Back to Basics: Sizing Hoses and Nozzles

Got a question about shot peening, abrasive blasting, or sample processing? Herb can help.

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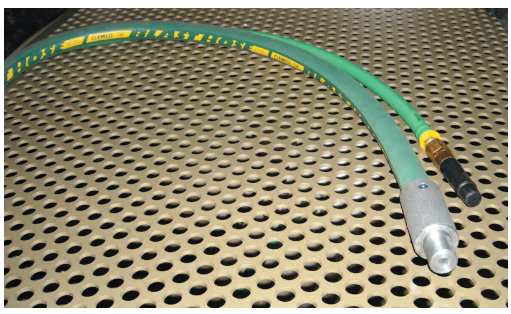
These uncertain economic times stop us in our tracks and encourage us to reconsider how we do things. We take the opportunity to examine our procedures and question our decisions so that we can find ways to make improvements. In a previous article, I wrote about how to select the right media for your application. In this article, I am offering more food for thought, this time about taking care to select and use the right size air supply hose, blast hose, and nozzle. Ultimately, all the choices you make impact system performance, productivity and efficiency. In good times, few people worry about being wasteful. We're in too much of a hurry getting product out the door and making money! Now that times are tougher, we're all inclined to think more about doing things properly to save money and time and to ensure we turn a profit.

To begin, a blast system needs to be designed for maximum performance. Next, it must be cared for to keep it performing as designed throughout its life, which for a blast system can be many decades. Proper maintenance will ensure it continues to provide optimum service for its intended purpose.

Properly sized components are carefully combined during system design. Making sure those components continue to be used through the life cycle of the product is critical. Replacing parts with the same sizes as originally specified is key to keeping the system operating at peak performance.

People frequently ask about the importance of hose size and its impact on their operation. Here are a few questions to ask yourself to raise your awareness of the important variables to consider:

- What is the application: blast cleaning or shot peening?



- At what pressure will the blasting or peening be done?
- What size and type of nozzle will do the job?
- What type of media is needed: angular or round?
- Where will the cabinet system be located and is there enough space available for proper hose arrangement?

Blast Cleaning vs Shot Peening

For blast cleaning or deburring operations, angular media are most often used and are frequently used with a rich media-to-air mix. Such a combination calls for a hose to nozzle size ratio of three or four to one. For example, a 1/4-inch nozzle calls for a 3/4-inch to 1-inch inside-diameter hose. It is the ID of the nozzle which determines air volume demand. When the recommended ratio is disregarded and the nozzle orifice is larger than recommended, premature hose wear occurs. The hose wears more quickly than it should because a larger orifice permits more media (more particles) to race through the hose, abrading the surface of the inner tube along the way. With hose and nozzle similar in size, the hose will wear much more rapidly.

In shot peening applications, round media are used in a leaner media-to-air mix, compared with blast cleaning. In these applications, the suggested hose to nozzle ratio is two or three to one. The smaller ID hose keeps velocity high, preventing excess media from accumulating in the hose and preventing surging in the flow.

Blasting or Peening Pressure

Pressure affects velocity. When using a small nozzle (No. 3 and smaller) at low pressure (20 to 40 psi), the ratio of nozzle orifice to hose ID may be further reduced to two to one. This tighter ratio keeps media moving, preventing the media from falling out of suspension in the blast hose. Media falling out of suspension causes media accumulation and surging. With higher blasting pressure (50 to 100 psi), and higher velocity, media remains suspended in the air and more easily maintains a constant flow.

Nozzle Type and Size

Your application will guide nozzle selection.

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For example, blasting into a restricted area will call for a straight-bore nozzle with or without an extension for adequate coverage. Blasting in a blind hole may call for a side-angle nozzle with a deflector tip. The nozzle orifice size will depend upon the size of the hole, ensuring there's adequate space available for blasting and evacuating media.

More accessible and exposed surfaces can be blasted with a venturi nozzle which produces a larger blast pattern and maximizes surface coverage. Blast nozzle liner material should be matched to the media to be used. Harder media calls for harder, more durable nozzle liner material. Typically, tungsten carbide is suitable with glass bead, but boron carbide is needed for more aggressive media such as aluminum oxide and silicon carbide.

Air Supply Line

A sufficiently large air supply line maximizes air delivery to the system in the required volume. Volume and pressure are equally important. Adequate air volume (cubic feet per minute, cfm) at a given pressure (pounds per square inch, psi) ensures that the blast system will perform for your purpose. Sufficiently large means as large as or larger than the blast system plumbing. The size and type of plumbing also affect the system's performance. To avoid pressure loss through the system, the plumbing in a pressure-blast system must be sized to maintain the volume of air provided to it and on through the blast hose and finally through the nozzle. Nozzle performance depends on adequate air volume and pressure to accelerate the blast media and shape the blast pattern. The size and configuration of the components are important each step of the way.

Type of Media

In shot peening applications, spherical media in a lean media-to-air mix do not normally cause rapid hose wear compared with blast cleaning applications. Spherical media do not abrade the surface as angular particles will. In a leaner mix, round particles will glide through the hose minimizing abrasion. In these applications, what's most important is consistent flow. Shot peening intensity issues develop when flow is inconsistent causing intensities to drift.

System Location

Many times so much emphasis is placed on the application that little or no attention is paid to the available space for the equipment in the shop. A critical consideration for optimal performance is minimizing the number of bends in the hoses and keeping any necessary bends in sweeping rather than tight arcs. Regardless of the application, hoses will wear prematurely where media comes into constant contact with the hose at each bend. Too many bends will reduce velocity and negatively affect blast pressure at the nozzle. In peening applications, hose bends can cause media to fall out of suspension and also cause inconsistent peening intensity.

Conclusion

Paying attention to the principles of air movement through a blast system will ensure a properly performing one. Creating a maintenance checklist and making sure the list is consulted for servicing will pay dividends in an easy-to-use, reliable and dependable blasting or peening system. If you need help, I'm only a phone call away (636-239-8172). ●