

# DENSE PHASE CONVEYING



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## CONCEPT

In dry materials handling, the product being conveyed and the application are used to determine the best type of conveying system.

Highly abrasive products and those subject to degradation move best through a high-pressure, low-velocity conveying system. On long distance, high-rate applications, a high-pressure, low-velocity system can offer energy savings. Smoot Dense Phase Pneumatic Conveying System is such a system.

Unlike dilute phase systems, there is not an airlock feeder for introduction into the line. Dense phase systems use a pressure vessel or transmitter. While airlocks are normally limited to a pressure differential of only 15 psig, dense phase transmitters have no pressure limitation. With their high-pressure capability, dense phase systems allow for higher rates and lower velocities in the same line size. Slugs of product can be “pushed” through while dilute phase suspends all product in the airstream.

Dense phase could be your best choice—particularly if you are dealing with abrasive products or products that degrade.

Smoot designs and manufactures both dense phase and dilute phase systems. We will help you select the best system for your application.

## FEATURES

A key feature of a Smoot dense phase conveying system is the exclusive air management system. By using a pressure control regulator, airflow control orifice and bypass valve, total air flow to the system and product-to-air ratio (the combination of air flow and conveying rate) are automatically controlled at the vessel.

When air flow and the product-to-air ratio are not accurately controlled, boosters or trace air lines are required. Not only are they expensive to purchase and install, but they add air to the system, increasing the energy requirements and line velocity. Our method saves money, allows easy access because all controls are located on the pot, and provides for an easier and more affordable installation.

Friction in a conveying line can only be overcome by pressure, not air flow. Air flow can increase or decrease friction, but pressure is the energy consumed to overcome the friction. The amount of pressure it takes to overcome friction is a function of product-to-air ratio, conveying line diameter, and conveying line length. Since line diameter and length are set, the only variable is product-to-air ratio. If the product-to-air ratio can be controlled, pressure can be controlled.

The key to unsurpassed system efficiency, reliability, flexibility, and overall performance is accurate control of air flow and product-to-air ratio at the vessel.

At Smoot, we are so confident of the superiority of our air management system that we include air flow meters on all of our dense phase systems. These tell you exactly how much valuable compressed air is being consumed.

Smoot is an American Welding Society and American Society of Mechanical Engineers qualified shop.

All of our vessels are built to these standards.

To assist with this, Smoot has complete test facilities for both top and bottom discharge transmitters.

## DISCHARGE

When handling a granular or non-fluidizable product, Smoot recommends a bottom discharge transmitter. The principle of operation is the same, except that the bypass valve causes slug formations instead of steady state product-to-air ratio. When handling a fluidizable product, it is recommended to use a top discharge transmitter.



# PROCESS

## 1 Fill

- Vessel at atmospheric pressure
- Inlet valve opens to allow product to fill vessel
- Displaced air is vented down the convey-line
- Inlet valve is closed when desired weight or level of product is reached

### BYPASS VALVE OPERATION

The bypass valve is used to allow displaced air to vent from the top of the transmitter, through the bypass line, and down the convey line. This eliminates the need for an additional piping connection for a vent line and valve. By using the convey line for venting, dusty air will be discharged to an existing dust collector.



## 2 Pressurization / Start Convey

- Air is rapidly introduced into the vessel through the fast-fill manifold
- Transmitter starts to pressurize and product is fluidized above the porous media
- Product and air mix enters the dip tube and begins down the convey line
- The transmitter's pressure raises to the desired optimum operating pressure
- The speed and efficiency of pressurization eliminates the need for a costly, high maintenance discharge valve

### BYPASS VALVE OPERATION

The bypass valve remains closed to allow the transmitter to quickly come up to optimum operating pressure.



## 3 Convey

- Air introduction is switched to standard flow manifold
- Product and air mix are discharged from the transmitter at the optimum operating pressure

### BYPASS VALVE OPERATION

The bypass valve accurately controls the product-to-air ratio as product is discharged from the transmitter. When the convey pressure is reached, the bypass valve bleeds clean air from the top of the vessel into the convey line. This brings the product-to-air ratio to the proper proportion for the selected convey pressure. This requires only a simple regulator setting on the bypass valve for field adjustment. The valve setting is initially determined based on product conveying characteristics and system configuration (i.e., line size, number of elbows, distance, etc.).



