Optimise Your Blasting – 2. What Affects your Blast Efficiency?

When it comes to dry abrasive blasting, the efficiency of your blasting setup is often measured by how much area you can cover in a given time, and the amount of abrasive you use to do it.

In this video series we will be showing you how you can optimise your blasting setup to save time and dramatically reduce the overall cost of your job, without sacrificing quality or safety.

In part one, we covered what an abrasive blast system is, and how the aim is to give your abrasive as much kinetic energy as possible to ensure an efficient blast. In part two, we will be identifying the key variables that affect your blast system's efficiency, including how to reduce dynamic pressure loss.

So, going through the blast system from start to finish, the variables that affect the efficiency of your blasting process are:

- Compressor Pressure setting
- Compressor air capacity in either l/s or cfm
- Air quality
- Dynamic Pressure Losses from your Blast Machine's design and efficiency
- Abrasive Media Valve Setting
- Dynamic Pressure Losses from the length, condition, and positioning of your Blast Hose
- the size, design, and inlet pressure of your blast nozzle
- And your chosen abrasive's characteristics, such as hardness and size.

So, we're going to address each of these variables to explain how they affect your blast system, and what we can do to improve it.

Air quality predominantly relates to the amount of water in the air that you are compressing. If there's more water in the air due to a more humid environment, then it can get into your system and compromise the process. This can be counteracted by having an air dryer in the air supply from your compressor. The air dryer could be built-in to your compressor itself or a separate unit that's attached to the air supply before the first item to receive air in your system - so typically before your Air Distribution Manifold, or if you're blasting without one, before your Abrasive Blast Machine. This ensures the air entering your blast system is as dry as possible.

When it comes to the abrasive you are using, your choice of abrasive will most likely be defined by what it is you are blasting and what abrasive is available to you. Typically, the harder the abrasive, the more effective it will be at removing rust and previous coatings, and efficiently creating a surface profile. When it comes to the size of abrasive particles, it is typically accepted that larger particles create deeper profiles and smaller particles create smaller profiles.

As we mentioned in part one, typically the higher the pressure at the nozzle, the more efficient your blast. So to ensure you have enough pressure at the nozzle you will want to avoid dynamic pressure losses.

Dynamic pressure losses are caused by how the air moves through the blast system. As mentioned, these pressure losses occur mainly in the abrasive blast machine, and across the length of the blast hose.

In the blast machine, friction is the main cause of dynamic pressure loss.

If we think of the air going into a blast machine as water in a river, when a river is straight, the water flows faster. However, when there are bends in a river, typically the water slows down. The same is true of air moving through a blast machine – if the pipework has lots of bends and constrictions in it, the air speed and pressure drops.

Also, as water flows through a river, typically water at the centre of the river flows faster than water that's closer to the edges. This is the Boundary Layer Effect, and similarly occurs when air flows, as air around the circumference of a pipe travels slower than air in the centre. Since the amount of slow moving air around the circumference is always the same, regardless of how large the pipe is, smaller diameter pipes proportionally have more frictional losses compared to larger pipes. So as a result you get more, fast flowing air in larger diameter pipes, compared to smaller ones.

So, if you have a blast machine with larger diameter pipework, and is designed with as few restrictions as possible, it's reasonable to predict that your dynamic pressure losses will be reduced.

This is why the pipework on Elcometer's Abrasive Blast Machines have an internal diameter of 1½" (38mm), providing 41% more area for air to flow over competitor's 1¼" (32mm) pipework resulting in less pressure loss; and are designed to minimise restrictions throughout the blast machine - from the air intake, through the Remote Control Valve, down the Pusher Line, to the Mixer T; to optimise air flow and reduce pressure losses.

To prove it, here you can see this needle pressure gauge currently reading at 166psi (11.5bar), and it is attached at the inlet of an Elcometer Blast Machine, which is currently blasting using copper slag. If we move around to look at the needle pressure gauge attached by the exit of the machine, as you can see it reads exactly the same; meaning very little pressure is being lost in the Elcometer ABM. We must admit it's very rare to see both pressure gauges reading the same value, as it is perfectly natural for a blast machine to lose a small amount of pressure while blasting, but this shows how efficient the Elcometer ABM's can be.

Frictional pressure losses can also occur in the blast hose. If the hose is laid flat and straight, it will incur less dynamic pressure losses than a hose with lots of bends or elevation changes in it, just like the previous example of the bend in the river, though admittedly depending on what it is you are blasting, sometimes you don't have a choice in how your blast hose is positioned.

The condition of your blast hose also affects the amount of pressure loss. A newer, more rigid, or more highly rated blast hose holds its shape better, ensuring a straighter, smoother path for the air and abrasive to flow; whereas an older or lower quality blast hose is softer and more pliable, creating bulges and irregularities in the hose that affect the flow.

The remaining factor affecting the amount of pressure lost in your blast hose is its length. Put simply, the longer the blast hose, the more pressure you lose across the distance. In-fact, tests have shown that on flat ground, depending on the compressor pressure setting, you can lose up to 2bar of pressure across 50m of hose. Any elevation changes to your blast hose will affect this further.

But, while having a shorter blast hose means less pressure loss, once again depending on what you're blasting you may be restricted by what your minimum blast hose length can be.

So, now we have identified the key variables that affect the efficiency of your blasting process, and discussed a few of them, including how to reduce dynamic pressure loss. In part three, we will be discussing the effects of the remaining variables, which will lead us to explore the difference between air pressure and air flow, and how it affects your blasting setup.

For more information on the Elcometer Blast Machines, Valves, ancillary equipment, Personal Protection Equipment, and our complete range of spare and replacement parts – simply visit elcometer.com, or click on one of the links on-screen.

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