



Controlled **Low Velocity**

dense-phase pneumatic conveying
& injection systems

Macawber

Welcome to Macawber Engineering, Inc

Macawber Engineering is the parent company of the Macawber Group of companies. Since its establishment in 1977 the company has remained focused on its core technology to achieve the highest level of expertise in Low Velocity Dense-Phase Pneumatic Conveying for fragile and abrasive bulk materials and advanced methods of Bulk Material Injection Systems for Pressure Processes.

Today, over 10,000 systems later, the Group has a worldwide reputation as a supplier of reliable and cost-effective systems for a wide variety of applications from lime to peanuts, coal to baby powder and everything in between covering every process industry involving bulk materials handling.

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System Performance and Reliability

Macawber Engineering's successful approach focuses on providing a system design most appropriate to each customer's unique requirements, while ensuring that an optimal systems performance and reliability is achieved at the lowest possible initial cost and providing many years of positive return on original investment.

Total Materials Handling Solution Provider

Macawber Engineering's expertise and experience lends itself to other areas in bulk materials handling and its product range now also includes complimentary products, such as mixers, weighing systems, inflatable seat valves, and complete turnkey installations.

Markets

Each process industry has to consider a variety of industry and customer specific issues when choosing pneumatic conveying or injection equipment. With over 40 years of experience working around the world, with almost every type of process industry, Macawber Engineering brings an unmatched level of experience and knowledge to share with every customer in each market division. In addition, Macawber Engineering's product groups are designed to apply across a range of markets, being able to serve customers in the following industries:

- Basic Metals
- Chemicals
- Food/Pharmaceuticals
- Plastics/Resins
- Minerals
- Pulp/Paper
- Utility Power Plants
- Miscellaneous processes and applications

Quality, Manufacturing and Testing

The company is ISO 9001 Quality Assurance certified. In addition, all products undergo rigorous factory testing prior to delivery.

A common Macawber Group quality program ensures that all systems delivered, regardless of point of origin, meets the requirement of the corporation and all local and state requirements.

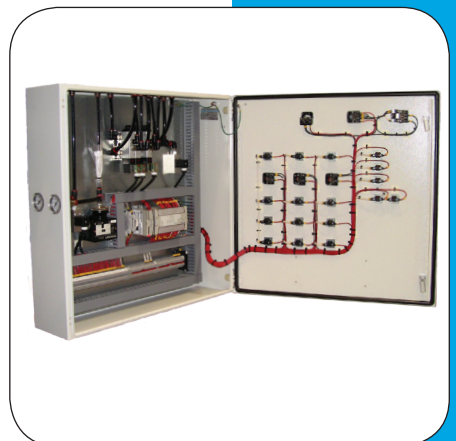
Manufacturing of our standard parts take place in our regional factories located in the USA, UK, China, India and Brazil.

Complete product testing can be carried out in a purpose-built test laboratory. Full material profile characteristic can be defined as well as demonstrated in conveying circuits up to 2800 feet.

Worldwide

Macawber Engineering activities are worldwide with integrated cooperation with other Macawber Group of companies in the United Kingdom, South America, India and China, ensuring consistent best practices for design and application.

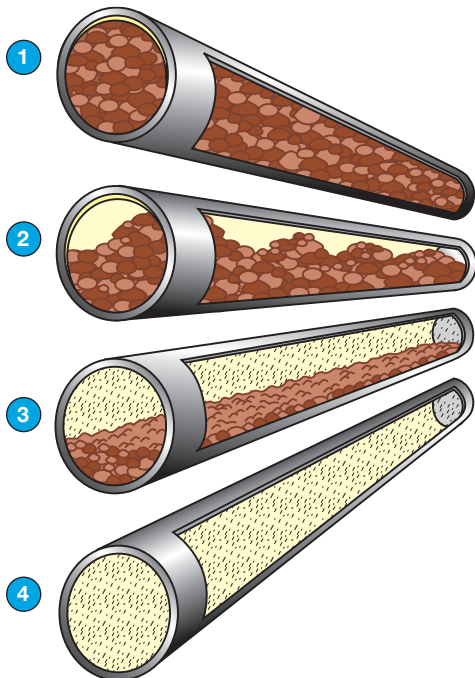
In addition, Macawber Engineering partners with associate companies with well established reputations for advanced bulk handling systems.



