



THE

UNRESTRICTED

TRUTH

ABOUT



**K&N AIR FILTERS AND
MASS AIRFLOW SENSORS**

DISPELLING THE MASS AIRFLOW SENSOR URBAN MYTH



We here at K&N are aware of the “urban myth” created by a few dealerships that a vehicle's MAF sensor can be contaminated by K&N Air Filter Oil. No evidence has ever been provided to support this myth, and three years of diagnostic testing by K&N has shown that not only is this allegation not real, it is not even possible. In our opinion, it is an excuse for a dealership and/or the vehicle manufacturer to avoid a legitimate warranty repair. In the last 4 years, we have sold over 10,000,000 lifetime air filters and received only a few hundred calls from consumers who are having dealership or service provider challenges. We believe that the dealerships', or service providers', real incentive may be to discourage the use of reusable products so they can sell disposable products over and over.



Every K&N Air Filter we sell comes with this sticker, which we advise consumers to place prominently on their air box. The sticker is to alert service technicians that they should not throw away your K&N Air Filter because it will last for the life of your vehicle. When service technicians see this sticker it means “STOP SELLING THIS CUSTOMER DISPOSABLE AIR FILTERS OVER AND OVER.” In our opinion, this

is why some dealerships or service providers may attempt to discourage a consumer from using a K&N Air Filter, or worse, blame a vehicle repair on our lifetime air filter. Most dealerships provide excellent service and fulfill car warranty obligations without issue, argument or tardiness. The rest of this discussion is about a minority of dealerships who are either misguided or misinformed.

No dealership or service provider, when contacted, has ever been able to provide us with evidence to support this myth. In fact, our investigations have revealed that even authorized dealerships are simply speculating and do not have the test equipment necessary to know whether a mass airflow sensor is contaminated at all.

In the last 4 years, we have had more than 300 sensors sent to us by dealerships that claimed our product had caused them to fail. Microscopic, electronic and chemical testing revealed that none of these sensors were contaminated by K&N oil. What is perhaps the single biggest clue to what is really going on, is that two-thirds of the sensors sent to us were not malfunctioning in any way or for any reason. Additional information on our test procedures and findings can be found at knfilters.com/maf.

1-800-858-3333

We have not yet encountered a dealership or service provider with test equipment necessary to determine the cause of a MAF sensor failure. Therefore, the diagnosis of a failed MAF sensor is an educated guess. Nowhere is their lack of care in this regard more evident than in an actual Technical Service Bulletin published by a major American vehicle manufacturer that directs mechanics to "test" a sensor by removing it from the problem vehicle and placing it in a functioning vehicle of the same type. If the problem occurs in both vehicles, the sensor is to be diagnosed as the problem. If you are a technician, and you have a broken 2003 vehicle in front of you, how often will you even have access to a properly functioning 2003 vehicle of the same type? In light of such "technical" support, it is no wonder most technicians revert to hearsay and educated guesses and never even attempt to complete the manufacturer's test. This is why we believe such a high percentage of the sensors we recover are not damaged at all.

We have tested hundreds of MAF sensors claimed to be damaged. We can fully diagnose their condition and likely cause of failure. Not one of these suspected MAF sensors sent in for laboratory evaluation was shown to have failed due to contamination from K&N Air Filter Oil.

We are so confident about our testing and the quality of our product that we offer a Consumer Protection Pledge. So if you ever get in a bind with a dealership, please call us, because we are the solution.

Even at three times the airflow found in a normal engine, K&N filter oil will not come off of our air filters.



K&N has also taken the time to test, and disprove, the idea that oil will come off of a K&N Air Filter. The oil treatment on our cotton is very small (usually less than 2 ounces) and is a critical component of our filtration technology. Once our oil is properly and evenly absorbed through the cotton, no oil will come off, even under extreme engine conditions. More in depth research about this topic is discussed later in this brochure.

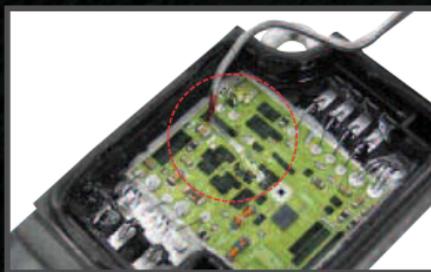
In addition to laboratory testing, K&N has constructed several airflow units, like the one pictured above, to demonstrate that the idea of oil coming off our filter throughout its life is truly ridiculous.

KNFILTERS.COM

WHAT CAUSES A MASS AIRFLOW SENSOR TO FAIL?

Contamination of hot-wire and hot-film type sensors does occur. The usual suspects include substances like silicone potting compound, dirt, oil, spider webs and even insects.

Potting compound, used in the manufacture of MAF sensors to environmentally seal them can migrate onto the wire.



This photo shows a probe demonstrating the stickiness of the silicone material.



