Abrasive Selection Requires Evaluation of Needs, Cost, and Productivity

By Lori R. Huffman, JPCL

Gone are the days when inexpensive silica sand was the abrasive of choice for contractors looking to maximize productivity, minimize cost, protect their workers as well as the environment, and achieve the cleanliness and surface profile required by project specifications.

Now that high-silica abrasives, with their link to silicosis in workers, are roundly shunned by the painting industry and a greater variety of alternative abrasives is available, contractors are presented with a much larger decision tree when selecting abrasives for surface preparation. This article presents tips on selecting the right abrasive for the job from two abrasive distributors and one painting contractor.

Factors Influencing Selection

Abrasives may be divided into four categories: non-metallic, naturally occurring, byproduct, and manufactured, says Jeff Theo, vice president of Vulcan Painters, Inc. (Bessemer, AL). A basic requirement for any abrasive is that it be clean, dry, and free of dust to yield the most productivity during abrasive blasting.

The two most important considerations in selecting specific types of abrasives are anchor profile and cleanliness requirements set out by the coating specification, says Tom Westerman, owner of Corpus Christi Equipment Co. (Corpus Christi, TX). The anchor profile achieved by an abrasive is directly related to its size and angularity. The larger and more angular the abrasive, the greater the resulting anchor profile, he says. However, the cleaning rate for abrasives is inverse to particle size, with larger abrasives achieving slower cleaning rates. Westerman suggests that contractors select the finest abrasive that can yield the desired anchor profile to boost cleaning rates.

The type of steel substrate to be prepared (such as new steel or coated steel) influences the choice of abrasive, as well, says Tim Poor, abrasive rental and service manager for CESCO (N. Charleston, SC).

The bottom line is important in the selection of abrasives—the overall cost of coating materials rather than the actual cost of the abrasive, that is. Contractors have to look at how abrasive selection and its relation to anchor profile depth can add to the cost of materials, says Westerman. In short, "the deeper the profile, the more coating material required to fill it," he says.

Abrasive selection is also influenced by local regulations and productivity issues, says Westerman. For example, a fabricator with a blast room may choose a different type of abrasive (one that can be recycled, for instance) than that selected by a field contractor.

Jeff Theo of Vulcan Painters

Tom Westerman of Corpus Christi Equipment

Tim Poor of CESCO

Environmental issues such as dusting and waste disposal also play a role in abrasive selection, says Theo. Contractors have to look at the dusting characteristics of abrasives when determining the best abrasive for a job involving the removal of hazardous wastes, for example. Should waste minimization requirements pertain to a painting job, a contractor must weigh the use of additive-treated abrasives against the use of recyclable abrasives to achieve "total waste minimization." And, in considering recyclable abrasives, the contractor should compare the number of reclaims possible with each abrasive and evaluate the ease of cleaning for each product.

The cost of transporting abrasives is another factor that can make one abrasive more attractive than another for contractors. For example, the cost of transporting slag abrasive a few hundred miles by freight can increase its total price by 25% or more, says Theo.

The possibility of abrasive embedment during blasting can also encourage the contractor to select one abrasive over another, notes Theo. Contractors must evaluate candidate abrasives to ensure that their potential for surface embedment does not exceed the cleanliness requirements laid out in

the specifications, he says.

The influence of hardness on the suitability of one abrasive over another is a "gray area," according to Westerman. "When you dissect the hardness issue, it's a lot like shopping for carpet. There are some variations [among abrasives], but they aren't that great," he says, referring to abrasives such as sand, coal slag, garnet, and aluminum. In fact, hardness can be a liability. For instance, says Westerman, the hardness of steel abrasives can affect their ability to be recycled. "If they're too hard, they break down too fast," he says.

From Sand to Slag

With concerns over the hazards of silicosis having caused contractors to turn away from silica sand, the transition to other abrasives has not necessarily yielded an apples-to-apples result in achieved anchor profiles, says Westerman. When contractors began to use coal slag in place of silica sand, they found that the same particle mix of the two abrasives, 16/40, resulted in different anchor profiles. A 16/40 silica sand yields an anchor profile of 1.5 to 2 mils (37.5 to 50 microns); a 16/40 coal slag gives an anchor profile of 2.5 to 3 mils (62.5 to 75 microns), says Westerman. A finer particle mix of coal slag and even garnet, say 20/40 or 30/60, will achieve the same anchor profile as 16/40 silica sand and close the gap on production rates for cleaning as well, he says.

