The Basics of Pneumatic Conveying

DYNAMIC AIR®
Conveying Systems

How It Works

The two most distinct categories of pneumatic conveying can be described as either low pressure or high pressure systems.

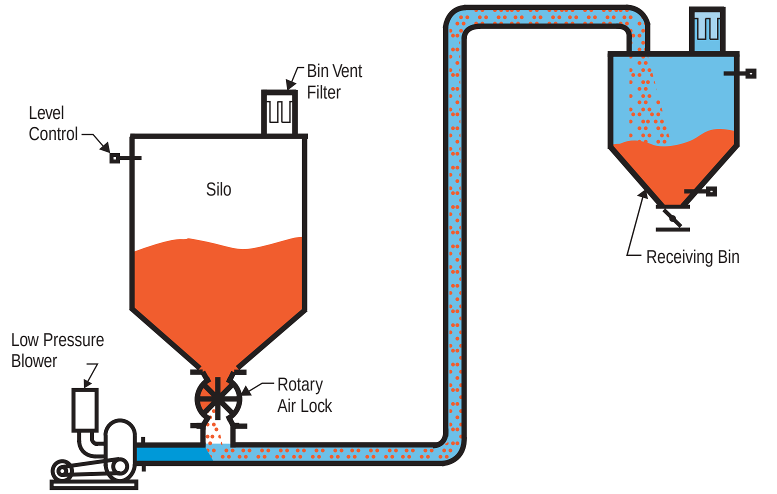
The first category is low pressure systems, sometimes referred to as dilute phase pneumatic conveying systems. These systems utilize air pressure under 15 PSIG and use either positive or negative pressure to push or pull materials through the conveying line at relatively high velocities. They are described as low pressure/high velocity systems and have a high air to material ratio.

If you look at a typical low pressure system using a rotary air lock feeder, you will notice a high pickup velocity of around 2500 feet per minute at the beginning of the system, and about 6000 feet per minute at the end. The conveying line pressure is under 15 PSIG at the beginning versus near atmospheric pressure at the end.

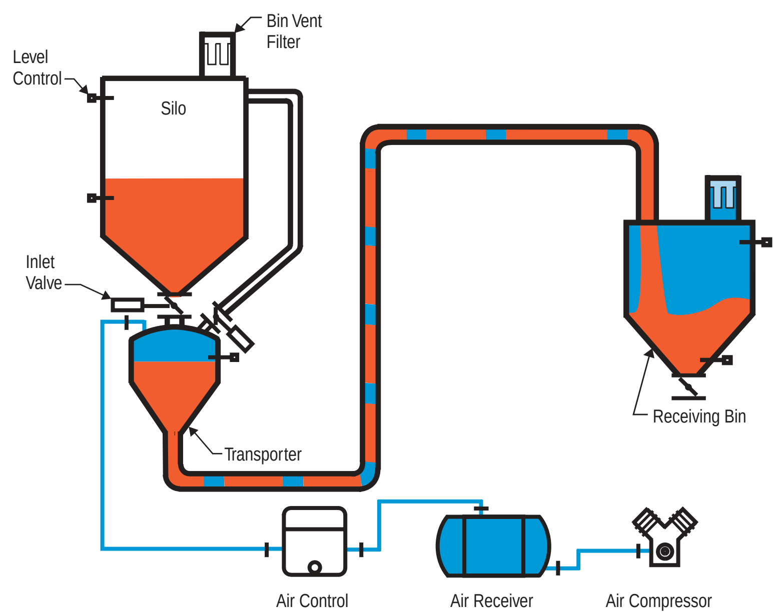
Low pressure systems generally use a low pressure positive displacement blower or a fan as the power source.

The second category is high pressure systems, generally known as dense phase systems. These systems utilize air pressures above 15 PSIG and use positive pressure to push materials through the conveying line at relatively low velocities, much like extruding. They are generally described as high pressure/low velocity systems and have a low air to material ratio.

If you look at a typical high pressure system using a high pressure vessel to maintain conveying pressure, you will notice a low pickup or starting velocity of about 50 feet per minute and a higher conveying velocity at the end of the system at about 500 feet per minute. The conveying line pressure at the beginning of the system is typically at about 45 PSIG versus the pressure at the end of the system, which is at zero.