Understanding Pneumatic Conveying makes vital decisions much easier

Selecting the correct pneumatic conveying regime for your requirements is a vital decision for a successfully designed system.

Typical Conveying Regimes



- 1. Solid Dense Phase** - Very low material velocity, pipeline full of material - regime for fragile materials.
Material velocity 3-6ft/sec.
- 2. Dune Flow Dense Phase** - Low material velocity - with highline loading ... material moves in plug flow fashion - best regime for most applications in which power economy, pipe erosion, and material degradation issues are important.
Average material velocity 3-16ft/sec.
- 3. Moving Bed Dense Phase** - Higher velocity than dune flow dense phase, but much lower than dilute phase.
Used for handling powders that can be fluidized.
Average material velocity 10-23ft/sec.
- 4. Dilute Phase** - Material velocity above the saltation velocity - no upper limit to the velocity - least attractive regime for operating economy - unsuitable for fragile or abrasive materials or materials with wide particle size distribution.
Average material velocity >50ft/sec. depending on material.

Almost all applications will benefit from a regime providing the heaviest pipeline loading and the lowest material velocity. The main benefits of low velocity pneumatic conveying are:

- Lowest air consumption and energy cost per ton of material transferred
- Little or no pipeline wear over very long periods
- Little or no degradation of fragile materials conveyed
- Small reception hopper filters
- Segregation of conveyed mixtures avoided
- No product loss due to material spillage
- Environmentally acceptable



The Scientific Approach

Macawber Engineering's philosophy is a scientific approach to design with unmatched innovation and experience. We realize that every system is different and each company has different needs.

Therefore, before we present any recommendations, we carefully review the two major issues of any bulk handling system: material characterization and the system design objectives.

The result? An optimized design for your individual needs, which addresses both technical and economic considerations, backed up with a wealth of experience.



