# DESIGN TIPS
## FOR PNEUMATIC SAND TRANSPORTER SYSTEMS

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**ARTICLE TAKEAWAYS:**

- **Understanding the differences between dense and dilute phase conveying**
- **Proper layout of pipe**

Most every foundry has to move tremendous amounts of sand as part of their daily operation and to handle and distribute such amounts effectively can sometimes grow into an ongoing major material handling battle. How much more practical would it be if the foundry engineer could develop a data base assuring the most practical data utilization and a knowledgebase to fall back on before trouble starts raising its ugly head.

Belt conveyors and elevators are used many times to distribute the sand but air conveyors or pneumatic transporters are probably most widely accepted as a means to move sand around the foundry. Pneumatic transporters are practical because of their simplicity and flexibility; however, because of their operating characteristics certain design and operating details should be followed to achieve a reliable system with minimum cost of operation.

Unlike most mechanical equipment in a foundry pneumatic transporter systems require compressed air as their motive force and producing compressed air is expensive. Therefore, it only makes sense to try to minimize the amount of compressed air required to keep operating costs as low as possible while at the same time optimizing the air requirements to minimize abrasion of the pipeline from the moving sand.

Pneumatic transporter systems in general can be divided into two broad categories. Dilute phase conveying and dense phase conveying. Dilute phase conveying, mostly used for powdery materials such as iron oxide and bentonite, works by vacuum or low pressure air and high velocities (4000 FPM and higher), while dense phase conveying works by medium to higher pressure air and lower velocities (2800 - 4000 FPM). For sand, which can become very abrasive at higher velocities, special low velocity systems (400- 1500 FPM) can be designed which should be used exclusively.

Like for any project, system specifications should first be prepared describing the planned system in detail and outlining operating requirements. For a pneumatic sand transporter system we start with the basics such as:

- Type of sand to be transferred
- Bulk density (pounds per cubic foot)
- Particle size distribution (AFS number)
- Temperature (Deg. F)
- Moisture content (%)
- Free flowing (Yes/No)
- Capacity required (tons/hour)
- **Layout of pipe run:** to establish the pipe run, specify location of the transporter blow tank, the location and number of receiving bins and the shortest practical distance of horizontal and vertical connecting pipe sections.

  **Note:** In laying out the actual pipe run utilize only horizontal and vertical pipe sections connected with long centerline radius (40 inch) pipe bends. Long radius bends are preferred because they have a lower pressure drop than short radius bends. Changes in elevation of the pipe run should consist only of vertical pipe sections with 90 degree pipe bends. To prevent premature pipe wear from excessive abrasion do not use inclined pipe sections.

- Developed length of pipe run (ft):
- Identify individual pipe sections for horizontal and vertical pipe sections as H1, H2, H3 etc. V1, V2, V3 etc, where each straight pipe section is identified separately such as H1 being the first horizontal section from the transporter material outlet, and H2 the next horizontal section normally some elevation above H1; similarly with V1 being the first vertical section, etc.
- Total number of pipe bends, all with a long centerline radius of 40 inches:
- 90 Deg. Bends _____, each equal to 15 ft. of developed pipe length;
- 60 Deg. Bends _____, each equal to 10 ft. of developed pipe length;
- 45 Deg. Bends _____, each equal to 7.5 ft. of developed pipe length;
- 30 Deg. Bends _____, each equal to 5 ft. of developed pipe length;
- For standardization design the pipe run for the shortest practical distance between the transporter blow tank and the receiving point(s), using the standard degree bends shown, rather than pipe bends with odd angles.
- Number and location of receiving bins ____________________
- High Level probes present in receiving bins(Yes ____, No __)
- Dust Collection present (Yes ____, No __)

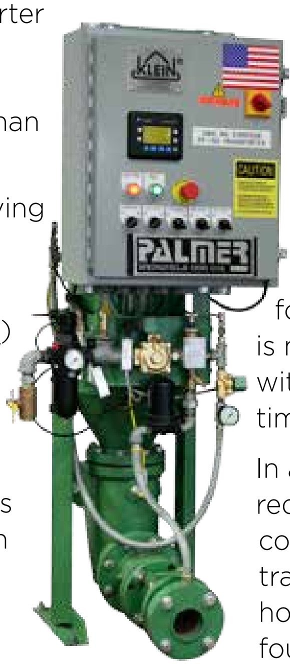
Regarding developed length for vertical pipe sections proceed as follows: To get developed length for vertical pipe sections in first one third of pipe run multiply the actual vertical pipe section length by 1.5 and if in second and last third of pipe run multiply the actual vertical pipe section length by 2.0.

The system's developed length of the pipe run is then based on adding all horizontal, vertical sections and pipe bends.

The final developed length of the pipe run can then be used to arrive at the capacity of the system based on the pipe diameter. Finally all the established data can be used as the basis to solicit equipment quotations.

To overcome the problems of abrasion when conveying sand pneumatically it has become common practice to utilize pressure systems such as dense phase conveying. Blow tanks for these systems are normally sized to match system requirements with higher tonnages requiring larger blow tanks.

All of these transporter systems, however, have a relatively large number of components subject to wear and to reduce cycling frequency of affected components and increase their life expectancy the largest blow tank for a given capacity is normally specified with an average fill time of 90 seconds.




In an attempt to reduce operating costs of pneumatic transporters, however, it was found that smaller blow tanks with faster fill times (14 seconds or less) were not only cheaper to build and require less space but also had lower compressed air consumption of up to 45%..

**A note regarding energy requirements:**
It has become accepted practice to ask for and quote air consumption figures for a pneumatic sand transporter installation and to use such quoted figures as a measure of transporter efficiency.

Without considering additional data such air consumption figures are misleading because they do not relate to any measurable dimensions. The reader has no way of comparing one CFM figure against another CFM figure without taking into consideration the pipe line diameter, developed pipe line length and tonnage.

Installation of the pipe run should be with solidly anchored pipe supports so that the piping cannot move during operation. Pipe and bend connections should be only with special bolted flanged arrangements, eliminating any gaps between pipe ends and never welded pipe to pipe connections.

Finally, after the system has been installed and the pipe run has been pressure tested and found to have no leaks a factory trained technician should be utilized to perform the system startup and to make final correct air volume and air pressure adjustment which should be recorded and filed for future reference.

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