Don't Discount Operators or Equipment

Blasting equipment and the workers who operate it can affect the outcome of surface preparation, no matter how judiciously the abrasive is chosen. The surface cleanliness achieved during abrasive blasting is determined by how fast a worker is moving the blast stream over the surface, says Westerman. For instance, a worker abrasive blasting at 100 psi with an abrasive with a 20/40 particle mix will impart a 2.5-mil (62.5-micron) anchor profile to the steel surface, but he or she will take 25% more time to clean the steel to a Near White (SSPC-SP 10) finish than to achieve a Commercial Blast (SSPC-SP 6). The link between experienced blasters and productivity with any type of abrasive is critical, says Westerman.

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In addition, the diligence of workers monitoring equipment and the functioning of that equipment can negatively impact the quality of the blast. "You have to be aware of air pressure," says Westerman. "A 20/40 coal slag will give a pretty consistent anchor profile, but air pressure fluctuations during abrasive blasting can cause fluctuations in profile."

What's Being Used?

Coal slag is used in the majority of abrasive blasting jobs in the southeast U.S, says Westerman. He attributes the popularity of coal slag to several factors: cost and the prevalence of field projects and outside shop blasting. Although coal slag can be less expensive than other abrasives, its price has increased as much as 40% over the last decade, notes Westerman.

Garnet is gaining market share in Westerman's region due to the advantages it offers in recyclability and its fair-

ly stable cost. "The cost [of garnet] has come down in relation to other abrasives," he says. "Garnet is selling for roughly what it cost ten years ago." Other abrasives commonly used in his area include aluminum oxide, glass beads, and steel abrasives, all of which are used primarily in shop-related work.

Theo notes that many shop blasting facilities in the southern U.S. are using blends of steel grit and shot to balance cleaning, profiling, and productivity considerations. As for field operations, coal slag abrasives still dominate, in part because the regional availability of abrasives such as garnet is limited.

Poor's company has seen a threefold increase in the use of staurolite abrasive since it stopped selling silica sand. Coal slag is also a big seller, and crushed glass is gaining users, as well. He notes that garnet is becoming more popular, owing to its ability to be reused.

Common Mistakes in Abrasive Selection

Same As It Ever W as

One common mistake contractors and fabricators make in selecting abrasives is sticking with what they know, rather than what is best for the job, says Westerman. "We see a lot of people use one type of abrasive for everything. They aren't evaluating abrasives for individual jobs."

For example, a contractor might use a 12/40 abrasive on the interior of a small storage tank to achieve an anchor profile of 3 mils (75 microns) to comply with lining requirements. The contractor mistakenly uses that same abrasive to prepare the exterior of the tank, which may only require a 1.5- to 2-mil (37.5- to 50-micron) profile. By not changing abrasives to meet the needs of the specific job, the contractor has used more abrasive than necessary, has generated more anchor profile than required, and will need increased coating materials to achieve the specified dry film thickness on the exterior of the

tank. In addition, the contractor loses productivity in blast cleaning time, while increasing energy, labor, and material costs, as well as increasing wear on blasting equipment, says Westerman.

Likewise, he says, it is common to see contractors using fine abrasives as a standard practice, without changing to a coarser abrasive when tougher jobs like steel refurbishment come along. A coarser abrasive takes less time to remove heavy rust and thick existing paint, he says.

The most expensive mistake that a contractor can make in regard to abrasive selection is not sizing and choosing the appropriate abrasive for the specified profile, says Theo. Once a contractor has exceeded the profile requirements laid out by the owner, there is little that can be done to correct the problem.

Know the Existing Coatings

When contractors aren't sure of the type of coating they must remove from steel, they run the risk of choosing an unsuitable abrasive and wasting money as well as time, says Poor. Often, uninformed workers in this situation take a "more is better" approach to blasting, using excessive amounts of the wrong abrasive in an attempt to remove the coating, and end up redoing their work with a different abrasive, he says.

Mind the Equipment, Not Just the Abrasives

Another abrasive-related mistake occurs when contractors don't pay attention to the operation of their blasting equipment, says Westerman. Venturi nozzles are the most commonly sold abrasive blasting nozzles today because their design boosts productivity by 10% over standard straight-bore nozzles, he says.

However, this gain in productivity is quickly lost when contractors do not closely monitor nozzle wear. Many times, contractors will not change a worn venturi nozzle until they notice a loss of air pressure, by which time they have already consumed unnecessary energy and abrasives, he says. "A 10% (air pressure) production loss isn't something you can notice easily," he says, especially when the worker monitoring the abrasive blasting equipment may also be responsible for tracking environmental conditions, safety procedures, and regulatory compliance on the job.

Where We Are...

Abrasive selection may be a more complex proposition than it used to be, but with careful consideration of available products, the specification's requirements, and the contractor's needs, the best abrasive for the job can be found.

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