Optimise Your Blasting – 4. How your Blast Setup Affects the Project Cost

When it comes to dry abrasive blasting, how much area you can cover in a given time, and the amount of abrasive you use to do it, are typically the key indicators for how efficient your blasting setup is.

In this video series, we've been showing you how you can optimise your blasting setup to help you save time and potentially reduce the overall cost of your job.

In part three, we looked at how the abrasive media valve setting, compressor pressure setting, compressor air capacity, and your choice of blast nozzle, affects the efficiency of your blasting process. This led us to explore how getting the right combination of these settings is vital, and that using a higher compressor pressure and compressor air capacity, meant you could blast efficiently using a larger diameter nozzle, allowing you to cover a greater area at any one time, which we demonstrated using Elcometer's blasting simulation software.

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?

Well in this part, we're going to find out not only if this is true, but also how changing your blast setup affects the overall cost of your job.

To find out, Elcometer commissioned a series of tests, undertaken by an independent blasting company, with more than 30 years of industry experience. A number of steel panels were blasted to a nominal profile of 75µm (3mils), and were inspected using an Elcometer 224 Digital Surface Profile Gauge to ensure uniform test samples. The panels were then coated with a 3 coat glass flake epoxy within the thickness range of 500-600µm (19.5-23.5mils). Each layer of the coating was checked with an Elcometer 456 Dry Film Thickness Gauge, during the application process, and prior to testing to ensure uniform results.

Using an Elcometer Abrasive Blast Machine, the panels were then blasted with a 60/30 copper slag, at three different compressor pressures (8, 10, 12bar), using three different Single Venturi Nozzle sizes (#4/¼"/6.35mm nozzle, #6/⅜"/9.5mm nozzle, #8/½"/12.5mm nozzle); and how long it took to blast a pre-defined area to a minimum of SA2.5 would be recorded. The blast machine would also be weighed before and after the test to measure the amount of abrasive used. The hose length was fixed at 90 metres (295ft) with an internal diameter of 32mm (1¼"), and pressures were recorded going into the blast machine, coming out of the blast machine next to the abrasive media valve, and at the nozzle inlet – our all-important nozzle pressure.

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

So, what did we find?

After testing the nine different pressure setting and nozzle size combinations, one thing became clear immediately – higher compressor pressures with larger nozzle sizes were blasting the surface quicker than lower pressures with smaller nozzles.

If we isolate the results of the widely used 8bar compressor pressure with a ⅜" nozzle setup, and compare it to the fastest time to cover a m^2, which was the 12bar ½" setup, you can save up to 36% of your time, every m^2. That's a saving of up to 41 hours for every $1000m^2$.

If we compare the fastest and slowest setups side-by-side, you can visually see how much more effective the 12bar ½" setup is at cutting through the coating than the 8bar ¼" nozzle setup. Interestingly, when we measured the nozzle pressures of these setups, they were both around 7bar (102psi) – the widely stated industry target that, whilst still being manageable for the blaster to continuously hold, should yield optimum performance. However as the footage shows, this isn't always the case - compressor pressure and nozzle size clearly are more defining factors.

If we compare the nozzle pressures of all the different setups we tested, immediately we should discount any setup where the nozzle pressure is around 9bar (131psi) or higher, as in a real-world setting the pressure at the nozzle would be far too great to continuously hold. Even if the setup is particularly effective at blasting the surface quickly, such as the 12bar 3/8" setup, to expect the blaster to hold 9bar of pressure for the duration of a typical shift is not realistic or safe.

So, what remains are the viable options for the most efficient blasting setup, with the 12bar ½" setup so far the quickest, while still being comfortable to hold.

However, in cutting through the coating more quickly with a larger nozzle, are you in-fact using more grit? Well, comparing our viable setups once again, our abrasive used graph per m^2 follows a similar pattern to the time taken – higher compressor pressures with larger nozzle sizes were blasting a m^2 with less grit; 7kg less when you compare the widely used 8bar ⅜" setup with the 12bar ½" setup.

