The air-gravity conveyor goes by many names — aeration conveyor, air-activated conveyor, air-gravity fluidized conveyor, air slide, and various proprietary trade names — but no matter what it’s called, this conveyor uses a combination of air and gravity to economically transfer fine, dry, free-flowing materials from one place to another. The air-gravity conveyor can transfer materials short distances — such as a meter or two from the bottom of a storage bin to a process vessel — and longer distances — such as 40 meters (131 feet) or more from a bucket elevator to a series of storage silos.

The air-gravity conveyor has a simple design. It consists of a long, light-gauge steel rectangular duct that can have a closed or open top and is divided horizontally into two sections by a porous membrane clamped between the sections’ connection flanges, as shown in Figure 1. The area below the membrane is the air plenum, and the area above the membrane is the material plenum. The porous membrane allows

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What you should know about air-gravity conveyors

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Lo que debe saber sobre los transportadores por aire

Los transportadores por aire usan una combinación de gravedad y aire de baja presión para transportar materiales empleando relativamente poca energía. Además de describir el funcionamiento de este tipo de transportadores, el siguiente artículo responde a las preguntas más frecuentes sobre su utilidad y beneficios.

Was sie über eine Luft-Schwerkraftförderanlage wissen sollten


Figure 1

Air-gravity conveyor
(usually) low-pressure air to flow from the air plenum, through the membrane, into the material plenum to fluidize the material to be conveyed. The conveyor has a material inlet, an air inlet, and a material discharge. A positive displacement fan or blower supplies the air to activate the fluidization.

**Fluidization reduces the material’s angle of repose, allowing for a much more practical slope for the conveyor.**

The conveyor is installed at a slight downward slope to allow gravity to do much of the work of conveying the material. The slope angle is determined by the material’s fluidized angle of repose. To convey entirely by gravity, the conveyor would have to be installed at an angle steeper than the material’s angle of repose. For instance, a load of fly ash with a 47-degree angle of repose (Figure 2a) could only be gravity-conveyed if the conveyor’s slope was more than 47 degrees (Figure 2b), which would greatly limit the horizontal distance it could be conveyed in most installations. But fluidization reduces the material’s angle of repose, allowing for a much more practical slope for the conveyor. For example, the fly ash mentioned above could be easily transferred by an air-gravity conveyor with a 4-degree slope (Figure 2c).

The following questions and answers provide more detailed information about the air-gravity conveyor’s capabilities and applications.

**What are the conveyor’s main disadvantages?**

The conveyor is sensitive to changes in the characteristics of the material it’s conveying. If the material changes particle size or shape to become less fluidizable, or if the material’s moisture content increases, conveying problems may arise.

Also, the conveyor requires a downward slope, so if the conveying distance is long, there may be a headroom problem as the conveyor nears its endpoint.

**What are the air-gravity conveyor’s main advantages?**

The conveyor provides gentle conveying and needs almost no maintenance because it has no moving parts. This also means that it produces little noise. It’s easy to clean, and the most vulnerable part of the conveyor — the permeable membrane — may not need to be replaced for 10 years or more.

The conveyor takes up very little space in the plant. It’s installed overhead, so it takes up no floor space. And the closed conveyor is dust-tight, eliminating contamination and cleanup concerns.

In addition, the conveyor is energy-efficient and economical to operate because it relies on free gravity for much of its conveying power. The air used to fluidize the material is usually low-pressure air, so its cost is minimal.

**What kinds of air pressures are we talking about?**

Typically, the air-gravity conveyor operates with low pressure up to about 703.1 mm H₂O (0.07 bar, 1 psig). The conveyor can also be used to provide fluidization to storage bins and silos. In such a case, a medium-pressure positive displacement blower supplies the air at pressures up to 0.7 bar (10 psig).
If a material’s characteristics change only slightly, or if the conveyor is going to be used for a different type of material than it was designed for, can the conveyor adapt?

