Optimise Your Abrasive Blasting - How to Save Over 30% of your Total Blasting Costs

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 show you how you can optimise your blasting setup to help you save time and potentially reduce the overall cost of your job by almost 30%, saving over four hours in blast time alone every $100m^2$. To show how this is possible, we talk about what an abrasive blast system is, the variables that affect the efficiency of your blasting process, how to reduce dynamic pressure loss, the difference between air pressure and air flow, and how changing your blast setup affects the overall cost of your job.

In this video we're going to go over the key points of the series that result in us finding a blasting setup that can save you both time and money - but remember you can always watch any part, at any time if you want the full story.

In part 1, we cover what an abrasive blast system is. Typically, an air compressor feeds air to an Abrasive Blast Machine, where the high pressure air is mixed with the abrasive media, which then travels along the blast hose, and out of the nozzle at the end; hitting the surface being blasted, creating a surface profile for painting, removing any rust or existing coatings in the process.

The main goal of an abrasive blast system is to provide the abrasive with as much energy of movement, also known as kinetic energy, as possible. The amount of kinetic energy the grit carries is dependent on two things; the mass of the grit, which is defined by the size and weight of the abrasive you are blasting with; and the speed of the grit, which is created by the inlet pressure at the blast nozzle.

The more kinetic energy your abrasive has, the more severely it will impact the surface you're blasting, which allows you to complete the job in less time, using less abrasive. This means the more kinetic energy you can give your abrasive, the more efficient your blast.

So how do we give the abrasive more kinetic energy? This is discussed in-detail in part 2, by looking at the key variables that affect the efficiency of your blasting process, addressing the effects of air quality (air humidity in particular), and choice of abrasive. We also look in more detail at how to reduce dynamic pressure losses.

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

To best illustrate the effects of dynamic pressure loss, we likened the air moving through a blast machine, to 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. Importantly, the amount of slow moving air around the circumference is always the same, regardless of how large the pipe is, so as a result you get more fast flowing air in larger diameter pipes, compared to smaller ones.

So, with all that in mind, if you have an Elcometer Abrasive Blast Machine, which has 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.

When it comes to dynamic pressure losses 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, again like the example of the bend in the river. Newer, more rigid, or more highly rated blast hoses also incur less dynamic pressure losses than worn or more pliable blast hoses, as they provide a smooth, straighter path for air to flow. The length of the blast hose also makes a difference, as 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. However, depending on what it is you're blasting and where, you may be restricted by how short your blast hose can be, and how it is positioned.

In part 3, we look at the remaining variables that affect your blast efficiency, which include the importance of finding the optimum setting on your abrasive media valve, to get the right mix of air and abrasive.

The remaining variables; 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 getting the best combination of these settings is vital for ensuring you get a higher pressure at the nozzle, ensuring a faster abrasive speed, giving your abrasive more kinetic energy, resulting in a more effective, cost-efficient blast.

This leads us to discuss the difference between air pressure, and air flow, and how it affects your blasting setup.

To demonstrate this we set up a typical blasting scenario which aims to achieve 7bar (102psi) of pressure at the nozzle, as it has been widely stated in the industry that this amount of pressure delivers optimal blasting performance. So we model a setup that's widely used in the industry today that achieves this, as you can see from the settings above. Then we asked if this could be improved. In short, yes.

If you move 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.

To be able to blast efficiently with the larger ½" nozzle you need more compressor pressure and more air flow, in order to replenish the air exiting the larger orifice. With the additional pressure and air flow capacity, you can 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. This means you can cover a greater area at any one time, without sacrificing your abrasive's kinetic energy, and this setup can still be held by the blaster.

But how much faster is blasting at a higher pressure, with a higher cfm, using a larger blast nozzle; and how does it affect your overall project costs?

Put simply, it can save you time and money; and in part 4 we find out how much, through a series of Elcometer-commissioned tests undertaken by an independent blasting company, with more than 30 years of industry experience.

Full details of the tests and how they were done are shown in part 4, but in short, we tested a combination of three different compressor pressures and three different nozzles sizes, and timed how long it took each setup to blast a predefined area of a coated panel, with each panel prepared and coated to the same specification. The amount of abrasive used to complete the blast was also recorded.

We would then use the results of these tests, and incorporate the costs of abrasive, clean up (not including disposal), labour, the blast machine depreciated over a standard 5-year time period, compressor fuel, and a 550cfm compressor once again depreciated over 5-years; to work out exactly how much it costs to blast per m^2 for each combination of compressor pressure and nozzle size, to find the most cost efficient blasting setup.

What we found was blasting with 12bar compressor pressure and a ½” nozzle was the most effective combination - blasting a m^2 36% faster, using 19% less abrasive, and, when all project costs are considered, up to 29% cheaper than the widely used 8bar ⅜” setup. And remember, that’s up to 29% cheaper per m^2 with the costs of buying a new compressor and an Elcometer Abrasive Blast system included. This just goes to show how minor the relative costs of a new blast system and compressor are per m^2 compared to your ever-present fuel, abrasive, and labour costs. If we were to expand that to a 10,000m^2 blasting project, that’s a saving of 420 hours in blast time alone just from changing your setup. That’s over 17 man-days of non-stop blasting saved, every 10,000m^2.

As well as testing the Elcometer Abrasive Blast Machine, four leading competitors’ blast machines were also tested. What we discovered was, once the same costings were applied to the data, when comparing the project costs per m^2 of each abrasive blast machine within each viable setup, the Elcometer Abrasive Blast Machine proved the most efficient. When blasting with the widely used 8bar, ⅜” nozzle setup, the Elcometer Abrasive Blast Machine was up to 16% more cost effective.

But, more importantly, what about when using the most efficient setup from our tests: the 12bar compressor setting using a ½” nozzle? Well, the Elcometer Abrasive Blast Machine saved 13% over the next best competitor. If you combine that with the initial 29% saving of changing your setup that we mentioned before, you could be saving over 40% on project costs overall, per m^2.

This series of videos shows that when you increase the compressor air flow capacity and compressor pressure, and combine it with a larger nozzle size, typically you will be able to blast with greater efficiency compared to smaller volumes of air, compressor settings and nozzle sizes; saving both time and money. What’s more, when using an Elcometer Abrasive Blast Machine, that’s been designed from the ground up to be safer, more reliable, efficient, and easier to maintain; we’ve proven it can deliver a more cost efficient blast than the next best competitor.

For more information and training 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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