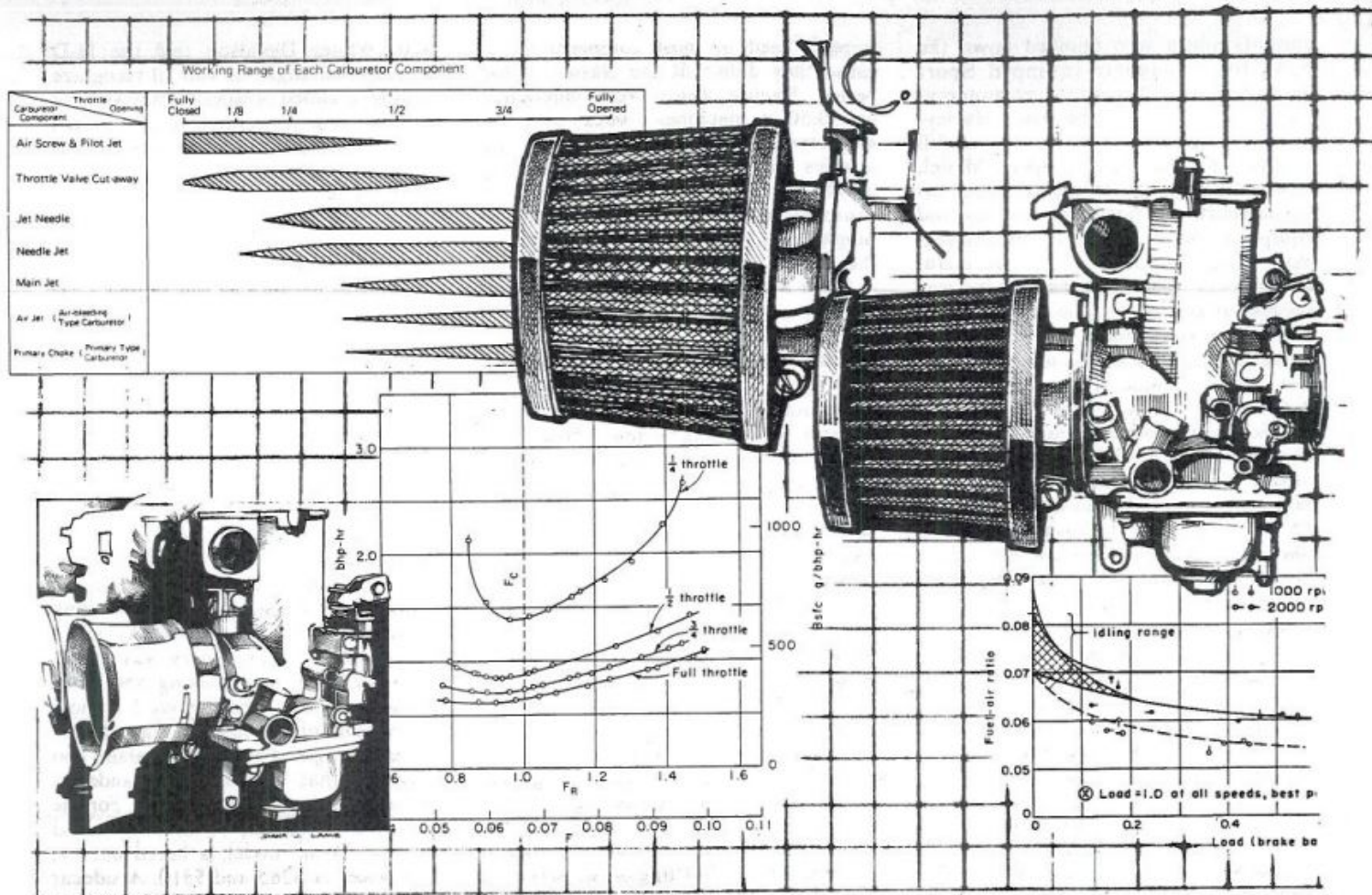




In Search of the Free Lunch

Help! My bike has individual air filters in place of the stock airbox, and also has a 4-into-1 exhaust. It doesn't run worth a damn. It was faster when stock. What jets should I use to make it run right?

That letter is mailed to the Service column of this magazine every day, by dozens of riders of every make and size motorcycle. In an attempt to find more power and better mileage motorcyclists change exhausts, airboxes and air filters. The results are not always satisfactory. Unfortunately, the answer to the amateur mechanic's dilemma is not always satisfactory, either. We don't know exactly what jets will make your bike work better. Not even Tex Peel or Byron Hines or Pops Yoshimura or Erv Kanemoto know exactly what jets your bike needs.

What they do know is how to find out.

That's the secret to performance tuning: knowing how to make parts work together. It's done by experiment, and, when you have the equipment, it can be made easier with instrumentation. That's how the factories determine the combinations of engine parts that work so well together.

Just how difficult is it to make a motorcycle work with changes to the intake and exhaust system? To find out we started with a Suzuki GS1100E, a good example of a current strong, fast motorcycle that is often modified, and a Yamaha Seca 650, a good mid-size motorcycle that doesn't have much equipment available to modify it.

Procedure was straightforward. We collected the motorcycles (the Yamaha was a long-term test bike, and we actually used two Suzukis, one from U.S. Suzuki and the other borrowed from a private owner) and the aftermarket additions, and then tried various combinations on the bikes. In order to obtain the most information, we made arrangements to test a GS1100 on the Kerker dyno. The Kerker facility has essentially the same equipment the motorcycle manufacturers use for engine testing, and is used to produce most of the power curves seen in the motorcycle press. The dyno itself is a Schenck eddy current model, and will easily hold an engine at a constant rpm while the load is varied and different throttle positions are tried. In addition to the dyno, Kerker has other equipment that is invaluable in determining air-fuel

ratios on running engines. Until recently, Kerker technicians have relied almost completely on a Sun EPA 75 exhaust gas analyzer for jetting information. To supplement the measurements made with the exhaust gas analyzer, Kerker added two Onosokki digital fuel consumption meters to the dyno room several months ago.

The two instrument types measure different quantities, but both can be used to extract air-fuel ratio information. The exhaust gas analyzer measures hydrocarbon (HC) and carbon monoxide (CO) emissions. From experience, the dyno operators know that about 6 percent CO output corresponds to best peak power mixture strength. Four percent CO would be too lean, on the verge of a power drop and perhaps misfiring, while eight percent CO would be too rich for best power by a jet size or two.

Instead of exhaust measurements, the fuel consumption meters provide precise measurements of fuel flow during a dyno run. Along with the horsepower measurements made by the dyno, the fuel flow data can be used to calculate specific fuel consumption (SFC). Specific fuel consumption is defined as the