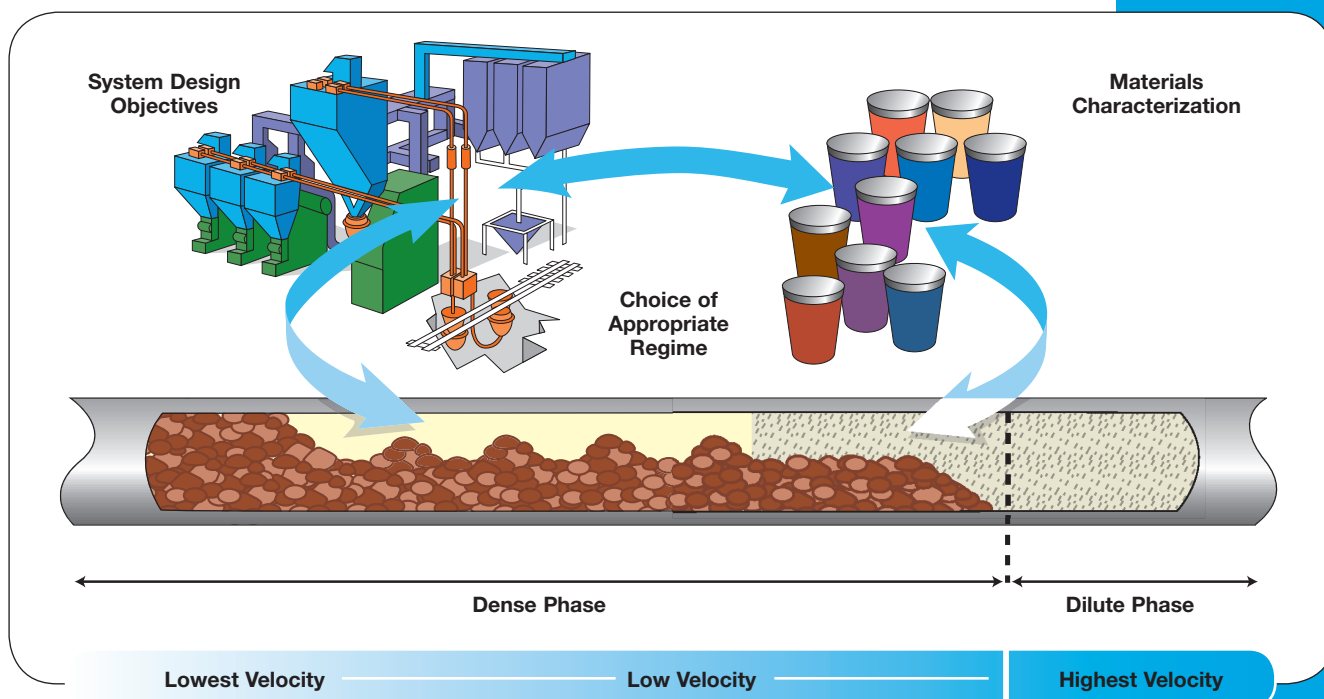
Considerations

Design Objectives

- Transfer rate
- Transfer or injection
- Positive or negative pressure
- Distance and conveying route
- Feed consideration
- Conveying medium type
- Material integrity
- Velocity / pipewear
- Operating cost

Material Characterization

- Particle size and distribution
- Bulk density
- Moisture content
- Flowability
- Chemistry
- Abrasiveness
- Friability
- Temperature
- Permeability



Technology Groups

Macawber Engineering has developed a range of technology groups to reliably and economically satisfy a diverse array of market requirements.

The technology groups collectively respond to the entire spectrum of pneumatic conveying regimes and individually satisfy application-specific needs.



DENSEVEYOR

The ultimate system for handling difficult-to-convey materials; hot, abrasive, and wet materials; or for providing gentle handling of products to prevent degradation of friable materials or separation of blended materials.

SANDPUMP

Designed specifically for dry sand conveying. The Macawber Engineering Sandpump is based on proven dense phase pneumatic principles. Air introduction, simplified system controls, and top discharge have been designed specifically for this use. The Sandpump can be manufactured without custom modifications and sold "off-the-shelf" for fast, easy installation.



MINIDENSEVEYOR

A sensible alternative to high material velocity dilute-phase vacuum or dilute pneumatic conveying systems. High efficiency material transfer without material degradation is achieved in a very compact, low cost system. This is a perfect choice for low transfer rate requirements for fragile food or plastic materials.

MACPUMP

A retrofit for conventional, screw pump conveying systems that reduces power consumption by half, and maintenance costs to almost nothing. Capable of conveying such materials as cement, lime, and fly ash at rates of 275 tonnes per hour up to distances of 7550 ft. The retrofit package is designed to be installed with the least amount of rework to the supply hopper and without change to the pipeline or the existing air source.



SUPERDENSEVEYOR

An important development of the Denseveyor, the SuperDenseveyor achieves a solid dense phase conveying regime for very low material velocities and little or no degradation of the most fragile materials, such as food products.

VARIFLO

Low-cost, simple transfer systems for medium duty applications using a low pressure air source with a unique method of preventing pipeline blockages while maximizing conveying capacity. A distinctive approach for increasing transfer capacity in dilute phase pneumatic conveying systems.



ASHVEYOR

Designed specifically for conveying hot, abrasive ash. The Macawber Engineering Ash Conveying System will convey bottom ash, clinkers, or fly ash from boiler beds, baghouse, or electrostatic precipitators at temperatures up to 300°F, and may be arranged in multiples of one to ten units in a single line. Uses about 50% less power than existing fly ash conveying systems.

CONTROLVEYOR

The Controlveyor provides accurate injection of powders and granular materials up to distances of 1000ft with flow accuracies of 1%. Materials can be injected against high, varying back pressures without loss of accuracy and with smooth, unpulsed flow. 10:1 turndown is provided as standard.





The Incomparable Dome Valve®

The Dome Valve® is unique in its ability to close and seal in one action through a static or moving column of material.

Pressure tight sealing against a pressure differential is achieved with an inflatable elastomeric seal engaging the periphery of the dome component. The inflatable seal entraps particles preventing wear by erosion to the valve seat and seal. These advantages are maintained even through severe application conditions for abrasion, temperature and high pressure.

