

Techlusion R259 For BMW's R1100/R1150

WHEN BMW INTRODUCED the R1100RS in late 1993, it was a radical departure from the much beloved, albeit outdated, air-cooled R100 Boxer it replaced. With 90 bhp pulsating from a completely redesigned air/oiled-cooled engine, BMW's newest "Oilhead" boxer was adorned with a number of technological improvements such as ABS brakes, Telelever front suspension, Paralever rear drive/suspension, new seat and brake/clutch levers, an adjustable windshield, grips, a catalytic converter and, wow...fuel injection. Unfortunately, many R1100 owners soon complained to their dealers about what is now universally referred to as "surging."

Although it is equipped with an oxygen sensor for closed-loop operation, the Bosch-manufactured Motronic Engine Control Unit (ECU) actually operates in two modes, open and closed loop. In *open loop*, the fueling data is read from a programmed map, and typically, any high-load situation causes the ECU to go into open loop. In *closed loop mode*, the system relies on the oxygen sensor to control fueling. This is where the bike operates most of the time, under light acceleration and cruise, and this is where most of the dreaded surging occurs. The problem is that, despite being emissions friendly, BMW's closed loop system is too lean to provide smooth power output.

Some innovative, but unsuccessful solutions undertaken by dealers/owners to solve this problem included replacing the OEM multi-electrode spark plugs with Autolite spark plugs, substituting or removing the Cat Code Plug (or CCP, which defaults the fuel system to a rich condition, but one that can damage the catalytic converter), replacing the intake manifold with one from another R1100 model, and/or finely tuning the throttle bodies. The results of these efforts demonstrated that each bike reacted differently to these changes, and while some were improved, no universal remedy was found for those Oilhead engines that exhibited severe surging.

Complicating matters even more was BMW's steadfast refusal, until recently, to acknowledge that a surging problem existed within R1100/R1150 model bikes. (See MCN's April 2002 Letters for the details.) And since marques like Ducati, Triumph and Harley-Davidson also have EPA-approved, fuel-injected motorcycles that don't surge, to put it kindly, this has situation has puzzled many Oilhead owners. Now, almost 10 years and one engine revision later, surg-

ing remains the proverbial albatross around BMW's neck in these otherwise superb motorcycles.

Identifying the problem proved to be relatively easy. Finding a solution, however, has not been as straightforward since the degree to which the surging affects some

To address this concern, Techlusion Performance Group enlisted support from Battley's Cycles in Gaithersburg, MD, a company that they had an over-15 year R&D relationship with Dobeck. This collaboration resulted in the latest generation controller, the Techlusion R259.

Where the Techlusion R259 differs from its predecessors is that it now modifies the signal to the ECU to add fuel in the closed loop mode, based on input from the oxygen sensor. The oxygen sensor is the primary fuel control used in the problematic closed loop operation. This sensor allows the ECU to maintain a supply of *residual* oxygen in the exhaust gas stream which is then used by the catalytic converter to behave as an afterburner for any unburned fuel. Because Techlusion believes that the oxygen left after combustion is a result of a lean fuel-air ratio which creates the surging, the R259 slightly richens the fuel mixture, thus reducing the surging or hunting. The oxygen sensor signal is the *only* ECU input that is modified with this device.

Tom Buzas, the General Manager at Battley's Cycles, allowed us to test a pre-production Techlusion R259 installed on a new, 2003-model R1150RT. With only 150 miles on the odometer, this test was a worst-case scenario in many respects since surging is more evident on newer Oilheads, partly because the BMW bore finish is so hard that full cylinder/ring break-in takes significant time and mileage.

The Techlusion R259 was connected to the wiring harness via five wires: Two wires to the oxygen sensor, two wires to one fuel injector and a ground wire. The device itself was conveniently attached to the top of the airbox under the driver's seat. Battley's Cycles fabricated a multi-pin connector so we could disconnect the Techlusion R259 and convert it back to stock operating mode quickly. We also made sure the stock CCP was in place, and using BMW's MoDiTeC computer, we also ensured that there were no fault codes and that the oxygen sensor was actually working when the Techlusion R259 was connected.

In stock operating mode, our test bike exhibited all the characteristic symptoms of lean surge; i.e., "hunting" was evident at constant throttle in every gear, from 2800-5000 rpm. To gain familiarity with its individual behavior, the bike was ridden stock for another 150 miles before connecting the Techlusion R259. We immediately noticed an improved throttle response, and our seat-of-the-pants impression was that the engine



Four generations of Techlusion computers: the Fuel Nanny, Techlusion 83i Power Box, Techlusion TFi and the new R259.

