Mid-South Engineering Company

Issue No 24 Working Together **Fourth Quarter, 2007**

Basic Process for Evaluating Low-pressure Pneumatic Conveying Systems *By: J. Tom Wright*

Low-pressure pneumatic conveying systems (dilute phase conveying) are based on the principle that air, under certain conditions, is able to capture and convey material from one location to another. This is accomplished by creating a pressure difference between two points, within a pipe or system of pipes (ductwork). This pressure difference causes air to flow from the high pressure end to the low-pressure end. When evaluating an existing system to determine why the system isn't operating at peak performance or when trying to determine if an existing system can be expanded to include additional pick-up points there are three basic factors that should be the focus of the evaluation: the system's air flow characteristics, system components' capacities (fan, filter, airlock, cyclone, etc) and the ductwork design.

The first step in evaluating an existing low-pressure pneumatic system is to take direct measurements of the air velocity or velocity pressure and static pressure, with measurements taken at several locations within the system while the system is operating under normal conditions. This information can then be used to determine the system's total system pressure, air volume (CFM), and loading capacity. The system pressure has a direct effect on the system air volume and loading capacity, this is a result of the system pressure vs. air volume performance relationship of the system fan. When a low-pressure fan's RPM remain constant and the total system pressure is decreased the air volume will increase. Adversely, when the system pressure is increased the air volume will decrease. This pressure vs. volume relationship directly affects the overall system capacity because a system's capacity is determined by the total air volume. A good rule of thumb for determining a system's loading capacity is that for every pound of material per minute that is to be captured and conveyed through a system will require approximately 40 CFM of air to transport the material. (This will vary by material type, shape, material density, air density, etc)

In an existing pneumatic system any changes in air volume will directly affect the air velocity within the ductwork. This is due to the fact that air velocity inside ductwork is a function of air volume and the cross section area of the ductwork. The minimum required air velocity inside the ductwork will also vary depending on the type of material being conveyed. For example, wood sander dust would require a minimum duct velocity of 4,000 ft/min. while larger wood chips would require 5,000 ft/min. to be properly conveyed. As you can see, these three air flow characteristics discussed earlier, are inherently tied together; by which when one characteristic is altered it directly affects, and changes the values of, the other two.

A second focus in evaluating an existing low-pressure pneumatic conveying system is the system components' capacities. This would include the filter, cyclones, fans, and airlocks. The filter specifications should be checked and compared to the system air volume to insure that the air velocity through the filter (can velocity) is below 350 ft/min and that the air-to-cloth ratio is reasonable; depending on material type and particle size. The pressure differential across the filter should not exceed 5" wg.; if this pressure is much higher it might be the indication of plugged or dirty bags or a more significant problem. A second system component to evaluate would be any cyclones within the system. The cyclone size, design type, and their respective air volume should be compared against the manufacturer's specifications to insure the cyclone is operating within it's design limits, this will insure the cyclone is operating at it's maximum efficiency. Thirdly, the fan specifications should be referred to in order to determine if the fan is operating at the conditions that it was designed for; this will require gathering information off the fan's name plate and contacting the manufacture to gather specific information on each particular fan. This manufacture's information would include a fan curve, fan construction, and the original fan speed. The fan speed should also be measured in the field using a tachometer to determine what, if any, changes have been made to the original drive speeds. If the fan speed has been altered, the manufacture should provide updated information on how the fan is operating at the existing conditions. Extra precaution should be given that the fan is not operating above the maximum safe speed. Lastly, information should be gathered from any airlocks included in the system (make, model, speed, etc); this information should be used with the manufacture's specifications to insure that material loading at the inlet side of the airlock does not exceed roughly 35% of the total airlock capacity. This would apply to all the airlocks included in the system with respect to the individual airlock's loading scenario and the material density. This information gathering process is necessary to insure that none of the system components are operating above their design conditions and is an important step in determining the effective and safe operation of the pneumatic conveying system. *(continued on back)*

"The Barn" built in the 1930's to house Welsh ponies, serves as Mid-South's offices.

Finally, the ductwork design should be visually inspected for unnecessary elbows, leaks and damage to the ductwork or duct supports. By eliminating any unnecessary elbows from the system the total system static pressure will decrease and therefore improve the air flow characteristics within the ductwork. Obviously any leakage that is occurring at ductwork connections or through damaged ductwork will rob air from the pick-up points and decrease the systems effectiveness to capture and convey waste material.

Hopefully this brief description of basic evaluation techniques will aid your engineering, maintenance, and operations personnel to better understand the low-pressure pneumatic conveying systems within your facilities.

Cary Office Staff

Concrete Curing Speed

Concrete poured at the same time does not always cure at the same speed. There are a number of factors that can change the speed with which concrete cures or stiffens. The additives and mix formula are obvious contributors. Some project portions require that the concrete cure rapidly and the admixture will involve an accelerant to help achieve a quick cure that will allow you to reduce the amount of time a production process is “down”. Since lost production means lost revenue, you can spend some money on the concrete mix formula and come out dollars ahead. Other admixtures can increase the time for the concrete to cure. Retarding admixtures may be needed for various reasons but mainly are chosen because of a desire for a uniform strength in adverse conditions.

Other items that can affect the cure time of concrete are ambient temperature and other weather related events, such as rain or snow. Dealing with moisture properly makes a huge difference in how your foundations or concrete work will finish. Surrounding equipment or production operations can create the same affect as weather related events. An operating kiln or oven nearby may cause one area of a new foundation to be warmer than other parts and create issues with how the concrete cures and how quickly it sets up. Similarly, a cold storage or refrigeration area may cause a slowing of the concrete to stiffen.

It is important to understand the circumstances, weather and other conditions surrounding the concrete placement of a project in order to properly specify and design the mixture. It is equally important that the contractor understands what corrective steps need to be taken should something change or should it become apparent that the concrete in one area is curing at a different speed than another area. For example, if a slab is poured and it begins to rain and tarps or a cover are not put in place to shield the surface from the water, then the concrete surface could “spald-off” and leave you with a poor finish.

Time on concrete is better spent on proper planning than it is in the implementation stage, and even more important than on corrective action. Remember the seven “P”s: Prior Proper Planning Prevents Pitiful Poor Performance.

Mid-South Engineering Company

1658 Malvern Avenue - Hot Springs, AR 71901
501-321-2276 -FAX:501-624-4214 or
email:info@mseco.com

CPM

Division of Mid-South Engineering Company

1149 Executive Circle, Suite A-Cary, NC 27511
919-481-1084 – Fax: 919-481-1184
email: info@mseco.com