Proper Nozzle Selection Critical to Automated Peening, Finishing, and Blasting Success

AUTOMATED BLASTING, peening, and finishing are the solutions of choice for companies seeking consistent results when processing high volumes of parts with specific finishing specifications. **Repeatability** is the value proposition that makes these operations successful, and a critical component to achieving repeatability is choosing and properly utilizing the right nozzle for the job.

Repeatability in high-volume parts peening, finishing, or blasting operations is achieved by delivering a uniform quantity of media at a consistent velocity and striking the target surface area in the same way each and every time. The internal shape of the nozzle guides and distributes the media as needed for the application. Different nozzles with different shapes offer different advantages depending on the application.

Pressure blasting is chosen for some high-production air-powered processes because it propels media at a higher velocity through the blast nozzle than suction blasting. In air-powered pressure blasting, media feeds from a pressure vessel into a moving stream of compressed air through a metering valve, blast hose, and nozzle.

Two types of pressure blast nozzles are generally used. Both are designed with unique internal shapes to achieve different objectives. Both types have a broad entry area, which sharply tapers to an orifice—the smallest inside diameter (ID) of the nozzle and, in fact, the smallest area in the entire blast system. The rapid reduction in ID and the controlled expansion of the compressed air, moving through the nozzle, work together to accelerate the media toward their target.

As its name implies, a straight-barrel nozzle has a straight, constant-diameter barrel between the orifice and the exit-end of the nozzle. When the air and media reach the nozzle exit, the less-dense air quickly expands once the influence of the nozzle barrel is absent, and momentum carries the media along the center of the blast pattern.

The straight-barrel shape creates a relatively small blast pattern with a very high intensity and then tapers out to lower impact at the perimeter. While it takes longer to cover a large surface area with such a small hot spot of higher intensity compared with other nozzle shapes, the straight-barrel shape works well in recessed or restricted areas.

Unlike the straight-barrel nozzle, the venturi nozzle gradually tapers outward from the orifice to the exit-end of the nozzle. This gradual exit expansion allows a mixing of air and media within the nozzle causing them to expand uniformly before leaving the nozzle.

Clemco's straight-barrel nozzle

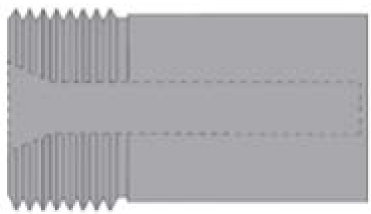
A venturi nozzle provides excellent peening intensity and cleaning capability with a broad pattern. The performance of the venturi nozzle depends on a precise ratio of length to orifice size, and to entry and exit tapers. This design creates a large blast pattern that produces uniform peening intensity and maximum acceleration for cleaning.

Once the proper nozzle is selected, it is important to monitor the nozzle's condition for effectiveness during ongoing use. Nozzles wear from continuous exposure to high-velocity media when more air and media are allowed to pass through the orifice. The resulting larger area within the nozzle consumes more air volume, which in turn places greater demand on the compressed air source. Unless air volume can keep up with the


Venturi nozzle

increased flow, pressure at the nozzle will drop. Reduced pressure causes peening intensity and productivity to fall, and efficiency suffers.

A rule of thumb to follow for ensuring continuous high production is to replace the nozzle when the orifice wears to the next larger size, generally to 1/16" or 1.5 mm. In the USA, nozzle sizes are measured in 1/16" increments. A No. 6 nozzle has an orifice of 6/16" (3/8"); the next larger size is No. 7 with an orifice of 7/16" (11 mm). In Europe and elsewhere, nozzle sizes are indicated in millimeters.


Straight-barrel nozzle

The relative life expectancy of a nozzle depends upon the combination of its liner material and the abrasive media being used. The harder the media, the more durable the liner material must be to withstand exposure over an acceptable life.

A commonly employed industry reference for measuring relative hardness is the Mohs' scale, which offers a method of measuring relative hardness on a scale from 1 to 10 for non-metallic media and nozzle liner materials. Metallic media (steel) is measured on the Rockwell scale. Common steel media range from soft Rc-35 to hard Rc-65.

Besides the choices of nozzle shape and liner material, the other critical factor to achieving repeatability when pressure blast cleaning, finishing, and peening is the distance between the nozzle and the target object. The target area must be covered with precision for efficient cleaning and finishing and to adhere to strict peening intensity specifications. Overlapping coverage wastes valuable resources in cleaning and finishing and may not produce the specified results in peening applications.

With the relatively larger pattern produced by the venturi nozzle, it is also important to be able to calculate the area the blast will cover. Calculating the blast pattern size is easy: Simply multiply 0.125 times the distance between the exit end and the target surface and add the ID size of the nozzle orifice. For example: The pattern size produced by a 3/8" (9.5 mm) nozzle positioned 8" (203.2 mm) from the surface is 1.375" (34.9 mm).


Venturi Nozzle Clemlite

Once the blast pattern size is calculated, the area covered by the chosen nozzle(s) can be determined. This helps determine precisely what system configuration (i.e., number of nozzles needed) will do the job in the desired timeframe and within the defined budget. The result will be repeatable results delivered efficiently and effectively.