



Collecting dust

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Sizing your dust collector for fiber laser
cutting applications

from CO₂ laser cutting machines to newer fiber lasers. If you've recently made the switch, or are considering it, now is a good time to reevaluate your air quality equipment and make sure you have the right dust collector for the job.

The great dust up

High-speed laser cutters produce large volumes of dust and fumes that are hazardous to personnel and equipment, making dust control essential. So how much dust are we talking about? Well, it depends on three factors:

- The width of the kerf (the slit created during cutting, which represents the amount of material removed)
- The thickness of the material
- The length of the cut

This can be understood as a formula representing the amount of material that is vaporized during the laser cutting process:

Kerf x thickness x length = total material removed

Proper sizing of dust collection equipment for laser cutting is still a mystery for many manufacturers. No one wants to overspend on dust collection equipment that has more capacity than needed. But, if your dust collector is undersized for the amount of dust produced, you'll end up paying more in the long run through shorter filter life, greater energy use and wear and tear on the dust collection and laser cutting equipment.

The sizing question is especially relevant right now as many manufacturers are making the switch



Accumulated particulates can damage sensitive laser cutter components.

Therefore, to properly size dust collection equipment, you need to understand how quickly dust is produced over time and how much total dust is produced over the course of each day or shift.

Speed at which dust is produced is generally dependent on the total wattage of the laser cutter; the more powerful the machine, the faster it can move through the material and the faster dust is produced.

The amount of dust produced over the course of the day depends on the number of hours the laser cutter is running. Manufacturers operating equipment 24/7 need a much bigger dust collector than those running only one shift a day.

From CO₂ to fiber

CO₂ lasers have been around long enough that laser equipment suppliers have developed rules of thumb to determine the size of the dust collector →



Manufacturers switching from CO₂ to fiber laser cutting may need to upgrade their dust collection equipment, too.

they recommend to their customers. However, when making the switch to fiber, those same rules may no longer apply. Fiber lasers have some significant differences compared to their CO₂ counterparts.

The width of the kerf with fiber lasers is generally narrower than the kerf for CO₂ lasers, meaning less material is removed with each cut, especially when working with thinner materials.

However, fiber lasers are usually faster than equivalent wattage CO₂ lasers. When cutting with oxygen, this difference may not be noticeable, but when cutting with nitrogen or shop air the differences can be stark – anywhere from two to six times the cutting speed.

The narrower kerf means that there is less material vaporized (and, thus, less dust produced) per inch of material cut, assuming material thickness is

equal. However, because fiber lasers are so much faster, they still produce significantly more dust per minute than a CO₂ laser of equivalent wattage. This can cause problems if you are not prepared.

Hidden costs

Controlling hazardous dust and fumes produced by laser cutting is essential to protect human health and safety. But even when operating in contained hoods or in lights-out manufacturing with no human exposure, inadequate

dust control can cause big problems. These problems include:

- *Damage to the laser:* Accumulated dust particulates can foul the optical lens on the laser machine, resulting in a poor cut quality or damage to the lens itself. Dust can also damage the sensors that keep the laser head at the right height from the cutting surface, raising the risk of crashing the laser head. Finally, dust can get into the linear actuators and create friction as the machine moves, →



The amount of smoke produced by laser cutting depends on the thickness of the material, the length of the cut and the kerf, or width of the slit produced by cutting.

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damaging delicate components over time. In fact, the damage to the laser cutting equipment can easily end up costing more than a dust collector.

- *Increased filter costs:* If you don't have enough filter media for the dust being produced, particulates accumulate faster than they can be pulsed off by the machine, significantly shortening filter life. It also drives up energy costs as the machine tries to compensate for clogged filters.
- *Increased maintenance time:* If your dust collector is too small, you will

need to change the filters more frequently, resulting in a higher burden on maintenance staff.

- *More downtime:* Inadequate dust control results in more production shutdowns, both planned (for necessary maintenance) and unplanned (as a result of damage to the dust collector or the laser cutting equipment).

For companies running on a 24/7 production schedule, the dust collector can become the limiting factor in productivity. More frequent line shutdowns may be needed to pulse off extra dust accumulating on the



RoboVent has partnered with major laser cutting OEMs, such as Mazak Optonics, ALLtra Corp. and Hornet Cutting Systems.

filters. And the costs associated with an unplanned shutdown to repair the dust collector or the laser cutting equipment can be catastrophic. Properly sizing the dust collector for the amount of dust produced will help you avoid these hidden costs.

Dust collector sizing

You should look at two variables when sizing a dust collector: cubic feet per minute (CFM) and square feet of filter media.

CFM is the measure of the volume of air you are moving per minute. CFM requirements are directly related to the rate at which dust particulates are produced and the total volume of air in the space that you need to clean. Larger spaces typically require more CFM than smaller spaces. Processes that produce a lot of dust may or may not require higher CFM than processes that produce a little. You need to make sure that your CFM is adequate to turn →



A high-powered, centralized dust collector can provide effective dust control for multiple laser cutting units.

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over the air in your space at a rate that keeps particulates at acceptable levels.

The amount of filter media required is directly related to CFM and total particulates produced. The higher the CFM, the more filter surface area you will need. The ratio of CFM to filter media is known as the air-to-media or air-to-cloth ratio. In general, the more particulate you are producing, the lower your air-to-cloth ratio should be. If the air-to-cloth ratio is too high, particulates are driven deep into the filter media before they can be pulsed off, causing rapid filter clogging and reducing filter life.

For most laser cutting applications, you should look for an air-to-cloth ratio between 1.0:1 and 1.6:1. Processes that produce heavier particulate loads – thicker materials, continuous production or higher velocity – may need even lower ratios, between 0.5:1 and 0.75:1.

These variables tend to be poorly understood by end users and laser cutting equipment suppliers, especially when moving from CO₂ to fiber. A good

example is a company that moved from a 4-kW laser to a 6-kW laser without reevaluating their dust collection requirements. Problems developed quickly when their existing dust collection equipment, sized to keep up with the particulate load of a 4-kW laser machine, failed to keep the laser cutting area clear. Ultimately, they didn't need increased airflow, but a lower air-to-cloth ratio (more filter media).

An experienced air quality engineer can help when it comes to evaluating your processes and determining the right size dust collector for your application. The RoboVent Plaser Series comes in a range of sizes to meet the needs of CO₂ and fiber laser cutting applications.

When choosing a dust collector, don't let size be a limiting factor in your productivity. The cost of the right size dust collector is a small fraction of the cost of a new laser cutting unit. Making sure it is sized correctly is simply a good investment. ●

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