TECH TIP

LASER EXHAUST SYSTEM DESIGN

What is the Laser Exhaust System?

The laser exhaust system is designed to efficiently remove the smoke and particulates by drawing them out of the enclosure. This is a key component to the safe operation of the laser system. A properly working exhaust will also keep the inside of the laser cleaner and keep the air around the laser safe to breathe.

Configuring the Laser Exhaust Fan

Consult the manufacturers' manual to determine the air flow and pressure needed to configuring the exhaust system. These specifications are given in Cubic Feet per Minute (CFM) and for pressure in Inches of Water or Static Pressure. A typical exhaust specification for a 20x32 table laser system would be 600 CFM at 6" static pressure for a 24x4 table laser system would be 1200 CFM at 6" static pressure.

Keep in mind that the air volume and pressure specification is needed at the exhaust outlet of the laser system. The number of bends and the length of the duct will reduce the airflow and pressure. As a rule, keep the number of bends to an absolute minimum and keep the length of the duct as short as possible.

Proper Duct Basics

Using the correct materials is a must in order to have both a safe and long lasting exhaust system. The main duct should be constructed of 4" or 6" metal duct. Most laser systems have a 4" fitting which makes the 4" duct easy. If the duct total run length is over 35', a 6" duct will be more efficient and give more air flow.

Use only metal duct which is available at home centers and is affordable. The metal will act as a ground to discharge any static electricity that may be generated by air flowing through the duct. Local and national building codes make metal air ducts mandatory. An extra level of safety would be to ground the duct and exhaust fan. This is done using an electrical ground like a metal conduit or a cold water pipe.

Sealing each joint of the metal duct needs to be done. Sealing can be done in several manners.

- Caulk-like sealing compound that comes in a tube. Apply the caulk sealing compound before assembling the duct work. This sealant dries hard but stays flexible to provide a positive seal.
- Special aluminum tape. Do not use fabric tape or duct tape.

Apply either of these sealant types to all the seams, including any elbows.

Self tapping sheet metal screws are best when assembling the metal duct sections together. A duct system that is screwed together is more secure and makes the duct stronger, keeping the expelled fumes where they belong.

Rigid Flexible duct is recommended to go between the laser system and the rigid metal duct. It is important to keep the amount of flexible duct to the absolute minimum for efficient airflow. Do not use dryer vent hose.

Air flow effect in flex hose and elbows is as follows:

5' flex hose = 15' of straight pipe. Two 90 degree elbows = 12' of straight pipe.

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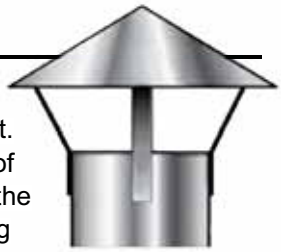


End of the Duct

Venting the fumes produced from the laser up and away from your building is very important. The tail end of the duct is called the stack and this should rise 2' to 3' over the highest part of the roof. It should be topped off with a cap to keep water, birds and debris from getting into the exhaust duct. Installed correctly, this will keep fumes from being drawn back into the building by the air conditioner or fan system.

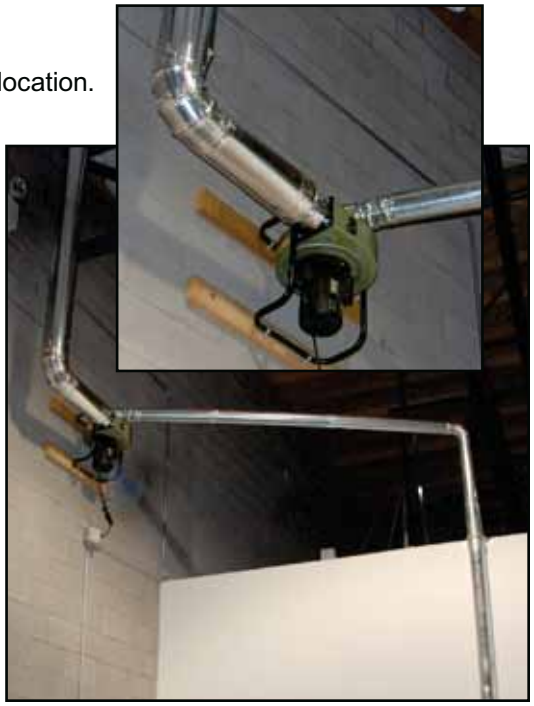
Choosing the Correct Laser Exhaust Fan

When choosing the size and type of fan for the exhaust system, the CFM and pressure specifications are important factors. The correct fan for the laser engraver is an impeller type unit. Motor sizes are typically 1/2, 3/4 and 1 Horsepower electric motors that power the fan. Choose a fan that is rated for continuous duty and has bronze or ball bearings in the motor.

The correct size of exhaust fan depends on the length and size of the duct and the number of bends in the run. To calculate the exact air flow would require an HVAC engineer, although, the more common method is to slightly over-size the fan to give adequate flow and pressure. A simple rule of thumb for a 20x32 table laser system and a duct run of 20' or less, would be a 1/2 HP fan that is rated for 660 CFM at 4" static pressure. This would be enough to meet the system manufacturers' specification. If you have a longer duct run or more than 3 or 4 bends, you will need a larger sized fan and consulting a HVAC company may be a good idea.

Laser Exhaust Fan Location

Fans can be loud, so mounting the fan outside the building is the best location. If this is not possible get as far away from the laser system as you can.



Locating the fan at the tail end of the duct system has an important safety bonus in addition to lowering the ambient noise. The pressure will be lower because the air is being sucked out instead of being pushed. This means if there is a break in the seal, which creates a small leak; the contaminated air will leak in rather than out into the work environment.

The drawback in having the fan located at the end of the duct system is the on and off switch will be hard to reach. There are a couple ways to solve this problem. The best way is to have an electrician install a remote switch outlet, and locate this switch near the laser for easy access. The other solution is to use a remote controlled outlet device that plugs into the outlet and then the exhaust fan plugs into this switch. Take care that this remote device can handle the current of the exhaust fan, and note that a heavy duty rated remote switch may be required. The remote switch is battery operated so it can easily be located next to the laser system.

Temperature

Heating or cooling a room which has a laser may be a challenge, especially if you are exhausting the temperature controlled air at 500 CFM or more. If running the exhaust puts extra load onto your heating/cooling system, one solution is to create a fresh air duct to the inlet of the laser engraving unit. The idea is to let the laser system draw air from the outside which will be exhausted back out into the environment. Contact your HVAC expert if there are questions on how to accomplish this type of special vent fabrication.