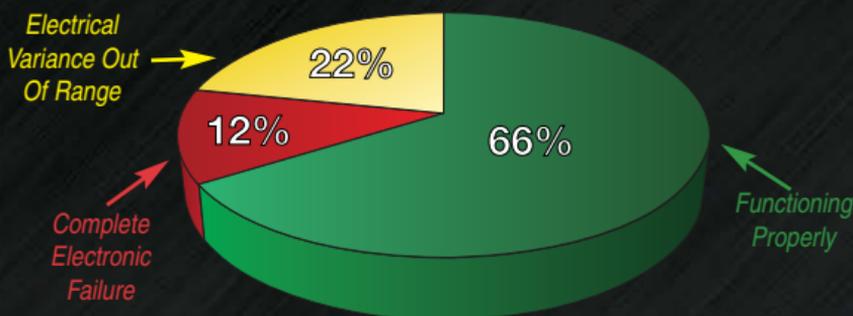
This thermistor shows an example of "wet contamination", a black sooty appearance is a tell tale sign of internal contamination.

Oil most often enters a MAF sensor in the form of vapor via an engine's Positive Crankcase Ventilation system. In an effort to lower emissions, positive crankcase ventilation systems recirculate fuel and oil vapors from the crankcase, back to the air intake to be burned in the

combustion process. This can allow crankcases gases to flow past the MAF sensor, leaving deposits behind. When a throttle body or airflow meter needs cleaning, the black, oily film and carbon that is removed is largely a product of this system. K&N Air Filter Oil does not turn black, and a black sooty appearance is a tell tale sign of contamination from within the engine.

A problem unique to hot film MAF sensors is delamination. Delamination occurs when the coating applied to the hot film begins to peel off, exposing the electrical circuitry underneath. Delamination can occur from a manufacturing defect, or as the result of particle impingement. This is when dirt and dust particles impact the film, causing pitting and eventually, peeling of the film. Delamination can be very hard to diagnose as it requires a very high level of magnification to visually identify peeling of the hot film.

We occasionally get instances where a dealership or service provider has blamed our product for a vehicle problem. In issues regarding MAF sensors, we have been able to recover many of the allegedly "bad" sensors and test them to diagnose the actual cause of the failure. In most of these cases the "bad" sensor was actually functioning properly and was misdiagnosed by the dealership or service provider.



Of the sensors we have received, only 34% of the sensors were truly malfunctioning. 12% had a complete electronic failure in which the sensor's voltage output was a flat line. This is generally caused by a connection or circuitry problem within the sensor.

1-800-858-3333

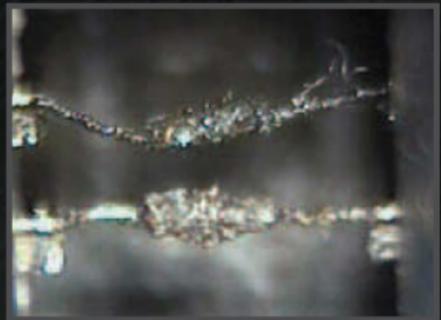
When a sensor is responsive but its voltage output is not within the normal limits we refer to this as "out of range." This condition can be caused by circuitry problems and it can also be caused by a sensor's thermistor becoming dirty or contaminated. We sent 29 out of range sensors to an independent laboratory for an elemental and chemical analysis and all of them were found to have silicone as the contaminant.



The above graph shows a comparison between a new MAF sensor and the MAF sensor supplied by the customer. This particular sensor's voltage output was too low and therefore out of range.

Silicone is used on the circuitry of these sensors because it acts as an excellent thermal and electrical insulator, sticks to most surfaces, and is resistant to moisture and heat. Some MAF sensors use a high temperature burn-off cycle to eliminate normal engine contaminants from the sensor. Silicone is resistant to this process.

Thermistors are used in MAF sensors to measure the transfer of heat from the thermistor to the air passing by the sensor. A thermistor's resistance changes as its surrounding temperature changes. The greater the air mass and airflow, the greater the transfer of heat. When a thermistor is "silicone contaminated" the thermistor becomes insulated and can result in an out of range condition.



Shown here is a "silicone contaminated" thermistor. Silicone is used on the circuitry of MAF sensors as an insulator.



"Dry contamination", as seen above, is typically composed of very fine dust held to the thermistor by static electricity.

In addition to out of range sensors, functioning and failed sensors have also been sent to an independent forensic laboratory for analysis. A few of these sensors were found to have trace amounts of oil on the thermistor. The amount of oil was so minimal that an accurate analysis of the oil's source could not be determined. The trace amount of oil can conceivably be from two possible sources: fuel in the combustion chamber or motor oil used as an engine lubricant that gets suspended in crankcase vapor. Our experience in the lab is that trace amounts of oil don't change the sensitivity of the sensor enough to cause an "out of range" electronic signal. Furthermore, our testing has shown that K&N Air Filter Oil will not come off a K&N Air Filter even in extreme conditions.

