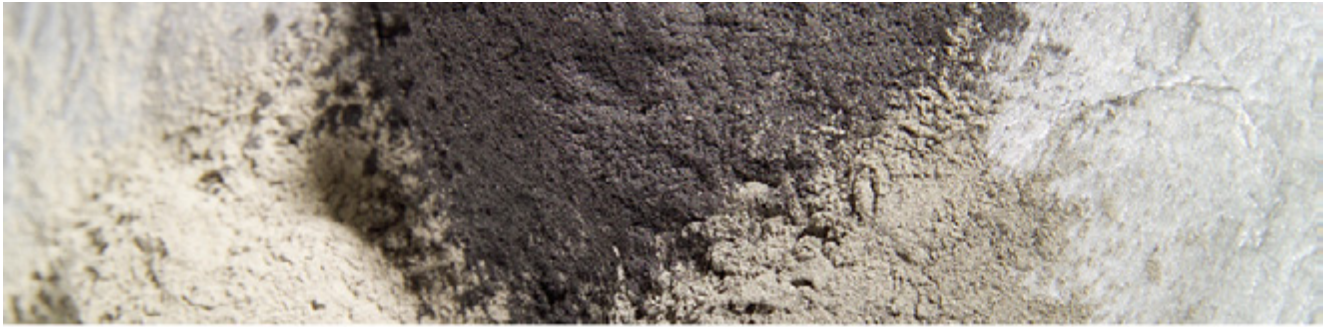
THE PRACTICE of chemical engineering underpins chemical processing. Universities teach design methods for unit operations such as distillation and heat transfer. However, colleges seldom cover solids processing operations; if any discussion takes place, it only focuses on basic particle physics issues related to drag and turbulence. Yet, many processors extensively handle solids. For instance, I once worked for a company that made over 70% of its final products in a particulate solid form.

My lack of schooling about solids hindered my troubleshooting. Don't get me wrong — many of the fundamentals I learned in engineering school were very useful in analyzing and understanding what was causing a problem with our products. However, I found many exceptions that were hard to explain, because particulate solids always are a two-phase mixture, which gives them an additional degree of freedom. Besides physical changes, chemical interactions may complicate the situation.

One important and relatively common example is agglomeration of particles, often an unwelcome result of handling. Rolling particles over one another can increase the surface energy

or impart a charge to the surface. If water is in the fluid or atmosphere around the particles, the surface charge will attract the dipole of the water and draw the particles closer together; Van der Waals forces can continue to hold the solids together even after the water has been removed. Many granulators take advantage of this to convert a fine powder into an attrition-resistant particle. However, I determined many years ago that if you're trying to fill a bulk bag this may not be a desirable outcome and can promote other undesirable effects.

Our plant produced a very fine particle so it would dissolve rapidly for the customer. However, filling the bag was difficult due to the low bulk density, requiring an extended period of time exposed to the un-air-conditioned plant atmosphere at the southern U.S. site. The warm solids drove off attracted moisture but allowed the bulk material to clump during storage. Had this been the only problem caused by clumping, the story would end there. However, moisture trapped in the bulk bag condensed and dissolved some of the solids as the bags went through different temperature environments. This enabled particles to recrystallize as a different non-soluble polymorph.



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We redesigned the process to eliminate the moisture contact, solving the problem. (For information on the causes of clumping and the problems that can occur, see: “Clamp Down on Clumping,” <http://goo.gl/mYCPOQ>. Phase changes in the downstream processing or handling of solids don’t receive adequate attention but can cause many problems, as detailed in: “Don’t Let Phase Changes Faze You,” <http://goo.gl/v7jdMJ>.)

Another, quite different example of a solid-state transformation that screamed polymorph involved a drying operation. The prior experience of the company’s research group suggested a process could be scaled up to avoid over-heating of the solids by using a dryer with a fixed inlet temperature and residence time. Occasionally, a batch would have slightly higher total starting solvent content with an imperceptible difference in final total solvent. However, some particles weren’t as dry as the others when the level of the starting solvent was high. Downstream milling released some of the trapped solvent, heated the solids and caused an undesirable polymorph to

form through a recrystallization process. Adding a sensor to provide a temperature measurement in the dryer permitted starting the fixed drying period only after reaching a specific temperature (close to when free solvent has been removed). The final solvent was uniform throughout the particulate solids, avoiding the polymorph during milling.

