



TOOLMETRIX

PEAK PERFORMANCE MATTERS

ToolMetrix Benchmark Study

Laguna PFLUX1 and CFLUX1 Dust Collection Cyclones



About this project

ToolMetrix provides this benchmark study of the PFLUX1 and CFLUX1 as an engineering service to Laguna Tools. The purpose of this study is to provide objective feedback to Laguna and its customers as to how its products perform under rigorous examination.

About ToolMetrix

ToolMetrix Group, LLC provides engineering services for manufacturers of woodworking and DIY tools to assist in product development, market research, and quality assurance. For more information about ToolMetrix Group please visit [facebook.com/Toolmetrix](https://www.facebook.com/Toolmetrix), or find our videos at www.youtube.com/c/ToolMetrix.

Overview

ToolMetrix put the PFLUX1 and CFLUX1 through a series of tests to determine effectiveness of these products in four key areas which we view as critical to effective dust collection:

Air Flow. How well do the machines draw air from a variety of duct configurations? Our goal here was to determine the type of ducting arrangements that would be appropriate for these tools.

Air/Dust Separation. For every gallon of dust that enters the machine, how much ends up in the drum, and how much goes into the filter where it will bog down the machines performance?

Sound Output. How loud is each machine in a shop environment?

“Usability”. What features are included to make the systems easier to use and maintain so that dust collection can be as non-disruptive as possible.

Air Flow

We performed a series of air flow and static pressure measurements on these machines, and also tested with some actual ducting configurations to help determine which duct sizes and configurations could be supported. A fan curve plots the air flow for a dust collector,

Machine	CFM minimum
Radial Arm Saw	400
Table Saw	400
Band Saw	600
Disc Sander	400
Drum Sander	600
Belt Sander	600
Jointer	400
Lathe	600

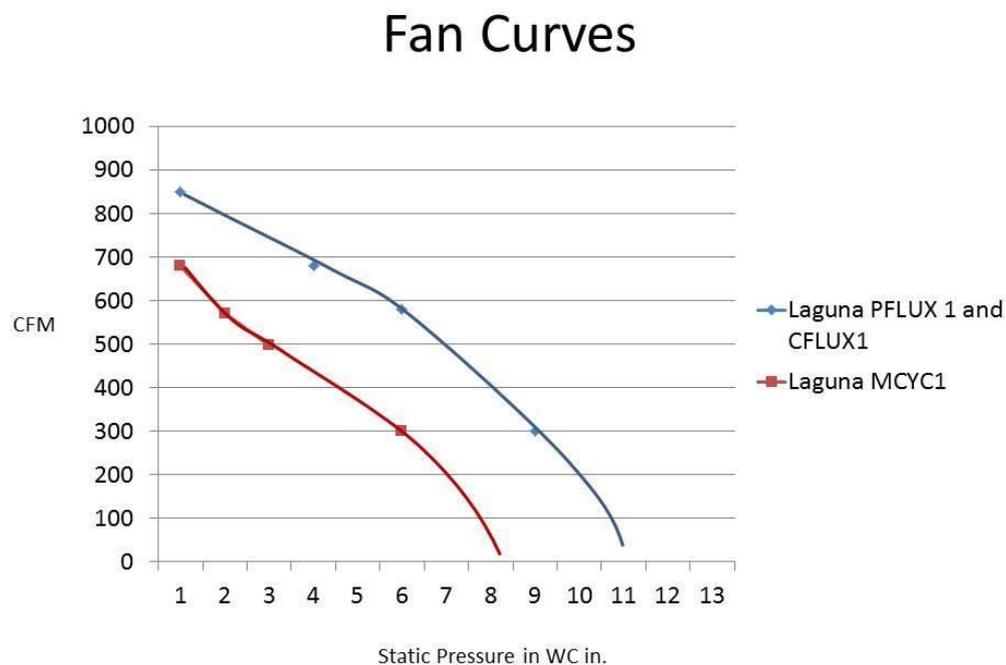
measured in cubic feet per minute (CFM), against the static pressure found in the pipe at the time of the test. Static pressure is the resistance to air flow found in ductwork. It is important to note that we actually measured the static pressure in the ductwork for each configuration rather than calculating it, because it is impossible to accurately determine static pressure using oversimplified estimating tools.