Dilute Phase System



Dense Phase System

High pressure systems generally use a high pressure air compressor as the power source.

Because high pressure or dense phase systems are so versatile, Dynamic Air offers four basic concepts. Each concept is particularly suited to certain applications and materials. Each has different capabilities, efficiencies, economic advantages and limitations.

“Because high pressure or dense phase systems are so versatile, Dynamic Air offers four basic concepts.”

Brute Force Concept™

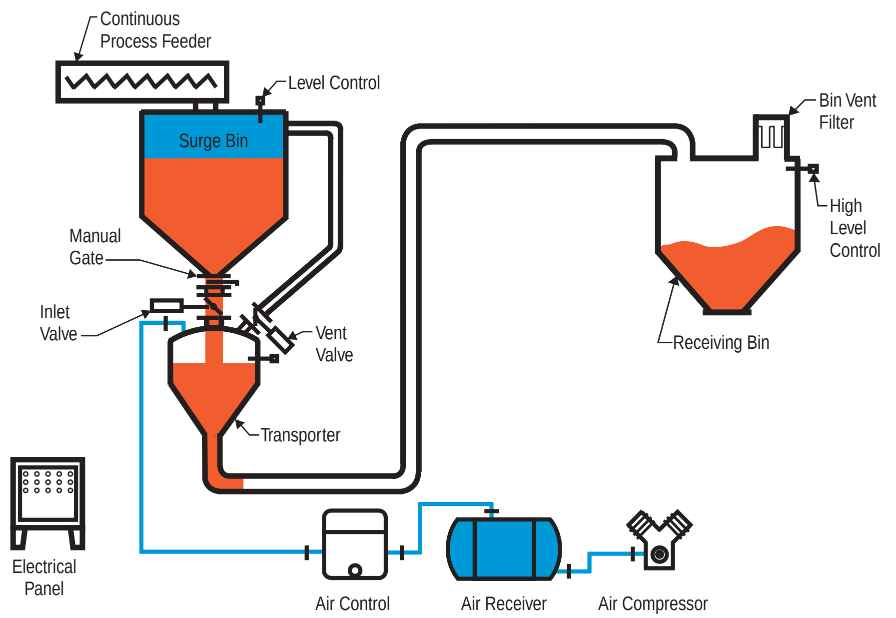
The first concept, which is the lowest cost of the four systems offered by Dynamic Air, is the Brute Force Concept. This system is a batch type system and is the most basic design offered. It is generally suitable for shorter conveying line distances and for granular, free-flowing, abrasive and non-abrasive materials, such as silica sand or plastic pellets. The Brute Force Concept consists of a pressure vessel, which is referred to as a transporter, and a conveying line.

During the filling cycle, material is charged into the transporter through an inflatable seated butterfly valve. Displaced air is vented up through a vent valve to allow easier filling and to prevent any back pressure that would retard material flow.

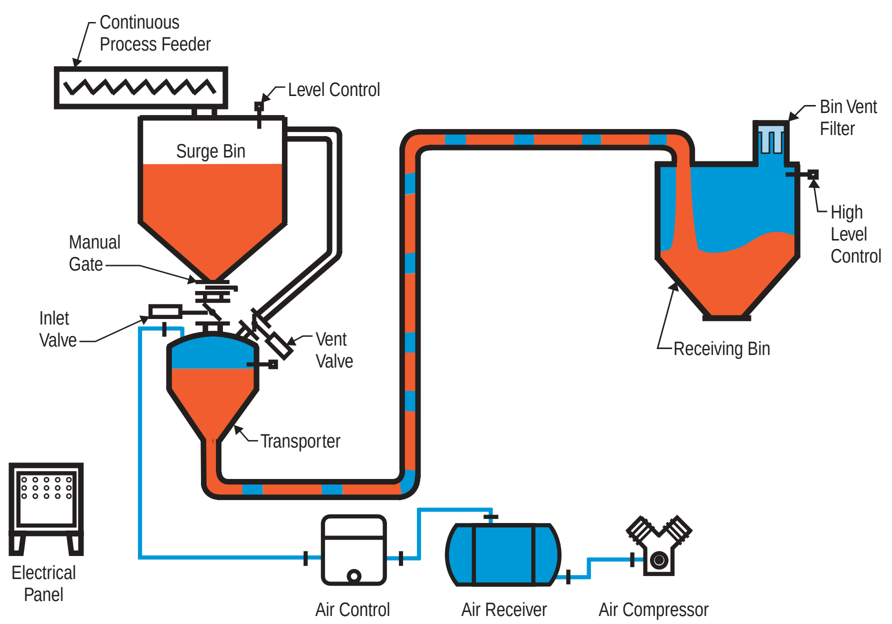
Once the transporter is filled, as signaled by a level control or weighing device, the inlet and vent valves close and seal. Then, all the high pressure air required to convey a given product, regardless of distance, is gradually introduced through the top of the transporter during the conveying cycle.

