## What is Micro-Abrasive Blasting?

The process of micro-abrasive blasting involves mixing a finely graded abrasive media with a compressed stream of air and forcing it through a small nozzle. The abrasive mixture generated with this technology creates an effective tool for:

- selective cleaning.
- focused cutting.
- precision deburring.
- surface preparation.
- material removal.

The concept behind micro-abrasive blasting relies on three important features of the process:

- the ability to evenly meter abrasive into the air stream
- the ability to achieve high particle velocity at the nozzle
- the physical properties of the abrasive media

Although frequently confused with the more familiar "bead" or "grit" blasters, or the smaller venturi type systems, micro-abrasive blasting fills distinct niches because of the size of the nozzle used, the precise control of the abrasive stream, and the consistency of the abrasive flow. Whereas large workstations use a very high volume of air and media, producing a shotgun effect, micro-abrasive blasting pinpoints the abrasive stream, allowing the operator to selectively work on a part.

## Where is the Technology Best Used?

Micro-abrasive blasting fits a wide variety of applications ranging from selectively removing conformal coating from high value circuit boards in rework operation to aggressively cutting burrs off precision machined medical implants. The precise nature of the abrasive stream makes it ideal for blasting on delicate parts or on small areas of larger parts. This blasting process has found niches in industries ranging from dental ceramics to mold manufacturing using EDM.

### Technology Limitations

While micro-abrasive blasting is used in a wide variety of applications, there are some limitations to the technology. Micro-abrasive blasting is not appropriate for:

- coverage of large areas.
- use with very coarse abrasives.
- removal of large burrs.
- achieving a highly polished surface.
- use in a clean room environment.

## How Does the Process Work?

The foundation of the micro-abrasive blasting process is precision. A metering device precisely injects small amounts of abrasive into a very dry air stream. The amount of abrasive used can be varied, and typically operations will require between 0.5 and 2.0 pounds of abrasive per hour. Under pressures between 40 and 200 psi, the air/abrasive mixture is forced through the nozzle, which accelerates and focuses the abrasive stream.

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## What Constitutes a Micro-Abrasive Blasting System?

A basic micro-abrasive blasting system consists of six components: blaster, nozzle, media, air dryer, workstation, and dust collector. Each component of the system is an integral part of the micro-abrasive blasting process and has a specific job to do.

## Blasters

There are two common types of micro-abrasive blasters – smaller units designed for manual or intermittent use and larger, more robust units engineered for heavy production.

The smaller units are designed to cover the widest range of applications for micro-abrasive blasting. They are commonly used for manual applications where the operator needs a high degree of control over the abrasive stream. This style of blaster typically uses nozzles ranging from 0.015" to 0.060".

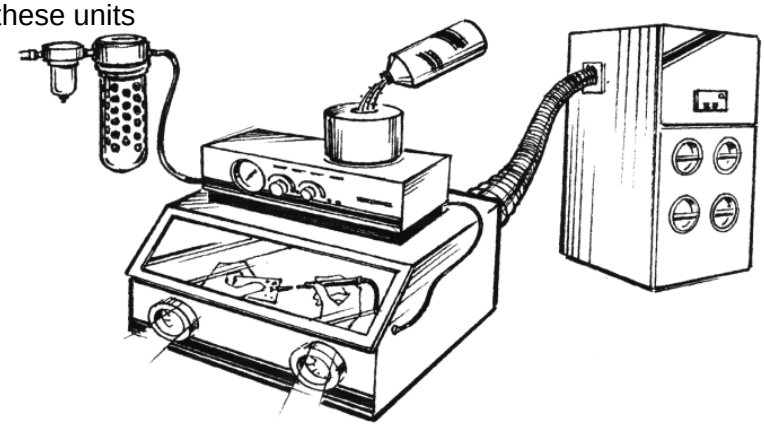
The larger machines incorporate additional enhancements to make them a superior choice for production environments. These units are designed to run under heavy production requirements with a minimal amount of maintenance. Wear points are hardened to resist the damaging effects of the abrasive. Additionally, the tanks on larger machines are capable of holding between 10 and 20 pounds of abrasive and are able to feed larger diameter nozzles or an array of multiple nozzles. The production processes on these units are typically operated with air flow rates of approximately 8 SCFM.

## Nozzles

The purpose of the nozzle is to give focus and velocity to the abrasive stream. When the air and abrasive pass through the nozzle, they pick up speed, or energy. This "kinetic energy" is released when the particles strike the surface of the work piece, removing material.

The correct nozzle for an application is a very important component of the micro-abrasive blasting process. A wide variety of nozzle shapes and sizes is available, from nozzles with right angle openings that can reach inside aircraft parts, to extended nozzles that can deburr cross-drilled holes in machined parts. Nozzle size is not, however, directly related to abrasive flow. Increasing the nozzle diameter will allow more air to flow and cover a larger surface. An appropriate nozzle has the capability to remove small amounts of material without affecting the surrounding surface.

New high performance nozzles have become more efficient tools for abrasive blasting. These nozzles were developed to increase the speed of the abrasive particles and keep them moving in a straighter line, decreasing overspray. Such improvements make them an excellent substitution in fixtured applications or in cutting and deburring projects that benefit from the higher particle velocity.



