



Pneumatic Conveying and Air Filtration
Running Hard for Over 30 Years.

Pneumatic Conveying Systems

MAC Equipment, Inc.



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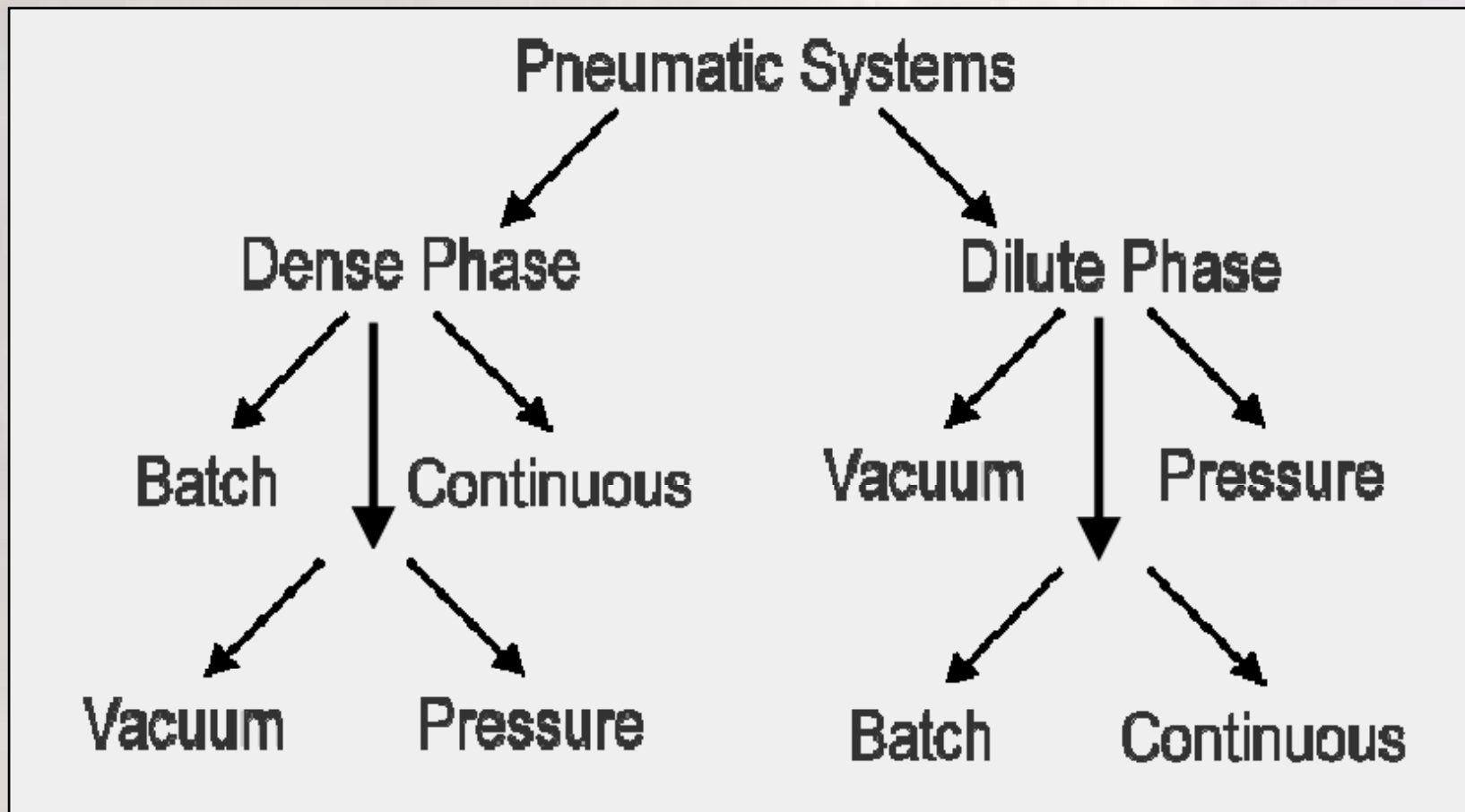
Pneumatic Conveying

Transport of dry material
through pipelines using air (gas)
as the motive force



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Pneumatic Systems





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Product Characteristics

- Bulk Density
- Particle Size / Distribution
- Fluidizability
- Minimum Entrainment (Pick-Up) Velocity
- Abrasiveness
- Temperature
- Explosiveness
- Moisture Content
- Fragility
- Oil/Fat Content
- Tendency to Absorb Water (Hygroscopic)
- Adhesiveness
- Cohesiveness
- Static Build Up
- Tendency to De-aerate
- Corrosiveness



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Process Characteristics

- Process Rate
- Convey Distance
- Available Height at Pick-Up and Receiving Points
- Number of Pick-Up and Receiving Points
- Batch/Continuous
- Availability of Compressed Air
- System Sanitation Requirements
- Electrical Classification for Process Area
- Indoor/Outdoor



