

“Conveying Options for Extrusion”

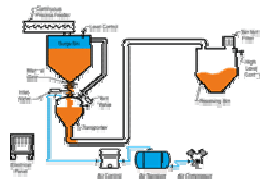
by
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Types of Conveying Systems

- Dense Phase Conveying
- Pressure/Vacuum Systems (push/pull)
- Pressure Conveying Systems
- In Plant Vacuum Conveying
 - Positive Displacement Blowers
 - Ring Compressor Blowers
 - Self Contained Loaders

Dense Phase Conveying - Strengths

- Good for brittle materials
- Lower velocity air
- Less abrasive
- Higher throughputs
- Long convey distances



Dense Phase Conveying - Weaknesses

- Very expensive
- Maintenance intensive
- Loud
- Difficult to set-up/balance



Pressure/Vacuum Systems - Strengths

- Rail car or truck unloading
- Highest throughputs
- Long conveying distances



Pressure/Vacuum Systems - Weaknesses

- High cost
- High noise and maintenance
- Difficult to balance
- Outdoor installation
- Poor dust management



Pressure Conveying Systems - Strengths

- Economical
- High conveying distances
- Simple design
- Bulk truck equipped



Pressure Conveying Systems - Weaknesses

- Dust management
- High noise
- High maintenance
- Difficult to sequence



In-Plant, Positive Displacement - Strengths

- Easy to automate
- High throughputs
- Long conveying distances
- Good dust management



In-Plant, Positive Displacement - Weaknesses

- Noisy, high maintenance
- Higher capital cost
- Prone to vacuum leaks
- Sophisticated controls



In-Plant, Ring Compressor - Strengths

- Lower capital cost
- Less noise/low maintenance
- Compact/simple design
- Easy to work on



In-Plant, Ring Compressor - Weaknesses

- Shorter conveying distances
- Lower throughputs
- Less efficient
- Poor dust management



In-Plant, Self Contained - Strengths

- Very low cost
- Easy to maintain
- Compact design
- Versatile
- Easy to move or install



In-Plant, Self Contained - Weaknesses

- Short conveying distances
- Noisy
- Poor dust control
- Very inefficient



Classification of Pneumatic Systems

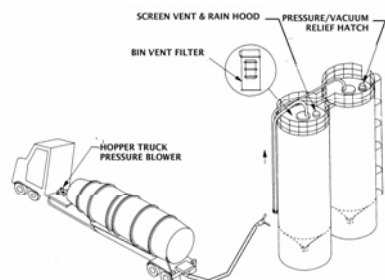
Parameter	Dilute Phase	Dilute Phase	Medium Dense Phase	Dense Phase	Air Activated Gravity
System	Fan	Blower	Pump	Blow Tank	Air slide
Pressure Range	± 20 in. water	± 7 PSI	15 – 35 PSI	30 – 125 PSI	Fan type 0.5 PSI (closed) 4-5 PSI (open)
Saturation Ft ³ air/lb mat ³ l	Vac: 10 – 30 Pres: 4.5 – 13.0	Vac: 3 – 5 Pres: 1.0 – 3.5	0.35 – 0.75	0.1 – 0.35	3 – 5 cfm/ft ³
Mat ³ Loading Lb mat ³ / lb air	Vac: 1.3 – 0.45 Pres: 4.5 – 13.0	Vac: 4.5 – 2.5 Pres: 3.8 – 13.0	45 – 18	135 – 45	n/a
Air Velocity (fpm)	6000	4000 – 8000	1500 – 3000	200 – 2000	10 through diaphragm
Max. Capacity (tph)	100	300	300	400	500
Practical Distance Limits (ft)	Vac: 100 Pres: 200	Vac: 200 Pres: 500	3000	8000	100 ft 6ft drop/length 3 – 10 deg. slope

(Source: Bulk Material Handbook, by Jacob Frutkinbaum, 1988)

Pneumatic Conveying Systems are:

- For pellet, granular, powder & flake plastic resins.
 - Relatively economical to install and operate.
 - Relatively clean running and easy to maintain.
 - Flexible in terms of re-routing and expansion.
 - Dilute phase most widely used in plastic extrusion.
- *Systems required for conveying, storage and in-plant distribution of pellets delivered by truck or railcar.*

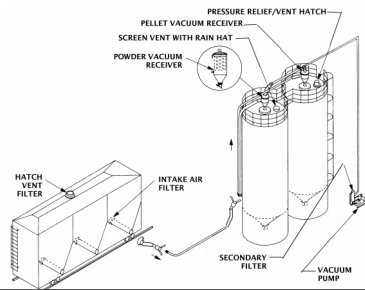
Pressure Delivery by Bulk Truck



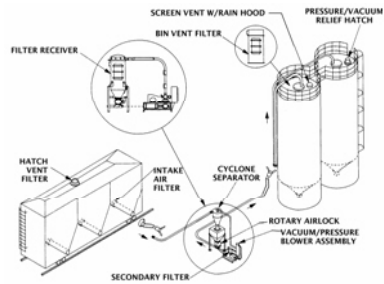
Bulk Truck Unloading

- Self contained, pressure pneumatic unloader.
- Properly equipped bulk storage silo.
- Silo close to building – good truck access.
- Driver responsible for unloading process.
- Silo mounted air cleaning assembly.

