The Airslide™ air activated gravity conveyor.

Powder Bulk Engineering/International

Airslide™ Air Activated Gravity Conveyor

1. The air- gravity conveyor is fabricated from light gauge steel in the form of a box. The Airslide™ box is designed with a material chamber in the upper portion of the fabrication while the lower chamber is the air plenum. The two chambers are separated by a porous membrane material, which permits a predesigned low pressure air flow to flow from the air plenum chamber to the material chamber fluidizing the material to be conveyed. In the case of silo or bin fluidization, the top section of the conveyor can be removed and the lower section with the aeration media can be used as an open type conveyor inside the silo or bin.

   The Airslide uses the principle of air fluidization and gravity to change the flow characteristics of many materials by allowing the material to take on the same flow principles as a liquid.

   The typical installation consists of a material inlet section, and outlet section complete with an air connection and inspection ports. Additional components such as flow control valves, turn boxes, side discharge sections and stream splitters can be used to increase the flexibility of the equipment layout.

   Low pressure air supplied from a positive displacement fan or blower is used to activate the fluidization and conveying of powdered materials.

2. **Main Advantages** - The major advantages of the air activated gravity conveyor are low maintenance with no moving parts which means no operational noise with the exception of the air supply source and minimal wear, clean operation and layout flexibility.

3. **Main Disadvantages** - The main disadvantages of the air activated gravity conveyor are the sensitivity to changes in the physical characteristics of the material conveyed. Fluidization of dry free flowing powders is essential. Should the material fineness change significantly or the surface moisture content change, the flowability of the material will affect the application of the equipment. Since gravity does the majority of the work in the movement of material, another disadvantage is the conveyor cannot move material in an upward slope. Because the Airslide requires a downward slope a
disadvantage could be the headroom required for the installation over a long conveying distance.

4. **Operational Air Pressure** - Typically the air gravity conveyor operates with low pressure air supplied by fans with pressures up to approximately 1 psig (703.1 mm/H₂O). When providing fluidization to small bins and storage silos, medium pressure positive displacement blowers with pressures up to 10 psig (7031 mm H₂O) are used. Special designed Airslide pads can be fabricated that are used for fluidized blending in large silos where compressors provide air at pressures up to 40 psig (2.75 bar).

5. **Acceptable Materials** - Materials best suited for the air gravity conveyor must be dry, free flowing materials that fluidize well when air (or similar gas) is introduced to the material. The list of materials is quite long including products like Cement powder, Diatomaceous Earth, Flyash, Talk, Starch, Flour, Copper Concentrate, and Alumina. The list goes on with a great deal more products.

6. **Unacceptable Materials** - Materials that are not suited for the air gravity conveyor are any material that will not fluidize well. This may be due to very large particle size or materials with high surface moisture content. Also, due to limitations of the fluidizing media, temperature of the product would limit the use of the conveyor. Materials above 1,000° F (538° C) would not be a good application. Cement Clinker is an example of both hot and very coarse material that would not be acceptable. Other products such as Pebble Lime, Beach Sand, Rock Salt and Wood Chips would not be a candidate for air gravity conveyors.

7. **Angle of Repose as related to Conveyor Slope** - When a dry free flowing powdered material is poured on a flat surface, it creates a pile. The angle formed by the pile is known as the Angle of Repose. Without any form of assistance, the pile must be tipped to an angle, greater than the Angle of Repose, to establish flow by gravity. With “fluidization”, the Angle of Repose becomes greatly reduced and gravity flow is easily achieved. The fluidized angle of repose provides indication of the required conveyor slope for conveying. Each material will have its own angles of repose depending on the physical characteristics of the material. Varying the gas flow through the porous media will increase or decrease the slope required for best operation.

8. **Materials with different angles of repose** - Materials with different angles of repose can be handled on a single air gravity conveyor. However, depending on the relationship of the new fluidized angle of repose of the new material to the original material, the capacity may be affected. Materials with a higher fluidized angle of will have a reduced flow velocity resulting in a lower capacity throughput. Materials with a lower fluidized angle of repose will have an increased flow velocity resulting in a higher capacity output. Many times an increase in air flow will reduce the fluidized angle of repose allowing more difficult materials to flow on existing conveyors.
9. **Indoor or Outdoor Operation** - The air gravity conveyor is designed to operate in both indoor and outdoor applications. The conveyor design is dust tight and sealed against the elements. The fabric media is sealed along the exposed edges to prevent a wicking effect of water on the fabric media. In addition, a weatherlip is designed on the fabricated steel top section to overlap the flange between the top and bottom section to further protect the conveyor from the outside elements.

