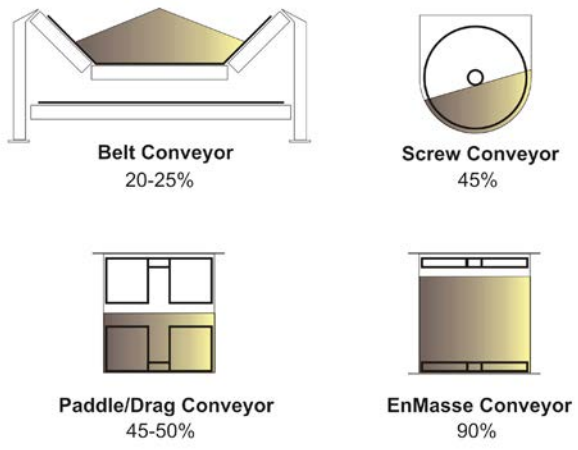
TECH BRIEF
Common Conveying Technology Comparison

The Most Efficient Conveying Technology for Bulk Material Handling

A material movement concept harnessed in the 1930's in the agricultural farming industry, En-Masse Drag Chain conveying is, by volume, the most efficient use of space to material ratio of any conveying technology. The operation of this conveyor type is derived from a moving a skeletal chain and flight assembly through a rectangular section of material. The principal of material movement is based on the motion imparted on the bottom surface of the trough by the chain, coupled with the shear friction between the particles conveyed.

Figure 1 demonstrates the effective utilization of space as compared to other typical conveying technologies. The efficient material movement principal of En-Masse conveying allows for high-volume material flow in a relatively small conveyor housing. This means when compared to other types of bulk material conveying options, the En-Masse Drag Chain Conveyor will use less floor space, require a smaller drive, it will use less energy to operate, and it will have a lower maintenance cost over the life of the equipment over other conveyors.

FIGURE 1



Comparison of effective utilization of space versus physical size of conveying media.

Common Conveying Technology Comparison

Belt Conveyors

Belt conveyors have the greatest advantage in distance, carrying material for miles across open terrain, and hundreds of feet from mines and pits into processing facilities. Depending on the material bulk density and distance, belt conveyors can also have a very high capacity rating. For example, recommended belt speeds for coal and other mining applications is 800 fpm with a belt width of 42-60", (http://www.kmg.agh.edu.pl/sites/default/files/pdf_BeltConveyorsCalculationsCEMA5_eng.pdf). As a comparison a non-abrasive mined mineral may have a speed of 200 fpm in an En-Masse drag conveyor. However, because approximately 20% of space is actually used for conveying, the physical size and space required for a belt conveyor is significant over other conveying technologies. In addition, there are many wear points on a belt conveyor and external dust controls systems are needed when the conveyed material is hazardous, very dusty, potentially explosive, or is corrosive.

Screw Conveyors

A screw conveyor is another technology type that is also very common for conveying bulk materials. The screw type conveyor is suitable for a wide range of material types, has a relatively simple operating principle and structure, and it has a low initial purchase price when compared to other conveying technologies, (http://www.fml.mw.tum.de/fml/images/Publikationen/EngMeet2000.pdf). In addition, a screw conveyor has an enclosed housing which makes the equipment inherently more safe and requires less external equipment to limit dusting and contamination over an open style belt conveyor. Regardless of simplicity, a disadvantage of the screw conveyor design is the required horsepower as a ratio of the capacity. The principal operation of a crew conveyor is based on friction and therefore required torque to achieve mass flow requirements can be significant depending on material type and bulk density. Another disadvantage of frictional mode of operation in screw conveyors is the degradation of material. A study of conveyed Prilled Sulfur conveyed in a screw conveyor showed a 6% degradation of material ranging from chipped to crushed, (http://www.fml.mw.tum.de/fml/images/Publikationen/EngMeet2000.pdf).

Pneumatic Conveying

The other typical, non-mechanical conveying technology is pneumatic conveying. Pneumatic conveying has several forms; dense and dilute phase where there are advantages and disadvantages of both, Figure 2 in general there are some common characteristics based on application needs. For example, a pneumatic system has the advantage of

layout flexibility and directional changes. This is especially important when in-plant conveying must work around infrastructure, processing equipment, elevation changes, and multiple discharge points. The disadvantages for most pneumatic systems are why many processors struggle with implementation and maintenance; low hourly capacities when compared to some mechanical conveyors, a very high horsepower ratio to tonnage handled, velocity and material flow creates wear points and the operating principle creates high maintenance requirements.

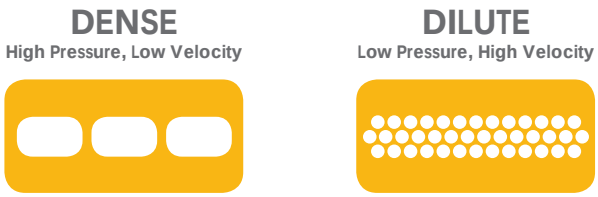


FIGURE 2

Common Pneumatic Conveying System Types

Dense Phase works with:	Dilute Phase works with:
Very fragile materials and mixtures, as the low speed and lower air volumes prevent materials from breaking down.	Non-abrasive and non-fragile materials with a light density.
Best for low- or high-rate transfer of abrasive or friable materials, as the slow convey speed reduces abrasion of convey lines	Certain batching systems
Slightly hygroscopic materials, without requiring the introduction of air drying equipment because air quantities required for dense phase are significantly lower than that of semi-dense and dilute.	Examples: Flour, cornstarch
Examples: Sand, sugar, carbon black prill	

Conveying Technology Summary

There are many types of conveying types for bulk process manufacturers to choose from. When selecting a conveyor type, the best advice is to compare the operating conditions of the conveyor with the type of material to be conveyed coupled with the capacity and operating needs of the application. Figure 3 offers a summary of each of the main conveying methods available to industrial processors. This summary is general because each application will be unique and design conditions different; therefore, a discussion with a trusted conveyor manufacturer and system designer is recommended.

FIGURE 3

Conveyor Technology Comparison Chart

Conveyor Type	Effective Utilization of Space	Maintenance	Enherently Safe/Dust Containment	Total Cost of Ownership	Analysis
Belt	Not efficient	High	No	High	Good selection for high capacity over long distances
Screw	Somewhat efficient	Mid-Range	Yes	Low	The best conveyor choice for moving non-friable material short distances
Pneumatic	N/A	High	Yes	High	A good choice when directional changes are required to move materials across plant
En-Masse Drag	Very efficient	Low	Yes	Low	The best conveying option for moving a wide range of bulk materials in a small conveyor footprint and low horse power requirements

ABOUT CDM SYSTEMS

For more than 40 years, CDM Systems has provided the best in En-Masse conveyors and conveying systems that set the industry benchmark for quality, dependability, and operational efficiency. We use our material handling experience and industry knowledge to solve the most difficult bulk transportation challenges. Our conveying systems are specifically designed for reliable 24/7 operation in aggressive and high-temperature applications. Whether unloading trucks, railcars, or vessels, or moving commodities within a process facility, we provide the technical support and the right equipment designed specifically for your needs.

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