Emissions Test: Car vs. Truck vs. Leaf Blower

Stinky Is Absolute, Not Relative

Published: 12/05/2011 - by Jason Kavanagh, Engineering Editor

Emissions Test: Car vs. Truck vs. Leaf Blower Video

| December 2, 2011 | Edmunds Video Productions

1 of 49

View Full Screen





Even in the complex, expensive and highly political world of emissions testing and certification, rumors are a bitch. And in California — where various government agencies bring to bear the world's toughest vehicle emissions regulations on the most dense car enthusiast population anywhere — it pays to

investigate rumors.

So that's what we're doing.

You've probably heard stories about the emissions of today's cars being cleaner than lawn equipment, about modern cars actually cleaning the air and about the pre-emissions-control era when birds fell from the stinking sky. So have we. We're all about busting myths, so we concocted an investigation to find the truth. Forget about the birds, but those other rumors, well, we've got them covered.

Big, Small and Handheld

Early on, we decided to go big. We'd run this emissions test at a real-deal emissions lab rather than a smog check station or asking Magrath to inhale at the tailpipes and offer commentary on their bouquets.

It would have been easy to load this test in favor of the vehicles by hand-picking the cleanest combustion-powered vehicle we could find. No, only the biggest, baddest truck will do, and they don't come much bigger or badder than the 2011 Ford F-150 SVT Raptor Crew Cab. Acting as a counterweight in perception to this pickup is our long-term 2012 Fiat 500.

The vehicles are absolutely poles apart. The Raptor packs a 411-horsepower 6.2-liter V8, weighs more than 6,200 pounds and has the aerodynamics of Mount Rushmore. The dollop-size Fiat weighs a mere 2,350 pounds and has a 1.4-liter four that generates less than one-fourth the amount of power as the Raptor. They couldn't be more different, and capturing extremes is the idea.

Like you, we made a trip Home Depot to buy a leaf blower. And like all trips to Home Depot, we lost 3 hours and bought more than we intended. In this case we ended up with two leaf blowers — a two-stroke backpack-style job and a handheld four-stroke unit. The two-stroke leaf blower in this test is an Echo PB-500T, a model that sits in the middle of the manufacturer's range of backpack-style offerings. It's powered by a 50.8cc two-stroke air-cooled single-cylinder engine. The Ryobi is a RY09440 model that brings a 30cc four-stroke engine. Yes, we're pitting a 6,210cc truck against a 30cc leaf blower.

Two-stroke engines have high power density, making them the engine of choice among commercial and prosumer-grade leaf blowers, but they emit more pollutants than four-strokes. The four-stroke leaf blower in this test is the Fiat to the two-stroke's Raptor. That was the idea, anyway.

Making the Sausage

It turns out that our local branch of the American Automobile Association (AAA), Auto Club of Southern California, runs exactly the kind of emissions lab we had in mind. It's called the Automotive Research Center, and it's in Diamond Bar, California. There, the fine people of AAA ran full FTP 75 emissions cycles on the Raptor and the 500.

The FTP 75 cycle is one of the primary yardsticks in the U.S. certification of light-duty vehicle emissions and fuel economy. It consists of — stay with us here — three major sub-tests called phases, each of which is defined by a specific pattern of speed versus time. Phase 1 is a 505-second cold-start cycle and is followed by Phase 2, which is a "stabilized" test that lasts 864 seconds. Phase 3 is a repeat of the Phase 1 test, the only difference being that it is performed when the engine is fully warmed.

All three phases of the FTP 75 are run with the vehicle strapped to a chassis dynamometer. But before the FTP 75 can be run, an elaborate pretest sequence is carried out for each vehicle. We'll spare you the details, but suffice it to say that it is very thorough, very tedious and very time-consuming. This pretest procedure takes the better part of a 24-hour period to carry out per vehicle.

Once the pretest is complete, the roller-turning, emissions-gathering part of the FTP 75 can be performed. Here, the vehicle is "driven" by a skilled technician on the dyno over a prescribed pattern of speed versus time while the exhaust is sampled and bagged. If the speed of the vehicle (as measured by the dynamometer) falls outside of a narrow band, the test is voided and the whole expensive process must be repeated, including that protracted pretest process. A technician that flubs with any kind of frequency has a very short career in this field.

It's worth noting that the load on the dyno rollers is adjusted to reflect the aerodynamics and drivetrain loss of the vehicle being tested. So the Raptor is indeed being asked to work harder at a given speed than the Fiat, just as they'd do in the real world.

Comparing Apples to Kumquats: Creating the Leaf Blower Test Cycle

The FTP 75 test simulates 11.04 miles driven over 31.2 minutes and includes idle periods, accelerations, decelerations and cruising. This driving cycle works great when testing things that boast driven wheels: less so for leaf blowers which, of course, don't.

Therefore we needed to come up with a test for the leaf blowers that provided a basis of comparison to the vehicles, yet still reflects the way lawn equipment is actually used in practice. Observe leaf blowers in the wild and you'll find they are very often operated at either full whack or idle. Our test would have to mimic this usage pattern.