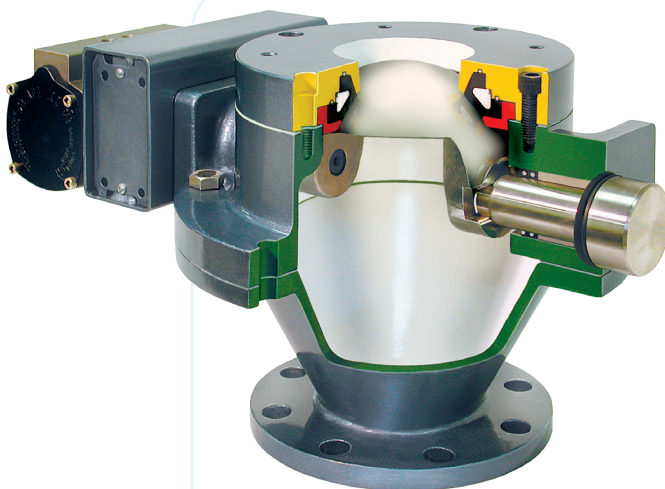
The Dome Valve® is maintenance free with lubricated for life shaft bearings, and is rated at 1 Million cycles between inspections, virtually eliminating costly maintenance and down-time.

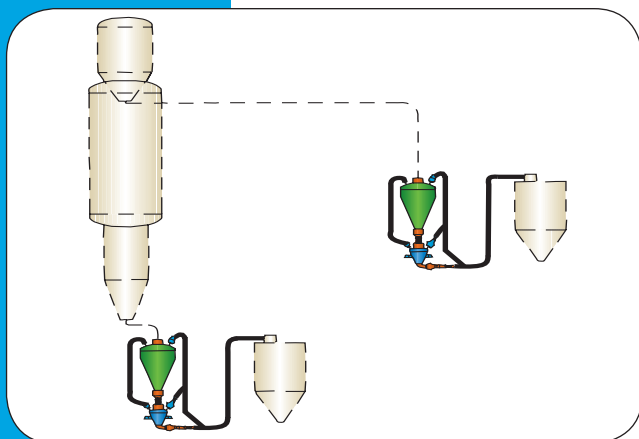
The Dome Valve® is wear compensating.

Every Macawber Engineering system is fitted with a Dome Valve® to ensure operating reliability and system efficiency.

There are tens of thousands of valves in service throughout the world.

Designs available to 36 inches and 100 psi performance, cast iron and stainless steel construction.





Power Plants, China

PRIMARY APPLICATION OBJECTIVES

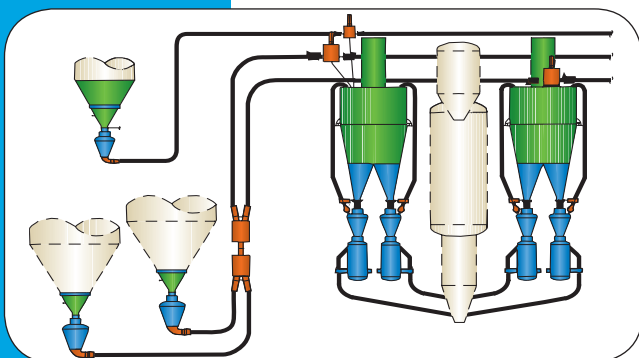
1. Ability to reduce pressure to atmosphere and convey ash at low velocity to a storage bin
2. Weigh and record all material conveyed to the bins
3. Low pipewear
4. Capable of operating at 575°F for sustained periods of time

Each system received material from a cyclone collector which was operating at a 37psi pressure. The ash was discharged by cooling screw into a pressurized surge vessel. The ash was gravity fed into the Ashveyor which had been pressurized to balance with the surge vessel. The Ashveyor then reduced the pressure to atmospheric conditions by venting the gas to an exhaust system. At this point the weigh system recorded the weight of ash in the Ashveyor, and the ash was conveyed by dense phase regime to a storage bin.

