

Application Example

Major Ingredient Transfer and Weighing for Snack Food Processing

Background

The manufacture of baked snack foods generally requires various ingredients to be transferred to mixing and extrusion processes. Depending on the percentage of each ingredient in the blend, materials are usually categorized as majors, minors and micros. In many cases, the transfer and weighing of these majors, minors, and micros can be a manual and tedious process. When increased production demand and lack of overall process efficiency caused a manufacturer of baked snack foods to switch from a manual to a more automated process, they approached the Coperion K-Tron Process Group for help.

Process Overview

The manufacturer agreed that utilizing pressure differential (PD) trucks for the bulk delivery of the major materials to their plant would be beneficial. Utilizing a pressure blower, the ingredients are transported from the truck to silos for storage until their usage is required. The ingredients can then be transported via a pressure system and delivered to the mixers in the proper amounts using a closed loop system with scale hoppers.

PD Transfer Operation Defined

Upon the arrival of the PD truck at the plant, a flexible hose is connected from the pressure blower to the PD truck and another from the PD truck to the conveying line. The system operator selects the desired destination (silo 1 for starch or silo 2/3 for flour) on the truck unload control panel. When the system is started, the blower pressurizes the PD truck and conveys material via positive pressure from the truck through the conveying line and directly into the silo. An inline magnet installed in the conveying line removes any metal fragments which may be present in the conveyed material. When the high level sensor in the silo is activated, the operator closes the material flow gate on the truck and allows the system to purge the conveying line before finally stopping the system.

Dilute Pneumatic Transfer – Positive or Negative Pressure?

In all of the material transfer steps, Coperion K-Tron pneumatic conveying systems are used to transfer the flour and starch. The systems use positive pressure dilute phase conveying. Positive pressure conveying systems are typically used to transport product over long distances and at high throughputs. Applications which involve pressure conveying often include loading and unloading of large volume vessels such as silos, cyclones, railcars, trucks, and bulk bags.

Conversely, vacuum (negative pressure) systems are often used for lower volumes and shorter distances. One of the advantages of vacuum systems is the inward suction created by the vacuum blower and reduction of any outward leakage of powder. This is one of the reasons why vacuum systems are often used in higher sanitary or dust containment applications. Another advantage of vacuum systems is the simple design for multiple pickup points. It should be noted, however, that due to the limitations in the level of vacuum that can be generated, the distances and throughputs on a vacuum system may also be limited. Often a combination of pressure and vacuum conveying designs are used for a system, taking full advantage of the process and efficiencies of each technology.

Efficient Storage Options

Since the raw ingredients are used in food production, the silos and the bin vents on the silos are painted with an FDA approved white paint, maintaining a sanitary material contact area. Stainless steel construction on these components is also available, but may become costly depending upon the silo size. In the case of the two flour

silos, an “intervent” is stationed on top for the two silos, allowing the use of a single bin vent filter for both silos.

In order to keep the material dry within the silo, especially in a high humidity climate, a desiccant bed dryer (DBD) is installed and connected to the silos by a separate line. With the DBD’s ability to produce dry air at an extremely low dew point, a cushion of air is blown into the top of the silos, guarding against moisture in the material.

In addition to drying the air within the silos with a DBD, the silos may also be fluidized by exclusive blowers. Since starch and flour both are easily compacted, this fluidization is essential in order to convey the material to the blending process. Solenoid valves mounted in the main control panel are opened whenever the material is conveyed out of these silos, in order to ensure this fluidization.