So, what are the lessons from these experiences? First, if it screams polymorph, pay attention; fine organic particulate solids are very likely to exhibit this trait. Second, the amount of information needed for a particulate solids operation is more extensive than for others and often involves chemistry in addition to the process mechanics. Third, prior experience may not suffice unless you understand the fundamental details (drying kinetics, particle shape/strength and zeta potential); you must investigate these details during process development. ●

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Measure Viscosity to Improve Your Mixing Process

Use these tips to select the proper measuring instrument to better monitor product quality

By Robert G. McGregor, Brookfield Engineering

VISCOSITY MEASUREMENT may be the definitive indicator for determining whether the mixing process has been effective. When liquids (e.g. lubricants, beverages) and soft-solids (e.g. grease, salad dressings, and ointments) are mixed together, the final blend is tested for acceptable performance. One of the important characteristics is its flow behavior. Does it appear to have the right consistency? Will it pour into the packaging container on the production line? Can the customer get the material out of the container without difficulty? Is its flow behavior during intended use by the customer correct? Viscosity turns out to be the parameter of interest that decides the answers to these questions.

TESTING VISCOSITY

Accurate viscosity measurement for these types

of blended materials is most often accomplished with rotational viscometers. The instrument uses a spindle immersed in the material that is rotated at a defined speed (Figure 1). The resistance to rotation is measured as a torque value and then mathematically converted into scientific units known as “centipoises” (abbreviated cP) in the Americas and milliPascal-seconds (abbreviated mPa-s) in Europe and Asia. (Fortunately, 1cP = 1mPa-s, so measured viscosity values are equivalent around the world.)

Spindle rotation at multiple speeds will typically produce different viscosity values. For blended fluids and soft solids, there is a high probability that the material will exhibit “pseudoplastic” behavior — decreasing viscosity as rotational speed increases. (See Figure 2 which graphically illustrates a plot of viscosity vs. shear rate to

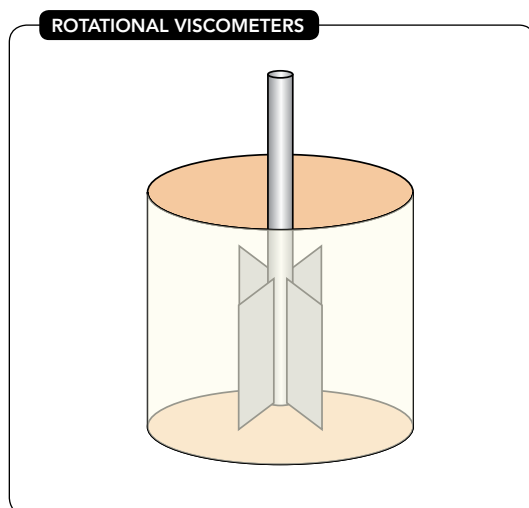


Figure 1. This instrument measures viscosity using a spindle immersed in fluid that is rotated at a defined speed.

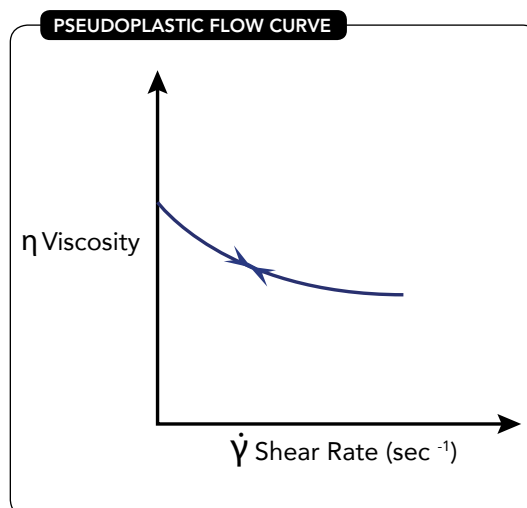


Figure 2. A plot of viscosity vs. shear rate shows pseudoplasticity. This flow characteristic is referred to as “shear thinning.”



show pseudoplasticity.) This flow characteristic is referred to as “shear thinning” and is a desirable property for several reasons. As the shearing action on the material increases, less energy is needed to move the material. Greases and other lubricants are obvious examples. The material will flow more easily in lubrication applications which is essential to reducing friction and minimizing wear on the moving parts.