BASIC DATA

COARSE ASH ■ 4/8 Ashveyor ■ 1.7 tons/hour at 265ft distance ■ Operating pressure 36psi ■ Design pressure 100psi ■ Operating temperature 212°F ■ Design temperature 575°F **ASH FINES** ■ 4/8 Ashveyor ■ 0.7 tons/hour at 265ft distance ■ Design pressure 100psi ■ Operating temperature 212°F ■ Design temperature 575°F

Gasifier, China



PRIMARY APPLICATION OBJECTIVES

1. Controlled, adjustable accurate stable injection of fuel
2. Infinitely variable feed rate range up to 10:1 turn down from maximum rate
3. Accuracy of flow maintained regardless of process pressure variations
4. Operating reliability

Eight pressurized fluid bed gasifiers were installed to provide town gas for the city of Shanghai in China. Each gasifier was equipped with four feed points and operated at approximately 30psi. The systems supplied were Controlveyor fuel injection systems. Each system (32 in all) comprised a lock vessel and an injection vessel. The lock vessel enabled coal to be taken from overhead storage bins at atmospheric pressure and transferred to the injection vessel operating at 30psi. The coal was injected on a continuous basis directly into the gasifiers. The systems met all primary objectives and are operating with a high degree of reliability.

BASIC DATA

■ 2inch fuel injection systems ■ Injecting .2 inch coal into pressurized gasifiers ■ 4 tons/hour ■ 23 each system ■ Ambient temperature

Peanut Industry, USA

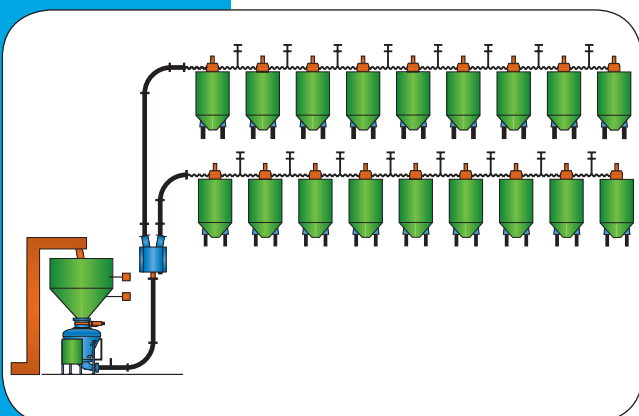
PRIMARY APPLICATION OBJECTIVES

1. Minimum damage to peanuts
2. Minimum peanut meal accumulation
3. Operating reliability
4. Elimination of spillage

Peanuts have traditionally been conveyed using mechanical systems. However, these systems cause spillage and accumulation of peanut meal requiring a high level of maintenance. The pneumatic conveying system had to produce degradation results equal or better than the mechanical system of at least less than 3%. The system supplied was the SuperDenseveyor which uses the solid dense phase method of conveying. The velocities produced were extremely low, and all turbulence and agitation was eliminated. The system completely eliminated spillage and meal accumulation and provided degradation levels of less than 2%.

BASIC DATA

■ 1x5 inch low velocity SuperDenseveyor system ■ 18 reception points ■ 13 tons/hour - 140ft ■ Whole shelled peanuts ■ Ambient temperature



Chemical Developer, [USA](#)

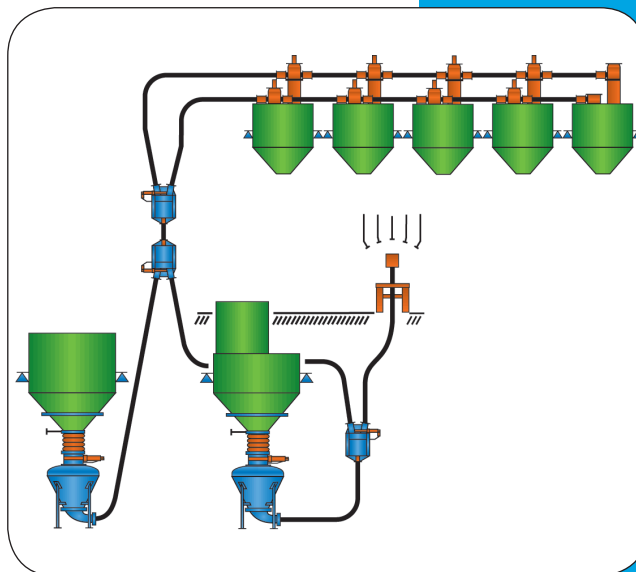
PRIMARY APPLICATION OBJECTIVES

1. Operating reliability
2. Accurate weighment
3. Low operating cost

A loss-in-weight batch weighment control was provided at each Denseveyor transfer unit. Any of six different materials were introduced to the system for pre-weigh and transfer to any of six receiving bins. TiO₂ is an unusual material which exhibits cohesive characteristics from its grain shape even when dry and apparently free flowing.