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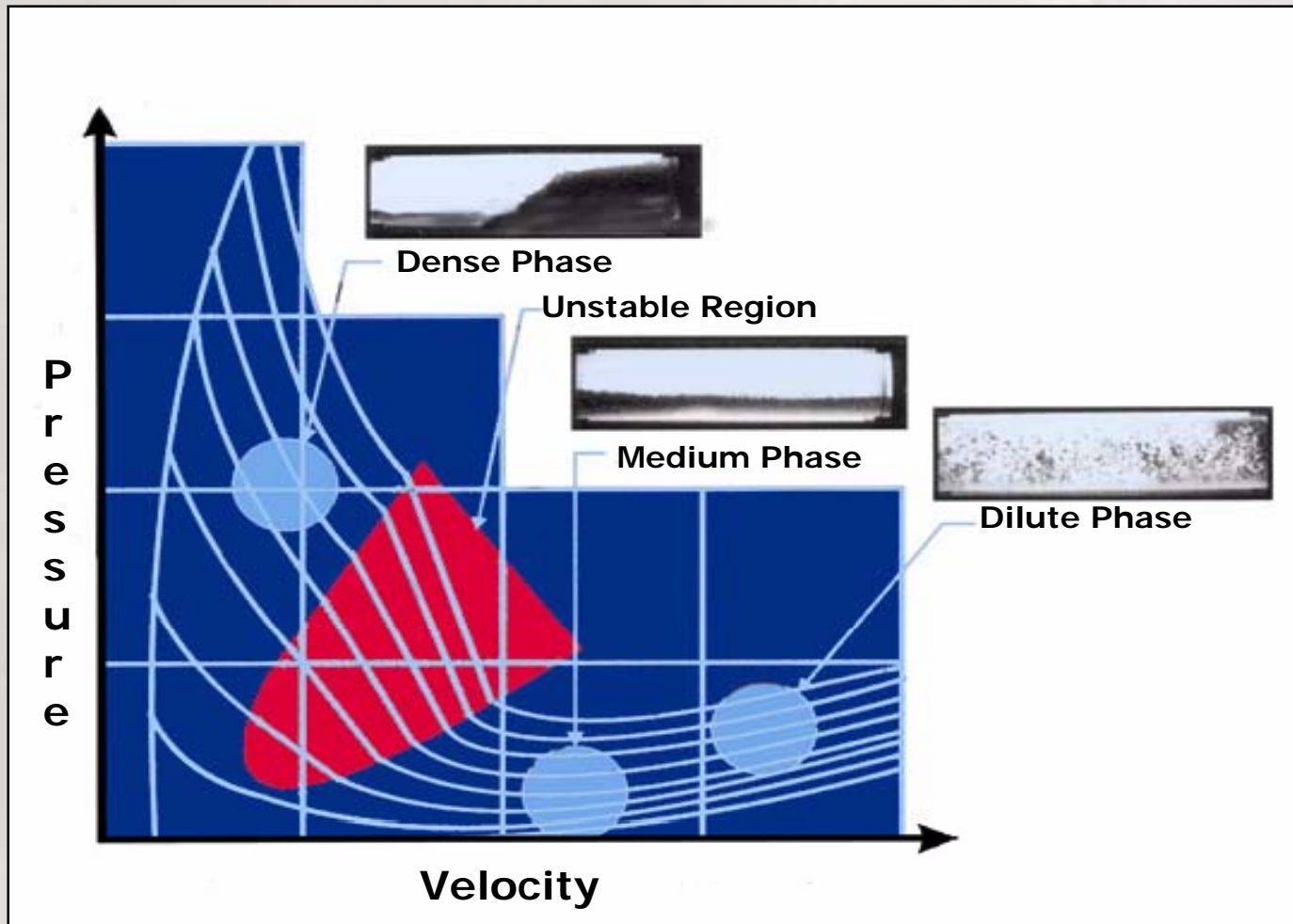
Pressure Loss

Major Contributors

- Acceleration of the product
- Over-all Convey Distance
- Number of Elbows
- Vertical Lift
- Product Friction Factor
- Product Particle Interaction



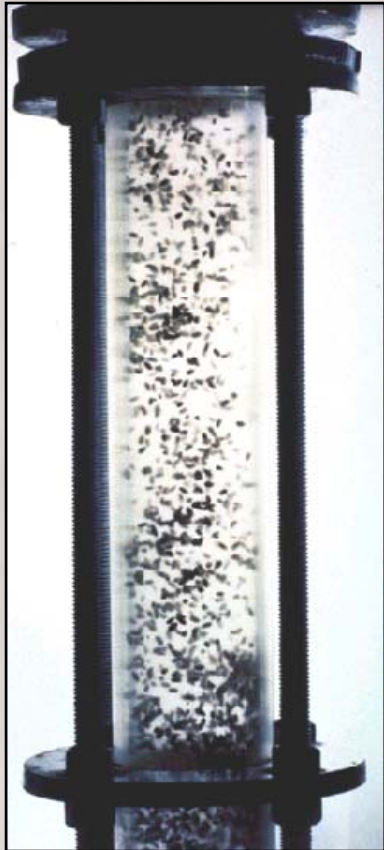
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Dilute Phase Systems

- Convey above minimum entrainment velocity
- Low material-to-air ratio (0 - ~10)
- High risk of degradation/abrasion
- Constant flow



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Dilute Phase

Key Factors

- Keep air velocity above minimum entrainment velocity
- Keep press/vacuum below 12 PSI/12 IN*HG (Standard pump goes to 15 PSI/15 IN*HG)
- Minimize convey distance and # of elbows



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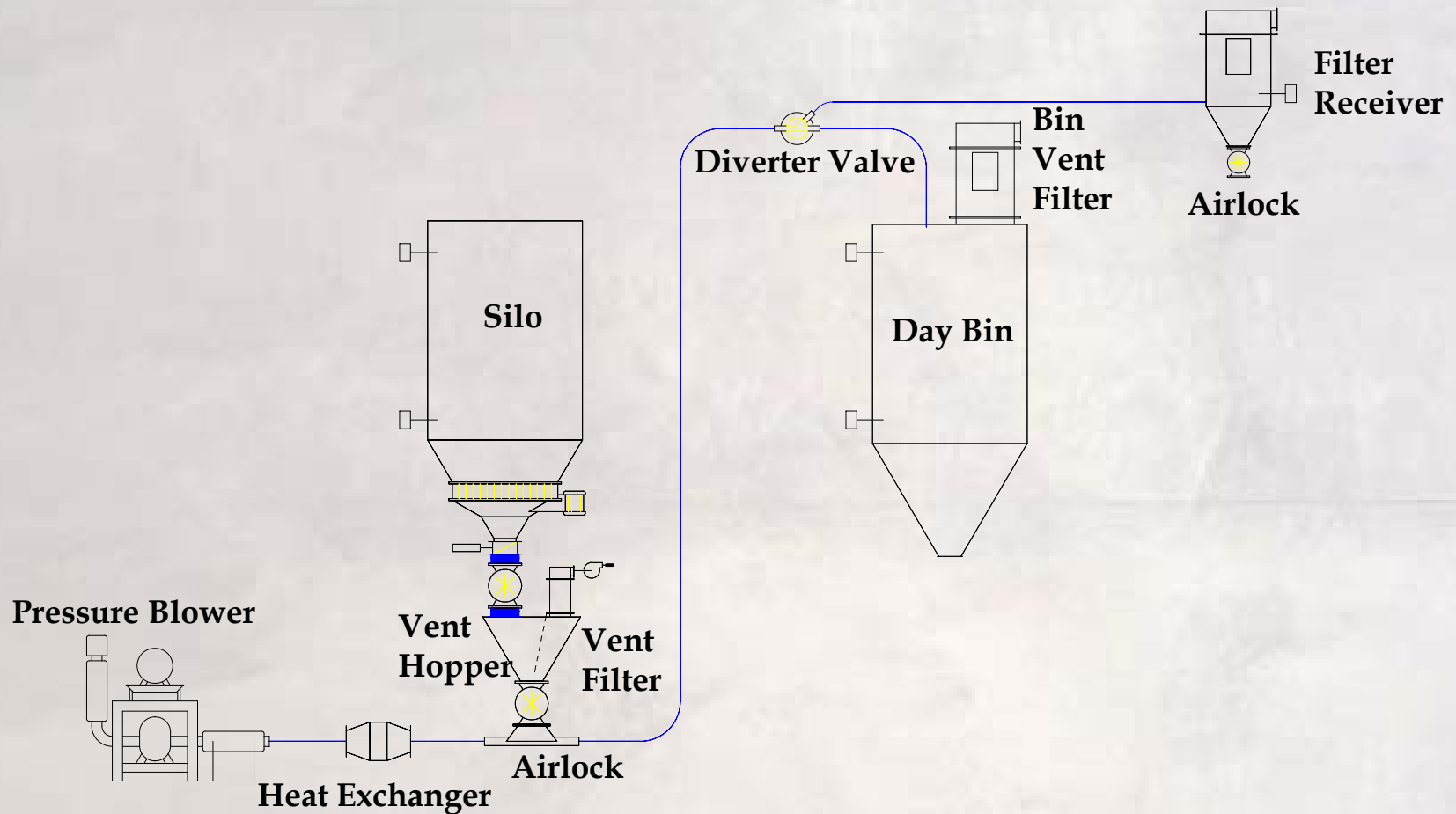
Types of Dilute Phase Systems

- Continuous Dilute Phase Pressure
- Continuous Dilute Phase Vacuum
- Continuous Dilute Phase Pressure/Vacuum Combination
- Variations (Less Common Types)...