To help understand “what good looks like”, it is important to know the requirements for effectively extracting all of the dust from each tool, including the finest particles which

are most likely to cause health problems. This chart using data from the Association of Advancing Occupational and Environmental Health provides the CFM values deemed appropriate for some common woodworking tools.

Fan Curves

We performed air flow tests on both the PFLUX1 and CFLUX1, and found the fan curves to be statistically the same. For comparison purposes, we also tested against Laguna's previous generation 1.5 HP cyclone, the MCYC1, and the difference in air flow was dramatic between these two machines.



Ducting Examples

To help make sense of the CFM requirements, we tested some “real world” small shop duct configurations to see how the CFLUX1 and PFLUX1 would perform.

Example 1: Keeping it mobile. For woodworkers who want to use a 10' flexible hose and connect to tools one at a time as needed, these machines provide ample air flow for any machine in a typical shop.

Laguna CFLUX1/PFLUX1



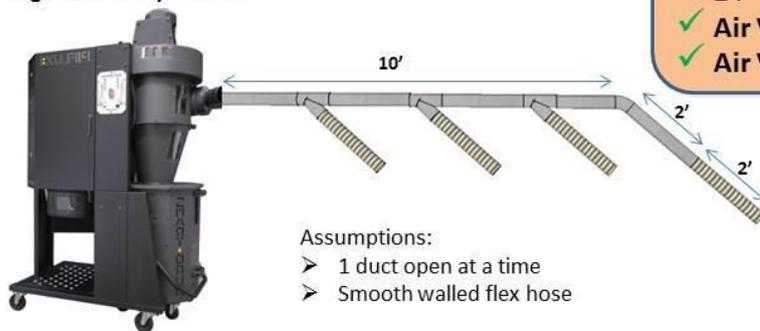
Duct Profile:

- 4" x 10" flexible hose
- ✓ Air Velocity: 7,700 FPM
- ✓ Air Volume: 670 CFM

Assumption:
➤ Smooth walled flex hose

Example 2: Small duct system. In this scenario multiple tools are connected, and any one can be used at a time with acceptable air flow for most tools, with the tools requiring the highest CFM placed closest to the cyclone.

Laguna CFLUX1/PFLUX1



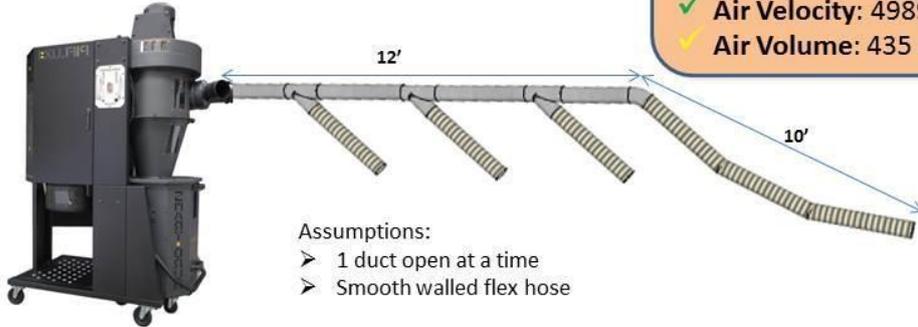
Duct Profile (longest run):

- 4" x 12' hard pipe
- 45 degree elbow
- 24" flex hose
- ✓ Air Velocity: 5807 FPM
- ✓ Air Volume: 506 CFM

Assumptions:
➤ 1 duct open at a time
➤ Smooth walled flex hose

Example 3: Slightly extended duct. In this configuration a slightly longer trunk line is introduced along with a longer piece of flexible pipe in the longest run. In this scenario the first three drops will provide adequate flow for any tool in the shop, but as you see the longest run delivers 435 CFM which will serve the needs of most tools, but larger producers such as large planers and drum sanders should not be positioned there.

