

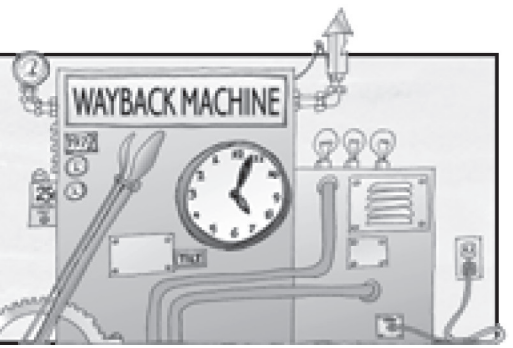


TURBO DIESEL

REGISTER



THE WAY WE WERE



From time to time we will crank up the “Way-back Machine” and repeat material that is relevant for present consideration. For this issue, I went back to Issue 80, pages 38-39 to revisit air intake systems for your Turbo Diesel truck.

AIR INTAKE SYSTEMS – REVISITED

by Robert Patton

Every now and then something comes along on the internet to remind you that you’ve “been there, done that.” Such was the case in Issue 112 (pages 26-28), where we revisited the topic of the exhaust aftertreatment system, its principle of operation and the “cost” of regeneration. So, with previous TDR data in mind, when you run across a topic we have covered, do you flip to the author’s conclusion to see if their results are the same as the tried and true experiments of the good ‘ole TDR “forefathers”?

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When I ran across this title, “Here Are Some Real Tests to See If Changing Your Air Filter Gives You More Power” I went directly to page 3 of the [Jalopnik](#) story. What would they conclude?

Here are their horsepower results from two different tests: one was a BMW naturally aspirated V8, 4.0-liter engine; the other was a Skoda turbocharged 2.0-liter engine.

BMW

| | |
|-------------|-----|
| Stock | 384 |
| K&N | 384 |
| K&N (dirty) | 376 |
| Eventuri | 381 |
| No filter | 380 |

Skoda

| | |
|--------------|-----|
| Stock | 231 |
| Pipercross | 235 |
| RamAir | 236 |
| RamAir (hot) | 231 |

Jalopnik’s Explanation

And the explanation by author Jason Torchinsky from the website [Jalopnik](#): “So, there really wasn’t any benefit to aftermarket air filters on the BMW V8—the stock setup worked best, and the only big change came from using a dirty filter, and that wasn’t a good change. Also, the engine performance dropped about 5 horsepower during testing overall, because, uh, engineering?” (**Editor’s note: likely the performance dropped due to engine and ambient heat and heat soak.**)

“Now, the Skoda’s TSI engine was a different story—the aftermarket air cleaners did add between four and six horsepower, and the reason for the two runs of the RamAir was that one run left off the heat shield, which drew hot engine bay air into the intake, which caused a performance loss.” (**Editor’s note: see previous comment, heat is the enemy.**)

So, the [Jalopnik](#) test crew confirmed what the TDR, its writers and its members had discovered long ago: Aftermarket air filters don’t make horsepower, cool air does.

A lot has happened since the three-part series air filters, air intake, and air temperature/air density were discussed back in Issues 58-59, about 13 years ago at the start of 2008. And, as much as I would like to believe that everyone has downloaded and read the TDR’s [Perfect Collection](#) book and its summary of these articles, likely you’ve not done that.

So, how do I make a review of the subject easy for you? Easy, just do a reprint.

I went back to the “Perfect Collection” to review the contents. Considering the majority of trucks are no longer “Second Generation/24-Valve” but rather Fourth Generation, the shift from yesterday’s tinkering and performance enhancements to today’s best maintenance practices is obvious. My choice of reprint material is an article/bulletin from Cummins, first printed in Issue 80, that discusses “The Importance of Using a Paper Filter.” It is still relevant in today’s maintenance practice world.