The challenge for quality control departments is to decide which rotational speed(s) to use for the acceptance test. If single data point viscosity measurement can do the job, that’s the way to go in order to save time because there are always many samples to test. However, it’s possible that two or more viscosity data points are needed because it’s necessary to ensure that the “shear thinning” behavior is sufficient (i.e. has a defined amount of viscosity reduction).

Choice of spindle type is another question to consider. The “vane” spindle shown in Figure 1 is appropriate to simulate what happens in mixing and blending applications. (Other selections might include cylinders, discs, cones, plates, etc.) The vane spindle accomplishes mixing of the mate-

rial while also sensing resistance to rotation, i.e. viscosity. The instrument shown in Figure 3 uses the vane spindle to measure viscosity at different rotational speeds and provides data similar to the graph shown in Figure 2.

For mixing applications that may use an augur principle to combine ingredients, perhaps soft solids like salad dressings, a viscometer accessory known as a spiral adapter may be more appropriate to measure the viscosity. The spindle is shaped like an augur and moves the material through a cylindrical channel while measuring viscosity. Figure 3 shows the spiral adapter which attaches to a viscometer.

One final consideration when selecting an instrument is to know the potential viscosity range of the material being tested. For example, beverages are typically low viscosity while grease is high viscosity. If the instrument will always test the same material using a single rotational speed, then a low cost viscometer can satisfy the application. If multiple speeds are required, or many different materials are to be tested, then a more expensive instrument, such as a rheometer, may be required. The instrument

SPIRAL ADAPTER ACCESSORY

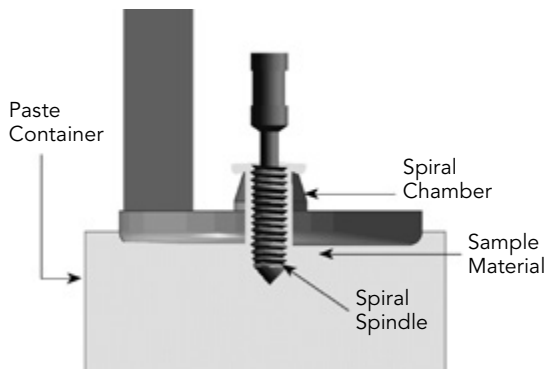


Figure 3. This vane spindle simulates augur mixing and measures viscosity at different rotational speeds, providing data similar to the graph shown in Figure 2.



SOFT SOLIDS TESTER WITH VANE SPINDLE



Figure 4: This rheometer has a much broader torque range capability compared to a viscometer.

YIELD STRESS TEST

- Algorithm in Yield Rheometer Firmware Determines Yield Stress Value
- Slope of Curve is Indication of Viscoelastic Behavior

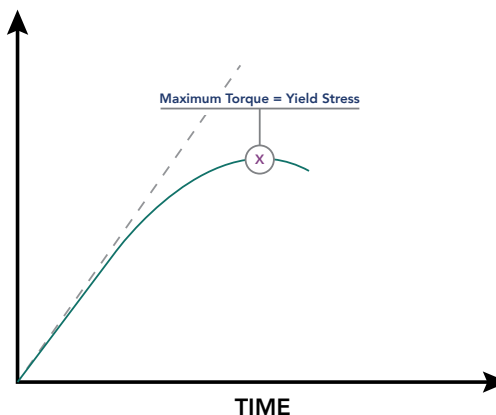


Figure 5. Torque associated with the peak viscosity value is the equivalent “yield stress” for the material.

in Figure 4 is a rheometer and has a much broader torque range capability compared to the viscometer.

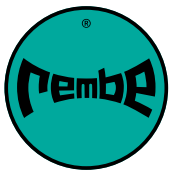
An added capability available when using rheometers is the ability to measure yield stress. This is the property that quantifies how much torque you must apply to the spindle to start the material moving. In a mix tank, think of this as the start-up torque required by the motor to rotate the blades. Figure 5 illustrates the graph from a typical yield stress test. The vane spindle rotates at very low rotational speed, perhaps 1rpm. Measured viscosity builds to a peak value and then starts to decrease. The torque associated with the peak viscosity value is the equivalent “yield stress” for the material.