10. **Multiple Inlets and Outlets** - The air gravity conveyor can be designed with multiple inlets and outlets making the conveyor extremely flexible.

11. **Conveyor Distance and Capacity** - Conveying distance is only limited by the headroom required due to the required slope of the conveyor for proper material transfer. Conveyors in excess of 200 feet (61 meters) have been used to transfer material from point to point. However, there is no limit to the conveyor length as long as the physical criteria of the area allow for the slope required for these distances. With regard to capacities, these vary depending on the supplier. Typical design capacities range as low as 720 ft³/hour (20 m³/hour) to as high as 87,000 ft³/hour (2,460 m³/hour) and some higher.

12. **Choosing this type Conveyor** - There are a number of factors that determine the choice of the air gravity conveyor by a company. Factors such as Maintenance, Power, Flexibility, Environment, Capacity and at times Cost are the major deciding factors. When you mention conventional pneumatic conveying I assume you are referring to pipeline conveying. Obviously, the pipeline conveyor is best suited for long distance applications where there are vertical legs required when moving material. As long as there is all horizontal conveying, the air activated gravity conveyor would be recommended based on the advantages listed above. Mechanical conveyors such as screw conveyors and belt conveyors are the closest match for comparison to the air gravity conveyor. Maintenance, power, environmental and cost are typically the disadvantages for the mechanical application.

13. **Compare Capital and Operating Expenses** - I don’t believe we have ever done a detailed comprehensive study. For sure the operating expense is lowest with the air activated gravity conveyor. As long as the end user maintains clean dry air for fluidization protecting the fluidization media, maintenance is almost zero for a long period of time. Material wear can be reduced by adding protective screen above the fabric media further extending the life of the conveyor. Mechanical equipment such as screws and belt conveyors have a great deal of moving parts which required constant attention. As far as capital cost, the air gravity conveyor is definitely lower per unit length as compared to a screw or belt conveyor.

14. **Conveyor “Footprint”** - In general the footprint for the air gravity conveyor is smaller than that required for mechanical conveyors, with possibly the exception of headroom. Mechanical screw or belt conveyors are generally horizontal when compared to the air gravity conveyor. Due to the slope required to convey with the air gravity
conveyor, the headroom required may be considered a disadvantage. Supporting structures required for support and installation of mechanical conveying equipment will consume a greater footprint.

15. **Energy Comparison** - The energy consumption for the air activated gravity conveyor is lower when compared to screw or belt conveying equipment.

16. **Airslide Configuration** - The layout flexibility shown in the FLSmidth literature is commonly used by all manufacturers of similar product. Each supplier has some unique features that distinguish each from one another. Most suppliers have the same flexibility in layout when it comes to the application of this type conveyor.

17. **Airslide Turnbox** - The turnbox is a simple means to change direction. The turnbox is a lower cost alternative to a curve section or a mitre curve section which require complex angles to horizontal plane for the fabric media. The turnbox also provides a means to offer multiple inlets or discharges. As a result multiple conveyors can merge to a single Turnbox. Likewise the same with discharging conveyors.

18. **PDF File by Len Schwartz** – I do not have access to that file. As a result I cannot comment on this comparison. You need to confer with Dave Bergenstock concerning the content.

**Bio Information** - LESLIE C. BARTHOLOMEW, JR.

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**Scope of work at FLSmidth:**

Les Bartholomew is the Cement Market Manager for pneumatic transport systems part of the Customer Service Division at FLSmidth, Inc. He has been with the FLSmidth group for 41 years providing material handling systems including blending and storage. A graduate from Penn State University in mechanical engineering, Les holds a patent for material blending and a patent for cement storage.

The latest published work includes Chapter 4.3 “Conveying Systems” included in the PCA Publication “Innovations in Portland Cement Manufacturing”.