



Cold Air Intake Systems

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If you are thinking about "upgrading" your engine's air intake system with an aftermarket Cold Air Intake, here are some things you should know about these products:

Don't Expect Big Gains with a Cold Air Intake

The makers of many Cold Air Intake systems claim rather optimistic horsepower gains of up to 30 horsepower. Typically, a Cold Air Intake with a tune that also alters the Air/Fuel mixture and spark timing may increase peak horsepower 5 to 8 percent, while a Cold Air Intake that does not require a tune might add only a 2 to 3 percent more power. It all depends on how restrictive the stock air filter and air intake system is and how efficient the Cold Air Intake system is that replaces it.

Reducing airflow restrictions and air temperature with a well-designed and properly located Cold Air Intake can enhance performance, but the gains will be mostly at higher engine speeds when airflow demands are the highest. A Cold Air Intake system by itself won't do much at low or mid-range speeds. So you won't feel much difference (if any) until the engine revs above 4,000 to 5,000 RPM.

Some Cold Air Intake systems are a simple bolt-on installation that do not require reprogramming your engine computer (PCM). The diameter of the tube between the air filter and throttle body is the same as the stock system, so it does not affect how the Mass Airflow (MAF) sensor reads air entering your engine. However, many Cold Air Intake systems do require reprogramming your engine computer because they use a larger diameter tube between the air filter and throttle body to increase airflow.

On fuel injected engines that use a MAF sensor to measure airflow, the MAF sensor tells the computer how much air is flowing into the engine so the computer can determine the correct Air/Fuel ratio for best performance, fuel economy and emissions. If the stock tube between the air filter housing and throttle body is replaced with a larger diameter tube, the MAF sensor will not read correctly and report LESS airflow than is actually occurring. This can cause the engine to run lean, misfire and possibly stall. So the computer has to be reprogrammed (retuned) to compensate for the altered reading of the MAF sensor.

Computer Retuning

Reprogramming a PCM requires a special "Tuner" scan tool that contains new calibration information for the computer. This adds to the cost of the installation (typically around \$300 to \$400 for the Tuner tool), but also provides other hacks that can further enhance performance.

The tuner tool is loaded with one of several different calibrations that have been developed for your vehicle: a mild tune for use with regular 87 octane pump gas, and maybe a "performance" tune for higher octane 90 to 92 octane gas. You provide the information about your vehicle to the tool supplier (such as year, make, model, engine, transmission, gear ratio, and details about any other modifications that have been made), and they load the proper tunes into their tool for your engine.

After you have installed your new Cold Air Intake, you then connect the tuner tool to the OBD connector on your car and follow the instructions for downloading the new calibration software into your engine computer. It might take 20 to 40 minutes depending on the application for the new software to load. Most tools can also store the original stock tune so you can go back to the stock calibration if you decide to remove the Cold Air Intake at a later date.

Many Tuner tools also allow you to modify other things on your vehicle. These include changing the factory rev limiter setting, changing the throttle response to make the engine feel more responsive, adding more fuel enrichment at various engine speeds

and throttle settings for more power, adding additional spark advance for more power (which requires using higher octane gasoline), changing shift points on an automatic transmission, and even disabling certain emission functions for "off-road" use.



Cold Air Intake Tuning Issues

Disabling emission functions or OBD monitors is NOT legal for street driven vehicles, and it can cause a real problem for you if you live in an area that requires OBD II plug-in emissions testing every year or two. If any emission functions or OBD monitors have been disabled by a performance tune (such as disabling the downstream O2 sensors that monitor the catalytic converter so you can remove the converters), your vehicle will NOT pass an OBD plug-in emissions test. You will have to reprogram your computer back to the stock tune, or select a tune that does not disable any emission functions or OBD monitors. Also, if you have removed or disabled any emission devices (such as the converters), they will also have to be reconnected or reinstalled to pass the test.

This is NOT an issue with Cold Air Intake systems that do not require retuning. It should also NOT be an issue with Cold Air Intake system tunes that do NOT disable any emission functions or OBD monitors. As long as a Cold Air Intake system and tune are "emissions legal" and meet EPA rules (look for a CARB executive order (EO) number), it should pass an OBD plug-in emissions test.

The best advice is to install a preset tune from the tuner tool supplier. They've done the research and dyno testing to figure out the best tune for your engine. The only time you should need a dyno tune is if you have made numerous other modifications and the tuner tool supplier does not have a tune that matches those modifications.

Also, if you do have somebody do a dyno tune on your vehicle, make sure they have the experience and know-how to do it right. An inexperienced person can really screw things up if they get the Air/Fuel mixture or spark timing wrong for a given throttle position/engine RPM and load. Too much spark advance and/or an Air/Fuel mixture that is dangerously lean under load can result in major engine damage or engine failure!

Cold Air Intake Noise

One big difference you will notice immediately after installing a Cold Air Intake is more throttle noise from the engine when you step on the gas. The air filter in a stock intake system is enclosed in a plastic housing to muffle and reduce noise. With an open air filter, you will hear more of a roar from the engine when you accelerate. Although this gives the impression of more power (like loud mufflers), it doesn't necessarily mean your engine is making more power. It just sounds more powerful. Any power gains that are happening as a result of installing a Cold Air Intake won't happen until much higher RPMs.