For the folks that are hooked on performance, the [Perfect Collection](#)’s “Understanding Air Intake Systems and Air Density” is a must read to understand that cool air is the key to more horsepower, not some “cool” looking, underhood box that sucks hot engine compartment air. Check it out at our website: [Perfect Collection](#), pages 59-73.

Again, to save you time, you’ll find the Cummins article from our Issue 80 magazine on the next two pages.

THE IMPORTANCE OF USING A PAPER FILTER (FROM ISSUE 80)

Back in 2013 Cummins wrote an article, "The Importance of Using a Paper Air filter." The article is worthy of reprinting for the TDR audience. Having "been there, done that," I endorse their position on air filtration. At the end of this article, I'll add some insight to further substantiate their position.

From Cummins: The Importance of using a Paper Filter

Maintaining a clean air filter is very important for the life of your engine. What does dust do to an engine? Let's follow the air as it enters the intake. First, the turbo gets hit with the dust—the blades are spinning as fast as 150,000rpm, and hitting just a small amount of dust at that speed can actually remove material from the turbo blades. Next, the piston rings and engine bore take a beating because the dust acts as an abrasive material, wearing away those two surfaces. Dust can then find its way into the oil by getting past the rings against the bores of the engine.

With the oil filter able to hold only so much dirt before plugging and then bypassing, eventually the rest of the engine bearings suffer. Editor's note: Likely before the oil filter is plugged, the rings are too polished and compression is too far gone.

The factory-pleated paper air filter is a critical element of the air system. It is designed to balance both the flow across the filter and filtered surface area. For example, a driver who uses a particularly dusty route may have 100g of dirt ingested into his air filter. The factory filter at 99.9 percent efficiency will have allowed 0.1g of dirt through the filter and into the engine. An aftermarket cotton-gauze filter or oiled cotton-gauze filter on the other hand typically runs around 97 percent efficient. That three percent difference can have a big effect on the life of your engine.

At 97 percent efficiency, 3g equal 30 times more dirt sent through to the engine! This multiplication is true for the life of the filter—the oiled cotton-gauze filter will always let more dirt through.

Now, let's compare and contrast your factory pleated paper air filter with some common aftermarket filters.

Cotton-gauze-style filters have a lower restriction when they are clean, but there are three fundamental issues with them, the first being dust-holding capacity. Due to the thickness of the material used, these filters have very low dust-holding capacity. The way in which they hold the dust means they plug up quickly, and just a small amount of dust makes the restriction increase substantially.

However, the biggest issue with cotton-gauze filters is their filtration efficiency. As mentioned earlier, restriction is based on a combination of the filtration level and the surface area. The total surface area of aftermarket filters is typically much smaller than that of the standard filters, so they manage to offer lower restriction on a clean filter by having much bigger gaps in the material, leading to much lower filtration efficiency.

Finally, oiled cotton-gauze filters are generally cleaned and reoiled at certain mileage intervals. However, the oil used in these filters is hard on the mass air flow (MAF) sensor and surrounding components. The oil tends to come off these filters as a fine mist and coat the intake systems. This leads to incorrect readings from the already-sensitive MAF sensor.

While all diesel engines are vulnerable to dust, using the recommended factory pleated paper air filter does the best job protecting your engine while balancing flow and restriction. The paper material leads to higher filtration efficiency, which will ultimately lead to a cleaner, stronger Cummins Turbo Diesel.

Cummins MidRange Engine Team

From the TDR: The Rest of the Story

Way back in Issue 77, I made mention of the paper-versus-gauze air filters. This “Cummins Column” gave me another opportunity to share the story with you.

Back in the fall of 1999, Cummins tested the K&N filter for air flow and dirt flow. The result: Yes, they flow more air and more dirt. At the time, the K&N was the number two selling item at our sister company, Geno’s Garage. As much as it could have hurt sales, the folks at Geno’s pulled the item from the shelves and no longer offer the K&N line of filters.

That is the abbreviated version, now “the rest of the story.”