Yes, up to a point. The conveyor’s slope and design air velocity are based on the angle of repose of the material to be conveyed. The air fluidizes the material, giving it a new fluidized angle of repose. Materials with different angles of repose can be handled in a single air-gravity conveyor. However, different materials can affect the conveying capacity. Materials with a higher fluidized angle of repose will have a reduced flow velocity, resulting in a lower throughput. Materials with a lower fluidized angle of repose will have an increased flow velocity, resulting in a higher throughput. Many times, an increase in airflow will reduce the fluidized angle of repose, allowing more difficult materials to flow on existing conveyors.

When would you use an open-top air-gravity conveyor?

Open-top air-gravity conveyors can be used in a storage bin or silo to aid material discharge. In such a case, the required number of conveyors is installed equidistantly around the discharge hopper’s interior wall. The air passing through the conveyors’ permeable membranes fluidizes the material entering the hopper so gravity can easily carry the material to the discharge outlet.

What kinds of materials are best suited to air-gravity conveying?

The best materials for this type of conveying are fine (typically passing 50 mesh or smaller), dry, free-flowing, fluidizable powders, such as cement powder, talc, copper concentrate, alumina, resin, silica, and many more. The conveyor can handle abrasive materials as long as they’re fluidizable; because they’re moving on a cushion of air above the permeable membrane, they generally won’t cause abrasive wear.

Materials with large particle sizes or high surface moisture usually won’t fluidize well, so they aren’t suitable for this conveyor. For example, pebble lime, beach sand, rock salt, and wood chips don’t convey well in this conveyor. Also, very hot materials may not be suitable because they’ll damage the permeable membrane, although some membrane materials can handle materials up to 538°C (1,000°F).

What’s the permeable membrane made of?

The membrane is usually made of a polyester fabric, which may be woven or needle-felted. Several different fabrics are available, with standard and proprietary characteristics, to suit different applications. Special fabrics handle high temperatures and highly abrasive materials or dissipate static.

What kind of distance and capacity does an air-gravity conveyor have?

Conveying distance is limited only by the headroom needed for the conveyor’s required slope. Conveyors longer than 61 meters (200 feet) aren’t unusual. However, there’s no limit to the conveyor length as long as the physical area allows for the slope required for the distance.

Air-gravity conveyors are available in widths from about 100 to about 850 millimeters (4 to 34 inches), and typical design capacities range from 20 m³/h (720 ft³/h) to 2,460 m³/h (87,000 ft³/h) and even higher.

Does an air-gravity conveyor operate only indoors?

No, it can operate in both indoor and outdoor applications. The closed air-gravity conveyor is dust-tight and sealed against the elements. The permeable membrane is sealed along the exposed edges to prevent moisture wicking. In addition, the fabricated steel top section has a weather lip that overlaps the flange between the top and bottom sections to further protect the conveyor and its contents from the outdoor elements.

Can an air-gravity conveyor be used in sanitary applications?

Yes, it can. The conveyor can be constructed of aluminum or stainless steel and can have an FDA-approved permeable membrane fabric.
What if multiple inlets and discharges or directional changes are needed?

An air-gravity conveyor is extremely flexible. It can have multiple inlets and outlets and can be designed with different legs going in different directions to fit around equipment or natural obstacles (Figure 3). Typically, even for a long, complicated layout, the conveyor has a single power source, although it needs an air connection about every 30 meters (100 feet). Each corner in the multiple-direction layout has a turnbox, which is a simple tubular “box” that can be connected to multiple conveyor legs at different angles. Multiple conveyors can also merge at a turnbox.

For further reading

Find more information on pneumatic conveyors in articles, books, and webinar recordings listed under “Pneumatic conveying” in Powder and Bulk Engineering/International’s article index on PBE/I’s website, www.pbeinternational.com. Additional articles, including ones on air-gravity conveyors, can be found in Powder and Bulk Engineering’s Article Archive. (All articles in PBE’s Article Archive are available free to registered users.)

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