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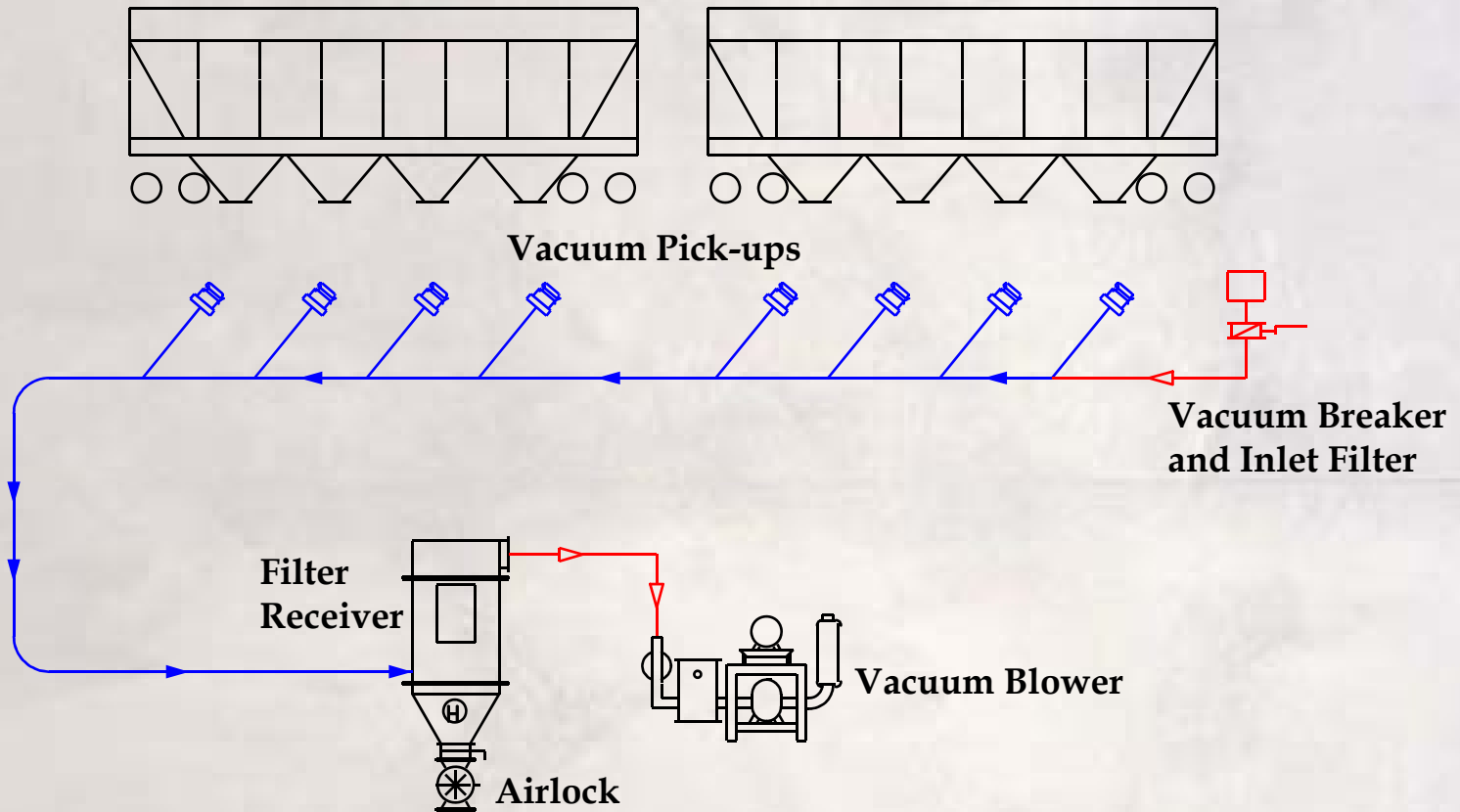
Pressure Dilute Phase





