



Understanding How Motorcycle Exhausts Work

One of the most popular modifications owners do to their motorcycles is to change the stock exhaust. But does installing a slip-on actually improve performance? What do you need to do after installing a full replacement exhaust? What should you be aware of before taking your modified exhaust onto the streets? Let's take an exhaustive look at how motorcycle exhausts work (first time ever that pun has been used, guaranteed).

What An Exhaust Does

It's probably first best to understand the purpose of your exhaust. While it most certainly performs the function of improving your bike's performance, it's just one of a number of important reasons that your exhaust system exists.

Probably the most important aspect from the riders point of view is that it routes the hot gasses from the engine after combustion. That's somewhat critical because if you spent too long breathing those gasses in, you'd probably feel sick pretty quickly (or die). In fact, your standard motorcycle exhaust will house a catalytic converter which helps convert the carbon monoxide expelled from the engine into carbon dioxide which at least makes it slightly more environmentally friendly.

Your exhaust system with the help of the muffler also reduces noise. How much noise? A lot – disconnect your muffler from the pipe and you'll see how much. You'd go deaf pretty quickly without it and you'd be public enemy number 1 around the neighborhood. Your muffler has nothing to do with exhaust emissions – nor with engine performance (but more on that later).

But finally, your exhaust performs a major function when it comes to how your engine performs. You may have read that aftermarket exhaust systems can help increase your engines horsepower by being 'less restrictive'. That's true, but does that mean that if you had no exhaust at all (and therefore no restriction) horsepower gain would be maximized? Not at all.

Your engine and exhaust system actually are designed to work together. It gets very technical and the practical application of how it all works includes things like reflected pressure waves. Suffice to say that without an exhaust connected to your engine, you'd be introducing air directly into the system in the wrong direction through the exhaust

ports (consider how much would enter when riding at speed) which would throw everything out of wack.

So an exhaust system is necessary – both from a legal perspective, from a not going deaf perspective and from a performance perspective. So what can you do to make some horsepower gains? There's two paths people take – the cheap way and the not so cheap way. That is, replacing the muffler with a 'slip-on' or replacing the entire system.

The Slip-On Fallacy

The subject of slip-ons is one of those things in motorcycle circles that many won't agree on. Do they or don't they actually help improve your motorcycles performance. In our opinion they do, but it's got nothing to do with improving engine efficiency. It's simply that most of the time an aftermarket exhaust will weigh less than what comes standard on your bike.

Motorcycle manufacturers are out to make a profit which means where possible, they'll use cheaper components to save money. A muffler is usually one of those cheap components. It doesn't hurt the engine performance in any way, but cheap on a motorcycle often means heavy – and OEM mufflers are often very, very heavy. Aftermarket exhausts on the other hand are priced in such a way that they can weigh many pounds less than what comes standard on your bike. Weight saving is a performance improvement.



But they don't increase horsepower. We'll probably get some comments arguing this point, but there's nothing we've ever seen that indicates that slip-ons do anything to improve engine efficiency. We've seen some argue that a good designed muffler will reduce the amount of air reflected back up the exhaust pipe but again, we haven't see any real evidence that this is actually true.

And yes, almost every slip-on manufacturer will provide a dyno chart showing the horsepower gains of their product. But it's not a fair comparison. Those dyno charts are done under conditions that are favorable to the slip-on – the engine has been tuned, higher octane fuel is used and potentially even ignition timing has been altered. If the same was done with a stock exhaust, the result would be the same. Slip-ons provide weight savings, not horsepower increase.

The Pipes Are Where It's At

Where a modified exhaust system does increase horsepower is in the header pipes connected directly to the exhaust ports. The less restrictive these are (i.e. the easier it is for the exhaust gasses to be expelled) the more horsepower gain there will be. If you compare a stock exhaust system next to an aftermarket one, you'll often notice that there are less bends (or gentler ones) and the headers will often direct gasses to one side of the bike instead of both – lessening the overall distance gasses need to be expelled.

This is further emphasized where you replace a 4-into-2 exhaust system with a 4-into-1 aftermarket exhaust – not only is there even greater weight reductions but you'll again be creating a less restrictive system. That being said some engine configurations are designed to work better with 4-into-2 systems as opposed to 4-into-1, so do research before committing to a big change.



Another simple reason that a full exhaust system will increase horsepower is often the absence of a catalytic converter. A catalytic converter will restrict the airflow in an exhaust and in some cases also increase back pressure, reducing engine performance. Yes, that means that your bike won't pass an emissions test on the street but if you're only using the aftermarket pipes on the racetrack it's not a problem.

Finally, another reason a full exhaust performs better is the lack of a resonator. A resonator, like a muffler, is designed to reduce noise. You'll know your exhaust system has one because it's an almost rectangular shaped bulge in the pipes – usually situated halfway between the muffler and the headers. It's just another part that restricts the exhaust gasses and hence by not having one, horsepower is increased again.

Don't Go Riding Just Yet, You Need to Tune First

Unfortunately, not only does a full exhaust system cost a lot more than a slip-on, you're also going to have to pay to get your bike running correctly now as well. The simple reason for this is that because the engine is now working more efficiently (in a way, it's

breathing better), your air/fuel ratio will now be out of alignment. Your engine is getting more air than before, but the same amount of fuel as previously.

You'll probably hear the term 'running lean' in reference to the issue when you install a full exhaust. At best, this means your bike won't run great and you'll hear a lot of noises like small explosions in your exhaust when decelerating. At worst, your engine can be running so lean that it overheats and things start melting. That's bad.



To correct this you'll need one of two things – depending on your bikes fuel management system. For bikes with a carburetor, you'll need a jet kit and a trip to a tuner for a dyno session. For EFI motorcycles, you'll need a fuel controller (like a Power Commander) and either an additional module to automatically adjust the air/fuel ratio or a trip to a dyno and have a qualified technician adjust things. That's another \$300 to \$500 there in addition to your actual exhaust system cost.

No doubt this cost is a reason why many take the slip-on route over the full system alternative. But in the end, if you're making modifications to your bike for real horsepower gains and not just aesthetics/weight savings, then like all things – you get what you pay for.



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