## 4 Depressurization / Purge Convey Line

- As transmitter empties, the pressure starts to decay
- Transmitter pressure decays to near clean line condition and air flow is turned off
- Fast-fill air flow can be used to purge the convey line if necessary
- Vessel reaches atmospheric condition and is ready to start the next fill cycle

### BYPASS VALVE OPERATION

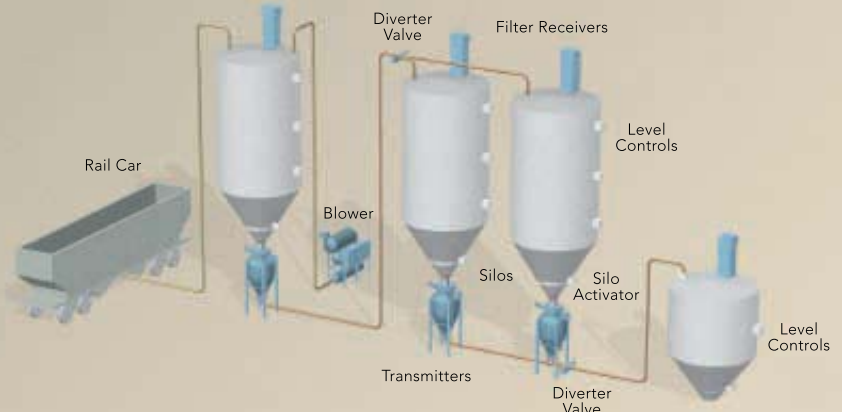
The bypass valve remains closed as pressure decays below the normal operating pressure. Remaining air in the vessel is vented down the convey line eliminating the need for a vent line, vent valve and discharge valve. Valve controls are reset to allow for the next fill cycle.



# APPLICATIONS

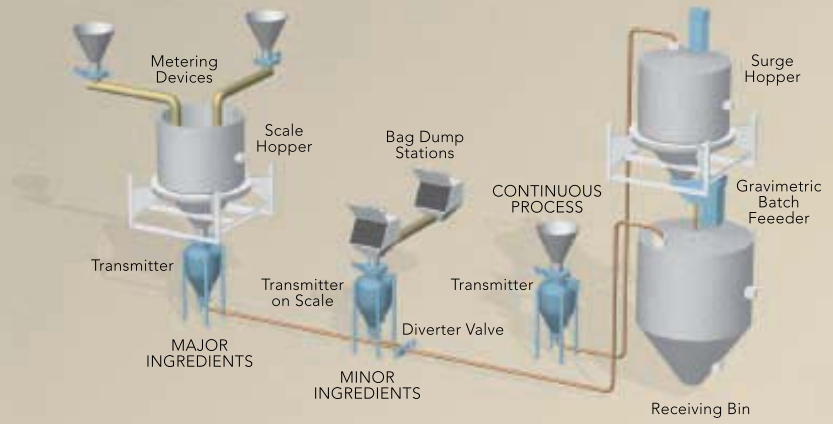
## Rail Car Unloading and In-Plant Delivery System

Dense phase conveying from rail car unloading pit to storage silos. In plant transfer from silos to receiving bins using a common convey line and patented slide diverter valve.



## Batch Weighing System

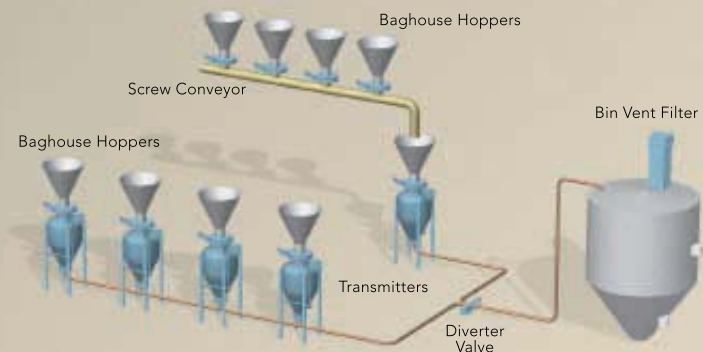
Major and minor ingredients are batch weighed and transported to a receiving bin or blending location. All products can be accurately metered, weighed and transported individually or as a complete batch. Also, transfer from customer continuous process.



## Dust Collection Transfer

Collection of abrasive dust from a baghouse or precipitator can be done one of two ways. A collection screw can direct product to a single surge hopper and transmitter and convey line can be used at each hopper outlet.

DUST REMOVAL WITH SCREW CONVEYOR



DUST REMOVAL WITHOUT SCREW CONVEYOR

## CONCEPT TO COMPLETION

Every pneumatic process is unique, so Smoot customizes every solution to meet your needs.

Pneumatic conveying systems and components are what we know, no matter how large or small your line. Tell us what you intend to accomplish and we'll make sure the pieces fit.

Dependable, versatile systems. Solutions that fit. It's the foundation of our business.



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