Laguna CFLUX1/PFLUX1



Duct Profile (longest run):

- 4" x 12' hard pipe
- 45 degree elbow
- 10' flex hose

✓ **Air Velocity:** 4989 FPM

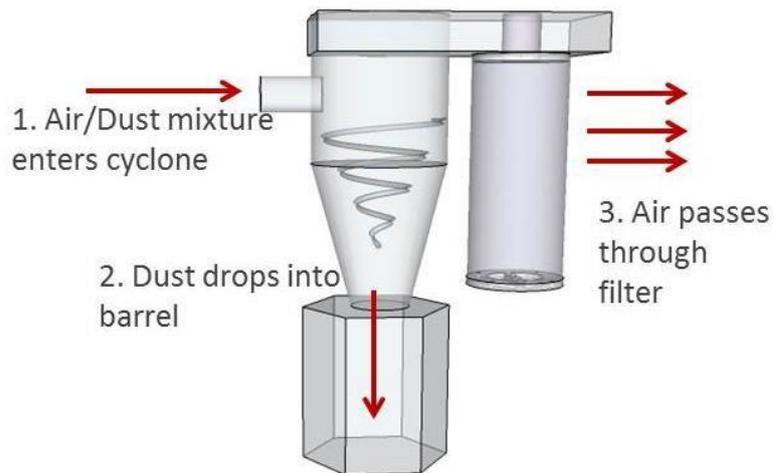
✓ **Air Volume:** 435 CFM

Assumptions:

- 1 duct open at a time
- Smooth walled flex hose

Air/Dust Separation

The goal of a two stage dust collection system is to separate air from dust, dropping the debris into the drum and sending clean air through the filter. When the cyclone fails to separate out the dust, and the dust instead ends up in the filter, there is an accumulative effect over time that causes performance degradation and requires maintenance.



We tested the CFLUX1 and PFLUX1 by sending 5 gallons of extremely fine MDF dust through the machine, and measured the amount of dust

that was captured in the filter. We found only 1 tablespoon of dust in the filter after this test, for an effective air/dust separation rate of 99.96%, which we found to be impressively high for a low profile cyclone. For comparison we ran the same test on Laguna's previous generation 1.5HP cyclone, the MCYC, and measured 6 tablespoons of dust in the filter, which indicates an 84% improvement over the previous model.

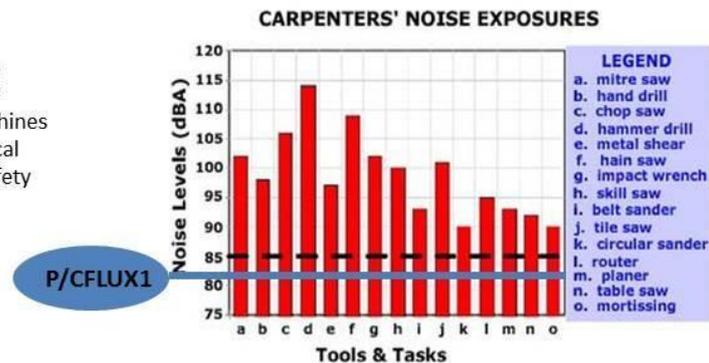
Sound Output

We measured sound output around a ten foot perimeter of each machine using a sound level meter, and averaged the values. The readings were taken in a 24' x 30' shop with 10' ceilings. By our measurements the average reading for the CFLUX1 was 83 db, and the PLUX1 produced sound in the 81db range. Because sound levels vary tremendously based on the environment in which the readings are taken, we ran a second set of tests outdoors for comparison purposes, and there we read an average of 76 db on the CFLUX1 and 74 db on the PFLUX1. The sound output is lower on the PFLUX1 due to the presence of acoustic foam which surrounds the top portion of the filter.

