

POWDER & BULK SOLIDS

The Source for Dry Processing and Bulk Handling Technology



**Reducing Costs
with Pneumatic
Conveyors**

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Scaletron Industries Ltd. introduces a new line of volumetric screw feeders for indirect dispensing of powdered or pelletized chemicals into water, wastewater, and chemical treatment processes.

The Model VMF-26 auger style feeders feature a fully integrated Scaletron scale. Precise dosage amounts are automatically weighed and added to treatment processes without requiring an operator to measure and weigh amounts. Data is displayed at a central monitoring station where operators can quickly make adjustments as necessary from the control panel.

Scaletron Industries, Ltd., Plymouthville, PA
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MicroMettler Instrument Corp., Tarrytown, NY
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Tank and Blender Cleaning: CIP Meets DIP

Sep 12, 2008 By Daniel VanderPyl

Competitive pressures in today's world economy necessitate higher productivity in all markets, and the powder and bulk solids sector is no exception. One major obstacle to maximizing production time is the essential CIP (clean-in-place) process required at every product change and/or shift change.

A tank, blender, and auger conveying system can only be as clean after CIP as it is dry. DIP (dry-in-place) must meet CIP. Just like a pit stop in auto racing, the longer a blending system sits idle in

order to complete the cleaning/drying cycle, the further behind on the production track the next blending shift becomes.

Unfortunately, the onus of tank drying falls upon the powder and bulk solids industry, since liquid processors only need absolute drying when rinse water must not cross-contaminate the subsequent product batch (as in pharmaceuticals), or when the storage of damp, empty tank/totes would allow bacteria to generate.

Fortunately, new technologies are now supercharging the process of drying tanks, blenders, mixers, and tube conveyors used for producing flavors and fragrances in food, cosmetic, wash powder, chemical, and pharmaceutical batch production.

The Lack of a Drying System

All too often, a facility has no cost-effective drying system in place. For many, because cleaning is often a manual process with handheld spray wands, drying (or gross water and puddle removal) is also a labor-intensive step. It usually involves a manual blow-out process conducted by an employee manipulating a handheld compressed air nozzle. However, the time taken is not the time actually needed to effectively dry the tank.

Complete drying requires a secondary evaporative drying stage in order to eliminate the residual interior moisture on every surface of the entire tank and blender and conveying system. This additional drying is accomplished today by using either standard blowers or fans together with in-line electric heaters or by simply opening the hatches and ports in the system and waiting until it air dries. Both of these options require valuable time.

Instead of shutting down the line while a mixer dries during the next shift, most manufacturers have made end-runs around the drying conundrum by installing multiple tank and blender systems. The necessity for such equipment redundancies, and their concomitant expense, can be greatly reduced by addressing the most time-consuming, nonproduction process: either an inadequate or complete lack of a forced-air drying system.

To better define the drying challenge, this article will discuss in more detail the current drying methods and their drawbacks. It will then outline the optimum balance of forced air volume, pressure, and temperature to dry tank, blender, and auger conveying systems.

Plant Air Nozzles and Natural Evaporation

The most common method is natural evaporation, which can take up to seven hours. For most tank, blender, and auger conveyor cleaning processes, the first step is for operators to blow the water droplets and puddles out using a compressed air nozzle before they let Mother Nature take over. Attention must be given to ensure that the compressed air filtration and condensate water traps are in the plant air lines before the air comes out the handheld nozzles.

Even if a high-temperature CIP rinse makes handheld nozzle blow-off unnecessary, leaving mixer lids, hopper lids, and auger conveyor tube ports open to atmosphere for extended periods may not be a good option either. Several hours of evaporative drying time do not guarantee that bacteria cannot grow, or that airborne powders and dust from other adjacent operating mixers won't cause cross-contamination for the next blending batch.

Blowers, Fans, and Heaters

Blower and fan units used in tank, blender, and conveyor tube drying can reduce drying time by an average of 50% compared with natural air drying. They are almost always a direct-drive design in order to minimize size and cost. However, an in-line electric heater must be added, and this ultimately raises both the cost and total power consumption. The final assembly still must be compact enough to mount on a portable cart to easily service multiple mixers, and this portability requirement limits the size and drying power of these forced-air dryers.