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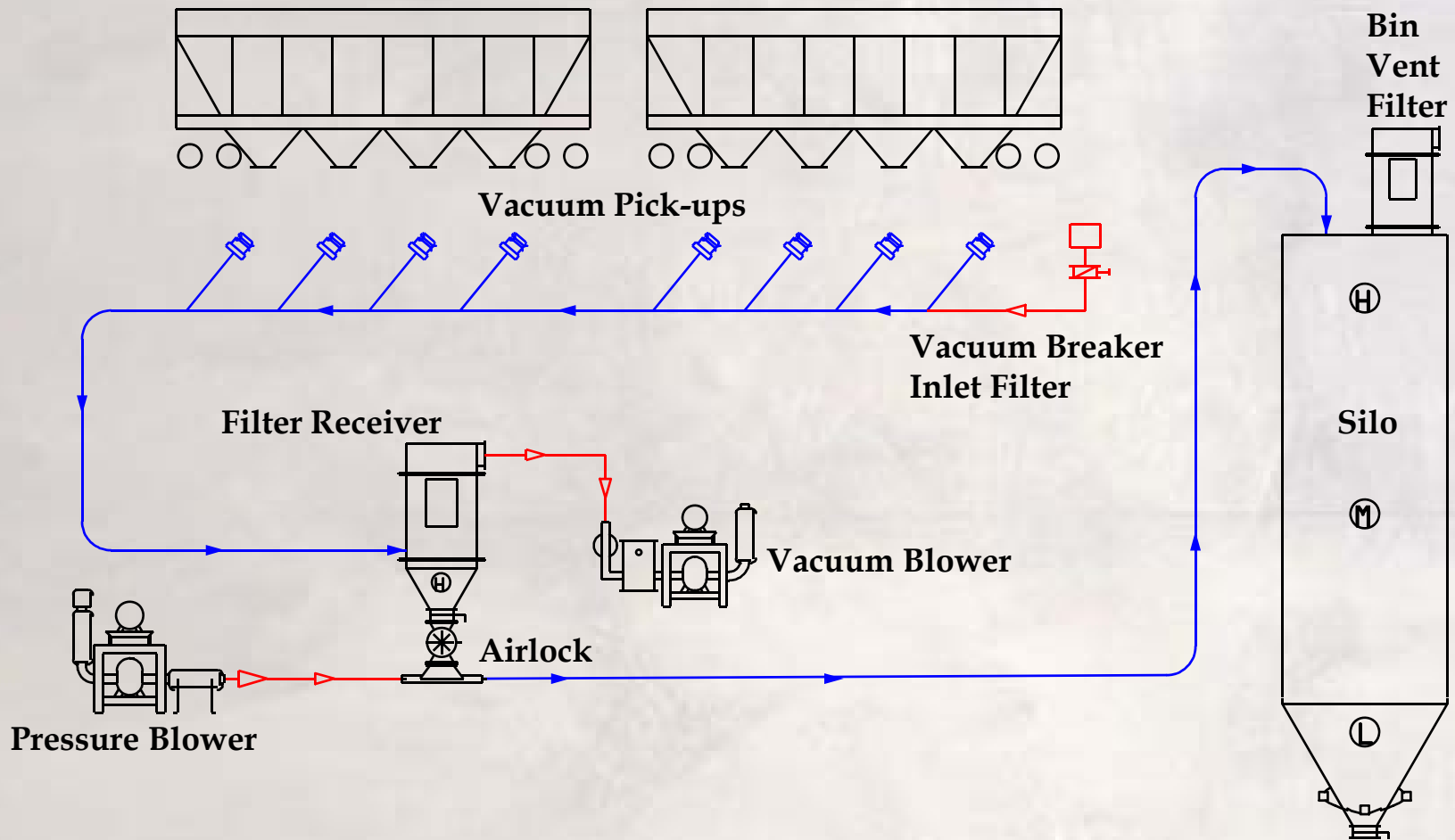
Vacuum Dilute Phase





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Pressure/Vacuum Combination Dilute Phase

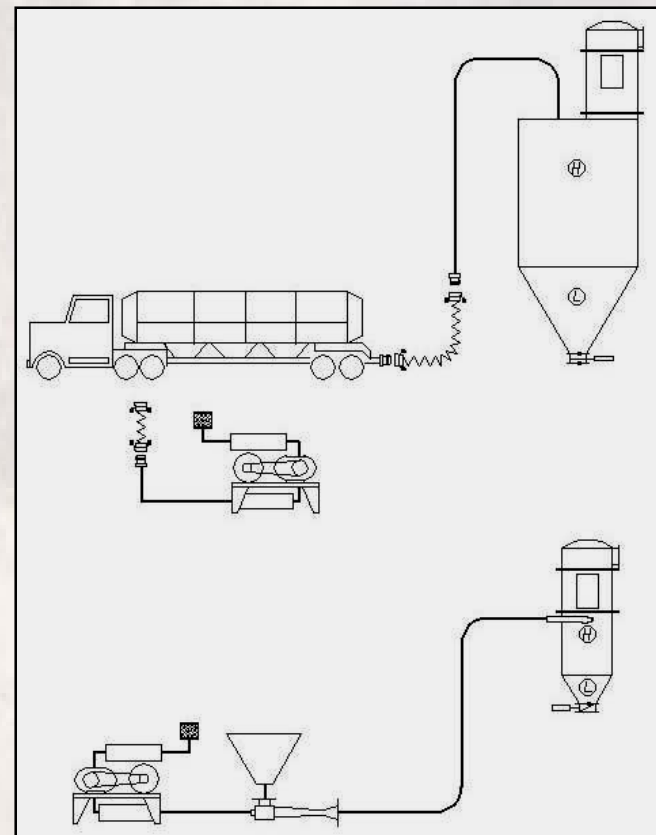




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Dilute Phase Variations

- PD Trucks & Railcars
- Eductors





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Dilute Phase

Advantages

- Gas flow amount is not critical
- Most products can be conveyed
- Flexible convey rates for a fixed line size
- Operating pressure below 12 PSI
- Simple equipment control



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Systems Comparison

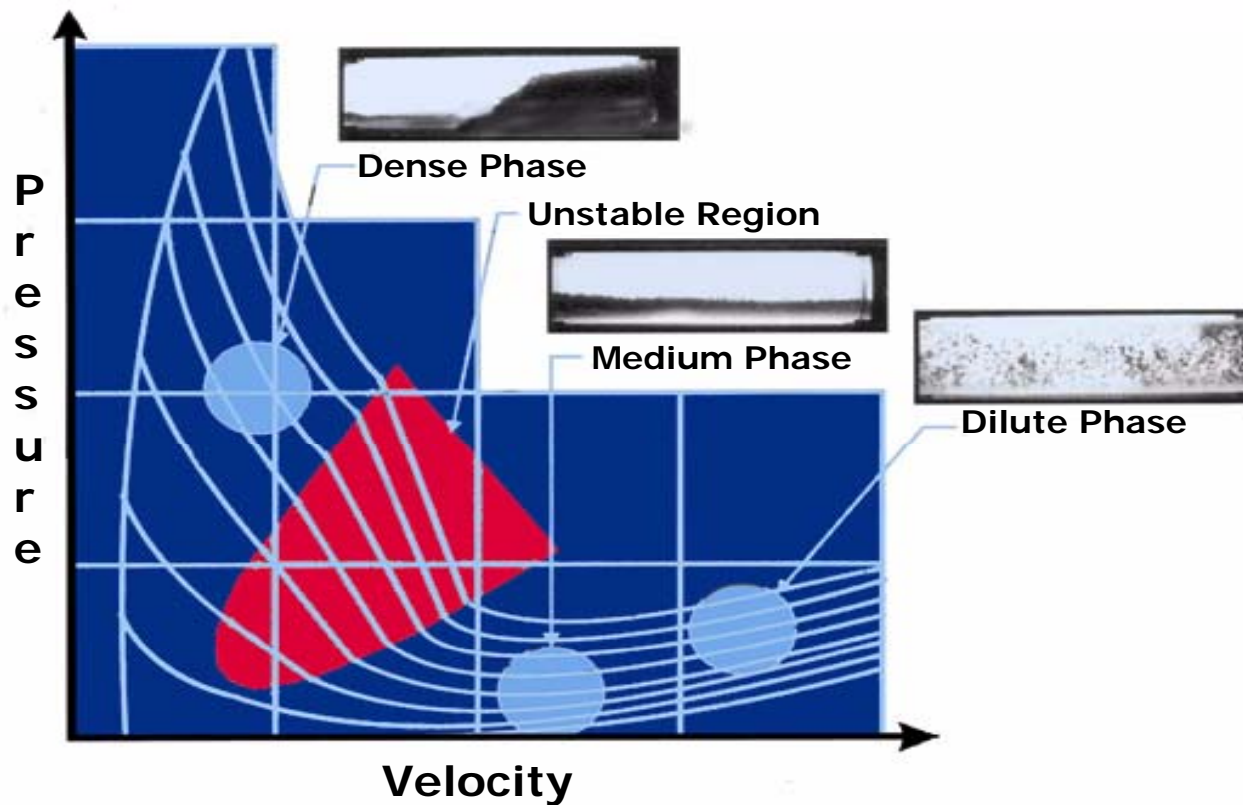
Dilute Phase Disadvantages

- Product degradation (fragile products)
- System component abrasion
- Product segregation
- Dust collection required
(high volume of dust laden air)



