Techniques of Air Abrasive Blasting

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For an air abrasive blasting system to work effectively, you must have good equipment, quality control of the operation, and a trained operator using proper blasting techniques. This Bulletin will briefly review equipment and quality control requirements, and then will offer some advice about blasting techniques. In addition, solutions to problems of moisture in the system that arise from working in humid environments will be presented.

Review: Equipment and Quality Requirements
To achieve high quality cleaning at an acceptable production rate, you have to use the proper combination of equipment and make appropriate quality control checks.

A review of equipment requirements includes the following:

- Compressor: The compressor must be big enough to deliver air volume and pressure sufficient for maximum productivity. Factors influencing compressor size requirements include blasting nozzles and their sizes, the amount of breathing air, and other equipment that requires air.
  - Blast Machine: The blast machine must be an ASME-coded pressure vessel with appropriate piping, valves, and fittings. A metering valve should give precise adjustments of abrasive flow, and a remote control must be provided to the blaster.
  - Hoses and Fittings: Air hose, blast hose, and fittings must be sized appropriately so that they do not have a negative influence on blast pressure at the nozzle. Avoid conditions that cause friction to impede air or abrasive flow, such as restrictive fittings, small diameter hoses, excessive hose length, or small radius bends in the hose. Pressure at the nozzle, as measured by a needle gage, should normally be in the range of 90-100 psi (Fig. 1).
  - Nozzle: The blast nozzle orifice size must be appropriate for the work. The nozzle interior must not be worn excessively: an increase of more than one number (1/16 in.) is excessive. The nozzle length should suit the blast job at hand. Normally, short nozzles about 3 in. long (7.6 cm) are used for easy to clean surfaces, and long nozzles (4 1/2 in. to 8 3/4 in. [11.4 cm to 22.2 cm]) are used to remove tenacious materials. Special nozzle configura-
The abrasive should be tested for size and contaminants before it is used; and air pressure can be checked just behind the nozzle with a needle gage.

- Abrasive Setting: Productive blasting requires using just the right amount of abrasive. Too much or too little abrasive lowers productivity. Abrasive adjustment is made with the metering valve. There is no scientific way to determine the setting. Keep changing the valve until you hear the blast line “sing.” More is not better. Feeding in more abrasive not only lowers productivity but also causes an unsightly cloud and visibility problems.

**Blasting Techniques**

Presuming that you have a good equipment set-up and good abrasives, and that you are using them according to manufacturers’ directions, then the final requirement for a productive system is effective operation of the nozzle by the blaster.

There are 3 main elements of technique in abrasive blast cleaning. They are stand-off distance, angle of attack, and dwell time.

**Stand-off Distance**

Stand-off distance is the distance from the blast nozzle to the workpiece. The shorter the stand-off distance, the more cleaning power the system has, and the smaller the blast pattern becomes (Fig. 2). Thus, there is a trade-off between cleaning power and productivity in the selection of stand-off distance.

When tenacious materials such as millscale must be removed, it is likely that stand-off distance will have to be relatively close to the workpiece, in the range of 12 in. (30 cm).
The stand-off distance can be increased to about 24 in. (60 cm) when less tenacious materials, such as old paint, are being removed.

When you first begin blasting, you should experiment with stand-off distance until you determine the optimum distance for cleaning and at the same time achieving the greatest production speed.

**Angle of Attack**

It is also necessary to determine the optimum angle of attack when you first begin blasting (Fig. 3). For rust, millscale, and heavily pitted surfaces, the angle of attack, or the angle of the nozzle in relation to the workpiece, should be 80-90 degrees. For removal of old paint, the angle might be about 45-60 degrees, and for general cleaning it can be 60-70 degrees.

A slight downward angle will help you direct the dust away from you as you blast so that you can see the work better. In confined spaces, lighting may be required to help you see your work.

In the case of both stand-off distance and angle of attack, you must operate the nozzle consistently. In both vertical and horizontal movements, you must keep the nozzle parallel to the workpiece (Fig. 4) and avoid arcing movements that will move the nozzle further away from the surface at the end of the pass.

At the same time you keep the nozzle parallel to the surface, you should maintain the angle of attack you established as the optimum one.

To accomplish this consistency, you have to limit the distance the nozzle travels during each pass across the workpiece. A good average distance for a pass is about 30 in. (76 cm).

The consistent operation of the nozzle is similar to the consistent operation required for spray painting, where smooth, easy strokes are made across the surface, with one stroke partially overlapping another.

**Dwell Time**

Dwell time is the amount of time spent cleaning any particular spot on a workpiece. When loosely adherent materials are being removed, dwell time is only momentary on any given spot. When tightly adherent materials are removed, dwell time will be longer, perhaps as long as several seconds. In instances such as this, therefore, the travel speed of the nozzle will not be uniform, because it will be necessary to dwell more on some areas than on others.

When you are blasting irregular surfaces, or when surface conditions are variable, it will be necessary to vary the stand-off distance and angle of attack, as well as the dwell time of blasting.

**Dealing With Moisture Problems**

One of the biggest problems with abrasive blasting is related to moisture. A large amount of abrasive blasting is performed during warm months when relative humidity is high. Compressing air at moderate to high relative humidity results in air exiting the compressor holding all the moisture it can. When the temperature of the compressed air drops, the water falls out of the air.

The most effective method to deal with moisture is to use properly sized and operating moisture traps. The valve on the bottom of the trap should be cracked open. This allows the water to drain from the trap so it doesn’t fill and then add water into the air stream. Under certain conditions, an air chiller may be necessary. The air chiller cools the air. Cool air holds less moisture than warm air.

**Summary**

Setting up the various equipment components in an air abrasive blasting system is critical in establishing the basis for productivity, but productivity cannot be achieved unless the abrasive blaster uses the proper techniques to operate the system.

Techniques important to blasting involve stand-off distance, angle of attack, and dwell time. When the blaster employs these techniques effectively, he achieves maximum productivity while doing a quality cleaning job. ATB