A MATTER OF INTERPRETATION

The readout on your smog test can be a valuable source of information, if you know what you're looking at. The graphs and charts presented in this article show basic relationships between the state of tune and air/fuel ratios (A/F).

In view of this information, we can glean the engine's condition, and what changes we can make to improve its performance and limit pollution.

For example, the percent of CO produced by your engine is a product of A/F. By taking that percentage and looking at this chart, we can see that Paul's engine had an A/F of 13.58 at idle and 13.81 at cruise, with 14 degrees of advance. Notice that the CO percentage didn't fall by much when the timing was retarded to 6 degrees BTDC.

What this tells us is that the carb is leaning out slightly at cruise. By referencing Graph A we can see that the A/F slides into the area that produces more NOx. And with the timing advancing with an increase in rpm, this situation would be exaggerated. Since calibration is always a compromise, it might be wise to fatten up the mixture, which may increase HC and CO output but inhibit the formation of NOx.

Notice how the HC parts per million (PPM) was cut in half by retarding the timing. Graph C shows the relationship between timing and A/F. The intensity of the ignition spark also has a bearing on HC production. Ignition at idle is more difficult than at higher rpm. Therefore a high-energy spark tends to stabilize the ignition process, promoting smoother idling and consistent burn, which reduces HC output.

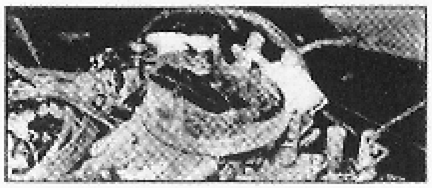
To reduce HC at idle there are several avenues you can take. First, get a high-energy ignition that's street legal, increase the plug gap and, finally, experiment with the idle mixture, since a lean mix is harder to ignite.

%CO	A/F	%CO	A/F
0.1	14.71	5.1	12.58
0.2	14.53	5.2	12.53
0.3	14.41	5.3	12.50
0.4	14.33	5.4	12.45
0.5	14.27	5.5	12.42
0.6	14.22	5.6	12.39
0.7	14.20	5.7	12.36
0.8	14.18	5.8	12.32
0.9	14.14	5.9	12.28
1.0	14.10	6.0	12.24
1.1	14.06	6.1	12.21
1.2	14.03	6.2	12.17
1.3	14.00	6.3	12.12
1.4	13.97	6.4	12.09
1.5	13.93	6.5	12.06
1.6	13.89	6.6	12.02
1.7	13.85	6.7	11.99
1.8	13.81	6.8	11.95
1.9	13.79	6.9	11.92
2.0	13.76	7.0	11.88
2.1	13.72	7.1	11.85
2.2	13.66	7.2	11.81
2.3	13.62	7.3	11.78
2.4	13.58	7.4	11.75
2.5	13.55	7.5	11.71
2.6	13.53	7.6	11.68
2.7	13.48	7.7	11.64
2.8	13.44	7.8	11.60
2.9	13.40	7.9	11.57
3.0	13.37	8.0	11.53
3.1	13.30	8.1	11.49
3.2	13.28	8.2	11.45
3.3	13.25	8.3	11.42
3.4	13.22	8.4	11.38
3.5	13.18	8.5	11.35
3.6	13.14	8.6	11.31
3.7	13.11	8.7	11.27
3.8	13.07	8.8	11.24
3.9	13.02	8.9	11.20
4.0	12.99	9.0	11.15
4.1	12.95	9.1	11.11
4.2	12.92	9.2	11.07
4.3	12.89	9.3	11.04
4.4	12.85	9.4	11.00
4.5	12.82	9.5	10.96
4.6	12.79	9.6	10.93
4.7	12.74	9.7	10.89
4.8	12.69	9.8	10.85
4.9	12.66	9.9	10.81
5.0	12.63	10.0	10.78

goal—a clean, lean machine. Because when gasoline is burned completely, all that's left is carbon dioxide and water vapor, which are harmless."

To illustrate the connection between pollutant emissions and the state of engine tune and build, we snagged Paul Fercho from behind the counter of the Super Shop outlet in Ontario, California. He has a '67 GTA Mustang fastback with a 390 that's been slightly modified. It has a 750 Holley carburetor, a Holley Street Dominator single-plane intake manifold, a dual-pattern Crane cam (278-degree/.548-inch lift intake; 290-degree/.580-inch lift exhaust), Hooker headers, a Mallory HyFire ignition with vacuum advance, an open-element air cleaner, and open-chamber 2V heads off a '78 truck motor for a compression ratio of approximately 9.5:1. (The truck heads were on the car when Paul bought it; he just traced the numbers.)

When we first asked Chris and his crew to see if they could get Paul's Mustang to pass a sniffer



Fuel management is critical for a clean-burning and hard-running motor. Surprisingly, the emissions were unusually low for this type of engine. The jetting of this Holley 750 was right out of the box. Paul just bolted it on the Holley Street Dominator single-plane manifold.

test, they sort of squirmed at the thought. As it turned out, it wasn't all that hard. We should point out at the beginning that since Paul is not the original owner, a retrofit anti-NOx device is needed to pass the California visual inspection. Otherwise, what Paul is running is all California legal for his year and model of car, as far as we were able to determine.

Kevin McClelland, who runs Kaufmann's Advanced Engineering West facility, was our consultant for this test. Kevin has four years of experience working with emissions at Edelbrock on its dyno, and he's a hard-core racer who owns eight cars. He's also in charge of the new L. A. Speed mail-order performance parts department at Kaufmann Products.

Kevin warmed up our test Mustang and put the sensor in the tailpipe. He pointed out that in California the test centers can decline to test your car if it has a turn-down exhaust. Some technicians don't like to get their knees dirty. Taking a reading with the 14 degrees of advance that Paul had it set at for optimum performance, we measured the following levels:

Idle: 880 rpm	Cruise: 2512 rpm
HC 120 ppm CO 2.41% CO_2 10.99% O_2 3.2%	HC 59 ppm CO 1.86% CO_2 12.43% O_2 1.8%

The reading turned out to be much lower than expected with the amount of speed equipment Paul had installed on his pony. "These levels are not that bad," Kevin said. "The engine is running fairly clean. Evidently, the combination of parts is working well together. But given the timing advance, you know this machine is generating lots of NOx when running hard. Let's see what happens when we retard the timing