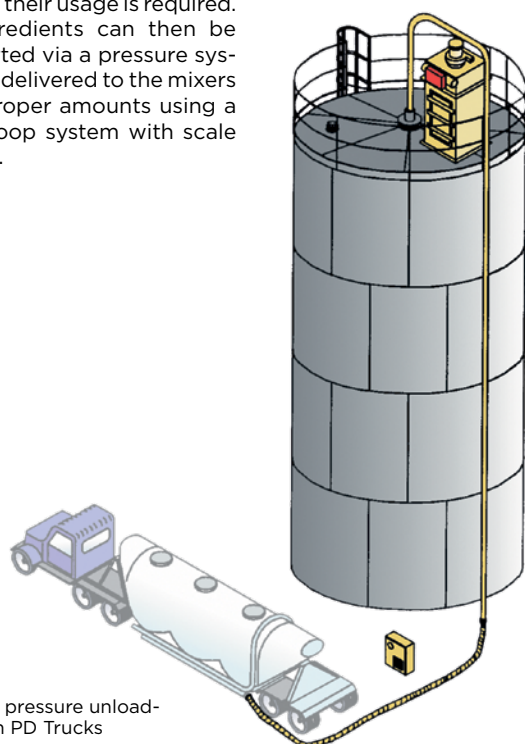
Scaling System

Batches of either one or two ingredients are needed for two mixing stations. The customer wanted surge hoppers for each mixing station to be filled concurrently but yet linked to both systems. In order to accommodate this, Coperion K-Tron system engineers designed the scale hoppers for multiple fill valves. The system operator has the ability to fill both scale hoppers at the same time.

After the fluidized material is discharged from the silos, it drops through to two Coperion rotary valves. From the rotary valves, the material is transported to a cyclone to separate the material from air. The material is then dropped into a sifter and then metered back into the conveying line by another rotary valve. Once in the line, it is then conveyed to the diverter valve, located above a scale hopper.

Principle of Operation

The diverter valve is ideal for diverting material directly into



Positive pressure unloading from PD Trucks

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a hopper from a conveying line. Due to the valve's low-clearance height, it is ideal when requiring inline diverters in tight spaces. The valve allows for the discharge of material into the hopper below when activated in the correct discharge position. When the scale hopper below indicates the batch is complete based on the weight signal, the diverter valve can be immediately shut. This allows for the transfer of the excess material in the conveying line either to the next process or scale hopper, or back into the original hopper/silo. This closed loop design results in a more efficient method of product transfer with higher product yields.

ing. Coperion K-Tron offers a variety of systems for batch weighing of pneumatically conveyed food ingredients, whether the application requires a single ingredient to be delivered to multiple destinations or multiple ingredients to be delivered to a single destination.

The material resides in the scale hopper until the precise weight and/or combination of materials is achieved. With the scale weighing system, ingredient accuracies of $\pm 0.5\%$ of the full scale capacity can be expected. After accurate weighing, the mixer then calls for material, a butterfly valve opens and the material in the scale hopper is discharged.

through a PLC system designed by Coperion K-Tron's experienced Systems Engineers. The ability to automate the once manual process has resulted in several process advantages. As illustrated in the extensive system design outlined above, the engineered material handling capabilities provided by Coperion K-Tron included state-of-the-art technology in both mechanical and process control design. This not only provided an improvement in overall manufacturing time, but also in overall process quality.

Coperion K-Tron Advantages

➤ The Coperion K-Tron Systems Group can supply integrated systems of Coperion K-Tron and ancillary products, with one source management and integrated controls.

- Each solution is custom developed, drawing from Coperion K-Tron's extensive experience in providing material handling solutions.
- All system receivers and components are designed with ease of maintenance and accessibility in mind.
- Additional design options are available in the P-Series of pneumatic receivers for specialty sanitary applications.
- Coperion rotary valves and diverter valves are available in a variety of sizes and design options and meet CE and ATEX 3D classifications.
- Coperion K-Tron Weigh Scale Hoppers and Batch Weigh Receivers are designed to provide batch weigh accuracies of $\pm 0.5\%$ of the full scale capacity

Batch Weighing with Scale Hoppers

Scale hoppers are receiving hoppers suspended on load cells for ingredient batch weighing.

Summary

The system sequencing and recipe control of the ingredients to be conveyed and the amounts to be mixed are all provided