BASIC DATA

- 6 inch low velocity Denseveyor systems
- 6 reception points
- 140 tons/hour - 690 ft
- Titanium Dioxide (TiO₂) and other materials
- Ambient temperature



Cement Supplier, [China](#)

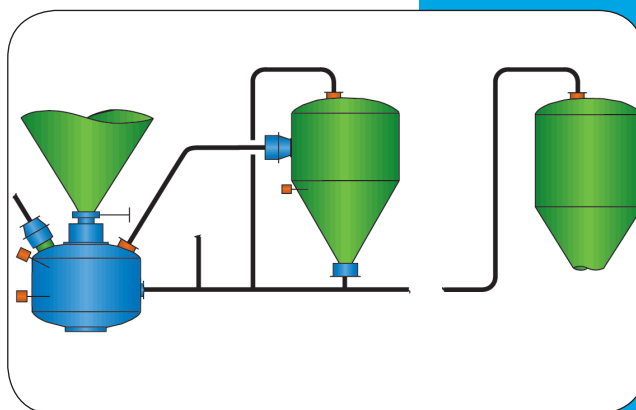
PRIMARY APPLICATION OBJECTIVES

1. Retrofit existing screw pumps re-using existing pipelines and air supply
2. Reduce energy consumption
3. Reduce maintenance costs
4. Optimize conveying rate

Each material was handled by Macpumps using a horizontal configuration. The Macpump transfer vessel was located below the modified existing feed hopper. The material was transferred to the Macpump dispensing vessel which was adjacent to the transfer vessel and connected into the existing pipeline. The Macpump saved between 100 kw and 200 kw per system for a total of 6 systems, exceeding 1300 kw overall savings.

BASIC DATA

- 8 inch Fly ash Macpump Systems
- 3x12 inch Cement Macpump Systems
- 2x12 inch Cement/fly ash mixture Macpump Systems
- Operating temperature ambient (material) 240°F (air)
- Fly ash 55 tons/hour - 950 ft
- Cement 155 tons/hour - 935 ft
- Cement/fly ash 155 tons/hour - 1710 ft



Plastic Plant, [India](#)

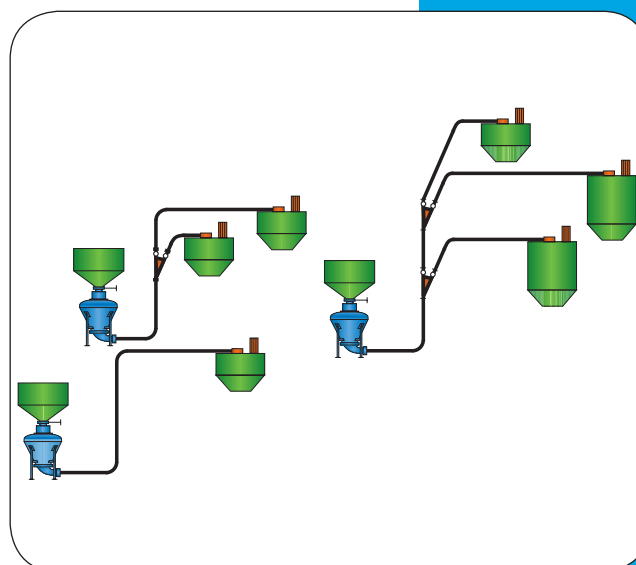
PRIMARY APPLICATION OBJECTIVES

1. Minimum particle size degradation
2. Operating reliability

Customer was very concerned about destruction of the polyester pellet in their new expansion program. The ten systems represented a major investment in upgrading and expanding their production process. In each, particle degradation was negligible, and all contract objectives were achieved.