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Convey State Diagram



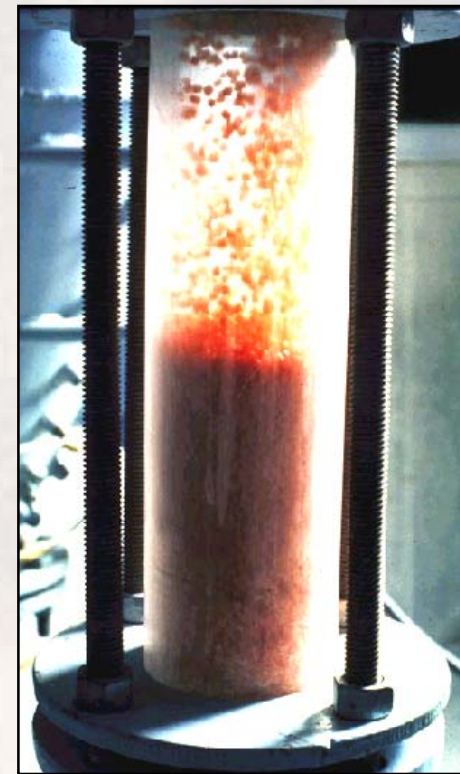


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Pneumatic Systems

Dense Phase Systems

- Convey below the minimum entrainment velocity
- High material-to-air ratio (~10 - 50)
- Low risk of degradation
- Pulse or slug flow

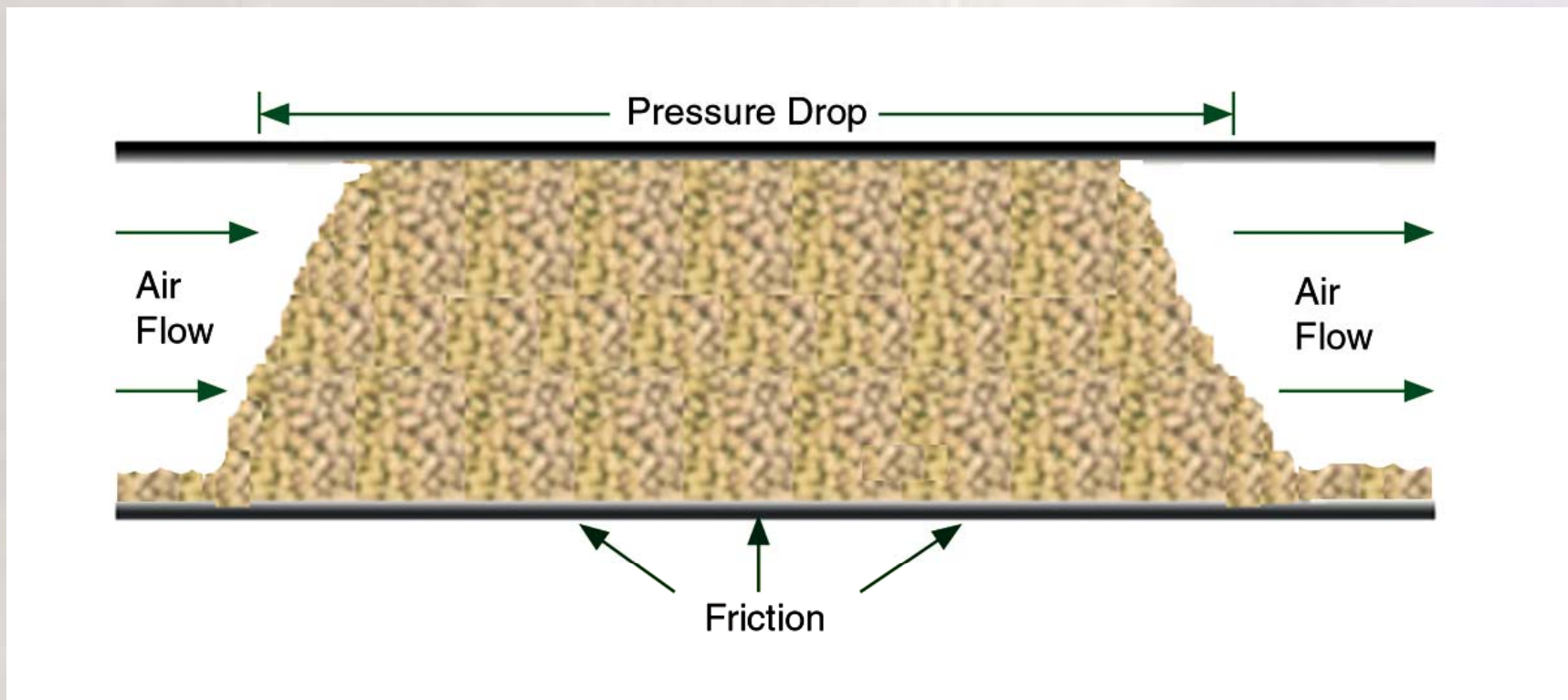




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Dense Phase Systems

Slug Formation





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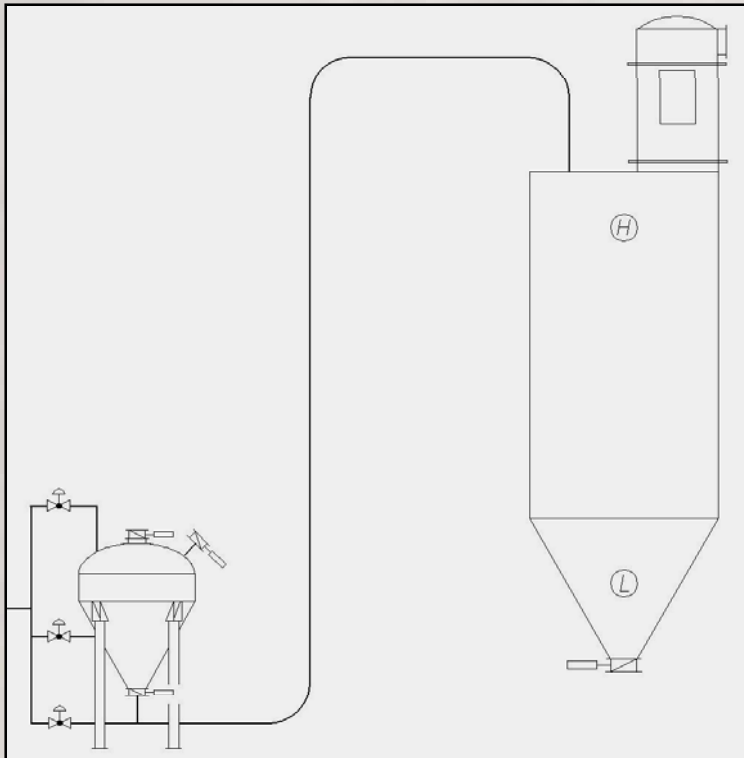
Types of Dense Phase Systems