The compressed air introduced into the transporter mixes with material and is forced through the conveying line. The material then conveys in discrete slugs until the transporter and conveying line are empty.

When the conveying line becomes nearly empty, the pressure in the transporter falls to zero and the air supply turns off, allowing the residual air volume to purge the transporter and conveying line.



Brute Force Concept - Filling Cycle



Brute Force Concept - Conveying Cycle

Characteristics of this system are high air flow at the beginning and end of the transport cycle and higher conveying line pressures. A characteristic “whoosh” signals completion of the cycle.

Fluidizing Concept™

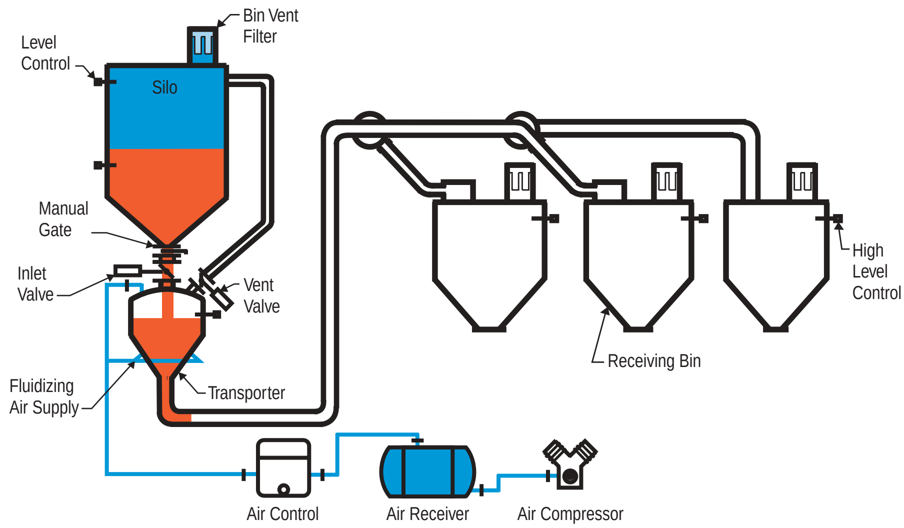
Dynamic Air's second concept, and next most economical design, is the Fluidizing Concept. This concept is generally suitable for shorter conveying line distances and very fine and non-abrasive powdery materials, such as talc or flour. The Fluidizing Concept is a batch type system that consists of a fluidizing transporter and conveying line.

The fluidizing pressure vessel employs fluidizing nozzles or membrane to "fluidize" the material during the conveying cycle, eliminating packing in the transporter vessel and promoting flow. This action is so effective it makes most powdery material flow much like a liquid.

