

Jeff Shelton, Dracyon Corp, discusses why many cement plants are not getting the most out of their air cannon systems, and the steps that can be taken to ensure they perform as effective cleaning devices.

KEEP ON CLEANING!

Air cannons have been in the cement industry for at least 50 years. While there are around half a dozen major air cannon companies, many smaller companies have their own designs as well. When making a decision regarding which air cannon design best fits a given application, the following factors should be considered:

- ▶ Air cannon design. What is the available warranty?
- ▶ Air cannon volume. The air in the air tank is the cleaning energy of any air cannon. How much energy will provide the best results?
- ▶ Not all nozzles are created equal. Which nozzle will allow maximum production from the air cannon?
- ▶ Is the air cannon protected from the harsh environment? The leading cause of air cannon failure is the environment.
- ▶ Can maintenance be safely performed on the air cannon while the unit is operational.

Poor reliability is related to two main factors: 1) the design of the air cannon, and 2) how the air cannons are installed. Many of today's air cannon designs are fundamentally good. Since that is the case, the reliability of the air cannons often comes down to how they are installed. Installation, in many cases, is the issue which will lead to greater air cannon failure rates. This is a major reason why Dracyon Corp believes

that it can make any currently installed air cannons more reliable while also improving plant efficiency.

One thing to note is that while several air cannon OEMs build a good air cannon, this is not true with air cannons from China. It is not unusual to see cases where the failure rate is quite high. There have even been cases where the pressure code ratings on the air tanks have been falsified. When questioned about this issue, at least one plant replied by saying, "That's OK because I can replace the entire air cannon for less money than fixing than the North American air cannon."

Firstly, this is not true for all North American air cannon OEMs.

Secondly, if a North American air cannon fails quickly then the plant operator should review how it was installed. It is most likely not the air cannon design that is to blame, but the environment in which it is installed.

Thirdly, if a plant can replace the entire air cannon, and it fails frequently the question becomes: 'are you getting what you paid for?'

Is there a better way than to accept such poor performance? Absolutely.

The greatest difference in air cannon performance can be determined by just how much each air cannon can clean. There are two crucial points to consider with regard to any air cannon's ability to clean:

- ▶ Reliability: It does not matter how powerful an air cannon is if it does not work.
- ▶ Cleaning power: It does not matter how reliable an air cannon is if it is not cleaning.

The key to any successful air cannon installation is successfully applying these two rules.

Cleaning practices

The primary factor that limits cleaning performance is the nozzle. In simple terms, the nozzle serves the same function as a governor on a car engine. One can have a high-performance sports car that has an engine capable of reaching 200 mph, but if this engine has a governor on it set at 55 mph, then 55 mph is the maximum speed. Simply put, the nozzle must be designed to allow for maximum performance. And unfortunately, this does not happen in most cases in the air cannon market.

The second limiting factor in cleaning performance is the air tank size. The air in the pressure vessel is the cleaning energy of the air cannon. If a plant has a 70 l pressure vessel, then 70 l of air pressure is



This is an example of poor air cannon installation. The valve assembly and air tank are located in a high heat area, which can lead to reliability issues and makes it unsafe to perform maintenance when the unit is operational.

the cleaning energy. If this tank size is increased to 140 l then the cleaning energy is doubled. Doubling cleaning energy also improves the cleaning ability of the air cannon without it needing to be fired as often. Think of using a leaf blower in the fall: when blowing leaves from a front yard, do not turn the leaf blower on and off, hoping a small, repeated burst of air will blow the leaves. Rather, turn the leaf blower on and let it do its work in one go.

The third limiting factor is related to the actual installation of the air cannons. Many air cannon OEMs' recommendations are that the air cannon must be installed as closely to the discharge point as possible to achieve maximum cleaning power. If the goal is to simply maintain the highest pressure possible, then this is 100% true. However, maximum air pressure is not the only factor to consider, and placing the air cannons right next to the application comes with high risks. Specifically, all air cannons hate two things: high temperatures, and material getting back into the valve. Installing the air cannons as close as possible brings both negatives into play. Moving the air cannon away from the discharge point will reduce the pressure (peak force) of the air cannon blast entering the nozzle, but when this is done properly it will improve air cannon cleaning and reliability.

Consider a couple of facts:

- ▶ Increasing volume does not increase peak force but it does increase the amount of air at the higher pressure.
- ▶ With a smaller air tank, the air cannon must be closer to the discharge point. If moving the air cannon away from the discharge point, then be prepared to increase the cleaning energy so that the loss of cleaning energy caused by the increased distance is not great enough to eliminate any remaining cleaning power.
- ▶ What impacts the cleaning ability of an air cannon? The general rule of thumb is peak force. While this does impact cleaning, it is not the only factor involved. Plants must consider momentum and kinetic energy as well as peak force. In all three considerations, the key factors are velocity and volume. Increasing the volume and/or the velocity, will also increase cleaning power.
- ▶ Buildup characteristics are often not considered. The key factor in air cannon cleaning is the fact that the air cannon blast must be able to overcome the mechanical bond that holds the buildup in the unwanted location.
- ▶ Cleaning buildup is much more complex than one factor (peak force of the air cannon) and many factors must be considered.

- ▶ Not all air cannon applications are created equal. Some applications involve moving a dry buildup which is easy to move, yet in other cases the buildup is sticky and/or wet and can be very difficult to move.
- ▶ In many applications air cannons should be used in conjunction with other cleaning devices to achieve the best results.