Vacuum Delivery from Railcar



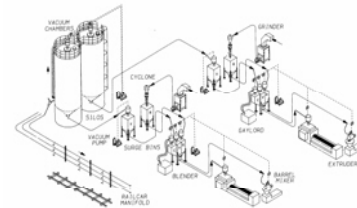
Combination Vac./Pres. from Railcar



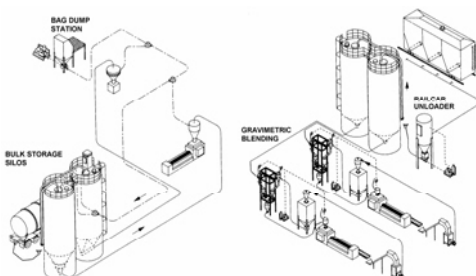
Railcar Unloading Systems

- Vacuum or combination systems (pull-push).
- Vacuum systems for lower cost/throughput.
 - Pump and dump, with gravity operated valves
 - Continuous loading, with rotary valves discharge
- Combination systems most popular.
 - Material drawn from railcar by vacuum
 - Passing through a transfer station
 - Blown into the silo by pressure
 - One or two blower packages depending on convey distance

Vacuum System from Silo



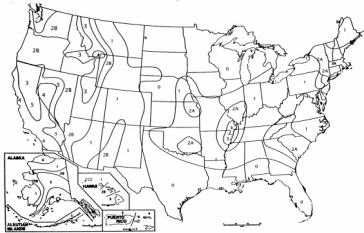
Bulk Systems with Truck & Rail Delivery



Silos

- Buying in bulk saves 2 – 4 cents per pound.
- Silos are link between delivery & distribution.
- Variety of capacities and construction.
- Carbon steel, aluminum or stainless steel.
- Welded, bolted or spiral construction.
- 12 x 70 foot typical – 220,000 pounds.
- Engineered/certified per seismic location.

Typical Seismic Zone Map



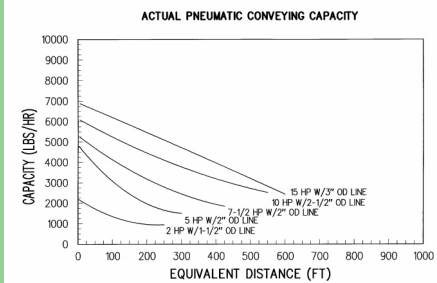
In-plant Distribution

- Material to be conveyed
 - Form – pellets, powders, regrind
 - bulk density and amount of dust/fines/stringers
- Pre-processing operations necessary
 - Inside storage bins
 - Metal detectors/de-dusters
 - Resin drying hoppers
- Control requirements
 - PLC systems for expandability

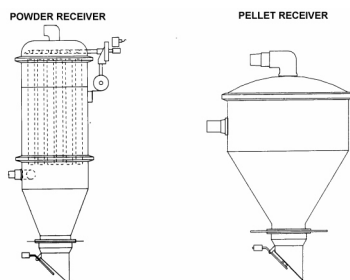
In-plant Distribution, cont.

- Vacuum systems most widely used.
 - Multiple supply/multiple destination
 - Lower capital investment than pressure or combination
 - Inherently cleaner operation – leaks draw clean air in
- Vacuum power unit is most critical
 - Positive displacement or regenerative/centrifugal blowers
 - Large central systems use positive displacement blowers
 - Regenerative for small central or beside the extruder loading

Conveying Capacity vs. Distance



Typical Vacuum Receivers



Material Selection/Sequencing

- Misc. hardware
- Multi ingredient manifold/selector



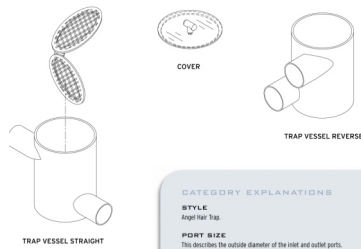
Piping Runs

- Direct between material pick up and drop off.
- Least # of direction & elevation changes.
- 5 ft. horiz./inch pipe dia. before each elbow.
- 2 inch pipe – 5 feet, 5 inch pipe – 20 feet.
- Angled rises should be avoided.
- Aluminum tube connected by comp. coupling.
- Pickup velocities of 4000 – 4500 fpm minimum.

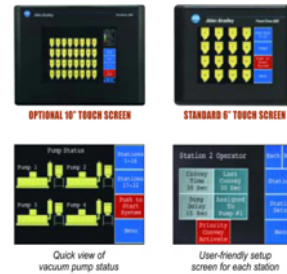
Stringer/Angel Hair Formation

- Treated pipe
 - Sandblasting, shot peening or spiral grooving.
- Pocketed elbows – pellets impinge on pellets.
- Reduce stringer formation by 90%.
- Angel hair traps

Angel Hair Traps



Conveying Control Systems



Control System Options

- Manual, semi-automatic, fully automatic.
- Manual too operator intensive.
- Fully automatic too expensive.
- Semi-automatic requires connecting.
- High level control - shuts down once full.
- PLC or PC based systems are preferred.

Major System Suppliers

Company	Material Handling/Blending Products	Location
The Conair Group, Inc	Conveying, Blending, Scrap Reclaim	Pittsburgh, PA
Process Control Corporation	Conveying, Blending, Control, Scrap Reclaim	Atlanta, Georgia
TSM	Conveying, Blending, Control	Atlanta, Georgia
Osprey Corporation	Conveying, Scrap Reclaim, Pelletizing	Atlanta, Georgia
Foremost Machine Builders	Conveying, Blending, Scrap Reclaim	Fairfield, New Jersey
ACS Group - AEC/Coloronics	Conveying, Blending and Control	Flint, MI
CRG Logics	Conveying, Blending and Control	Appleton, WI
Inox	Gravimetric, Blending and Control	Lancaster, PA, Germany
K-Tron International	Conveying, Gravimetric, Blending and Feeding	Pittman, NJ
L-R Systems	Conveying and Blending	New Lenox, IL
Maguire	Conveying and Blending	Aston, PA
Novatec, Inc.	Conveying and Blending	Baltimore, MD
Thomson McCosh	Conveying and Blending	Troy, MI