

# Vacuum Conveying for Tableting Operations

## Background

Pneumatic conveying by vacuum is quickly becoming one of the most popular means of transport for a variety of pharmaceutical products. The use of either dense or dilute phase vacuum transfer can be applied to tableting operations such as the loading of blenders, sifters, mills, capsule fillers, tablet presses, and even tablet and capsule handling without damage to the finished product.

## Dilute or Dense Phase?

Dilute phase conveying should be used with materials where segregation or attrition in the conveying line is not a concern. Comparative gas/air velocities in a 3" pipe for dilute phase can range from 15 m/sec (3000 ft/min) up to 35 m/sec (7000 ft/min). In dense phase operations, a reduced gas velocity range of 0.04 m/sec (80 ft/min) to only 9 m/sec (1700 ft/min) is utilized. In most applications the gas is air; however, in the pharmaceutical industry, nitrogen is also widely used due to its inerting capabilities as well as the natural purity of the gas.

The lower gas velocity used with dense phase conveying means the force exerted on the conveyed powder or granulate is much gentler. This gentle action also reduces the segregation often experienced with the more aggressive dilute phase operation. It should be noted, however, that there are limitations to dense phase conveying. These limitations include conveying distances in excess of 3.6 m (12 ft) vertical and 4.6 m (15 ft) horizontal, and conveying materials which are cohesive, hygroscopic, or so coarse in particle size that they will not readily form slugs.

## Dense Phase Principle

By definition, dense phase means a higher product to gas ratio, or a smaller amount of gas is used to move a large quantity of product. The less the gas requirement, the less the power consumed by the exhauster or vacuum pump. Typically material is picked up from the outlet of a specialty hopper (see lower photo at right), which creates a pressure differential and allows the slugs of product to form. In addition, the hopper also includes a type of makeup air inlet, which aids in the forming of the slugs as they travel and pulse through the conveying line. The combination of the relatively low air velocity and an expanded line size result in a "siphon-like" effect for conveying to the vacuum receiver, with less resultant attrition and segregation.

Regardless of the type of conveying technique used (dilute or

dense), the material is delivered direct to a vacuum receiver which allows for the break of the vacuum and the release of the material from the gas stream. This receiver includes a reverse jet filter, which is pulsed when the vacuum breaks to allow for cleaning of the filter media. The outlet of the receiver includes a valve, either flap type or butterfly. This valve is sequenced to open after the vacuum breaks and the filter has been pulsed, thus delivering product to the process below.