From the 1999 test, it is interesting to note that the K&N failed both of the Chrysler criteria for an air cleaner: dirt flow through the filter is the obvious; the not-so-obvious test is dirt-holding capability. In measuring dirt holding, as the term implies, the filter has to hold “x” amount in suspension before it is deemed clogged/too restrictive.

Seriously, the Cummins guy was tired of the Chrysler guy expecting that warranty claims would be paid for engines that obviously had been dusted-out.

This testing was done because . . . well, because of the Cummins video from the 1950s. Seriously, the Cummins guy was tired of the Chrysler guy expecting that warranty claims would be paid for engines that obviously had been dusted-out. The Cummins and Chrysler folks had the Cummins subsidiary company, Fleetguard “pour the dust” to the filters at their research center. As noted, the K&N filter failed both tests. But, you wanted the rest of the story. Oddly enough, the Fleetguard air filter failed a test, too.

Notice, I didn’t say the plural “tests.” The Fleetguard met the all important Chrysler test for dirt filtration. It did not meet the criteria for dirt holding, effectively meaning under severe dusty conditions the filter would become restrictive quicker than allowed by the Chrysler specification. Bottom line: you would have to change the filter too often.

Looking back to the Geno’s Garage catalog of the day, the Fleetguard part number for a Second Generation ’94–’98 truck was AF25090. Geno’s had been selling the AF25090 since Catalog One in 1996. In the fall of 1999, the part number changed to AF25541.

Subsequent to all of this testing and part number supersession, the folks at Chrysler issued an “information-only” technical service bulletin (TSB) to the dealer network telling them about “Dust-out Diagnosis for Cummins Diesel Engines,” of which the latest TSB number is 09-001-10, dated July 2, 2010. A summarization of this bulletin follows:

This information-only bulletin involves proper inspection procedures to determine engine failure due to dust-out condition. Engines damaged due to infiltration of dirt and/or debris through the air intake system are not warrantable.

This bulletin directs the technician to a document in the STAR center electronic file area. This eFile, along with the inspection and diagnosis procedures in the bulletin, shows the cause/effect that occurs with improper filtration and/or upgrade kits, fuel injectors, boxes or downloader devices that increase fuel delivery.

The bulletin is carefully worded. Nowhere in the bulletin does it say that you can’t use an aftermarket cotton-gauze filter. It simply gives Chrysler and the dealer network a push-back to the customer that effectively says, “When you select a filter, you are your own warranty station.” Likewise, and this is speculation on my part, should the customer say it is a “warrantable” item from cotton-gauze filter company Airflow-is-More.com, the response from Airflow-is-More would be “Failure of air filter maintenance” caused the engine’s demise.

As I mentioned earlier in this saga, the folks at Geno’s Garage immediately pulled the K&N filter from their shelves. Shortly thereafter the cotton-gauze filter for diesels in the Mopar Performance catalog was also removed.

As I mentioned earlier in this saga, the folks at Geno’s Garage immediately pulled the K&N filter from their shelves.

In the mid 2000s the folks at Geno’s grew weary of telling the cotton-gauze story to folks that were intent on purchasing a cotton-gauze filter. They added back into their catalog a seven-layer cotton gauze filter from aFe. Then in 2007, tired of dealing with aFe’s proliferation of part numbers, they changed vendors to Airaid’s seven-layer product. **Editor’s update: Finally in 2013 they completely dropped the cotton-gauze products. Cold air is the key to performance.**

To this day, the folks at Geno’s will tell you the cotton-gauze story and suggest you either stick with the stock system or focus your attention to ducting cold air to the airbox. And, not wishing to repeat stories ad infinitum that we’ve covered on the air filter, cold air intake, and the performance you should expect from these types of modifications, I will simply direct you to the coverage of the subject in Issues 56 and 59. These articles are also conveniently found at the Geno’s Garage website under “Technical Information” and then the title “Understanding Air Intake Systems,” or at the TDR’s website in the digital back issues area.

Robert Patton
TDR Staff