An open air filter creates more throttle roar when you step on the gas. The filter should be located well away from engine and exhaust heat, and shielded as needed to keep hot air out.

Cold Air Intake Installation Considerations

One of the claims of Cold Air Intake systems is that they reduce the temperature of the air entering the engine. Cool air is denser than hot air, so in theory it allows more air to enter the engine to make more power. That's true provided the Cold Air Intake is actually reducing the temperature of the incoming air. But it all depends where the air filter is located and where it is sucking in air.

A well-designed Cold Air Intake will have a long enough inlet tube so the air filter can be positioned far away from engine heat (especially the hot exhaust manifolds), or in front of the radiator, or down low so it can pull in air that has not been heated by the engine or radiator.

If a Cold Air Intake system positions the air filter inside the engine compartment, it should also have a metal or plastic heat shield to deflect engine and exhaust heat away from the filter. The filter should be located in a forward corner of the engine compartment, away from the radiator and in a location that allows it to pull in outside air that is cooler than that in the engine compartment.

Our advice is to buy a Cold Air Intake system that is specifically designed for your vehicle, and includes a heat shield to keep engine and exhaust heat away from the air filter and support brackets for a secure and vibration-free mounting. An inexpensive "universal" Cold Air Intake kit that you cobble together yourself may not fit or function as well as one that has been engineered for your engine.

The absolute WORST place to position a Cold Air Intake filter is right over a hot exhaust manifold. It will suck in hot air, and may actually REDUCE (not increase) engine power. Overheated air also increases the risk of engine-damaging detonation and pre-ignition.

Something else to mention is that an open style air cleaner is NOT a Cold Air Intake. You see a lot of old school muscle car V8 engines with aftermarket chrome air cleaners with an open filter element. They look nice and probably flow more air than a stock air cleaner, but they also suck in all the heat from the engine and radiator. This decreases air density and reduces power. The only way this setup works is if the air cleaner is raised up into a hood scoop, or outside cool air is ducted to the air cleaner from the base of the windshield (cowl induction) or through tubing from the front of the car or hood scoops ram induction).

Is the Cold Air Intake Really Delivering Cold Air?

Another factor to consider is how well the Cold Air Intake system keeps the air cool as it flows from the filter to the throttle body. A chrome or stainless steel tube, or a polished or anodized aluminum tube looks great under the hood. But metal conducts heat much better than plastic. Consequently, a metal tube will absorb more heat from the engine and exhaust system than a plastic tube, causing more heating of the air inside the tube as it flows through the tube. This basically defeats the concept of a Cold Air Intake. The temperature of the air entering the engine may be no cooler or maybe even hotter than the stock intake system.

In our opinion, the most efficient Cold Air Intake setup would be to use a plastic tube wrapped with insulation or aluminum foil to reflect heat. You could also paint the outside of the tube white or silver to reflect heat. Don't leave it black or paint it black because black absorbs heat.

Cost Benefit Calculation for a Cold Air Intake

Is the cost of a Cold Air Intake system worth the money? It depends what you want. If you want an intake system that looks cool, sounds more powerful and adds a few horsepower at higher engine speeds, then buy one. But if you are expecting huge horsepower gains for a couple hundred bucks, you will probably be disappointed.

A simple bolt-on Cold Air Intake system that does NOT require a tune typically sells for less than \$100 to \$300. The ones that require a tune will cost you \$500 to \$600 or more when you add in the cost of the tuner tool.

If you spend \$150 on a basic bolt-on system that does not require a tune and it gives you a 5 horsepower increase, your cost is \$30 per horsepower gained.

If you spend \$600 on a more sophisticated system with a tuner tool and it gives you 20 more horsepower, your cost is still \$30 per hp. But if you opt for the optional higher octane performance tune and get a 30 horsepower increase, your cost drops to \$20 per horsepower.

If You Want To Add Even More Horsepower

If you want serious horsepower gains, you'll need a lot more than a Cold Air Intake. You will need a power adder such as nitrous oxide, a supercharger or turbocharger. Nitrous oxide systems cost from \$300 to \$800 or more, and can provide an instant 50, 100, 150 or more horsepower on demand. Street superchargers and turbocharger kits typically cost \$4,000 to \$6,000, plus another \$1500 to \$2000 for installation (unless you install it yourself), plus tuning (add more \$\$\$ for a professional dyno tune).

A supercharger or turbo delivering 7 to 8 lbs. of boost will typically give you an extra 150 to 200 horsepower on a V8 engine, and maybe 100 to 125 hp. on a V6 or four cylinder engine. If you want more power, you just increase the boost pressure. But you soon reach a point where you also have to make other expensive engine upgrades to handle the extra power, things like stronger connecting rods, a forged or billet crankshaft, forged pistons, ARP head bolts, better head gaskets, boring and sleeving an aluminum block if needed for added strength, etc. These kind of modifications can get really expensive. Even so, it is possible to build street engines that can deliver 800 to 1000-plus horsepower at the rear wheels. And it often starts with installing a Cold Air Intake on an otherwise stock engine.



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