To see how the sound output of these machines compares to other machines that you might have in your shop, here are some comparison points that demonstrate that the CFLUX1 and PFLUX1 are quieter than many of the tools that you might already have running in your shop.

Sound Output

At 81 – 83db, the P/CFLUX1 machines are among the quietest in a typical shop, and deemed below the safety threshold. Source: OSHA



Usability

Here we looked at the common processes that must be undertaken when using the systems and maintaining them.

Turn on/off. Nobody likes walking across the shop every time you want to turn the dust collector on or off. Both of these units include a handy remote control switch that can be used to turn the cyclone on and off without having direct line of site to the machine.

Monitoring drum level. On both models there is a small window in the drum to view the full level, which may or may not provide enough visibility to confidently make the call without removing the drum. The PFLUX series includes a drum full indicator LED light on the console that takes the guesswork out of this process by lighting up as the debris level approaches the top of drum.

Determining filter cleaning interval. When the filter gets clogged with dust, the air flow performance will drop. On the CFLUX system, knowing when to clean the filter is a judgment call, and you'll want to develop a regular process for determining this. On the PFLUX system, there is a clever monitor that keeps tabs on the air flow resistance in the filter and a LED on the console lights up when it senses a drop in air flow.

Cleaning the filter. On the CFLUX series, a hand crank and paddle mechanism are used to manually clean the filter as needed. For shops where frequent cleaning is required, Laguna offers an auto-clean mechanism that will systematically clean the filter so you don't have to think about it. On the PFLUX series, compressed air is used to remove dust from inside the filter, and a paddle mechanism is not offered because it has the potential to damage the HEPA filter.

Emptying the drum. Both systems include a heavy duty drum that is lifted into position against the cyclone and sealed with a heavy rubber gasket. This design also eliminates the need for a piece of flexible hose between the drum and the cyclone, which further minimizes static pressure and encourages better air flow. Emptying the drum could not be easier; simply use the large lever mechanism to lower the drum, roll it back on its own casters, and lift the bag out of the drum. On the CFLUX series a metal drum liner is used to keep the bag in place, while on the PFLUX series the drum is pressurized so that the liner mechanism is not needed, which is a brilliant innovation.

Final Thoughts

The PLUX1 and CFLUX1 machines offer some great innovations over the previous Laguna cyclone products. A few final observations:

- Choosing between the CFLUX and PFLUX comes down to a few key decision points: 1) Convenience when emptying the drum, which is more user-friendly on the PFLUX due to the pressurized drum and no drum liner, 2) Dust filtration level, which is a respectable 1 micron on the CFLUX series and even lower at .4 microns on the PFLUX series, 3) Sound level which is a couple decibels quieter on the PFLUX series, and 4) monitoring for drum full or filter dirty conditions, which is automated on the CFLUX.

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- Laguna has squeezed as much sustained air flow out of the 1.5HP cyclone as possible with these models, but they are still only 1.5HP machines. Therefore, don't try to stretch them beyond the duct configurations described in this document or you will suffer poor performance and leave some fine dust particles behind. If you require longer ductwork runs, install a larger cyclone. There are larger versions of both the PFLUX and CFLUX available so you can find one that is right for your shop.
 - Electrical. We tested the systems on a dedicated 110 volt 20amp circuit and measured 18 amps on a sustained basis with no ductwork attached. That is adequate but doesn't leave much headroom on a 20amp circuit, so do not attempt to share this circuit with other tools, run on a 110V/15amp circuit, or use an extension cord. For shops with 220 volt service available, these machines can be rewired to run on 220 V, which will effectively lower the amperage draw and allow you to run on a 15 amp circuit.

Overall we are impressed with both the design and build quality of these machines, and believe that they will meet or exceed the expectations of woodworkers for use within the operating range described in this document.