- Batch Dense Phase Pressure
- Continuous Dense Phase Pressure
- Low Pressure Continuous Dense Phase
- Vacuum Dense Phase



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Dense Phase Systems



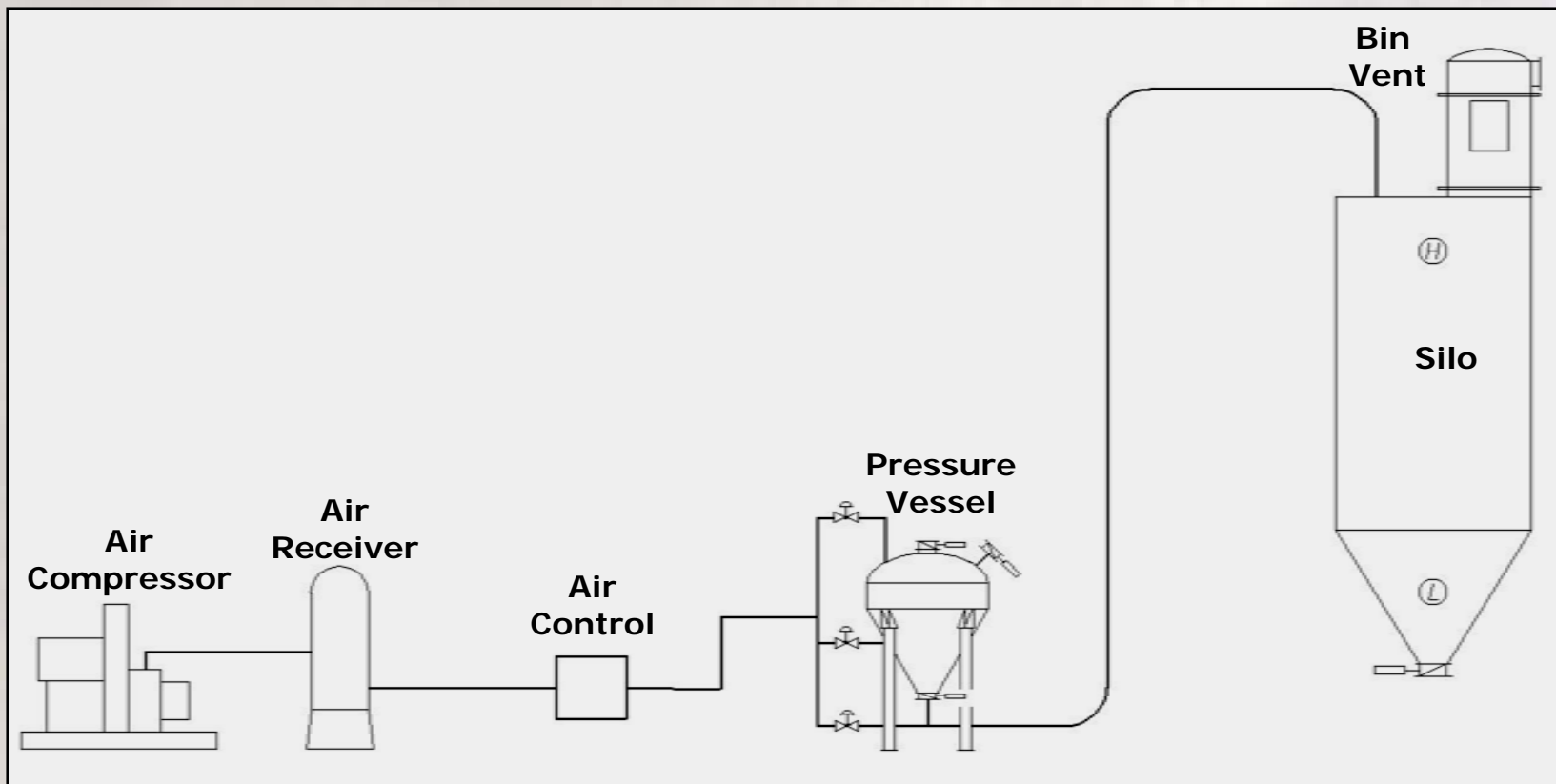
Batch Dense Phase

- Uses a pressure vessel to inject material into line
- Instantaneous rates are higher due to fill and switch times
- Flow characteristics vary during cycle



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Batch Dense Phase





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Batch Dense Phase

Requirements

- Large head height
- Surge capacity above vessel
- Compressed air

Applications

- Powders
- Heavy, granular materials
- Extremely abrasive materials
- Very long convey distances

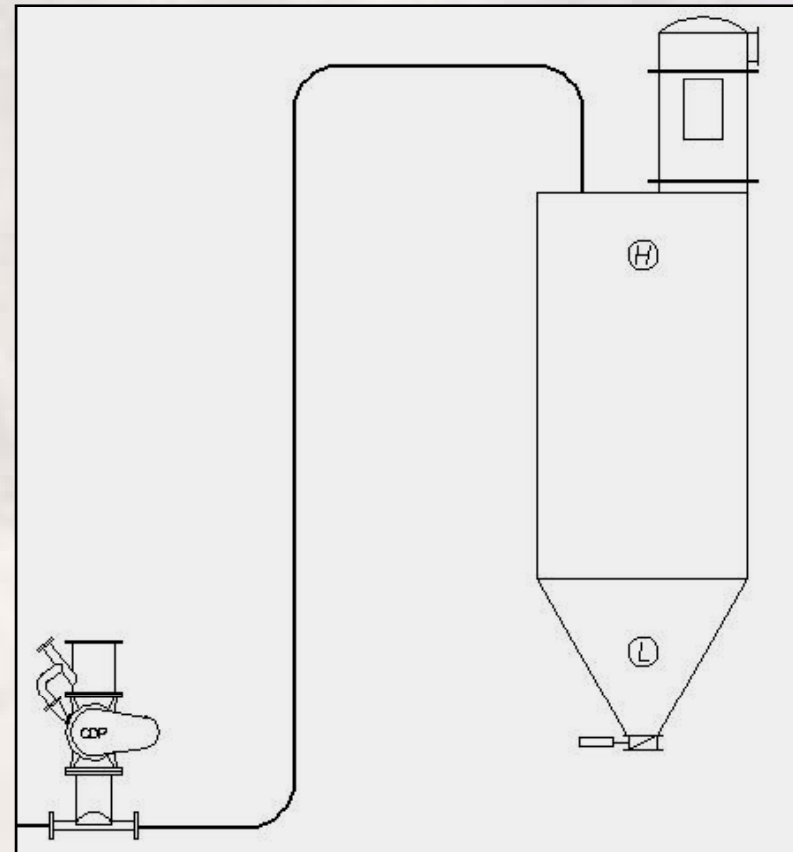


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Dense Phase Systems

Continuous Dense Phase (CDP™)

