

Open Road

Balance

THE AIRBOX IS basically the silencer for the intake side of an engine, just as a muffler is the silencer for the exhaust side. In both cases, best efficiency is obtained when the volumes are large, so sharp sonic events can be muted without severely limiting flow and power.

The airbox and muffler are not the same size because the fluid behavior changes when combustion converts steady pressure at low temperature into blazing hot pulsations, and it's harder to move ambient air. But, regardless of the utility of a good-sized airbox, too many engines essentially make do with whatever skimpy space might be found under the gastank.

When Erik Buell worked on H-D's ill-fated superbike effort, he knew the prototype's airbox was too small; he could see it like the nose on your face.

He reasoned that if any race engineers knew precisely the formula for size, they would probably work in Formula One, so he set about calculating the airbox displacement-to-engine displacement ratio of the then-current Cosworth F1 V-8.

Scaling for the superbike's smaller, one-liter displacement, it was clear that an airbox of the correct size would not fit in the racer's current configuration. There had to be another arrangement.

The hallmark of the great inventor is a unique problem-solving approach. First, there's a contemplative period of appreciation for the problem, which might even take years, resulting in a crystal clear picture of its nature. Then, in a leap of faith, he or she will ask a higher power for the answer. When it comes, the mystery is usually revealed in a flash of insight, often in a place far from the laboratory.

Buell's inspiration became his patented fuel-in-the-frame/airbox-on-top design. It offered many advantages besides its power potential: It was stiff, it reduced weight up high and the position of the fuel further lowered the center of gravity and tightened the center of mass. Alas, the road of the visionary isn't always smooth. Buell couldn't convince his superiors of the need for real innovation, and the depth of his frustration led to his departure from the team not long after. But Erik Buell is a very tenacious man, perhaps an even rarer quality than his skill at invention. It would take years, but he would prove his concept in the most dramatic way possible, making it the key design feature of a new motorcycle bearing his own name.

The question of intake flow was on my mind last week while working in the dyno room, testing and adjusting the 40mm



Mikuni TM40 pumper carburetor that had replaced the stock CV unit on our Suzuki DR650SE project. I'd promised a test of the two popular slip-on exhausts, and knew the jetting had to be optimized if the test were to be valid (a tragic mistake in most of the "Pipe Shootouts" of carbureted bikes printed over the years).

In stock form, the big DR has a small airbox that draws all incoming air through a surprisingly small 90° rubber snorkle on top of the airbox, under the close-fitting seat. Removing the airbox lid multiplies the flow area of this snorkel many times, essentially creating an open filter box.

This has a couple of serious consequences: much more noise from the airbox is one. I'd tried to minimize this with a sound deadening material on the side-cover, facing the open airbox, but it still produced 90 dB, 18" from the cover, with the standard exhaust system test protocol. By comparison, the aftermarket exhausts at 93 dB, were quite legal, but noticeably louder than the stocker's approved 88 dB.

The other is that the standard carb settings, particularly those affecting off-idle response and acceleration, are much too lean when flow restriction is reduced on both the intake and exhaust sides.

Having been through a similar exercise with my old TT500 Yamaha, I had a trick I wanted to try. The TT suffered from the same malady after fitting a SuperTrapp and replacing the airbox with a big K&N filter. The TT500's most popular replacement carb was a 36mm Mikuni from White Brothers. Reasoning I could save the cost of a new carb if I could make the very similar 34mm stock Mikuni work as

well, I studied the differences. Jetting options were not a problem, but the stock TT500 slide cutaway, which handles off-idle response, was much too big by comparison with the White Brothers Mikuni. But the TT's stock slide was unique, with a rack-and-pinion lift linkage, and was only available with the stock cutaway.

My solution was to shorten the stock slide to match the WB carb's slide cutaway. To avoid chipping the plating off the brass slide, I made sure the grinding wheel's direction contacted the chrome surface first.

Because the needle would now sit much deeper in the jet, it had to be lifted beyond the range of its notches. With the needle in a drill motor held in a vise, it was easy to cut a new groove with a jeweler's saw. The mod worked, giving much better response, but it still lacked the instantaneous power that makes such a difference to riding enjoyment and control.

As an attempted fix on the DR650SE, a new slide was purchased and modified the same way. But the experiment failed on the CV carb—no detectable change.

Years ago, Sudco used to sell an add-on accelerator pump that worked off a separate cable spliced into the stock one. It was cheap, around \$40 (vs. the high price of a Dellorto pumper), and easy to fit. It was the final piece in the TT500's puzzle.

A slide throttle carb opens as fast as the rider's wrist commands, but too sudden openings kill intake velocity, making it difficult to pull fuel from the jets or atomize what does reach the venturi. The accelerator pump covers this problem with a squirt of fuel. The decision to fit a pumper carburetor transformed the DR650SE, like the Sudco pump had done to the TT500, creating a deliciously direct connection between the throttle grip and the rear tire.

But getting it tuned to perfection took five separate dyno runs, with rejetting between. Concerned only with the O₂ readings, I first optimized the main jet and then dropped the needle in steps—eventually departing significantly from the suggested settings. The improvements were remarkable, and quality time with wrenches doesn't get any better than finding an 18% improvement in power with vastly better driveability.

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Happy Tinkering!

DAVE SEARLE

—Dave Searle
Editor