QUALITY COUNTS

Capital expenditure for this type of equip-

ment ranges from under \$5,000, maybe as low as \$3,000, for the viscometer with vane spindle that measures single point viscosity, to slightly over \$10,000 for the rheometer that measures both viscosity and yield stress. This investment is quickly amortized with measureable improvement in the consistent quality of blended mixes. Perhaps it’s time to seriously consider using this type of measurement instrumentation for mixing and blending if final quality of your manufactured materials is not meeting specification 100% of the time. ●

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Make Some Sense of Sensors

A variety of solutions exist for flow, level detection and inventory management

By Jenny Christensen, BinMaster Level Controls

SENSOR TECHNOLOGY today is not necessarily revolutionary, as there are many very effective and affordable devices already proven to perform in powders. However, it is evolutionary in that sensor manufacturers are listening to their customers and improving the design and functionality of their products. Chemical processors face the constant challenge of meeting regulatory requirements, higher quality standards, and driving efficiency, while at the same time demanding accurate performance and cost savings. A few of those evolutions are in flow detection, point level sensing, and inventory management.

GO WITH (OR WITHOUT) THE FLOW?

Preventing cross contamination of materials can be tricky business when there are powders involved. They clump. They stick. They flow ... or don't flow. Sometimes you think they are not flowing, but there is still that tiny trickle of powder making its way into the process. Unfortunately, that could be more than a mere hindrance and could ruin a product and cost thousands of dollars in unusable inventory that must be tagged out and written off.

RELIABLE FLOW/NO FLOW DETECTION

- Class II hazardous location approvals
- Single-piece design eliminates separate controller
- Detects solids, granules, pellets, meals & powders
- Low power microwave Doppler technology
- No contact with the material flow stream
- Installs quickly and easily in 1 ¼-in. NPS fitting
- Ideal replacement for mechanical switches

Enter a single-piece flow detector. A flow/no flow detector that, unlike many two-piece flow detectors, houses both the remote sensor and control console in a single NEMA 4X enclosure. Its purpose in process is to prevent cross contamination by ensuring flow has stopped entirely before a new material is introduced into the flow stream.

It can be used to detect the smallest amounts of powder flowing through gravity chutes, pneumatic pipelines, in feeders, onto conveyor belts, or flowing from bucket elevators. It can detect when powder is still flowing, even when it should not be due to a faulty valve or slide gate. It also can prevent downtime caused by blockages, conveyors running empty, lack of material flow to-and-from a process, or other absence of a critical ingredient in a chemical formulation that can cause production loss and equipment failure.

Microwave Doppler technology, similar to the Doppler radar in your evening weather report, is used for highly sensitive motion detection to see if any residual powder is flowing at a distance up to five feet away from it. These waves can pass through non-metallic material, which provides the sensor the ability to “see through” a plastic pipe, a glass process seal, or the wall of a chute to detect the material inside the contained area.

A switchable filter reduces the effect of vibration if it is present, and ensures the detection of very small amounts of material as well as moderate and fast-flowing materials. A single analog relay output communicates flow or no flow status to a PLC and has the option of using both normally open (NO) and normally closed (NC) contacts. LED indicator lights inform the end user of the device's status.

WHAT YOU NEED TO KNOW ABOUT HD PROBES

- Used for high and low level detection in bins, tanks, or silos
- Ideal in heavy materials with a high bulk density
- Teflon-coated probe resists buildup and false readings
- Heavy-duty, stainless steel probe that resists bending and breaking
- Suitable for use in temperatures up to 500°F (260°C)
- Attaches to standard or hazloc capacitance probes

The sensor is easy to install through a 1 ¼-in. NPS opening. It is completely non-intrusive and does not come into contact with the flow stream. This eliminates the risk of wear and assures long life and reliability.

Indicators and controls for the initial calibration and set up are easily accessible by simply unscrewing the lid of the device, as shown in the Flow Detect 2000 (Figure 1). Controls for adjusting sensitivity and the output delays are used during the initial setup.

FLOW DETECTOR



Figure 1. Indicators and controls for the initial calibration and set up are easily accessible by simply unscrewing the lid of the device.

CAPACITANCE PROBES FOR TOUGH JOBS

Capacitance sensors are used for high and low level detection in bins, silos, tanks, hoppers, chutes and other vessels used for material storage or process manufacturing. They operate by detecting the presence or absence of material in contact with the probe by sensing minute changes — as low as 0.5 pF — in capacitance caused by the difference in the dielectric constant of the material versus the air. Many chemical processing facilities require that the capacitance probes they use have Class II hazardous location ratings. One advantage of capacitance probes is that they are offered with a wide assortment of customer probes and extensions that make them appropriate for a variety of solid, liquid and slurry materials.