It didn't have to be leaf blowers. We considered testing lawnmowers or string trimmers, but they introduce an element of complexity — load. To properly load those devices we'd need the resistance provided by grass and shrubs, and there wasn't time to grow a lush enough lawn in Auto Club's dyno cell. That's why we settled on leaf blowers — they have essentially one knob, and that's blower speed.

With these factors in mind, the test we crafted for the leaf blowers followed the FTP 75's duration and speed-up/slow-down pattern with a twist — we substituted vehicle speed with leaf blower speed. We gave the blowers full speed during the cruise periods defined by the FTP 75. The idle periods remained idle periods and boom, there's our leaf blower emissions test.

The Results

During the FTP 75 test, exhaust gas from the vehicle's tailpipe is captured and analyzed by laboratory-grade equipment that's so expensive it makes the Kentucky Derby look like the Pinewood Derby. This lab equipment measures all kinds of compounds coming out of the tailpipe but the three we will focus on are those with which EPA and CARB are primarily concerned, namely, non-methane hydrocarbons (NMHC), oxides of nitrogen (NOx) and carbon monoxide (CO).

What's that? Fewer words and more numbers? Here, then, are pollutants measured during our testing expressed in weighted grams per minute:

	NMHC	NOx	CO
2011 Ford Raptor	0.005	0.005	0.276
2012 Fiat 500	0.016	0.010	0.192
Ryobi 4-stroke leaf blower	0.182	0.031	3.714
Echo 2-stroke leaf blower	1.495	0.010	6.445

Distilling the above results, the four-stroke Ryobi leaf blower kicked out 6.8 times more NOx, 13.5 times more CO and more than 36 times more NMHC than the Raptor.

The two-stroke leaf blower was worse still, generating 23 times the CO and *nearly 300 times* more NMHC than the crew cab pickup. Let's put that in perspective. To equal the hydrocarbon emissions of about a half-hour of yard work with this two-stroke leaf blower, you'd have to drive a Raptor for 3,887 miles, or the distance from Northern Texas to Anchorage, Alaska.

Clearly, engine displacement plays little part in the concentrations of these pollutants. Consider that the Fiat 500 produced more than double the NOx and more than three times the hydrocarbons of the truck. A close look at the vehicles' underhood emissions labels sheds further light — the Fiat 500 is classed as LEV-II, whereas the Raptor in California trim is ULEV-II. The Raptor's emissions control equipment is simply more capable. It's only in the production of carbon dioxide (CO2) — not yet directly regulated by EPA or CARB — where the Raptor is the higher emitter.

Here, I'll Tie One Hand Behind My Back

Maybe you think the above test was unduly hard on the leaf blowers. To evaluate that notion, we ran a follow-up test on the leaf blowers. We simply started them up and let them idle for 505 seconds — the duration of the Phase 1 portion of the FTP 75 — while collecting their emissions. Idling, that's all, nothing else. The only way the leaf blowers could produce fewer emissions than this is if they were shut off.

We then compared the leaf blowers' idle test results to those of the vehicles running their Phase 1 driving cycle of the FTP 75 test. Remember, this is the 505-second cold-start portion of the test, which is when the vehicles produce the majority of their total emissions since their catalytic converters are still waking up.

In other words, this is a best-case scenario for the leaf blowers and a worst-case scenario for the vehicles. The data below are expressed in grams per minute:

	NMHC	NOx	CO
Phase 1 - 2011 Ford Raptor	0.021	0.013	0.725
Phase 1 - 2012 Fiat 500	0.075	0.032	0.544
Idling - Ryobi 4-stroke leaf blower	0.077	0.002	1.822
Idling - Echo 2-stroke leaf blower	1.367	0.000	2.043

Here, the overall picture improves only slightly for the leaf blowers. Of note is that NOx is near zero for the lawn equipment. This is logical, as the formation of NOx tracks with combustion temperature, which is lowest at idle. Carbon monoxide output of the lowest-emitting Ryobi leaf blower outstrips that of both door-slammers combined, and the two-stroke Echo in particular still belches out several times more hydrocarbons than the vehicles.

You'd have to drive a Raptor 235 miles — stopping every 505 seconds and doing cold restarts — to emit the same level of hydrocarbons as simply idling the two-stroke leaf blower for less than 10 minutes.

Drive a Raptor. Clean the Air

Remember that crazy-expensive lab equipment that measures exhaust emissions? It also measures the emissions makeup of the ambient air that the vehicles draw in through their intake tracts. This is important because, well, what if your emissions lab was located next to a natural gas vent? Only by measuring what goes into and out of the vehicle and comparing the differences can the vehicle's contribution to emissions be accurately assessed.

Here's why you should care. When the Raptor (and the Fiat) was running Phase 2 of its tests on the dyno, it was cleaning the air of hydrocarbons. Yes, there were actually fewer hydrocarbons in the Raptor's exhaust than in the air it — and we — breathed. In the Raptor's case, the ambient air contained 2.821 ppm of total hydrocarbons, and the amount of total hydrocarbons coming out the Raptor's tailpipe measured 2.639 ppm.

