

Air Filters 101

In my last article we discussed choosing the correct size carburetor for a particular engine. The next logical step is to decide on a filter that supports the air flow your carb & engine needs to operate efficiently.

I have a friend who is an air filter designer and he will be helping me with future articles as they get a bit “nerdy”. For now, I’d like to explain a bit about filter material.

What are the most common filter materials?

- **Oil Bath**
- **Gauze**
- **Foam**
- **Paper**

Oil bath filters are a great design. Many original systems have a “catch jar” for large dirt, and use oil to collect the smaller particles. It is designed to be cleaned and reused for decades, so cost is very low. Most of us remove that system when building a pulling tractor to save weight and prevent oil splashing during nose high pulls... Concrete dead weight pullers know what I’m talking about.

Gauze filters are common because they can flow a large volume of air, they can filter when wet, they are easy to clean, and last a long time. The filter uses cotton gauze sandwiched between wire mesh, then pleated for strength and increased surface area.

K&N filters have been used for decades and now copied by others. The special oil they use is statically charged and attracts small dirt particles (at least until it becomes dirty). I am told the method used to create the “pleats” is critical and I’ll share more about that in future articles. I have yet to find micron ratings for cotton filters, possibly due to variations in how they are tested. K&N rates filters based on efficiency.

Foam filters are very common in the motorcycle industry. Foam material can filter dirt when wet, it is easy to clean and oil, it does a great job of catching dirt, especially with a two stage foam design. Foam filters are rated in PPI which is Pores Per Inch and generally come in different colors depending on the PPI of the material. I built my filter using green, which has 65 PPI.

Foam filter material will break down after time and can begin to tear at the seams. Inspection during routine maintenance is recommended but foam filters can last many years without issue.

Paper filters are best used in vehicles with an airbox. Filtration is good, price is low, no maintenance of the filter is needed, but it must remain dry. I am not aware of anyone in the tractor pulling world using one, but with a simple filter box (my Gleaner has one) paper is a perfectly acceptable material to keep out dirt.

One aspect of filters that I look for relates to the surface area or flow rating. A filter that is too small will rob performance regardless of material. There is no such thing as “too much air” so choose the largest filter you can.

Recently I designed an air box using stainless steel mesh wrapped in UNI filter brand foam. We flow tested in against a cotton gauze filter and to make things fair I installed a velocity stack into both filters. I calculated the surface area needed for my carburetor using a formula provided by K&N then tested on a SuperFlow 400 flow bench.



The results using 1.5” Hg (20.4” of water) were amazing...

218 cfm with no filter

218 cfm with my foam air box

216 cfm with K&N style gauze filter

Using 36” water pressure drop the results were...

288 cfm no filter

286 cfm foam air box

284 cfm K&N style gauze filter

As you can see, using a properly selected air filter does not cause a loss of airflow or performance! Choosing the right filter, regardless of engine size or performance level, is ALWAYS IMPORTANT. Next article we'll get into intake tube design and dig a bit deeper into materials used for proper filtration.