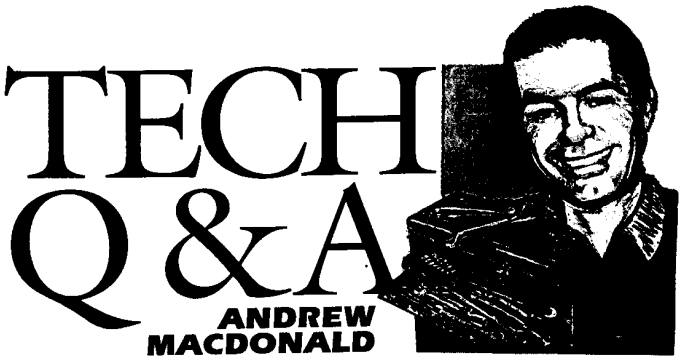

Exhaust Gas Analyzers

Q In your column you often refer to the use of an exhaust gas analyzer in tuning motorcycles. Now that many have of us have access to automotive emissions analyzers, it would be great for *Rider* to have an article on how to tune a bike using such an analyzer. If that isn't possible, please suggest a book or manual explaining the process, because neither my Honda CBR600F3 manual nor the analyzer manual explain it. Thanks.

Jim Lynn
Pittsburgh, Pennsylvania

An article that would do justice to the use of an exhaust gas analyzer would consume an entire issue of *Rider* and several issues down the road. It's not rocket science, though, nor does it take a 10 year apprenticeship under a scolding *meister* mechanic to learn. What it takes is about six months of probing the exhaust mufflers of umpteen different bikes to arrive at baseline readings of what is spot on, a little out of tune or "Houston, we have a problem" type readings.

Unfortunately, no text containing all this data exists that I'm aware of, and the only manufacturer that provides optimum, ideal emissions specs is Yamaha, which also offers gas analyzer training. Ever wonder what that small Philips head screw is all about in the middle of a Yamaha engine oil drain plug? It's for attaching a lead from the hand-held factory engine temperature gauge so that the low-speed carburetor-mixture screw adjustment can be set at the ideal engine temperature, which is listed in Yamaha service specifications right along with dry weight and oil capacity specs.

I suspect that some readers would be fascinated by columns of exhaust gas analyzer data, bike by bike from the last 20 years. But most, myself included, would sooner read *Favorite Rides.* What I can offer you here is a little insight and understanding of the stuff that flows out of a motorcycle's exhaust pipe with some examples of good and not so good.

Originally the exhaust gas analyzer (EGA) was designed to fine tune and diagnose problems with an internal combustion engine. Bike mechanics still use the original setup that reads two gases only-carbon monoxide (CO) and hydrocarbons (HC). During the '70s automobiles were fitted with air pumps and catalytic converters which gobble up these pollutants, so even though a car engine could be sick and shoving loads of these gases out the manifold, emissions control devices "hid" them from view-normal readings were still displayed on the two-gas EGA. The automobile industry responded with the four gas analyzer to include oxygen (02) and carbon dioxide (CO2), These additional dials on the EGA machine could be thought of as "night vision goggles" for the troubleshooting car mechanic seeking clues, because these gases are not consumed by the "cat" and air pump.

I don't believe a simple two-gas EGA is available new anymore. It's not cost effective for the EGA manufacturers to provide one for the small bike industry, so most bike shops end up buying a four gas that has two additional dials they won't be using. For the present.

The two gases we're interested in are very distinct from each other, yet have a calculable relationship. No four-stroke engine is perfectly efficient and will always kick out some unburned fuel called hydrocarbons. HC can be seen, smelled and tasted in the form of smog. Ever notice how a rough-running engine makes your eyes water and your nose wrinkle when you stand behind it? HC is expressed in parts per million (ppm); a normal reading for most healthy bike engines is 200 to 450 ppm.

For simplification let's call carbon monoxide-CO-a measurement of actual burned fuel. That's not entirely accurate, but most folks follow along more easily when it's explained this way. CO is odorless, colorless and deadly-just ask Dr. Jack Kervorkian. It's measured as a percentage on the EGA dial face, and for a baseline understanding we all know that years ago the accepted optimum ratio of air to gasoline was 13: 1. That works out to 3.8 percent Co. These days that's considered a little "fat" -1 to 2.5 percent is more like it, depending upon the bike. Commercial EGAs peg their dials at 2,000 ppm hydrocarbons and 10 percent carbon monoxide. If your bike's tail pipe emissions are anywhere near these limits you have one sick scooter! All readings are taken at idle or just slightly into the midrange.

The owner of a week-old Honda Gold Wing GLl500/6 came in complaining of a surging idle, no power on top and dismal fuel mileage. The Wing has a flat-six engine with two carbs one feeding the right bank, the other the left-and a maze of plumbing, vacuum lines, air pumps and a ton of electrical gizmos that sense everything but your birthday packed in around it. A formidable bike to troubleshoot. I immediately turned on the EGA, stuck the probe up the left muffler and got normal readings-50 ppm hydrocarbons and 1 percent Co. I then shoved the probe up the right muffler.