One option you might need in a capacitance probe is interference-free operation. Look for a probe that operates far below the RF level of 9 KHz. This ensures that the device will not interfere with two-way radios or other plant equipment operating in the radio spectrum. Also look for ease of calibration and fail-safe operation that includes a visual or alarm to indicate the sensor

status, so you are aware that the device is continually performing. It should also alert to a power failure.

Probes used with dusty, sticky or clinging materials should have a finish that prevents buildup to avoid false readings and assure accurate level detection. Another helpful feature is an adjustable time delay for covered or uncovered conditions to minimize false signals that might be caused by material shifts.

A capacitance probe can be outfitted with probes of various materials and lengths to accommodate a variety of chemicals in silos, tanks, and hoppers of many sizes. There are many types of probe options and literally thousands of different ways to configure them. At a high level, here are some of the more common probes:

- *Bendable probes.* These fit in tight spaces or in vessels with obstructions. Great for mixers and small containers in chemical processing operations.
- *Hazardous locations.* Certified for challenging environments where there is an explosion risk.
- *Sanitary applications:* Meets rigorous USDA, FDA and 3-A material and design standards in food, chemical or pharmaceutical operations.
- *Remote Electronics.* Electronics mount up to 75 feet away for high-temp, high-vibration or hazardous environments.
- *Flexible probes.* These probes (Figure 2) won't get damaged by material and can come in custom lengths up to 35 ft. They mount in a standoff pipe or nozzle.
- *Flush mounting.* A flat-faced device with “no probe intrusion” for tight spaces or where material flow might damage a probe.
- *Auto Calibration.* This type of probe offers simple and automatic calibration without opening the cover.

FLEXIBLE CAPACITANCE PROBE



Figure 2. These probes won't get damaged by material and can come in custom lengths up to 35 ft. They mount in a standoff pipe or nozzle.

- *Compact probes.* For level indication in small spaces or for plugged chute detection in tanks, bins, silos chutes, conveyors pipes or hoppers.

Some level applications demand a heavy duty (HD) probe that is still sensitive enough to detect low dielectric powders. An HD probe (Figure 3) is made of stainless steel and can be attached to either a standard or hazloc capacitance probes. This rugged probe comes in a standard 8-in. length and features a Teflon coating to ward against false readings from material

HEAVY DUTY CAPACITANCE PROBE



Figure 3. Made of stainless steel this probe features a Teflon coating to ward against false readings from material buildup.

buildup on the probe. The wide diameter of the probe increases the surface area for maximum sensitivity and performance.

An HD probe is suitable for use in temperatures up to 500°F (260°C), making it appropriate for challenging high-temperature processing applications. Because the probe is solid and 1 in. in diameter, it is resistant to bending and extremely durable. It can be used for low or high level detection in heavy materials such as fertilizers, phosphates, sulfates, carbonates, silicates, oxides, or detergents, a high bulk density.

VOLUME ACCURACY

Continuous level sensors measure the amount of material in a storage vessel on a continual basis, rather than just indicating whether the material

is above or below a certain point, as point level sensors do. This makes a continuous level sensor ideal for monitoring material inventory in your vessel to prevent downtime. However, just as with point level sensors, there are different continuous level sensors. Some have contact with the material; some are non-contact. Some measure just level, while others calculate volume. Some devices measure just one point or within a narrow beam, while others measure and map the material surface. Some work in high dust, most do not.

A 3D scanner (Figure 4) is a non-contact, dust-penetrating bin volume measurement system that uses acoustics-based technology to measure and map material levels at multiple points within the bin. You get far more volume accuracy — up to .5% to 3% — by using measurements from multiple points in the bin. When the material surface of the bin is uneven as it often is in powders, the 3D scanner accounts for these variations. This makes the 3D scanner able to estimate bin volume with greater precision than any single point measurement device.