R1100/R1150 engines, even of the same model, varies widely.

Mark Dobeck, former President of Dynojet, began working on a solution. It was determined that the too-lean mixture that results from closed loop operation was responsible for the surging, which might be thought of as a stagger due to inadequate combustion. His idea was to modify the fuel injection signal after it leaves the factory ECU in an effort to make the injectors remain open a few milliseconds longer to provide a slightly richer mixture. Dobeck developed two analog controllers which have been installed by many Oilhead owners (the Fuel Nanny and the Techlusion 83i Power Box) and later, a digital control box (the Techlusion Fuel Injection (TFi), through his new company, Techlusion Performance Group. However, these devices were a cure for some, but did not completely eliminate the surging on every problematic Oilhead and were not the universal panacea he had hoped for.

was "livelier" throughout the entire rpm range. The surging that was evident only minutes before in virtually every gear was completely eliminated in 1st-3rd gears, and was scarcely noticeable in 4th-6th, and only a narrow range, between 4300-5000 rpm. But being the persistent skeptics that we are, we established three test criterion to objectively evaluate the Techlusion R259 on the R1150RT.

Test #1—Fuel Economy

Miles per gallon is an important benchmark for many BMW owners, so an 86-mile loop consisting exclusively of highway miles was laid out. We ran the route back-to-back in the two configurations, stock and modified, in order to minimize the affects that temperature might have on the fuel economy. Traveling 65 miles per hour in stock mode, we averaged 43 miles per gallon. With the Techlusion R259 connected, we got exactly the same mileage—43 miles per gallon.

Test #2—Emissions

Our attention was then directed to exhaust emissions. With the R1150RT fully warmed to operating temperature and using a PAC-Gas 5-Gas Analyzer, we tested the carbon monoxide (CO), hydrocarbons (HC), carbon dioxide (CO2), oxygen (O2) and oxides of nitrogen (NOx) gases with and without the Techlusion R259 activated (it should be noted that this was a static test and not performed under load). From the results of the exhaust analysis it appears that the Techlusion R259 is indeed richening the fuel mixture as evidenced by the slight increase in CO emissions. See the gas analysis chart caption for an explanation of the various gasses.

Test #3—Dynamometer

Finally, and to test our initial seat-of-the-pants impression, we made 12 dyno runs on the R1150RT, six without the Techlusion R259 connected and six runs with it connected on Dynojet's Model 150 chassis dynamometer. Although there was an average incremental increase of 1.1 peak horsepower with the Techlusion R259 connected, it should also be noted that this minor horsepower increase is within the margin of error for even the most skilled dyno operator. However, there was a marked increase with respect to throttle response on the graph. The near vertical and linear lines in every gear also peaked as high as five horsepower over the stock settings, showing a measurable and improved throttle response.

In fact, the Techlusion R259 appears to operate within the parameters of BMW's closed loop mode without any apparent detrimental affect. To the contrary, there is

	STOCK			Techlusion R259 CONNECTED		
	IDLE	2500	4500	IDLE	2500	4500
HC	6	8	49	1	3	68
CO	0.00	.01	2.21	0.00	.02	3.83
CO2	6.98	9.14	7.88	7.26	9.30	7.06
O2	10.75	7.50	7.41	10.19	7.29	7.44
NOx	15	49	62	15	41	57

