



Intelligent Performance, Part 3 - Intakes

How to spend the least to get the best.

By Julian Edgar

Modifying the intake system can result in some appreciable power gains at almost no cost. And, unlike exhausts (covered last week), the intake changes can be easily made working at home with just hand tools. Power gains will vary substantially - it will depend on how good the original system is and how good the modified system is. However, we have seen dyno-proved gains of 5 per cent made by just fitting a better intake duct to the standard airbox.

Intake Ducts

A number of different approaches can be taken, but our preference is to retain the standard airbox and simply make sure that lots of air from outside the engine bay can get to it with a minimum of restriction. Taking this approach has advantages that are easily summarised - it's cheap and it's usually very effective. We suggest that you retain the standard factory filter element in the box - the huge power gains apparently made by replacing this element with an aftermarket one are simply mythical.



Investigate how the factory intake to the airbox works. Does it pick up air from inside the engine bay (bad, because most of the time this air will be hot). Does it have a duct that breathes air from near to a headlight or an opening in the grille (good, because this air is cool). Does the duct pass through a resonant box (bad, it'll cause restriction) or is a resonant box tee'd into it (not so bad). Is the mouth of the duct flared out so that it will pick up air more effectively, or is it just a sharp-edged ending, cut off square? Is the mouth of the duct pushed up hard against an obstruction? Based on your inspection, you might decide to retain a portion of the factory airbox intake, or to replace it entirely.



The use of 3-inch plastic stormwater pipes and fittings (available from hardware stores) makes for an effective and easily fabricated intake duct. The end of the pipe can be flared into a bellmouth if it is heated with a heat-gun until the plastic is just pliable and then the pipe is forced down over the outside of a funnel. The pipe can be adapted to the airbox intake with off-the-shelf sections that change the shape from round to rectangular, or the intake hole in the airbox can be enlarged to suit the new duct. Paint the finished item with a can of black spray paint and it'll all look OK too.

Some people use large diameter convoluted ducting to form a new intake, and that's fine as well.

However, with any type of duct, don't have the intake positioned only inches from the road. It will pick up dirt and small stones, and the stones can be breathed in with such speed that they'll penetrate a paper panel airfilter. Also, water will be easily ingested with a low air pick-up; it's not at all unheard of to hear of people who have hydraulic'd their engine through this technique. Rain isn't usually a problem - most airboxes have a drain hole in their base and it's easy to put some others in along the length of the duct.



You can't make an intake duct to an airbox too big, so if you're looking at a powerful engine, the use of more than one intake duct may be necessary. Note that a free-flowing duct will normally pick up more dirt than standard, resulting in the need for the filter element to be changed more frequently than the manufacturer recommends. A thin, oiled foam prefilter can be used in some applications.

Airbox Mods



If the airbox in your car is small (resulting in a small panel filter area) or both the inlet and outlet ducts are crudely designed, you may wish to replace the complete airbox with a better one from another car. With a bit of careful measuring, this is quite easily done. But which other car's airbox do you use? AutoSpeed tested 14 different airboxes for flow - the results are here: ["Box Breaths"](#). Of those that we tested, some specific later model Commodore ones were the goods in terms of flow, filter cost, and airbox cost.

If you find obvious flow restrictions within the standard airbox, but space or other considerations mean that you can't swap it for another, you can modify the standard box. Smoothing sharp exit and entrance radii, the use of a plastic bellmouth in the exit duct, and removing plastic ridges and strips located in the wrong places will all help flow. Smoothing is easily done with a file and then fine emery paper.

Pod Filters



Pod and cone filters will generally outflow the combination of a flat filter inside an airbox. However, removing the entire airbox and replacing it with a pod filter works in real life only when you can make sure that just cool air is breathed. Leaving a factory airbox duct directed at the new pod filter **does not** ensure that! Usually, extensive heat shielding or the fabrication of a whole new box is needed. And, when it's realised that the **design of an airbox is more important to determining flow than the filter which is used within it**, you soon realise that the airbox around the pod needs to be damned good if the flow isn't to drop back below standard!

Tuned Length Intakes



While thankfully it's getting rarer, there are still people who remove the whole airbox and intake pipe and place a pod filter directly on the throttle body. (Obviously, most often on engines that use MAP sensing not airflow meters.) This has two major disadvantages - hot air is breathed all of the time, and secondly, the resonant tuning that the manufacturer has made of the duct between the airbox and throttle is lost. Testing that AutoSpeed has performed has shown that playing around with this part of the system can massively vary lower rpm torque - and here, what the manufacturer has done is usually best. For some good examples of the power changes resulting from altering the length of this duct, go to ["Pipe Dreams"](#). This point does not apply to turbo cars, where the duct connecting the airbox (or airflow meter) to the turbo intake can be altered without problems.

Pressure Drops

It is quite possible to analyse the actual performance of the intake system (in either modified or standard forms), so that the restriction caused by the different components of the system can be measured one by one. For example, you can measure **exactly** how restrictive the airfilter element is. This removes a lot of the guesswork otherwise associated with the modifications. Measuring the pressure drops of the intake require the fabrication of a simple low cost tool called a manometer - how to make and use one is covered in the book [21st Century Performance](#). If you really want to know what's going on and are prepared to spend the time on the road testing, take this approach before doing **any** modifications to the intake.

Conclusion

You want good intake system performance at a low cost?

1. Fit a free-flowing intake duct to the airbox.
2. If the airbox design is poor, modify or replace it.
3. Use a standard airfilter element and change it frequently.
4. If you install an aftermarket pod filter, ensure that only cool air can be breathed by it.
5. Be wary of changing the design of the duct between the airbox and the throttle body.

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