When two bulk conveyors are better than one

EaglePicher Technologies is an American company that designs and manufactures batteries, battery management systems and energy devices for the defence, aerospace, medical and commercial industries. To manufacture high-purity chemical and isotropic products, EaglePicher engineer a new process in which five bulk products are transferred, weighed with a high degree of accuracy and conveyed to a mixing system.

After discussions with several different equipment vendors and a bidding process, EaglePicher ultimately chose a custom design from Flexicon Corporation that combined flexible screw conveyors and a weigh-batching centre to meet their exacting measurement requirements at the beginning of the process, with vacuum pneumatic conveying downstream to transfer 100% of the weighed ingredients to final blending.

EaglePicher's proprietary process involves mixing five dried products, four received in bulk bags and one in 23 kg bags, plus water. The ingredients are fine powders, relatively free-flowing, dry and dusty. Humidity in the system must be controlled to avoid absorption of room moisture by the dry feed.

Ingredient weights for the batch recipe vary from a minimum of less than 9 kg to a maximum of nearly 181 kg in each batch, and the process demands accuracies within ±1% of target over this broad range of ingredient weights, as well as for the water.

The process demanded bag unloading equipment and a weigh-batching system with powder conveying. Flexicon proposed a common gain-in-weight batching centre, using flexible screw conveyors to move the ingredients from the bag unloading hoppers and pneumatic conveying to move the weighed ingredients to the proper destination.

Bulk bags are unloaded with cantilevered J-beam bag unloaders equipped with electric hoists and trolleys, eliminating the need for a forklift. The bulk bag dischargers are part of a sealed system that contains dust and promotes the flow and total evacuation of material.

The fifth, minor ingredient is manually unloaded into a bag dump station with dust collection. The operator damps several bags at a time into the hopper, filling it with about a week's worth of the material.

The ingredients are transferred via flexible screw conveyors into the weigh-batch system. Each of the five screw conveyors is designed specifically for the powder being moved, with different sizes, materials of construction and screw designs based on each material's bulk density and flow properties.

The single, common gain-in-weight batching system measures ingredients in sequence as they flow into the central weigh hopper. Load cells transmit weight gain information to a controller that starts and stops the conveyors, slowing to a dribble feed rate as the weight approaches the target in order to meet the high-accuracy requirements. A slide gate valve at the bottom of the weigh hopper discharges the ingredient.

There are two different destinations for the weighed feed streams, two ingredients going directly to a wet blender and the other three mixed in a dry blender first. A specially designed wye diverter valve sends each ingredient to the correct place, either the dry blender or the wet blender. The first two ingredients bypass the dry blender, located just below the weigh batching system, and drop through a rotary airlock valve into the vacuum pneumatic conveying system that takes them to the wet blender. There they are pre-mixed with water and given time to blend. The other three ingredients drop through the diverter valve directly into the dry blender, where they are mixed for 30 minutes. The blended mixture is then discharged from the bottom of the dry mixer through the same rotary airlock valve and into the same pneumatic conveying system, for transfer into the wet blender.

The pneumatic conveying system was selected for its ability to handle the diverse range of powders with differing characteristics and because the system will evacuate itself of the material it conveys, minimising cross-contamination. Complete transfer of the material also ensures that both the individual and consolidated batch ingredients reach their destinations accurately by weight.

As each of the dry ingredients exits the pneumatic conveyor it is collected in a filter receiver that utilizes a load cell weigh module to confirm complete batch transfer. Another rotary airlock valve takes the powder directly into the wet blender below. A 15 kW positive displacement vacuum pump, located downstream of the filter receiver, provides sufficient airflow to transfer all the materials.

According to Loren Harding, EaglePicher's Manager of Operations, the integrated conveying package meets all process requirements and prevents contamination of its product and plant environment.

EaglePicher's ultimate choice of Flexicon was based on several important advantages, Harding said; "Flexicon had the weighing and batching experience to supply a unique integrated turnkey system, including PLC-based controls, with guaranteed accuracies. Furthermore, Flexicon's bulk bag discharger, with its bag-spout interface, was the best we encountered for maintaining a sealed system during unloading. Finally, and perhaps most importantly, Flexicon was the only company to propose a vacuum pneumatic system combined with mechanical conveying, the most advantageous solution for our requirements."

Flexicon Corporation (Australia) Pty Limited
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