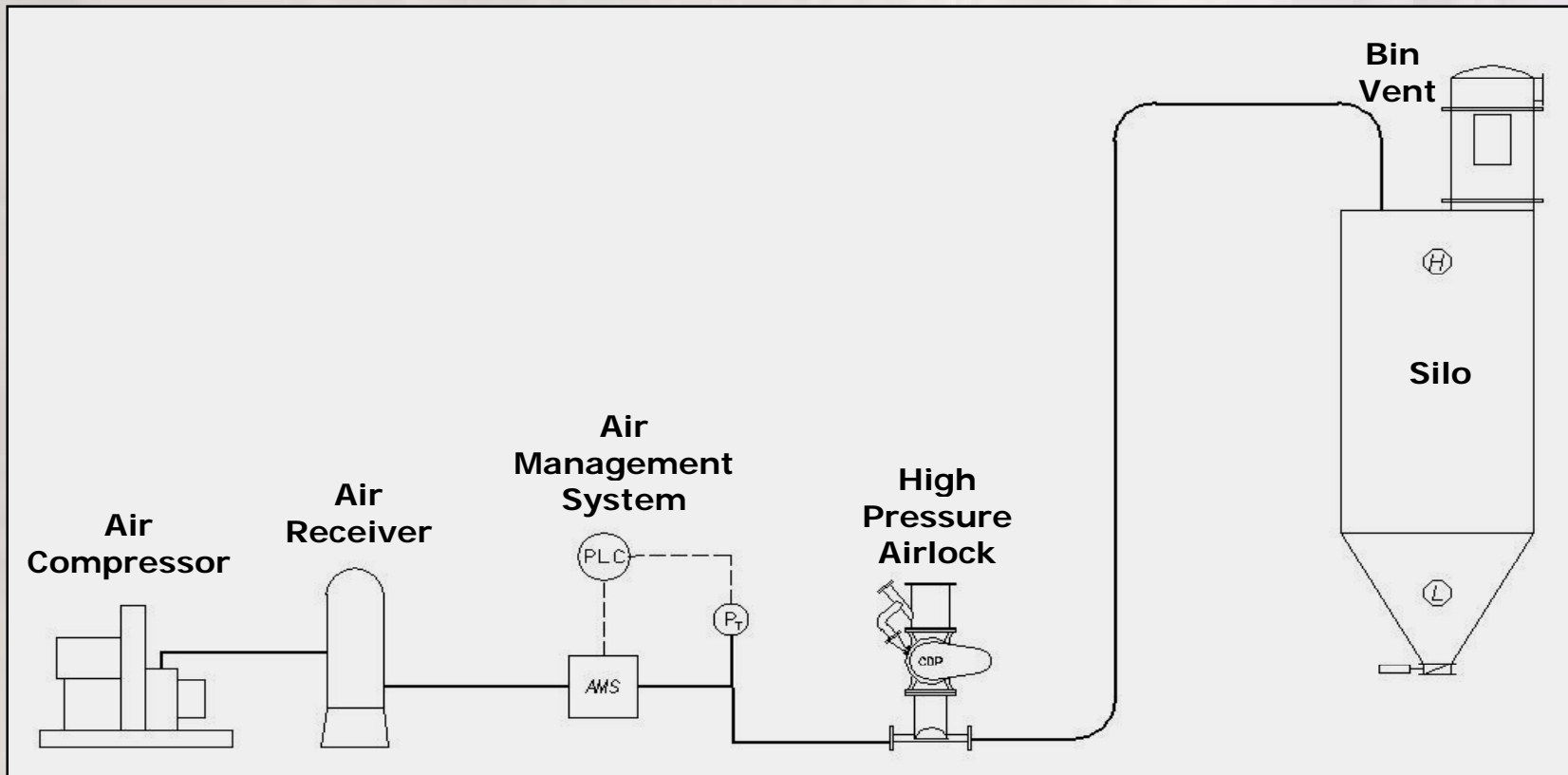
- Uses an airlock to introduce material
- Constant flow of material
- High pressure airlock required
- Low head height