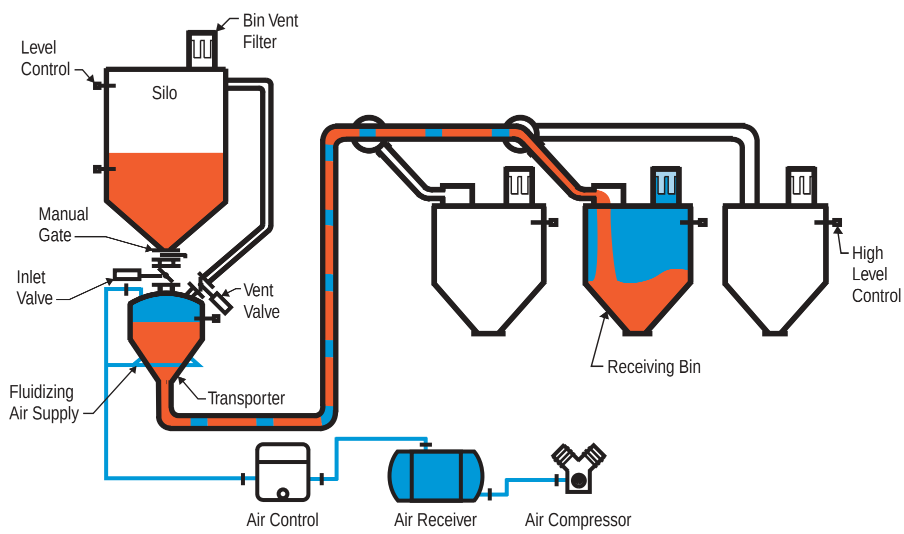
During the filling cycle, material gravity feeds into the transporter through an inflatable seated butterfly valve. Displaced air is vented up through a vent valve to allow easier filling.

Once the transporter is filled, as signaled by a level control or weighing device, the inlet valve and vent valve close and seal. High pressure air is then introduced gradually through the top of the transporter and fluidizing nozzles or membrane. Then, all air required for conveying is introduced into the transporter during the complete conveying cycle.

The compressed air introduced in the transporter mixes with the material. The material is then forced through the conveying line in a fluidizing condition and continues to convey until the transporter and conveying line are empty.



Fluidizing Concept - Filling Cycle



Fluidizing Concept - Conveying Cycle

When the conveying line becomes nearly empty, the pressure in the transporter falls to zero and the air supply turns off, allowing the residual air volume to purge the transporter and conveying line.

Characteristics of this system are high air flow throughout the transport cycle and lower conveying pressures.

Conventional Concept™

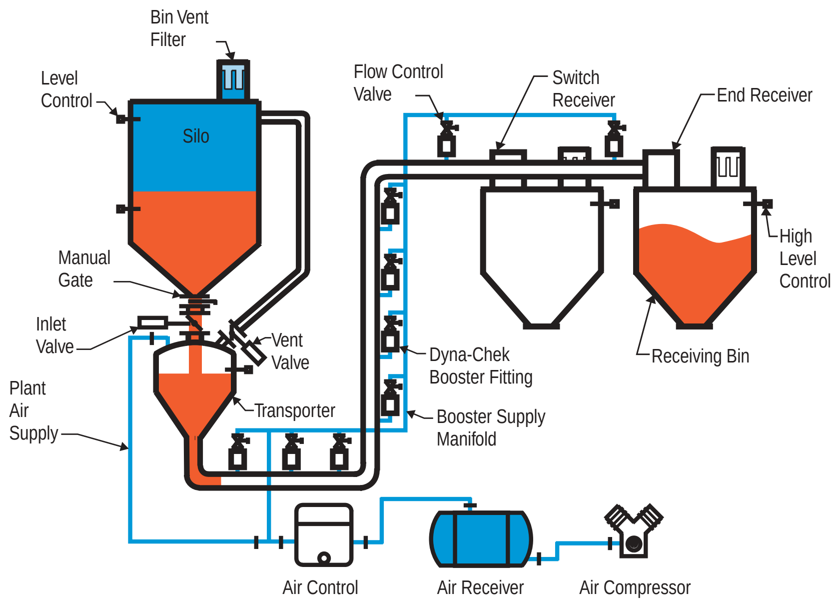
The third high pressure pneumatic conveying concept offered by Dynamic Air is the Conventional Concept. This concept is generally suitable for longer conveying line distances and fine, granular, abrasive, non-abrasive and difficult-to-handle materials, such as silica sand, refractory batch, soda ash or fly ash. The Conventional Concept system is a batch type conveying system that consists of a transporter, conveying line and Dyna-Chek® 4 booster fittings.