There are other performance issues and technical drawbacks that make blower and fan

units problematic for many users. They must be connected to an in-line electric heater in order to introduce hot air into the tanks, blenders, and auger conveyors. The blowers tend to have high pressure at low airflows, but low pressures at high airflows. The fan designs have low pressures at all airflow ranges and this low pressure makes it impossible to overcome air pressure resistance through the heater and throughout the tank, blender, and conveying circuit without losing all of the benefits of high air volume.

The end result is low air volumes for both the blower and fan dryer units. This causes equally low rates of air exchange throughout the whole tank, blender, and conveyor system. The net effect of such low air volumes at high air temperatures in regard to the heaters is that air temperature spikes can occur in certain areas. These become dry while other internal surfaces of the tank, blender, and conveyor system remain moist, thereby remaining at ambient temperature longer and not drying at the same rate. These temperature extremes can also cause damage to rubber glands and seals within the tank, blender, and conveyor circuit. Because electric heater elements have a typical surface temperature of 1200°F, safety considerations increase if the electric heater coils or the heater controller has any type of malfunction.

High-Velocity Air Blowers

High-speed belt drive blowers with electric motors ranging from 3 to 50 hp offer several advantages over the direct-drive blowers. They occupy the same smaller space of direct drive while having higher horsepower than the direct-drive blowers and fans. Because hot air is generated by recycling the natural blower heat, they do not require heaters. It is also possible to connect multiple tank, blender, and conveyor tube ports from one blower simultaneously, but care should be taken to make certain that the airflow is balanced to ensure that the drying time is equal.

As discussed earlier, the optimum design for drying tanks, blenders, and conveyors is by use of a pressurized air circuit in order to achieve the smallest temperature variance throughout. Since this pressure must be maintained along with an air exchange rate of 1–2/min, there must be some means of restricting exit air.

The Ideal Air Volume and Temperature

There are certainly a number of variables among the wide range of manufacturers of tanks, blenders, and auger conveyors, but the common denominators for defining an effective

drying system usually prove to be very much the same.

The first step is to determine the maximum continuous air temperature to which the entire circuit can be exposed. Although there are certain systems where Teflon seals and gaskets can handle greater than 200°F, a more common acceptable maximum is 160°F continuous air temperature. Just as with the high-temperature CIP solutions, operators must take care to avoid bare skin contact with metal surfaces at 160°F. However, food safety personnel endorse the 160°F air temperatures for the 15–30-minutes drying cycle as it supplements the CIP sanitizing process.

Next, to minimize air temperature gradients within the entire tank, blender, and conveying system, the drying air must be pressurized at all times to between 0.75 and 1.0 psig. Air molecules mix better at these slightly compressed levels, and the “hot spots” that are common with the low-pressure blower, fan, and electric heater systems are greatly reduced.

The last piece of the drying formula, with the air temperature at 160°F and the internal air pressures at ~1.0 psi, is to obtain a total air volume exchange rate sufficient to meet the drying cycle time objective. The more air exchanges, the faster the drying time. With a CIP wash temperature of 140°–160°F, the air volume exchange rates are as follows: with one air exchange per minute, the drying cycle is approximately 30 minutes; with two air exchanges per minute, the drying time is generally 15–20 minutes.

However, if the CIP temperatures are lower than 140°F or the target drying time is less than 15 minutes, the horsepower and size of the drying system will make a portable dryer less practical.

Evolving DIP

From ambient air evaporation to high-velocity forced-air drying technology, the evolution of the drying processes for tank, blender, and auger conveying systems is ongoing. As CIP meets DIP, the powder and bulk solids industry is setting new standards for absolute cleanliness.

[Air Knife Systems](#) - Sonic Air Systems designs and manufactures centrifugal industrial blowers and air knife systems for all sectors of manufacturing.

Daniel VanderPyl is cofounder and president of Sonic Air Systems Inc. (Brea, CA). He has written and published numerous articles, has made presentations at major industry forums, and has helped author technical books. Sonic manufactures a full range of blowers, air knives, enclosures, HEPA filters, and other accessories for dozens of applications in air/gas handling, and has been awarded two patents for blower and air knife technology.