BASIC DATA

- 10x4 inch low velocity Denseveyor systems
- 2 to 4 reception points
- 5.5 to 11 tons/hour - 200 ft
- Polyester pellets/powder
- Ambient temperature



Resins Facility, Belgium

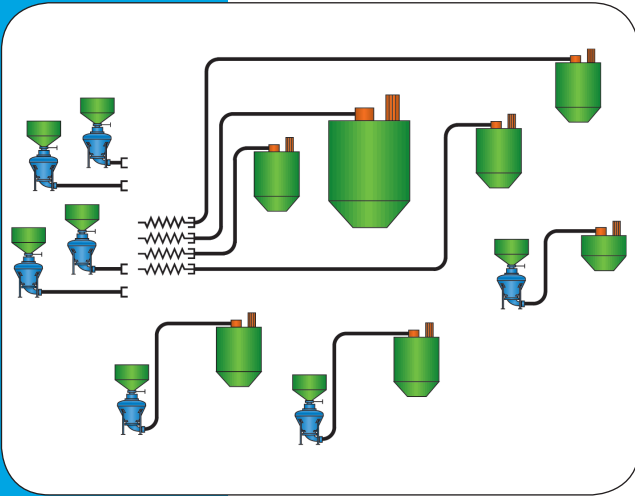
PRIMARY APPLICATION OBJECTIVES

1. Operating reliability
2. Low energy cost

Customer required absolute system performance and operating reliability. The customer researched specialist vendors on two continents for this important expansion to their facilities. The resin powders exhibited unique characteristics, and experience with this material became a fundamental requirement. All systems were installed on time to specification and performed as required.

BASIC DATA

- 7x4 inch low velocity Denseveyor systems
- 2 to 4 reception points
- Resin powders



Foundry, USA

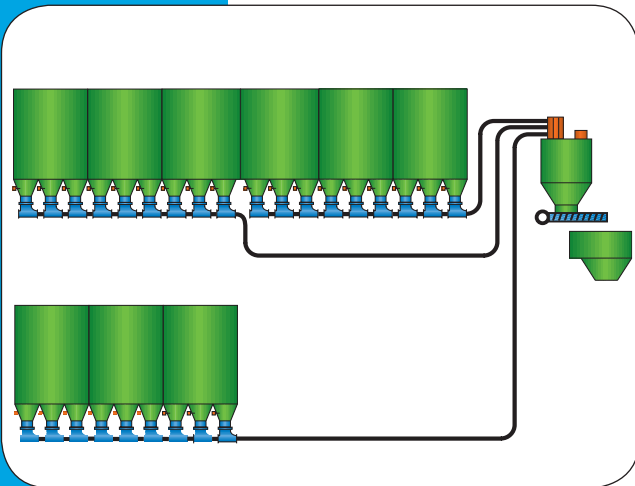
PRIMARY APPLICATION OBJECTIVES

1. Low operating cost
2. Operating reliability

Minimal headroom and extreme operating reliability is the prime design feature of the Ashveyor. In this case, the collected dust from a very large baghouse was required to be transferred to a single day bin for subsequent treatment. The Ashveyor is less than 3.3 ft high, allowing small baghouse support structures. The operating regime of the system prevented dust re-entrainment into the gas flow.

BASIC DATA

- 27x4 inch Ashveyor low velocity units
- 3 independent systems
- 2 tons/hour - 295 ft
- 350°F
- Baghouse dust (cupola) with 5% moisture



Processed Food Plant, USA

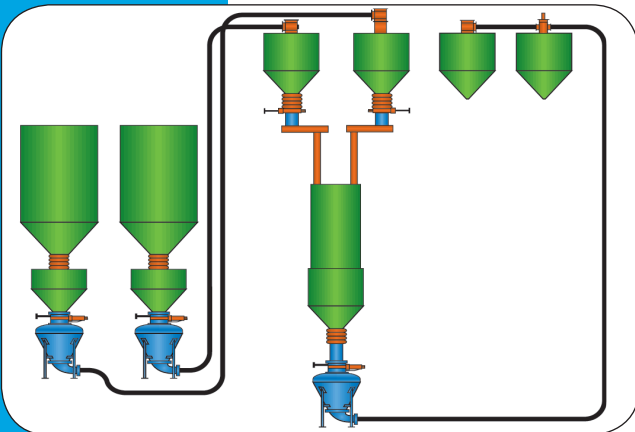
PRIMARY APPLICATION OBJECTIVES

1. Minimum particle size degradation
2. Low operating cost

Customer required the most modern handling system for fragile granular sugar and dextrose without any change to the product grain size or shape. Exacting degradation limits were established for pre-contract engineering. The system satisfied all objectives with negligible degradation of the sugar granule or the dextrose material.