During the filling cycle, material gravity feeds into the transporter through an inflatable seated butterfly valve. Displaced air is vented up through a vent valve to allow easier filling. Once the transporter is filled, as signaled by a level control or weighing device, the inlet valve and vent valve close and seal. The only compressed air that enters the transport vessel is the air that is used for material displacement. All other air required for conveying is added through the Dyna-Chek 4 booster fittings.

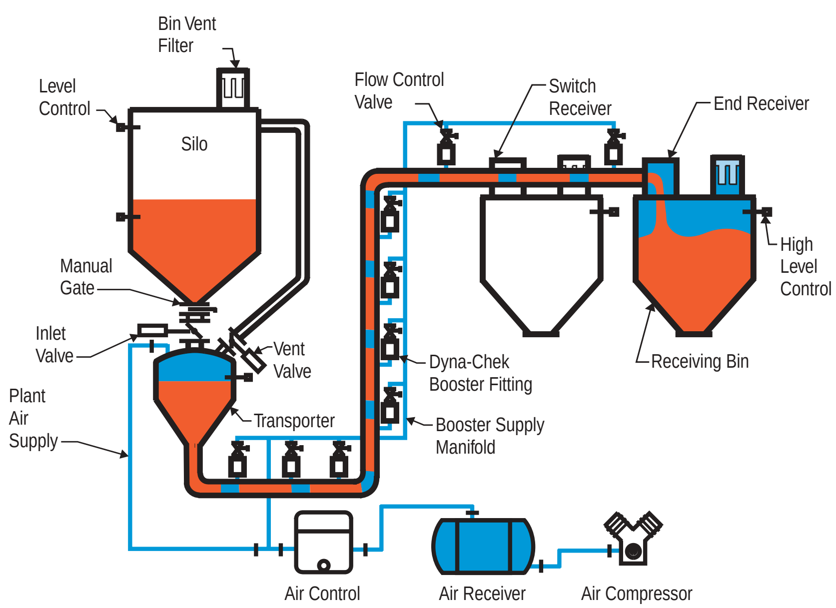
A cross-section of the Dyna-Chek 4 booster fitting shows how the diaphragm modulates to add air to the conveying line as it is required. The diaphragm, which acts as a check valve, allows the compressed air to enter into the conveying line while preventing material from back-feeding into the air supply lines. This is crucial to the reliability of the booster fitting and to overall system performance.

The spacing of the Dyna-Chek 4 booster fittings is completely dependent on the complexity of the material being conveyed. A very difficult material may have booster fittings very close together, whereas a very easy-to-handle material may have them spaced much further apart.

By spacing the booster fittings along the conveying line, the length of the conveying line, in effect, is reduced to the distance between the booster fittings, adding to system reliability and performance.



Conventional Concept - Filling Cycle



Conventional Concept - Conveying Cycle

When the conveying line becomes nearly empty, the pressure in the transporter falls to zero and the air supply turns off, allowing the residual air volume to purge the transporter and conveying line.

Characteristics of this system are high air flow at the beginning and end of the transport cycle and a low air flow in between, with lower conveying line pressures.

"Each concept is particularly suited to certain applications and materials. Each has different capabilities, efficiencies, economic advantages and limitations."

Full Line Concept®

The fourth concept offered by Dynamic Air is the Full Line Concept. This concept is generally suitable for longer conveying line distances and very fine granular, abrasive, non-abrasive, fragile and difficult-to-handle materials such as carbon black, silicon carbide, plastic pellets or silica sand. The Full Line Concept is either a batch type or continuous system that consists of single or multiple transporters and a conveying line with Dyna-Chek 4 booster fittings.

From an operating viewpoint, the main difference between the Full Line Concept and all three other concepts is that the Full Line Concept never allows the conveying line to become empty. The conveying line always remains full at the start and end of a conveying cycle.

The batch type system cycle begins with material feeding into the transporter through an inflatable seated butterfly valve. Displaced air is vented up through a vent valve to allow easier filling.