As of the date this brochure was printed, K&N Air Filter Oil cannot be confirmed as the source of contamination on any of the sensors we have tested nor can any oil type be attributed to a sensor's failure.

DOES OIL COME OFF OF A K&N AIR FILTER?

The oil treatment on our cotton is very small (usually less than 2 ounces) and is a critical component of our filtration technology. There is nothing unusual about the use of oil as a tacking agent to improve air filter efficiency. In fact, certain Ford Motorcraft and Fram disposable air filters have been treated with oil. This makes us wonder if it is only the oil treatment from reusable lifetime air filters that is alleged to cause vehicle problems? The idea that oil comes off our filter throughout its life is truly ridiculous. Just like oil treated disposable air filters, once our oil is properly and evenly absorbed through the filter media, no oil will come off, even under extreme engine conditions. We have conducted a test with an over-oiled K&N Air Filter in which we flowed 1,000 cubic feet of air per minute for over three days (few cars or truck could consistently generate even 500 cubic feet of airflow for this length of time). The use of an absolute filter confirmed that no oil came off of the K&N Air Filter tested, even in these harsh conditions.

EXTREME TEST WITH AN AIR FILTRATION STAND

K&N's laboratory technicians tested an over-oiled K&N Air Filter at a rate of 1,000 Cubic Feet per Minute (CFM) on our Filtration Test Stand which utilizes an absolute filter. An absolute filter is one specified by ISO 5011 which is used to capture test dust that passes through a filter during efficiency testing. In this case, an absolute filter was used to capture any filter oil leaving the filter and to allow us to measure any oil migration from the filter. We weighed both filters before and after the test and confirmed that oil does not migrate from a K&N Air Filter – even at CFM's far in excess of those seen in production engines.

What we did:

- Over-oiled a K&N Replacement Air Filter by 30%
- Weighed the test stand's absolute air filter and the over-oiled K&N replacement air filter
- Installed the test filter on the test stand
- Set test stand to flow 1,000 CFM of air for 3 days straight
- Weighed both air filters used in the test again



The absolute air filter catches anything that makes it past the K&N Air Filter.



The K&N Air Filter was the exact same weight after the 3-day test.

The test stand's absolute air filter is designed to catch anything that will get through the K&N Air Filter. Weighing the absolute air filter before and after will allow us to see if any of the oil came off the over-oiled K&N Air Filter. After the test was complete, both air filters weighed exactly the same before the 3 day test was run. This confirms that no oil was able to come off of the K&N Air Filter.

1-800-858-3333

REAL WORLD TEST ON A 2007 CHEVY SILVERADO

What we did:

- Cut and sealed a window in the top of the air box
- Installed a wind meter on the K&N Air Filter
- Tested the vehicle on an in-house dynamometer
- Measured the airflow at various speeds of the vehicle



The window allowed K&N technicians to witness the air speed in the air box.



Measuring the air traveling through the air filter during acceleration.

Conclusion:

K&N found that during normal driving conditions, such as getting up to 70 mph (like using a freeway on ramp), the maximum air speed that was achieved by the air filter was around 4 mph. Once the vehicle was up to speed at 70 mph, the air speed passing through the air filter was 1 mph.

The next test was done with the vehicle redlined in second gear. The air speed passing through the air filter as the vehicle was accelerated to maximum rpm level, was 12 mph.

EXTREME TEST WITH OIL COATED MAF SENSORS

What we did:

- Coated both hot wire and hot film style sensors with K&N filter oil
- Tested in both controlled (laboratory) and uncontrolled (real world) environments
- Monitored the sensor readings while spraying it with test dust

Conclusion:

We coated both hot wire and film style sensors with K&N filter oil in both controlled (laboratory) and uncontrolled (real world) environments - none triggered check engine lights. We created extreme conditions, beyond anything an engine would ever experience such as submersing a MAF sensor in filter oil and monitored the sensor readings while spraying it with test dust. Even under these circumstances, the MAF sensor was not damaged. In fact, we were able to take this same MAF sensor, clean it, and found that the readings were identical to the ones taken prior to the extreme testing.



MAF sensors were not damaged after being submersed in K&N Air Filter Oil.



We are so confident about our testing and the quality of our products that we offer the K&N Million Mile Limited Warranty® as well as a Consumer Protection Pledge. If you ever get in a bind with a dealership, please call us, because we are the solution.

More information about how K&N tests MAF sensors can be found on our website at:

KNFILTERS.COM/MAF

Details on the K&N Million Mile Limited Warranty® can be found at:

KNFILTERS.COM/WARRANTY

Read the full explanation of the K&N consumer protection pledge at:

KNFILTERS.COM/CONSUMERPLEDGE

1455 Citrus St.
Riverside, CA 92507

phone: (800) 858-3333
fax: (951) 826-4001

KNFILTERS.COM