BASIC DATA

- 3 low velocity Denseveyor systems
- 3 low velocity Denseveyor systems
- 2 to 5 reception points
- 13-33 tons/hour - 265 ft
- Sugar, dextrose and sugar dextrose blend
- Ambient temperature



Mineral Substation, Greece

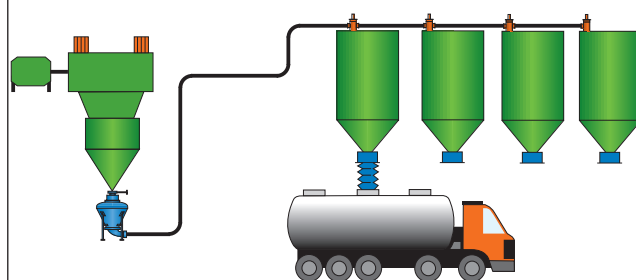
PRIMARY APPLICATION OBJECTIVES

1. Reliable operation
2. Minimal maintenance

The Denseveyor was a direct retrofit of a dilute phase system. The system was required to transfer a building product powder from the mixer into a silo storage. The conveying vessel of the unsuccessful system remained in place and acted as a feed hopper to the Denseveyor.

BASIC DATA

■ 1x12 inch Denseveyor ■ 690 ft distance ■ 15.5 tons/hour ■ 5 inch pipeline ■ Average transfer velocity 16 ft/sec



Biomass Plant, UK

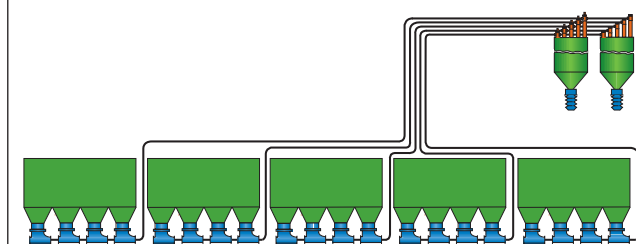
PRIMARY APPLICATION OBJECTIVES

1. Extreme reliability
2. Low power cost
3. Minimal maintenance

Customer was one of Europe's largest garbage fired power stations. Operating reliability and economic operation was a 24/7 demand. The 5 Ashveyor systems installed to handle household garbage fly ash were installed to retrofit previously unsuccessful handling system and all objectives were satisfied.

BASIC DATA

■ 5 x 1.5-4 inch Ashveyor systems ■ 5 x 985 ft distance ■ 5 x 11 tons/hour ■ 4 inch pipeline ■ Average transfer velocity 19.5 ft/sec



Chemical Refiner, UK

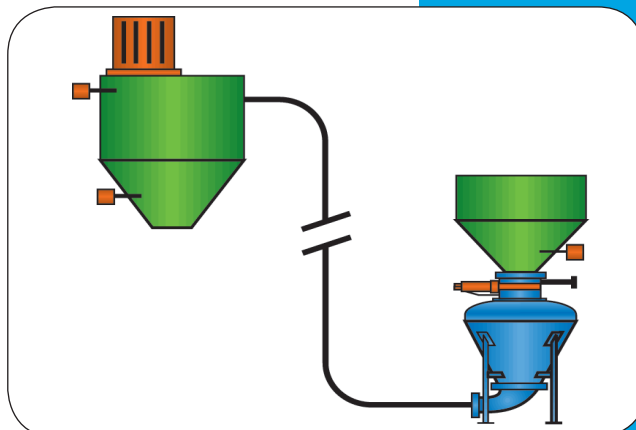
PRIMARY APPLICATION OBJECTIVES

1. Minimum particle size degradation
2. Operating reliability

Customer manufactured sodium bicarbonate which is used for a wide range of individual and consumer products. The quality of the product depends upon the consistency of the particle size distribution with a severe limit on fines content. To satisfy these requirements, low material velocity is required, which was achieved by the Denseveyor system.

BASIC DATA

■ 1x5 inch low velocity Denseveyor system ■ 1 reception point ■ Sodium bicarbonate ■ Ambient temperature ■ 25 tons/hour



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A Macawber Group Company

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