Optimise Your Blasting – 3. How Air Pressure and Air Flow Affect Your Blasting Setup

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 two, we 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're discussing the remaining variables, which will lead us to exploring how air pressure and air flow affect your blasting setup.

But first, back to our list of variables that affect the efficiency of your blast system.

The setting of your abrasive media valve is vital for getting an optimum mix of air and abrasive. Not enough abrasive in the air stream means it will take longer to blast the same area, wasting time and compressor fuel. While too much abrasive can slow the air stream down and reduce the abrasive's impact energy on the surface making it less effective, not to mention using unnecessary abrasive requiring additional clean-up, which increases project costs. That's why it's vital to get the right balance, so you can maintain nozzle pressure and abrasive speed, whilst having enough abrasive to efficiently blast the surface.

Due to the different designs and manufacturers of abrasive media valves, and depending on the nozzle pressure you're blasting at, and the abrasive you're using, there is no single ideal setting for your media valve, and typically needs adjusting as you are blasting. Patrick O'Brien of Sherwood Blast Cleaning has over three decades of experience as a heavy industrial abrasive blaster. Here, he explains the importance of media valve setting.

PATRICK: Whatever you're taking off, there will be a sweet spot between speed and grit usage. Only the blaster knows that between coatings, temperatures, [the] surface… You can't just turn the pot down – okay the pot's lasting an hour and a half; what are you doing? The compressor is roaring away, money's going down the drain, but you're getting nowhere. But likewise you can't turn it up that much [if] you're doing hundreds of metres but using tonnes and tonnes of grit. There is an optimum point and that's what the blaster should be finding.

So to address this issue, to help make it easier to find that optimal mix of air and abrasive, Elcometer's Abrasive Media Valves come with fingertip adjustment so you can precisely control the media flow, even when blasting.

The remaining settings; the compressor pressure setting, the often misunderstood compressor air capacity (typically measured in CFM or l/s), and your choice of blast nozzle; are all linked, and changing one setting affects your choices of the others. Getting the best combination of these settings is vital for ensuring you get a higher pressure at the nozzle, which as mentioned before, ensures a faster abrasive speed, resulting in a more effective, cost-efficient blast. But what is the best combination?

To find out, let's set up a typical blasting scenario. It has been widely stated in the industry that to get optimal blasting performance, you need 7bar (102psi) of pressure at the nozzle. Anything below this results in a drop in blast efficiency as the abrasive speed drops. Anything above increases the abrasive speed, but it becomes increasingly difficult for the blaster to hold the nozzle due to the greater pressure.

So let's create a typical setup that gives us this optimal pressure of 7bar at the nozzle. So here we have a 300cfm compressor set to 8bar, 40m of 1¼" blast hose as a typical example length, and a #6 ⅜" Single Venturi Nozzle attached. With these settings we can reasonably state the pressure at the nozzle will be around 7bar when taking all dynamic pressure losses across a typical system into account.

With 7bar at the nozzle, it is not only comfortable for the blaster to hold, the abrasive impacts the surface with a reasonably effective force, which is why this compressor pressure and nozzle size combination is widely used in the industry. But can this be improved?

Well, if we replaced our ⅜" nozzle with a ¼" nozzle, the nozzle pressure would go up, in theory increasing the abrasive speed. However, as the orifice area is less than half the size, less air and grit can exit the nozzle. What's more the spray pattern of the nozzle also reduces greatly because of the smaller nozzle diameter, meaning you are covering less area with less grit, compared to the ⅜" nozzle.

Alternatively, if we were to go from a ⅜" nozzle up to a ½" nozzle, the orifice area would be 78% bigger, creating a spray pattern that is significantly larger. However, because of the bigger orifice size, the pressure at the nozzle drops, so your abrasive loses speed, hitting the surface with less energy, meaning you'll need more abrasive and time to blast the same area.

If you're losing pressure at the nozzle, surely the answer is to add pressure into the system from the compressor? However, if we turned our compressor from 8bar up to 10bar, while the pressure at the nozzle would indeed improve, it would still not be enough to get the optimum 7bar at the nozzle and obtain the abrasive speed required.

The issue isn't just requiring more pressure. What you also need, is more air flow. At 300cfm, the volume of air simply isn't high enough to replenish the air exiting the larger ½" nozzle, which results in the nozzle pressure dropping below the required level.

But if we replaced our 300cfm compressor with, say, a 500cfm compressor, the increased air flow capacity is now sufficient to create the nozzle pressure required when using the bigger ½" nozzle. This means you can now achieve at least 7bar at the nozzle, creating a greater abrasive speed to the original 8bar ⅜" nozzle setup, but with the added benefit of having the wider spray pattern and hence the blast efficiency of the ½" nozzle.

To help demonstrate this, Elcometer have developed a piece of software that simulates blasting using different nozzle sizes, compressor pressures, and compressor air capacities, showing you how quickly you can cover a predefined area.

It's reasonable to predict that blasting with a larger nozzle, that can cover a greater area at any one time, with the exact same abrasive speed as a smaller nozzle, will get the job done quicker by comparison.

However, what about the amount of abrasive you use throughout the job and its cost? The cost of clean-up? The cost of buying and running a higher cfm compressor?

When all of the factors that affect the cost and efficiency of a blasting project are considered, is operating at a higher pressure, with a higher cfm, using a larger blast nozzle, *really* a more cost effective way to blast?

That’s what we’re going to find out in part four, where we look at the series of independent tests commissioned by Elcometer to see how changing your setup can dramatically affect the overall cost of your job.

For more information on the Elcometer Blast Machines, Valves, ancillary equipment, Personal Protection Equipment, and our complete range of spare and replacement parts, or to find out more about Elcometer’s blasting simulation software – simply visit elcometer.com, or click on one of the links on-screen.

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