Vacuum 101: How to Select an Industrial Vacuum Cleaner That Helps Maintain Safety and Product Integrity

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According to a new report by Roland Berger Strategy Consultants, increasing price and cost pressure, regulatory changes and expiring patents are leading to shrinking margins in the pharmaceutical industry. So, more and more, pharmaceutical manufacturers are "right-sizing" their operations to wring the most efficiency from limited resources.

Despite smaller budgets, contamination control is still one of a pharmaceutical manufacturer's most important responsibilities. They face serious cleaning challenges and need to comply with government regulations, as well as customer and insurance audits. The bottom line: companies are responsible for protecting their people and products.

The right industrial vacuum cleaner can help streamline housekeeping and keep a safe, efficient work environment. But finding the right fit requires an assessment of specific application and facility needs.

Dust Collectors Versus Industrial Vacuum Cleaners

Dust collectors and vacuum cleaners are very different machines. A dust collector has high airflow (cfm) but low waterlift (suction). Dust collectors collect airborne dust, but they do not pick up dust from the floor or other surfaces.

Industrial vacuum cleaners provide both airflow and waterlift, so that they can effectively collect liquids, dust, debris and other particles from all surfaces including machinery, overhead beams, walls and floors.

Industrial Vacuum Cleaners Versus Shop-Style Vacs

Shop-style vacuums and other general-purpose vacuum cleaners are not appropriate for use in pharmaceutical or nutraceutical environments because they aren't built to handle rigorous cleaning demands. Also, these machines are manufactured from materials that are difficult to sanitize, and they don't have high-quality filtration systems.

Industrial vacuum cleaners are high-performance machines specifically designed for use in a pharmaceutical environment. If the vacuum cleaner will be used in a cleanroom environment, regulations require a designated cleanroom vacuum with a HEPA and/or ULPA filter. Only these models meet the International Organization for Standardization (ISO) 14644-1 standards for air cleanliness and permissible particle size and levels of concentration.

Facility managers often designate different vacuum models for different cleaning tasks because one is better for thorough cleaning around production lines, while another handles liquids.

Continuous Duty vs. Intermittent Duty

To choose the best vacuum, it's important to determine the duration of use. Single-phase vacuum cleaners powered by universal motors are well suited for tableting suites or cleanrooms on a scheduled cleaning regimen – for example, if cleaning is needed once a day. They also work well for general cleaning of the suite and around the production equipment. Single-phase vacuums can also connect directly to intermittent-use production equipment (such as tablet processing lines), which minimizes the spread of fine dust and keeps all waste materials away from workers.

However, this set-up is not recommended for facilities that run their production equipment continuously. A vacuum cleaner powered by a three-phase regenerative blower is the most economical configuration for continuous use or 24/7 operations. Three-phase units operate with a higher electrical efficiency over longer durations compared with single-phase vacuums powered by universal motors.

It is especially important to get detailed specifications about vacuum cleaners for process integration, including the number of ports per machine and the airflow per port.

HEPA versus ULPA

One of the most important elements of an industrial vacuum cleaner is its filtration system. The type of filter depends on the particle size of the material a facility needs to collect. Most pharmaceutical manufacturing environments require a vacuum equipped with a HEPA filter or an ULPA filter. HEPA filters retain 99.97% of all particles, down to and including 0.3 microns. ULPA filters retain 99.999% of all particles down to and including 0.12 microns.

A true HEPA filter is engineered into the vacuum cleaner, as opposed to a retrofitted add-on. The HEPA vacuum should also meet Institute of Environmental Science and Technology (IEST) Standards and Recommended Practices (RPs) for cleanrooms and controlled environments.

Multi-stage and Oversized Filters

A vacuum cleaner with a multi-stage, graduated filtration system provides peak operating efficiency. Multi-stage filters use a series of progressively finer filters to trap and retain particles as they move through the vacuum, which protects the main filters from blocking up quickly and minimizes motor wear and tear over time.

Quality industrial vacuum cleaners use oversized filters with plenty of surface area for their primary filter. This optimizes the air-to-cloth ratio and slows the airflow across the filter. With this type of oversized filter, the vacuum can easily collect large volumes of

material over extended periods of time without clogging. Because clogged filters are the main cause of loss of performance and can shorten motor life, the correct filter reduces downtime and maintenance.

Upstream and Downstream

Another critical consideration for cleanroom applications is the filter's location inside the vacuum. Stringent ISO standards for pharmaceutical manufacturing require cleanroom vacuums with single-phase universal motors to have HEPA or ULPA filters installed upstream and downstream to capture particulate from both the airstream and exhaust stream.

In cleanroom environments, it's important to prevent any dust from being released back into the environment through the exhaust stream. A filter placed before the motor protects the motor from debris, while a filter placed after the motor captures the debris motor components can generate during normal operation. With the proper filtration, fresh clean air should always be exhausted from the back of the vacuum, regardless of what goes into the hose.

An upcoming Part Two of this article will explore other considerations including collection capacity and collection options. It will also review specific pharmaceutical facility challenges including liquid collection, as well as working with controlled substances and in controlled environments.

About the Author

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