## Conveying of Capsules and Tablets

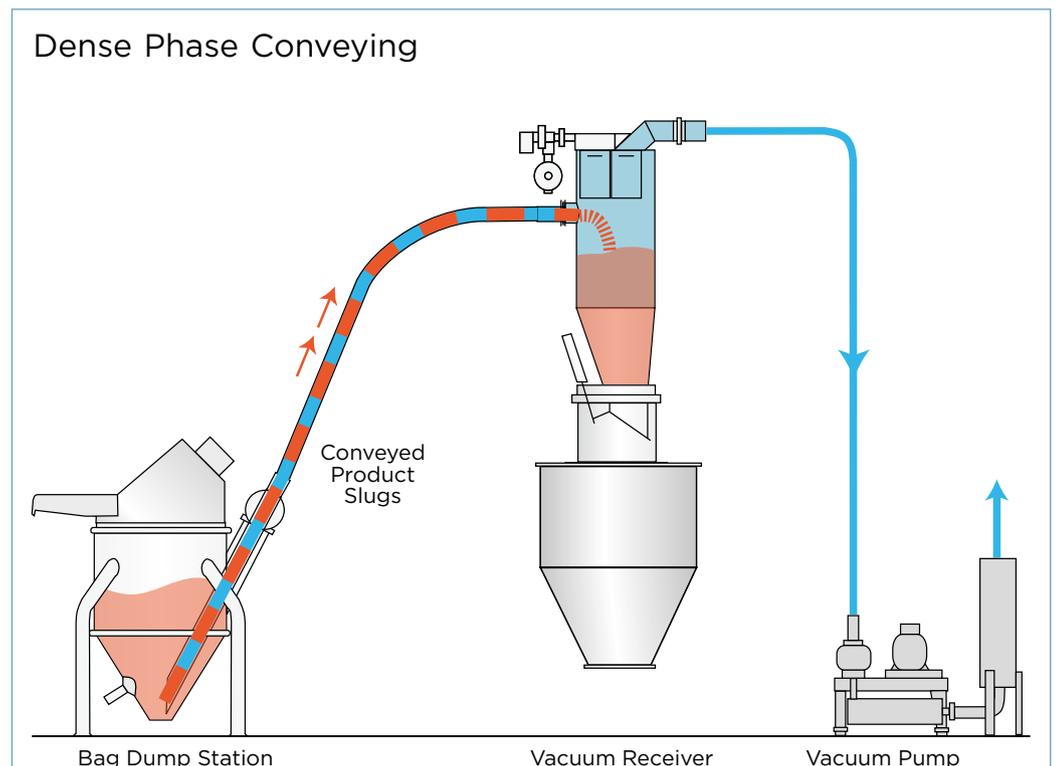
The conveying of filled capsules or tablets requires special modifications to the pneumatic receiver in order to avoid any damage to the product. Due to the individual particle density of filled capsules or tablets, and their overall higher mass, a lower overall velocity of the individual tablet is achieved. In



P-Series receiver in mirror finish



Pickup hopper



# Dilute and Dense Phase Vacuum Conveying for Tableting Operations

other words, a small granulate weighing much less will move a lot faster in equivalent gas velocities than a tablet the size of an aspirin. In order to balance the higher required gas velocities, the inlet to the receiver is tangential and expanded, to allow for a natural deceleration of the product before it enters the receiver. In addition, the receiver is often lined with a soft food grade rubber liner to avoid any product degradation which may occur after impact to a standard stainless steel receiver.

## Typical Pharmaceutical Applications for Pneumatic Conveying

- › Direct Blender Loading
- › Inline Conical Screen Milling
- › Inline Sieving
- › Tablet Press Loading
- › Granulator loading/unloading
- › Fluid Bed Dryer Unloading
- › Tablet/Capsule Conveying
- › Refill of Coperion K-Tron Pharmaceutical Screw Feeders for loading of continuous processes such as mixing, milling/micronization and extrusion

## Coperion K-Tron Advantage

- ✓ The P-Series pneumatic receivers are all designed with ease of cleaning and maintenance in mind
- ✓ All components include a quick clean, easy disassembly design complete with fully welded and polished housings and triclover clamps/ferrules
- ✓ All product contact parts are constructed to conform with strict cGMP standards and are standard in 316 stainless steel
- ✓ Each pneumatic solution is custom developed according to the process application, based upon Coperion K-Tron's extensive experience in providing material handling solutions



P Series vacuum receiver disassembled for cleaning



Special lined receiver and expanded inlet for tablet/capsule conveying



[www.coperionktron.com](http://www.coperionktron.com)

Manufacturing plants:

**Coperion K-Tron Pitman, Inc.**  
590 Woodbury-Glassboro Rd  
Sewell, NJ 08080, USA  
Tel +1 856 589 0500  
Fax +1 856 589 8113  
E-mail: [info@coperionktron.com](mailto:info@coperionktron.com)

**Coperion K-Tron Salina, Inc.**  
606 North Front St.  
Salina, KS 67401, USA  
Tel +1 785 825 1611  
Fax +1 785 825 8759  
E-mail: [info@coperionktron.com](mailto:info@coperionktron.com)

**Coperion K-Tron (Switzerland) LLC**  
Lenzhardweg 43/45  
CH-5702 Niederlenz  
Tel +41 62 885 71 71  
Fax +41 62 885 71 80  
E-mail: [ks@coperionktron.com](mailto:ks@coperionktron.com)