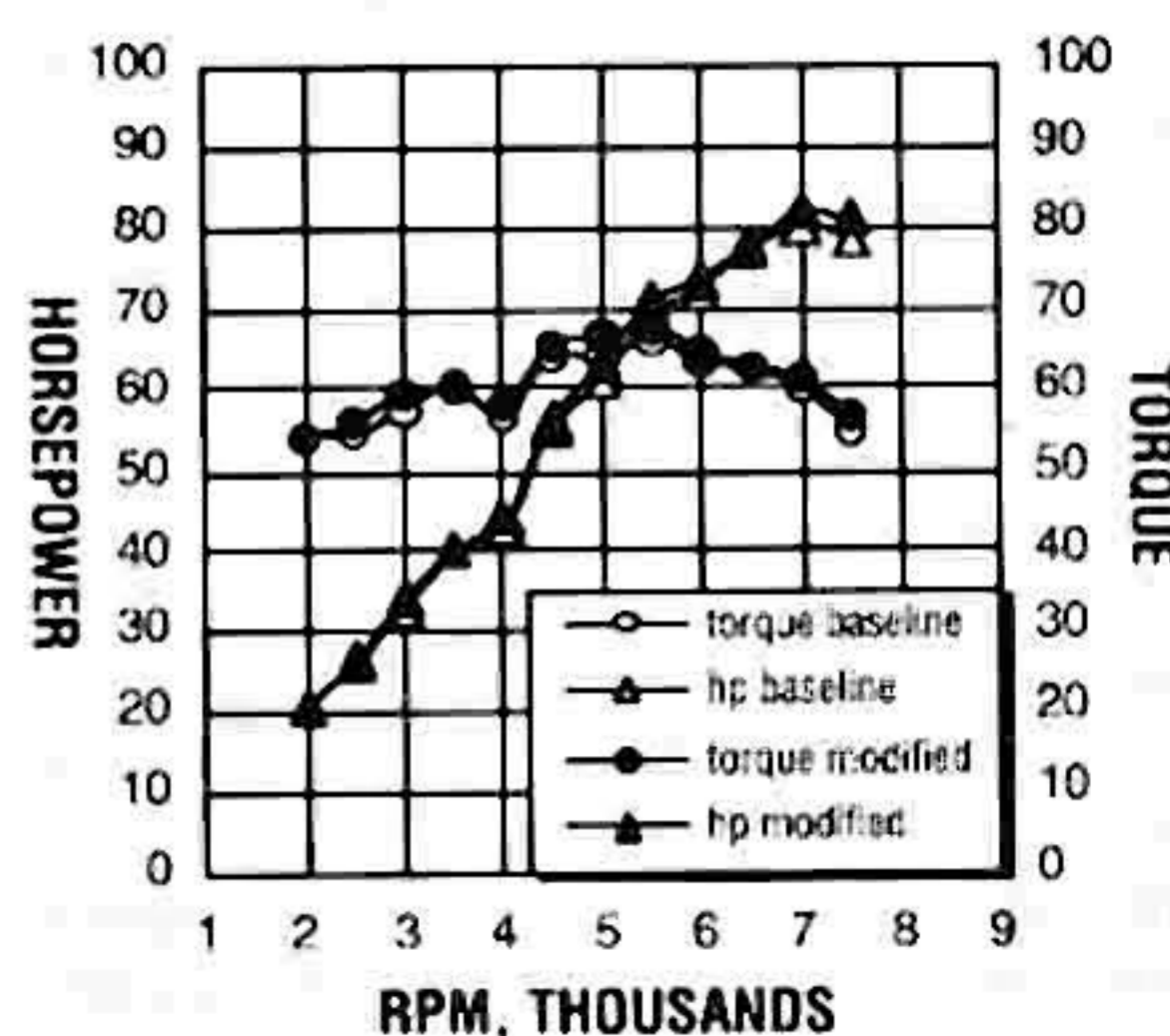
There is no one ideal proportion of gasses for all engines, but consider that CO (carbon monoxide) is a measure of burned fuel and HC (hydrocarbon) is a measure of unburned fuel. High HC is a special concern with bikes equipped with catalytic convertors as mixtures much richer than normal (considered to be 14.7:1 air/fuel) will destroy the catalyst. NOx (Nitrogen oxide) is a toxic gas, and the one that gives smog its nasal sting and characteristic light brown color. NOx increases with combustion heat while HC drops—another compromise. Poisonous CO (carbon monoxide) is formed when inadequate O2 (oxygen) is present, reducing the harmless CO2 created by combustion. For best power, all the O2 should be burned and excess HC would be tolerated, but for cleanest running we want the maximum portion of fuel burned and higher oxygen emissions would be okay.

a slight increase in horsepower and throttle response that does not appear to adversely affect the fuel mileage or emissions. And although it does not completely eliminate the surging, it does significantly reduce the worst effects of these symptoms and makes the bike much more manageable and pleasant to ride at constant throttle settings.

