Design, Technique, and Technology Make Most of Air Blasting Processes

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

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Photograph:
An integrated PLC provides vitally important monitoring and machine process controls

Blasting using compressed air as the energy source is an age-old process. Over time, enhancements have helped users of this technology achieve greater productivity, economy, and safety through nozzle design, air-flow management, and controls. Air blasting is useful for achieving results from many industrial surface treatments, such as shot peening, paint stripping, preparing new surfaces for coatings, deflashing, deburring, and general cleaning.

Nozzle Design

During air blasting, the air-blast media stream focuses on the substrate through the use of one or more nozzles. The stream can be concentrated on a small area, or dispersed to cover larger areas with a single wide-spray nozzle or multiple nozzles. Nozzle type—straight, venturi or side angle—creates unique spray patterns. Nozzles can be manipulated to provide coverage from an infinite number of simple or compound angles. More nozzles are added for tough areas and pressure can be reduced for sensitive substrates. This flexibility with air blasting variables allows greater blasting control when compared with centrifugal (wheel) blasting.

Shot peening uses steel shot, glass beads or ceramic media with either suction- or pressure-blast equipment. Choosing between them depends upon your application, and the size and type of media required as well as intensity and saturation requirements.

Air-Flow Management

Suction systems function by passing air through a jet in the blast gun. The air volume remains constant. The air jet and nozzle combination creates vacuum that draws blast media into the gun and from there accelerates the media through the nozzle. Air jet , nozzle design and correctly installing them are very important for an efficient process. The ZERO BNP gun is engineered to properly combine the air and blast media for effective results.

Suction blasting is usually recommended for smaller steel shot particle sizes from S-70 to S-230, because of their density (the media are pulled by vacuum from the hopper to the gun where they mix with the compressed air). As the air-blast media mix discharges from the gun/nozzle, it picks up velocity for a short distance as it travels to the work surface.

In a pressure blast system, it is the size of the nozzle orifice that determines the volume of compressed air passing through it. As the nozzle wears, the air volume needed to maintain a constant blast pressure increases. Pressure systems will normally do three to four times more work than suction systems; however pressure blast systems also require three to four times the volume of compressed air. With the added velocity, blast media breaks down faster, and maintenance costs increase.

Pressure blasting is recommended for larger steel shot particles because blast media enters the air stream at the metering valve at the bottom of the blast machine and together the mix travels through the blast hose. As they pass through the hose, they gain velocity and achieve peak velocity when they exit the blast nozzle. The larger the particle size, the greater the surface impact. Pressure blasting is used when the application is blasting into deep recesses or blind holes, and for tough jobs like paint stripping.

Control

Beyond determining suction or pressure blasting and the type of nozzle to use, an important ingredient in modern-day blasting is control. Today, a number of sophisticated technologies are used to achieve and document the blasting processes for productivity and safety. Inventions of recent decades are now common in automated blast systems.

One such invention is the programmable logic controller (PLC) built to withstand harsh industrial applications. When integrated into the blast system, it can control blast on/off time, blast pressure, part rotation, nozzle traverse speeds etc. Each blast nozzle can be individually monitored and individually controlled. These controls allow for data recording for recordkeeping and control for precise process repeatability. Monitoring and control are vitally important in shot peening applications to comply with stringent specifications, such as AMS-2432.

Shot flow controllers, for ferric media applications, used in conjunction with a media shut-off valve, monitor and measure blast media flow and control that flow ensuring it remains at the prescribed rate. These controllers are capable of generating alarms to warn the operator of an out-of-specification condition and shutdown the system to prevent damage to parts or unacceptable parts.

Light curtains are employed as optic-controlled safety mechanisms for protecting operators from harm when loading and unloading parts from semi-automated systems.

More and more frequently, robotics are incorporated into automated cabinet systems for safety and productivity enhancements. Robotics can provide pick-and-place loading and unloading of parts. They can meet peening specification requirements for critical parameters such as nozzle positioning, stand-off distance, and nozzle manipulation. Robotics can speed work flow, reduce labor costs, and provide greater flexibility by providing multiple-axis positioning and manipulation of nozzles.

Successful Operations

For a successful outcome every time, it's important to recognize that no two jobs can be assumed to be alike. Every application should be evaluated to determine which type of blasting is most suitable. The application will dictate the type of blasting, the appropriate blast nozzle, and the blast media. It's all about efficiently manipulating the variables to use the forces of compressed air, blast media, and new technologies for each and every job you tackle.