Optimising air cannon performance for the industry

Dracyon Corp offers their services as an air cannon consultant for the cement industry, seeking to help plants solve a wide variety of issues related to the purchase, installation, and proper use of air cannons.

The major issue today is not the air cannon design, but basic air cannon philosophy: how they are installed, which nozzle is used, and the operational sequence of the air cannons.

The benefits of this consulting will include the following:

- ▶ Extend the cleaning range of the air cannons, which will allow plants to stop using high pressure water washing or cardoxing to supplement air cannons. This will improve production levels and plant efficiency, increase worker safety, and directly extend refractory life.
- ▶ Improve air cannon reliability which will also result in improvements in production and plant efficiency.
- ▶ Make online maintenance of air cannons safe. There is no need to use air cannons if they cannot be fixed online. Plants today often stop online maintenance because it is deemed unsafe. For the plants that still perform maintenance, the limitation creates such a hardship that often plant maintenance crews refuse to perform this work.

The purpose of this consulting service is to show plants how they can reclaim their investment in air

cannons and achieve the results which are required to justify air cannons.

When new air cannons are required, Dracyon tends to argue that IGS air cannons are amongst the best, both in terms of operational efficacy and cost-effectiveness. With that said, the consultation will also offer pros and cons regarding each system and air cannon.

In many plants, the buildup experienced is not the same, and plants will need a 'family' of air cannons to meet these needs. The right air cannon for each application will be recommended. The family of air cannons per tier recommendation will include any existing air cannons as well as all major air cannon OEMs, delivering an unbiased opinion about how to best help each plant.

Air cannon maintenance

Air cannon reliability is key to success. Dracyon Corp offers an air cannon maintenance solution. This plan includes the following:

Diagnosis

The first step is to understand the air cannon issues, in order to diagnose the problem.

Not all plants experience the same issues. Dracyon Corp will perform a 'walk the tower service' in person at the customer's plant. This will be a two-day service in which a walk down of the installations will be conducted and specific recommendations will be made for each air cannon that is installed. During this walk down, a photo of each air cannon will be taken and a labelling system will be developed. This is critical because this will allow the plant to document when and how often each air cannon requires maintenance.

Solution

Included in this trip the company will extend one day to perform maintenance training for the system. Dracyon Corp will then provide a document which will be included which discusses recommendations for each air cannon.

When problems arise, the company will be available through an internet meeting (e.g. Zoom, Teams, etc.) to discuss any customer issues and how to solve them quickly and effectively. 'How-to' videos regarding standard air cannon maintenance will also be offered. In addition, Dracyon Corp will include video safety glasses which will allow them to see what plant operators are seeing and help solve the problem. If 'a picture is worth a thousand words,' how much is a video worth?



A fan jet nozzle with a focus blast capable of moving clinker further away helps maintain better control of snowmen.



Three different air cannons; all installed incorrectly, and all of which will require frequent maintenance.



A properly installed air cannon on a material chute. The air cannon is installed close to the discharge points with a high temperature hose which minimises vibration in the chute. This vibration had previously caused many air cannon failures.

Dracyon Corp will also work with the plant setting up onsite spare parts. When an air cannon needs repair, the quicker, the better. It is recommended that these on-site spare parts be purchased on a consignment basis: paying for the spare parts as they are used. Some air cannon OEMs are open to this type of arrangement and will help customers get set up.

Dracyon's service includes review and suggestions regarding the installation of any new air cannon recommendations to solve buildup problems. This service will also include two days at the plant's annual outage for inspection and recommendation.

Case study

The goal is not to sell every plant new air cannons, but to make every customers' existing systems work as well as they possibly can. It is expected that improvements from this service could be as high as US\$1 million annually per plant. The objective is to make a small investment in order to make significant long-term savings.

The following is one example of the service process and the projected savings for the plant:

A walk down was performed on one tower and the following was found: this plant had 135 air cannons installed, 56 of which had failed. Many of the air cannons were installed improperly and the maximum benefit was not being achieved by the plant.

But interestingly, it was also found that at least 35 of these air cannons were not even needed. Furthermore, at least 70% of these air cannons were leaking air. These leaks resulted in the plant having difficulty in maintaining proper air pressure, which was affecting all of its air cannons. The operational pressure for this application should have been at least 80 psi, but it was at an average of only 60 psi.

50% of the nozzles were also a limiting factor on the performance of the air cannons.

Buildup issues were occurring at both the feed shelf and riser duct. A Dracyon Corp recommendation to improve performance included the following:

- ▶ Remove from service all air cannons that are not needed. This reduces the clutter around the tower and represents a huge saving in air usage. The result would be an increase in operational pressure for the remaining air cannons, thus improving air cannon cleaning for all the remaining air cannons. This removal is also a great source of spare parts.
- ▶ Replace all the wrong/ineffective nozzles with improved nozzles. This is generally recommended to be done when the nozzle already needs replacement, but this is not the case for all air cannons. In the critical areas, the proper nozzle may need to be replaced asap to eliminate the need for high pressure water washing.
- ▶ The firing sequence of the air cannons was believed to be improper and will need to be adjusted as required. Many air cannons are fired too frequently and thus use more air than is required. Reduction of the frequency of air being used will help improve air pressure and lead to improved air cannon cleaning throughout the plant.
- ▶ Establish a plan for the critical areas which will increase performance to help improve production and plant efficiency.

Based on the above recommendations, the plant in question should save at least an additional US\$500 000 annually. ■