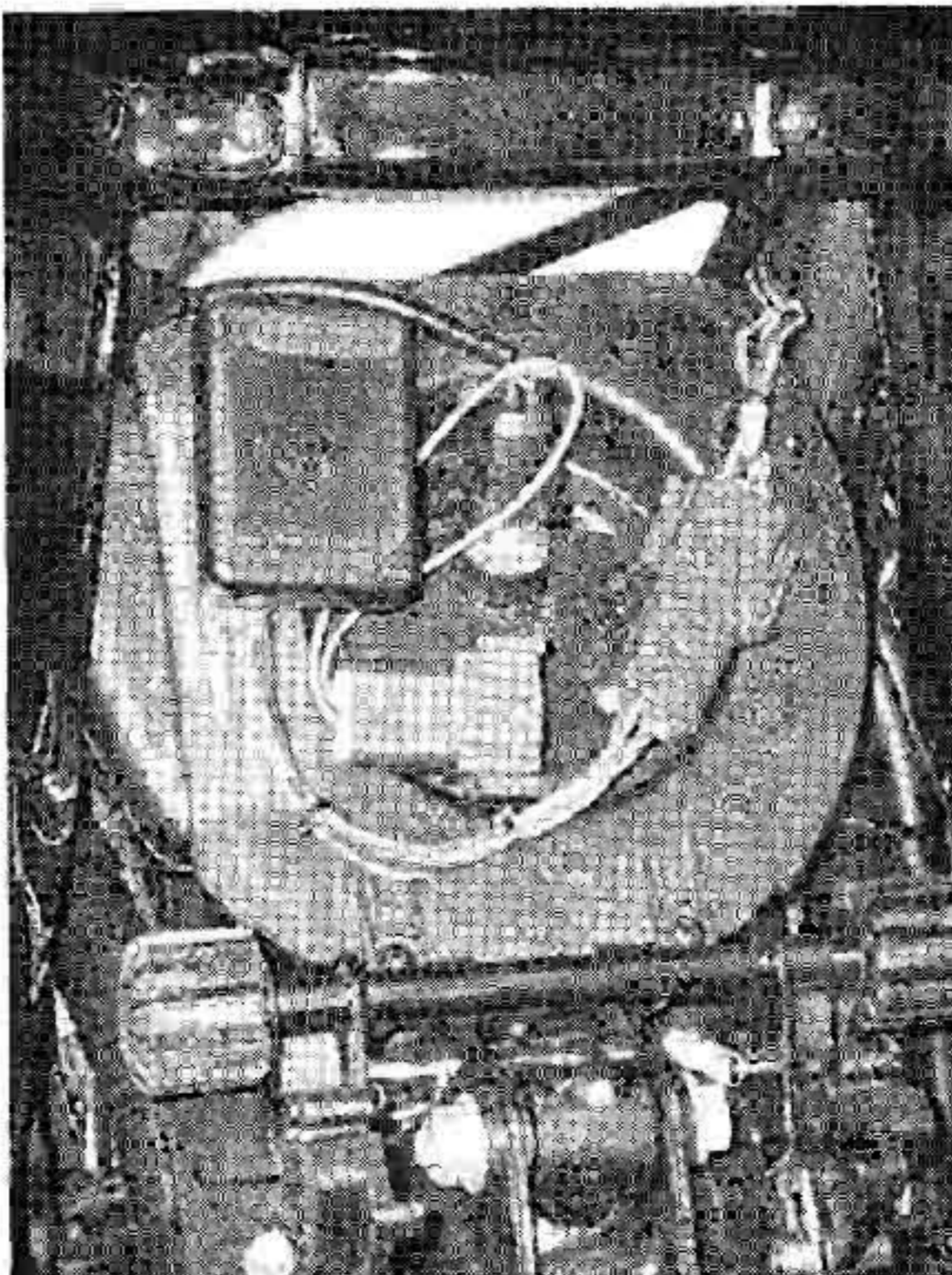
Unlike the ancient mariner in Samuel Coleridge's classic poem, BMW has not been able to rid itself of the fuel injection "surging" albatross that has plagued many R1100/R1150 engines. And just as the aftermarket has stepped forward to provide relief in the form of self-canceling turn signals for R1100/R1150 owners, it has also found a solution that virtually eliminates the problematic surging dilemma on many Oilhead engines.

Retailing for \$249.99 from Battley's Cycles, the Techlusion R259 can be installed on any BMW R850/R1100/R1150 motorcycle and should be available in February. We are very impressed with the effectiveness of this system, which, as tested, has just reached the final prototype stage. While we don't hesitate to recommend it, we are eager to hear from those of you who purchase the production systems, to find out if it works as well for you as it has for us.

—Bill Shaw



Before and after dyno charts indicate slight horsepower improvements from the Techlusion device, but the biggest gain is in drivability and the absence of the infamous surging.



Above: The Techlusion R259 installed underneath the seat on top of the R1150RT's airbox.

RESOURCES

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