Powders used in the processing of many chemical are problematic to store, handle, and measure due to being dusty, clingy, and sticky. The 3D scanner is proven in industrial organic and inorganic chemicals, plastics, resins, detergents, paints, agricultural chemicals, and with ethanol producers. A few examples of difficult to measure materials where the 3D is emerging as the preferred inventory management system include:

- *Alumina.* Dusty material with low dielectric that presents problems for laser, radar, and ultrasonic. It can be stored in very large diameter bins with multiple empty points leading to irregular topography.
 - *Lime.* Dusty material that can also be clingy in addition to piling irregularly.
- Other non-contact sensors

3D SCANNER



Figure 4. This non-contact, dust-penetrating bin volume measurement system uses acoustics-based technology to measure and map material levels at multiple points within the bin.



struggle to stay clean in lime, plus a single-point measurement does not provide any volume accuracy.

- **Carbon Black.** Yet another dusty material that can be problematic for other non-contact technologies. It is also highly conductive, which can lead to issues with signal absorption, resulting in unreliable measurements.
- **Calcium Carbonate.** Dusty and clingy, but a 3D scanner equipped with a Teflon horn stays clean. It also piles very irregularly so single point measurement is problematic.

This sensor is unique in that it is able to map the topography of the bin and create a computerized profile of the material topography. 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 the 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.

A 3D scanner performs in tanks up to 200 feet tall and in materials with bulk densities greater than 12 pounds per cubic foot. Facilities that install 3D technology are seeking improved inventory accuracy, with a 3D scanner proven to deliver precise volume

accuracy when mounted in the proper location and used in a bin that is less than 45-ft in diameter.

For bins greater than 45-ft in diameter, a multiple scanner system can record measurement data from multiple devices and then combine the data to report volume to a personal computer and provide a single graphical representation of the bin contents.

Volume accuracy is especially desirable in monitoring the inventory of high-cost chemicals to optimize purchasing, delivery logistics, production planning, and financial management. Advanced software provides a very realistic view of inventory levels and helps managers more closely track inventory and reduce production shut downs. By detecting buildup, a 3D scanner allows maintenance crews to perform timely preventive maintenance and cleaning, which over the long term can protect the tank from potentially damaging structural stress.

The 3D scanner can output data to a PLC or HMI, send the information to a PC with 3D software (Figure 5). An advanced system using multiple sensors can report data from multiple vessels at your site or from vessels at multiple sites, making it easy to monitor your entire operation's inventory status. Imagine if you're the purchaser for a large manufacturer of detergents, and being able to monitor the inventory of all of the chemicals that make up those formulations from a single software.

SENSOR ADVANCEMENTS

Using sensors makes a lot of sense. They enhance safety, save time, improve inventory management, optimize storage capacity, and help support business functions such as purchasing, production, and finance. Plus, they are highly cost effective as most are very affordable and can quickly provide a solid return on the investment by preventing contamination, overfills, downtime, and the need to carry excessive safety stock. The choice of sensor solutions continues to evolve, grow and improve with advancements in mechanical and information technology. Let's look forward to the next big breakthrough! ●

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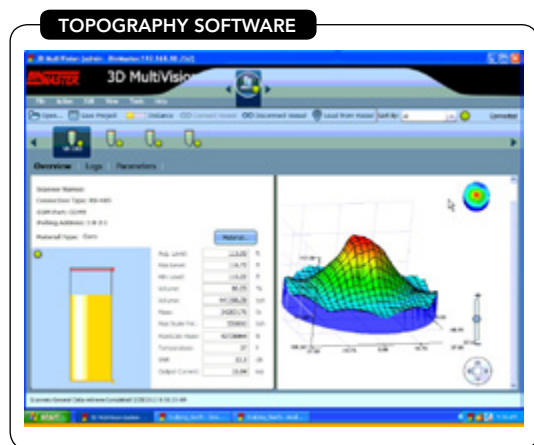


Figure 5. The 3D scanner software generates a visual topography that indicates uneven surface areas in a bin.



ROUND COLLECTORS SUIT VACUUM APPLICATIONS

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eliminates need for a rotary valve**

Schust Standard Products is extending the Liberator series with a line of round collectors. The Schust Round Collectors (SRC) are suitable for vacuum applications and other high pressure conditions. The SRC can operate with pressures low as -70 inches of water column. The Schust Round Collector features an integrated cam-lock canister. This mobile self-centering canister seals directly to the collector housing eliminating the need for a rotary valve. Compact bottom load bag configuration provides space savings for indoor applications. Stainless steel construction available.