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CDP





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Continuous Dense Phase

Requirements

- High pressure airlock
- Superior air control
- Compressed air

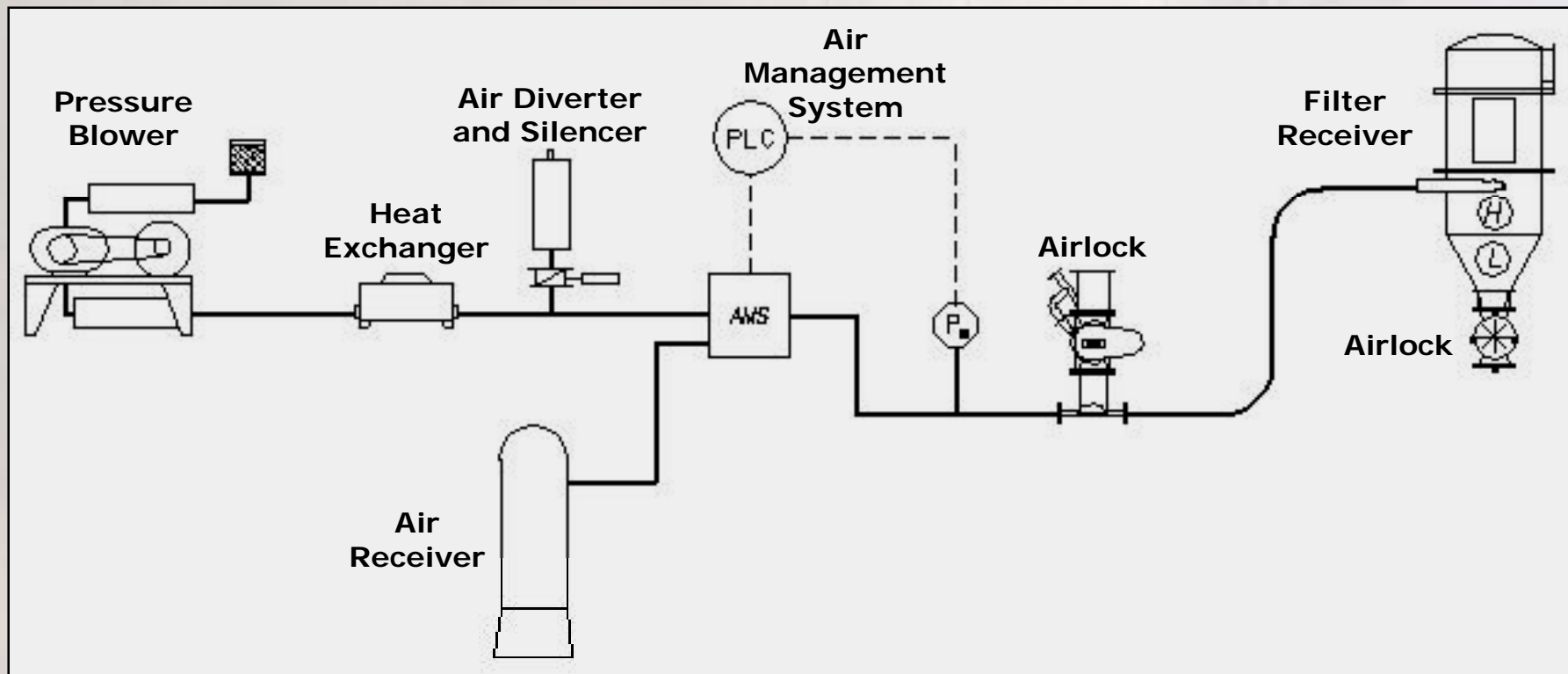
Ideal Applications

- Medium weight granular & pelleted materials
- Mildly friable materials
- Medium to long convey distances
- Continuous processes



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Low Pressure CDP





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Low Pressure CDPTM

Requirements

- Standard airlock
- Superior air control
- PD Blower

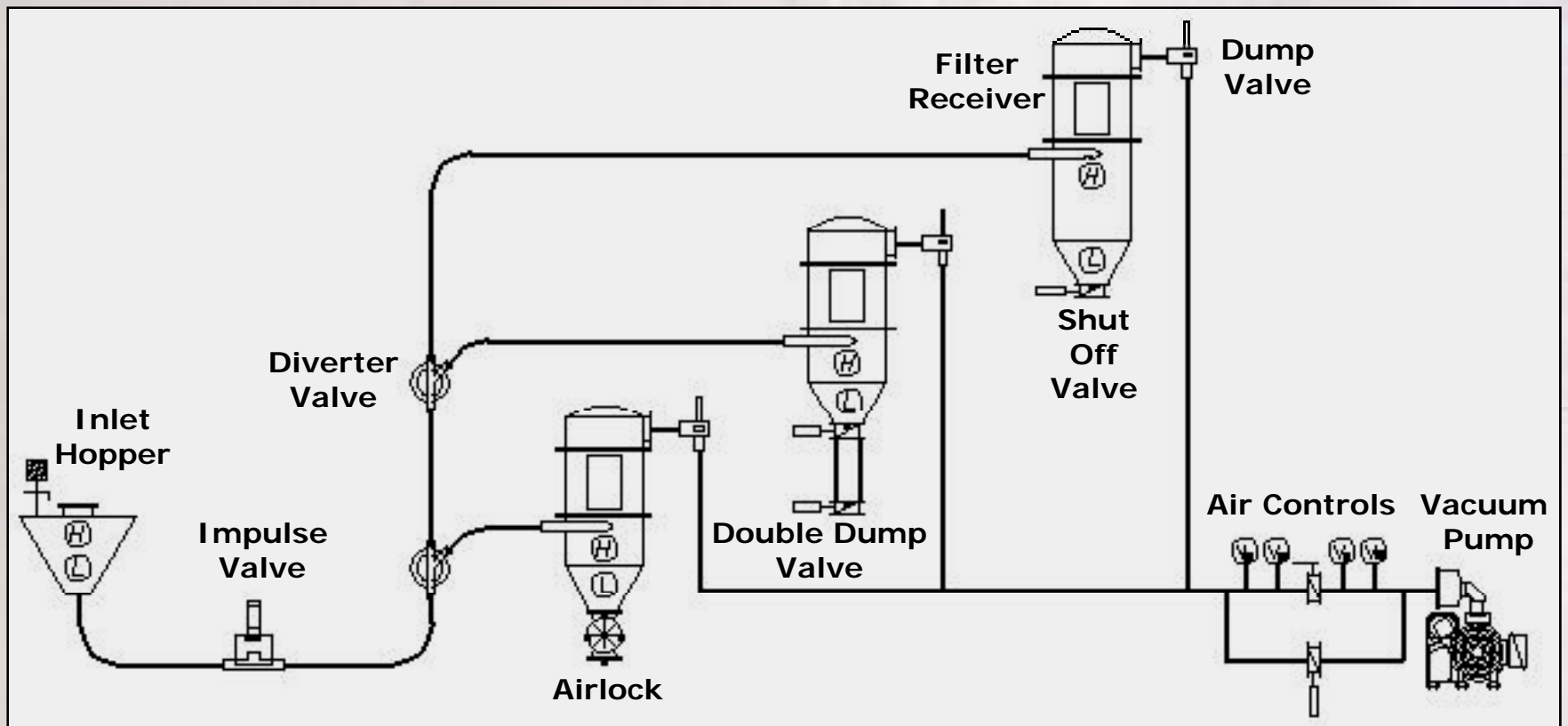
Ideal Applications

- Light to Medium weight granular & pelleted materials
- Friable materials
- Short to Medium convey distances
- Continuous processes



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Vacuum Dense Phase





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Vacuum Dense Phase

Advantages

- Flexibility and capital cost of a vacuum dilute phase system.
- Minimized degradation of a dense phase system
- Lower power requirements than pressure dense or dilute



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Vacuum Dense Phase

Requirements

- High vacuum pump
- Surge capacity at feed point
- Standard airlock (to run continuous)
- Convey run less than ~200 FT

Ideal Applications

- Light to medium weight materials
Friable, abrasive or fluidizable materials
- Short to medium convey distances



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Dense Phase

Typical Advantages

- Slower Velocities
 - Lower degradation / abrasion
 - Less fines / dust generation
 - Smaller airflows
 - Smaller filter receivers



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Pneumatic Advantages

vs. Mechanical or Manual

- Degradation
- Maintenance
- Housekeeping
- Plant floor space (foot print)
- Flexibility (distance, # of points, etc.)



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The End