So if you want to go green, ditch the yard equipment and blow leaves using a Raptor.

The manufacturer provided Edmunds the Raptor for the purposes of evaluation.

View more Features articles

Comments

tridoc927 Posts: 1
November 2014

I'm so glad I bought an electric leaf blower!

stever Posts: 52,683
November 2014 edited November 2014

My manual rake works fine, doesn't raise much dust and doesn't disturb the neighbors.

brixton Posts: 1
February 2016

another reason to hate those noisy @#$% leaf blowers. Also, way to go car makers!

luke_mj Posts: 1
November 2016 edited November 2016

Tremendous article and research, Edmunds, thank you. Our organization references it frequently when consulting our clients. With respect, let me add that as alarming as these numbers are, they don't include the key factor of CO2. This is not the fault of Edmunds. Despite CO2 being the major human contributor to global warming and climate change, the EPA simply hasn't yet fully addressed the issue of CO2 emissions from SOREs (small off-road gas engines). Since the EPA doesn't measure it, there's no CO2 regulation for the manufacturers, and therefore, all the research and evidence about how hazardous gas lawn and garden equipment is still doesn't include this critical pollutant. So, how much CO2 comes out of these machines? Well, our partner and science advisor Dr. Jamie Banks, PhD co-authored an authoritative study (https://www.epa.gov/sites/production/files/2015-09/documents/banks.pdf) which indicates that a full 76% of the pollutants from SOREs are CO2! That means the jaw dropping Edmunds findings above are only a quarter of the full story. For more information about gas emissions in the lawn and garden industry, and advice about how to transition to cleaner, quieter, healthier, zero-emission battery electric tools, check out http://www.AGZA.net. Peace.

Leave a comment

Comment As ...

More on Edmunds

Tips & Advice | Most Researched Vehicles | New Car Ratings | Compare Popular Vehicles | Car Reviews

Incentives & Rebates

Car News
Automobile Forums
Car Leasing
Car Financing

Popular Makes

Acura
Audi
BMW
Buick
Cadillac
Chevrolet
Chrysler
Dodge
FIAT
Ford
GMC
Honda
HUMMER
Hyundai
INFINITI
Jaguar
Jeep
Kia
Land Rover
Lexus
Lincoln
Maserati
Mazda
Mercedes-Benz
Mercury
MINI
Mitsubishi
Nissan
Oldsmobile
Pontiac
Porsche
Ram
Saab
Saturn
Scion
smart
Subaru
Suzuki
Toyota
Volkswagen
Volvo

Popular New Cars

New Chevrolet Cruze
New Chevrolet Equinox
New Chevrolet Malibu
New Chevrolet Silverado 1500
New Chevrolet Silverado 2500HD
New Ford Edge
New Ford Escape
New Ford Explorer
New Ford F-150
New Ford F-250 Super Duty
New Ford Focus
New Ford Fusion
New GMC Sierra 1500
New Honda Accord
New Honda CR-V
New Honda Civic
New Hyundai Elantra
New Hyundai Sonata
New Jeep Cherokee
New Jeep Grand Cherokee
New Jeep Patriot
New Jeep Renegade
New Nissan Altima
New Nissan Rogue
New Nissan Sentra
New Ram 1500
New Ram 2500
New Toyota Camry
New Toyota Corolla
New Toyota RAV4

Popular Sedans

Used BMW 3 Series
Used BMW 5 Series
Used Chevrolet Cruze
Used Chevrolet Impala
Used Chevrolet Malibu
Used Chrysler 200
Used Chrysler 300
Used Dodge Charger
Used Ford Fusion
Used Ford Taurus
Used Honda Accord
Used Honda Civic
Used Hyundai Elantra
Used Hyundai Sonata
Used Kia Optima
Used Mercedes-Benz C-Class
Used Mercedes-Benz E-Class
Used Nissan Altima
Used Nissan Sentra
Used Toyota Camry
Used Toyota Corolla
Used Volkswagen Jetta

Popular SUVs

Used Chevrolet Equinox
Used Chevrolet Tahoe
Used Ford Explorer
Used Jeep Grand Cherokee
Used Jeep Wrangler

Popular Pickup Trucks

Used Chevrolet Silverado 1500
Used Ram 1500
Used Ford F-150
Used Ford F-250 Super Duty
Used GMC Sierra 1500
Used Toyota Tacoma
Used Toyota Tundra

Popular Minivans

Used Chrysler Town & Country
Used Dodge Grand Caravan

Popular Hatchbacks

Used Ford Focus

Popular Crossovers

Used Chevrolet Traverse
Used Ford Edge
Used Ford Escape
Used GMC Acadia
Used GMC Terrain
Used Honda CR-V
Used Hyundai Santa Fe
Used Kia Sorento
Used Nissan Rogue
Used Toyota RAV4

Popular Convertibles

Used Chevrolet Camaro

Popular Coupes

Used Ford Mustang