## Media

Micro-abrasive blasters are capable of using a wide variety of media. The particular media selected is determined by the type of work to be performed and the material composition of the work piece. The range of media runs from very soft sodium bicarbonate to extremely hard silicon carbide.

The media used in micro-abrasive blasting is very different from what could be used in a larger "grit" blaster. Micro-abrasive blasting requires the media to be very dry and highly classified (free from impurities). Abrasives that are typically used in "grit" blasters are not acceptable for micro-abrasive blasting.

### Dryness

Micro-abrasive blasting frequently uses media that is much finer than media used in other blasting systems. The most common media sizes for micro-abrasive blasting are between 17.5 and 50 microns. The relatively small particle size makes micro-abrasive media highly sensitive to moisture. Moisture causes the fine abrasive particles to stick together, forming clumps that cannot be effectively metered into the abrasive stream. To prevent clumping, most abrasives must be kept drier than 0.5% moisture content.

Proper storage of abrasive material will help to extend its useful life. It must be kept sealed to avoid the absorption of moisture. Once the package is opened, the media should be used immediately. Dryness of the media cannot be stressed enough and is one of the most common reasons for down time of the system.

### Purity

When working with fine micro-abrasive media, care must be taken to eliminate the very fine and coarse particles. A broad distribution has two effects on the process. First, the wider distribution of particle sizes increases the likelihood of abrasive packing up in the tank and not feeding properly into the abrasive stream. Second, using a media with a wide distribution of particle sizes can cause more variation in blasting aggressive-ness than is acceptable for the process.

### Selection

Abrasives can be broken down into three categories: media that is aggressive against brittle materials, media that is aggressive against pliable materials, and peening media.

**Aluminum Oxide** and **Silicon Carbide** are examples of very aggressive media used on hard, brittle materials. Their own hardness combined with sharp edges make them very effective at cutting through metals.

**Sodium Bicarbonate** is the most effective media for cutting pliable materials. While not nearly as hard as aluminum oxide, its needle-like shape allows the particles to "cut" through polymer materials where a "blocky" particle would simply bounce off. **Plastic Media** and **Walnut Shells** have characteristics similar to sodium bicarbonate.

Lacking sharp edges, **Glass Bead** is not used for cutting applications. Instead, this media is used to "peen" a surface. Glass bead is often used where the preservation of tight tolerances is critical, combined with the need to relieve machined stresses, light deburring, or applying a satin-like finish.

**Choosing the appropriate media for an application will have the single most significant impact on the success of a project.** A detailed description of media characteristics and uses is available in another Comco Technical Bulletin.

## Air Dryers

Moist air is the biggest enemy to the micro-abrasive blasting process. While most grit blasting operations are capable of using compressed air after it passes through a refrigerant dryer, this is *not* sufficient for micro-abrasive blasting.

Media such as Sodium Bicarbonate is more sensitive to moisture, and a lower dew point is needed. For a single station, a sufficient dew point can be achieved with a desiccant type dryer. For multiple stations, or a station operating multiple shifts per day, a membrane or continuous duty dryer is more efficient and cost effective. In order to maintain the integrity of the dry air, the dryer should be kept as close to the blaster as possible.

## Workstations

In the micro-abrasive blasting operation, the workstation serves three functions. It is designed to contain spent media, illuminate the work piece, and create a comfortable environment for the operator. Beyond these basic criteria, a workstation must also be designed to provide a good air flow over the parts, allowing the dust collector to work effectively.

Accessories such as magnifiers and microscopes can be attached to the workstation to assist with the processing of extremely small parts. Special workstations that incorporate static dissipative devices can be used to protect sensitive electronic components from static discharge while blasting.

## Dust Collectors

The micro-abrasive blasting process is only able to use media one time. Once the media has been shot from the nozzle, it must be collected and removed from the work area. The only effective approach to filter out the fine media particles is to use an industrial dust collector. These units are designed to trap the small particles, while still providing a high volume of air flow.

We recommend that a dust collector for a single station be capable of providing 400 SCFM of air through the work chamber. The dust collector is frequently connected to the work chamber with a short, flexible hose.

Dust collector manufacturers have developed new tools to make these units more reliable in a production environment. If you are evacuating a large amount of spent media from a station or multiple stations, you should consider a collector that uses pleated cartridges and pulsing jets of air to keep the filter cleaner. These collectors utilize a hopper to assist with the disposal of the spent abrasive.

## Custom Blast Systems

Special blasting systems can be developed for production processes to allow for high volume or precision requirements. The capabilities of micro-abrasive blasting can be significantly expanded with the addition of automation. Applications may call for a programmable X-Y table, tracing over parts, or parts may be carried on a conveyor belt under the abrasive stream to abrade the top surface. Many different configurations have been effectively integrated to handle parts in the abrasive stream, from semi- to fully-automatic.

## Summary

A variety of media, precise definition, the potential for automation, and the ease of operator training are all key benefits of micro-abrasive blasting technology. Micro-abrasive blasting can be incorporated into almost any system that requires precision in an abrasive process to achieve selective cleaning, focused cutting, precision deburring, surface preparation, or material removal.