So it seems like at this point, using 12bar compressor pressure with a ½" nozzle is proving the most efficient – blasting a m^2 36% faster and using 19% less abrasive than the typical 8bar ⅜" setup.

But what about all of the cost implications? Well, we took the data from the tests and then added proportional costs to cover:

- Abrasive usage and its cost
- Labour costs for the blast teams and abrasive clean up teams
- Diesel fuel used and its cost
- The purchase cost of 550cfm diesel compressor depreciated over a standard 5-year timespan
- And the cost of an Elcometer Abrasive Blast System, again depreciated over a 5-year period

Incorporating these costs with our test data, if we were to take the widely used 8bar compressor ⅜" nozzle setting as the baseline standard cost of a blasting project, and compare it against our viable alternative setups where the nozzle pressure is less than 9bar (131psi), the 8bar ¼" nozzle setup is far more expensive, producing costs up to 52% higher per m^2.

However, as we increase both the compressor pressure, and the nozzle size, the costs decrease; with the most cost effective result coming from blasting using the ½" nozzle, with the compressor set to 12bar, which is up to 29% cheaper per m^2 than the typical setup. 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 days of non-stop blasting saved, every $10{,}000m^2$.

Now, some may have reservations about the costs of making these changes, which may include replacing their current compressor with a 500cfm model or higher, or replacing their 8bar rated blast machine with one that can operate up to 12bar.

But look at it this way – even if we depreciated the costs of a 550cfm compressor and a 12bar Elcometer Abrasive Blast system over just one year, the relative costs per m^2 are still minor when compared to your ever-present abrasive and fuel costs.

Many will also be concerned about what the effects of having a larger compressor and a larger diameter nozzle will do to their fuel and abrasive costs respectively, but as you can see they needn't worry. Due to the running time saved, fuel and abrasive costs per square meter uniformly drop due to the efficiency gains resulting from the compressor setting and nozzle size increases.

As well as testing the Elcometer Abrasive Blast Machine, four leading competitors' blast machines were also tested to find out two things: if the nozzle size and compressor pressure setting results were consistent across different blast machines; and how the Elcometer Blast Machine compared against them.

It's worth mentioning that not all abrasive blast machines operate up to 12bar. Of the four competitor machines we tested, only two operated up to 12bar, one operated up to 10bar, and the remaining up to just 8bar.

What we discovered was, once the same costings were applied to the data, that every blast machine followed a similar pattern – higher compressor pressures with larger nozzle sizes typically resulted in faster blast times, less abrasive usage, and lower overall project costs per m^2 – with the 12bar ½" setup consistently yielding the best results.

What's more, 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, with a 12bar compressor setting using a ½" nozzle, proving the most cost effective setup of all – saving 13% over the next best competitor.

If we visually compare these tests; Elcometer on the left, the next best competitor on the right; you can see how far behind the competitor is once the Elcometer Blast Machine has completed a m^2, and used 6kg less abrasive to do so.

Now we aren't saying that 12bar compressor pressure with a ½" nozzle is the setup you should be using for every job, because depending on what it is you are blasting and where, your blast hose length and position will change; meaning the amount of compressor pressure you will need to effectively power the system, will also change.

However, what we *are* saying is that when you increase the amount of CFM air flow and compressor pressure, and combine it with a larger nozzle size, as long as you have a nozzle pressure that is comfortable to hold, typically you will be able to blast with greater efficiency compared to smaller volumes of air, compressor settings and nozzle sizes.

And, in addition to the potential 29% cost efficiency savings per m^2 from simply changing your setup, due to the unique design of Elcometer's portable and static Abrasive Blast Machines, you can be up to 13% *even more* cost efficient than the next best performing blast machine at 12bar, to ensure you have truly optimised your blast setup.

However, we understand that this series is a lot of information to take in, so in the fifth and final part, we will be summarising the key points of the series to help ensure you know exactly how you can optimise your blasting setup to save time and money.

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, 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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