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Consider Used Equipment

Here's some guidelines to help select the right pre-owned machine for an application

BUYING THROUGH original equipment manufacturers (OEMs) often means long lead times and higher prices, which may not be necessary, nor acceptable for many manufacturing needs. Previously used or surplus pharmaceutical, nutraceutical, chemical, and plastics equipment used in production can also be found for sale, and in inventory, from qualified used equipment dealers. In fact, some of these pieces have never been used, or were installed, but never used in production. But before purchasing, here's some tips to better facilitate the buying process.

First, a good used equipment dealer typically gives a prospective buyer, who knows what they need, a competitive purchasing deal. For those who need more guidance, an established dealer will be up to date on what's current, what's new, what you may need, or what controls and requirements are available for your specific manufacturing needs. Large companies often employ in-house scientists that develop products and teams to transfer that knowledge into production. Smaller or less established companies may not have those assets.

To that end, an established equipment dealer can work closely with small and medium-sized companies to find solutions uniquely suited to their needs. And some dealers already have established agreements with those larger companies to find a home for their surplus equipment. Equipment customers of every size are experiencing a shift in equipment needs with changes in technology and demand. New ingredients, formu-

lations and batch sizes can significantly change what they need to create high-quality, effective products, thus freeing up machines.

ADVANTAGES OF USED EQUIPMENT

Buying used equipment cuts down on the time it takes to get into production. For example, new machines can have long lead times, anywhere from eight to 16 weeks, depending on the make and model. Used equipment, already in a dealer's inventory, is often ready for delivery and can reduce the time an owner-operator might spend working out the kinks of new machines. Only in recent years have companies come to view pre-owned equipment as acceptable. Nowadays, many companies either consider or actually purchase used equipment. The quality of pre-owned equipment and the expertise of a qualified dealer in selecting the right machine for the right job have come a long way in changing that.

A good used equipment vendor will also help you find the machine at a much lower cost than new. Cleveland-based Federal Equipment Company works with customers to not only find the ideal machine, but often at 60% to 70% lower cost than new. ●

FEDERAL EQUIPMENT COMPANY provides asset management and supply chain support. The company's equipment catalog serves industries ranging from chemicals and plastics to pharmaceuticals, which includes nutritional product and vitamin manufacturing equipment. Learn more at www.fedequip.com



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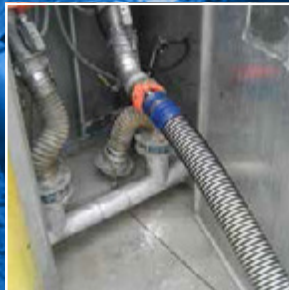
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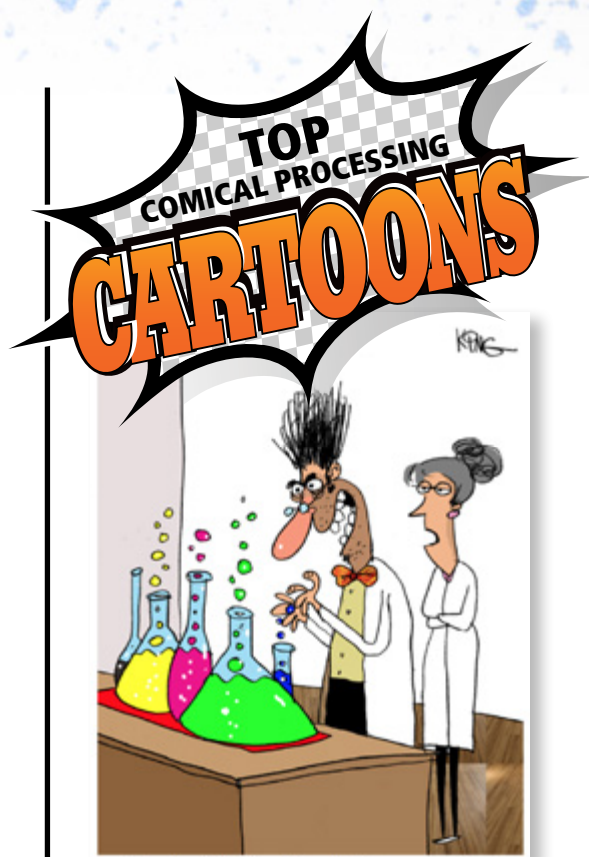
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