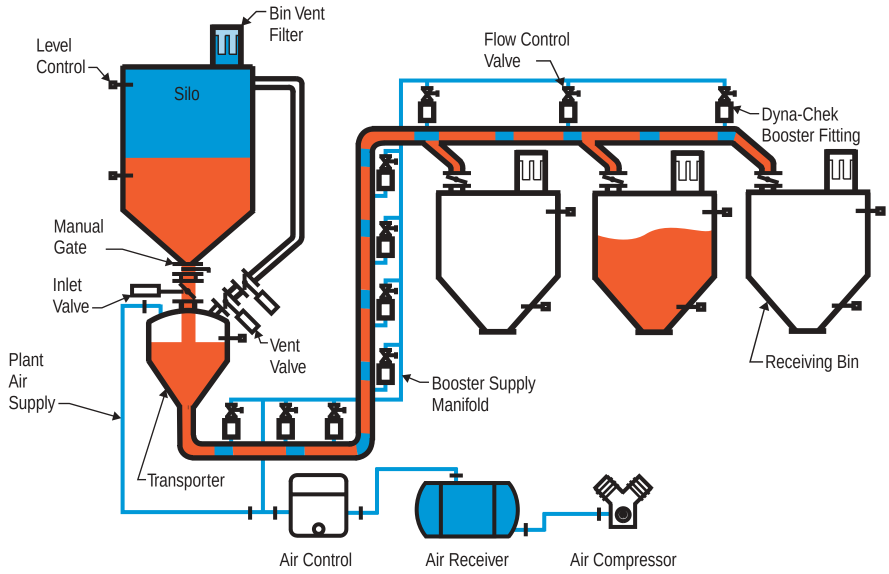
Once the transporter is filled, as signaled by a level control or weighing device, the inlet and vent valves close and seal. The outlet valve then opens and compressed air is introduced into the transporter to displace the conveyed material.

All other compressed air used for conveying is added through the booster fittings spaced along the conveying line.

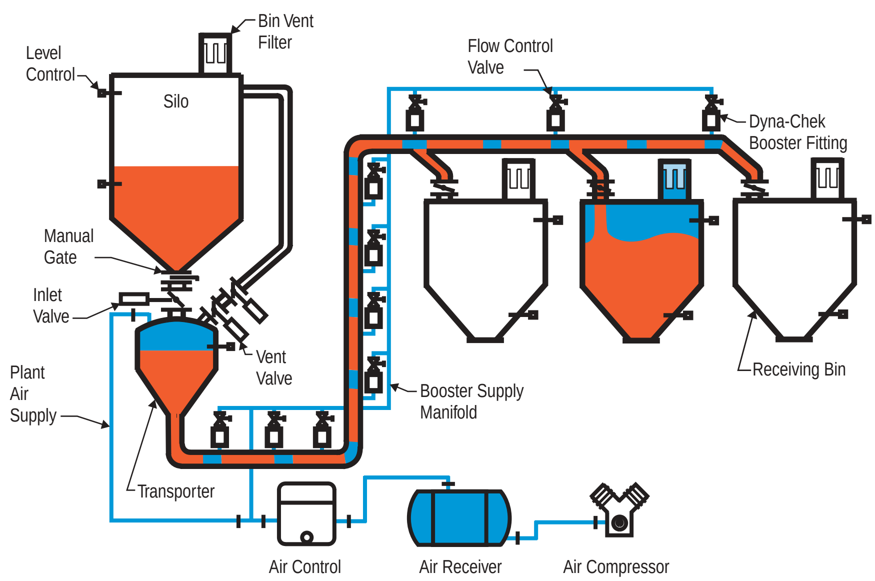
When the transporter is completely empty, as signaled by a low level control, the compressed air is turned off and material stops in the conveying line. Prior to refilling of the transporter, the air pressure inside is vented through a special vent valve that remains open during the filling cycle. Because the conveying line does not purge itself, the high velocity normally seen with the other three concepts during the purge cycle is eliminated, making the Full Line Concept ideal for abrasive and/or fragile materials.

Since the line always remains full, no time is lost in emptying and filling the conveying line. In addition, air consumption is drastically reduced, making the Full Line Concept ideal for long conveying line distances and where a single material is being conveyed.

