

## Background

Conical Screen Mills (also referred to as Cone Mills) are gentle size reduction mills which are often used to pre-condition the material prior to its entry into a process, either by delumping or coarse size reduction. These mills utilize a rotating propeller/stationary screen combination to gently compress material against the screen wall and size the material accordingly. Vacuum conveying is often used to move material through the conical screen mill, help improve overall throughput of the process, contain dust or exposure, and also to assist in improvement of end product quality.

## Dilute Phase Principle

Typical dilute phase conveying operations involve materials where segregation in the conveying line is not a concern. Comparative 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 many cases the conveying medium is air. However, in the pharmaceutical industry nitrogen is often used due to the relatively low volumes of gas used to convey relatively short distances. Nitrogen offers two benefits: it can inert the process when conveying highly explosive materials, and it is a naturally pure gas which does not need added filtration. As an alternative to the vacuum pump, a venturi can also be used for applications that require short conveying distances and minimal lift requirements.

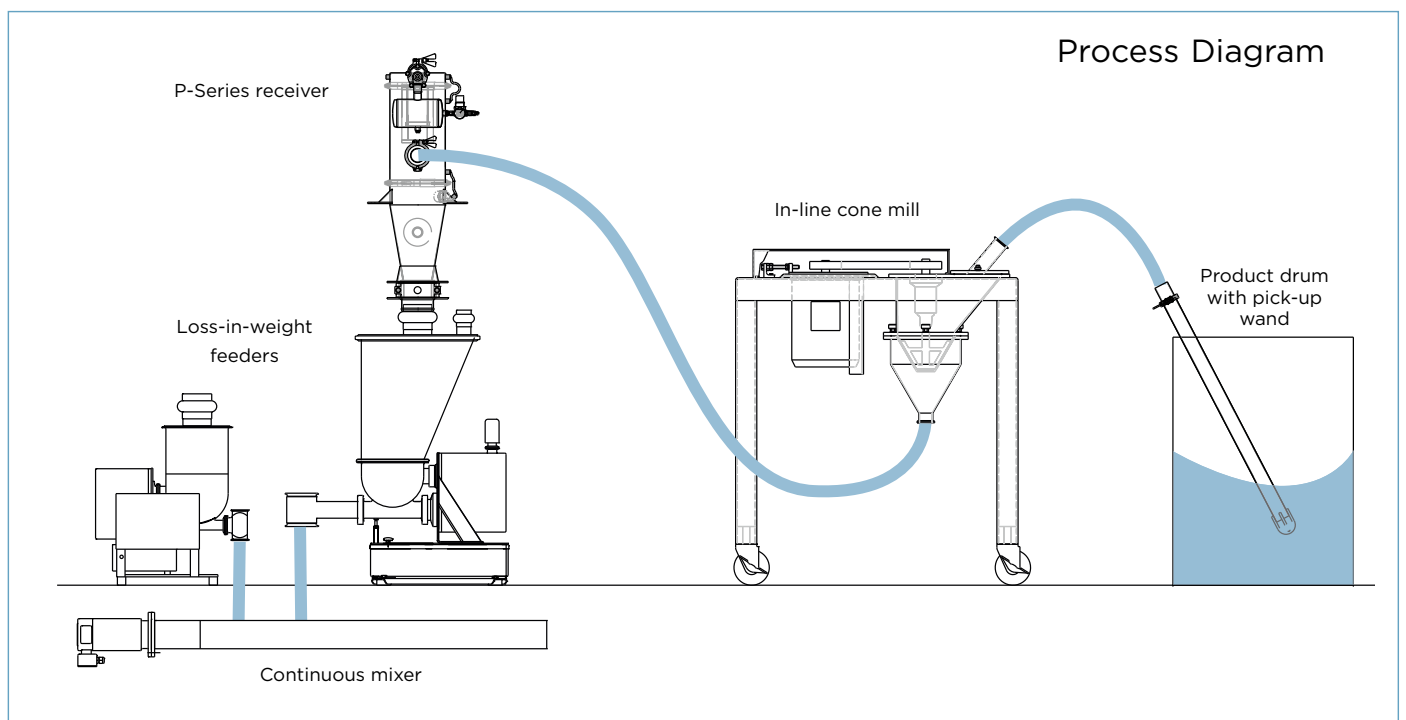
After conveying through the specified equipment, the material is delivered directly to a vacuum receiver, which allows for the break of the vacuum and the release of the material from the gas stream. This receiver includes a reverse jet filter, which is pulsed when the vacuum breaks to allow for cleaning of

the filter media. The outlet of the receiver includes a valve, which is chosen based upon the material characteristics and process requirements. Typical valve types include butterfly valves, (both single and split butterfly for high containment), pneumatic flaps and rotary valves. The discharge valve is sequenced to open after the vacuum breaks and the filter has been pulsed, thus delivering product to the process below.

The source of vacuum for the process is a vacuum pump. When sizing this pump, the complete system is reviewed, inclusive of the pressure drops throughout the process equipment in question. In addition, an in-line HEPA (High Efficiency Particle Arrestment) filter can also be used at the exhaust of the receiver, in order to protect the pump from any dust which may bypass or penetrate the primary filter in the receiver and avoid any release of this dust in the pump exhaust.



P-Series P10 receiver in mirror finish



# Conveying through Conical Screen Mills

In-Line Dilute Phase Vacuum Conveying for Conical Screen Mills



## Application Details

When conveying through process equipment, the system must of course be sealed and suitable for operation under vacuum. Such equipment includes flat deck or rotary sieves/screeners and conical mills.

In each of these cases, the material can be picked up from a variety of sources, including drums, bag dump stations, IBC's (intermediate bulk containers), or pick-up bins/drums as illustrated in the process diagram. Material is then conveyed through the equipment and into the vacuum receiver described above.

In the case of conical screen mills, the operation under vacuum can actually improve the quality of the product. Since all milling is based upon actual residence time in the mill, operating under vacuum actually gets the product in and out faster. This reduces the attrition that may be applied toward the product by added circulation in the milling chamber, thus reducing the amount of fines/dust produced by the mill, and improving the overall particle size distribution of the end product.

The use of pneumatic vacuum in-line operations has inherent containment advantages as well. Since the complete system is closed and under a negative pressure, the product is completely contained within the system, without the product leaks often experienced in positive pressure systems.



Conveying in-line through two mills, the first as a deagglomerator and the second for finer particle size

## Typical Pharmaceutical Applications for Pneumatic Conveying

- Direct Blender Loading
- In-line 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

- P-Series pneumatic receivers are all designed with ease of cleaning and maintenance in mind
- All components feature 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 to strict cGMP standards and are constructed of 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



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