Characteristics of the Full Line Concept system are very low air flows throughout the conveying cycle and high conveying line pressures.



Full Line Concept - Filling Cycle



Full Line Concept - Conveying Cycle

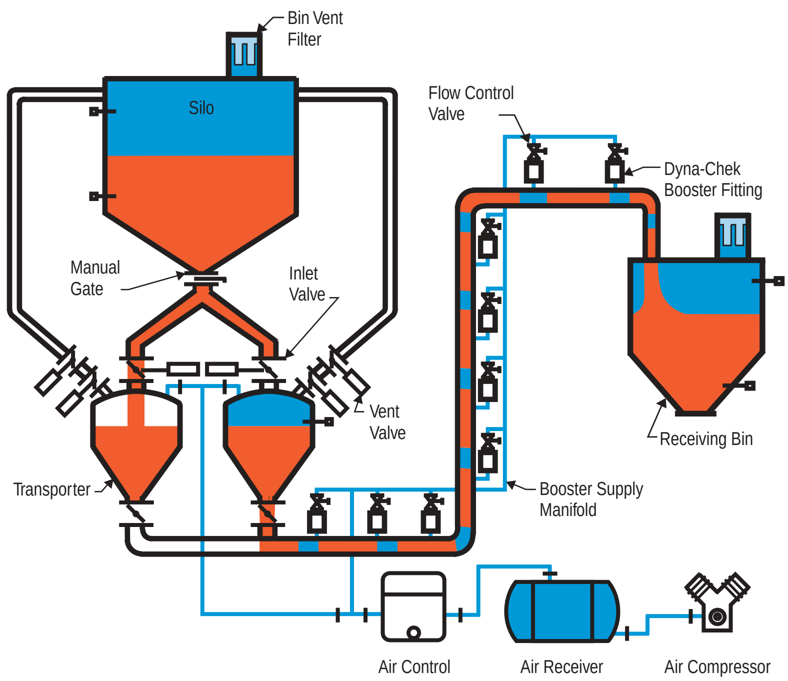
A Better Solution To Your Material Handling Needs

Continuous Full Line Concept®

Dynamic Air has taken the Full Line Concept an important step further by offering it in a continuous type system. This system is ideal for conveying over longer distances or at high conveying rates. The continuous Full Line Concept system consists of multiple transporters, a conveying line and Dyna-Chek 4 booster fittings.

The components are very similar to those utilized in the batch type Full Line Concept except for the use of multiple vessels which operate alternately with respect to filling and conveying. When one transporter is filling, the other is conveying, providing a continuous flow of material from the transporters and eliminating any time normally lost during filling. This offers the ultimate in conveying line utilization and efficiency.

Characteristics of this system are extremely low air flows throughout the conveying cycle and high conveying line pressures.



Continuous Full Line Concept

This has been a brief overview of the basics of pneumatic conveying along with the "How It Works" of Dynamic Air's broad range of low velocity dense phase pneumatic conveying systems.

Since each system concept offered by Dynamic Air has different capabilities and operating characteristics, you can be assured that the system chosen for your application will be a better solution to your material handling needs.

Typical Materials Handled by Dynamic Air Pneumatic Conveying Systems:

- *Aluminum Oxide*
- *Alumina*
- *Ball Clay*
- *Barite*
- *Bauxite*
- *Bentonite*
- *Beryllium Oxide*
- *Borax*
- *Carbon Black*
- *Cement*
- *Electrostatic Precipitator Dust*
- *Feldspar*
- *Fine Coal*
- *Flour*
- *Fluorspar*
- *Fly Ash*
- *Glass Batch*
- *Glass Beads*
- *Ground Meal*
- *Gypsum*
- *Iron Oxide*
- *Kaolin Clay*
- *Kynite*
- *Lime*
- *Litharge*
- *Magnesium*
- *Milk Powder*
- *Peanuts*
- *PVC Resins*
- *Quartz*
- *Roofing Granules*
- *Salt*
- *Silica Sand*
- *Silicon Carbide*
- *Soda Ash*
- *Sodium Sulfate*
- *Steel Chips*
- *Stoker Coal*
- *Sugar*
- *Talc*
- *And More...*

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