How's your VALVE LASH?

In the past, getting the exact valve lash settings required for peak engine performance has been more or less a hit and miss proposition. Only the really top tuners recognized the advantages of minutely correct valve clearances, but now everyone is getting into the act with a tool that puts horses into horsepower

Photos By P & G Company, Eric Rickman

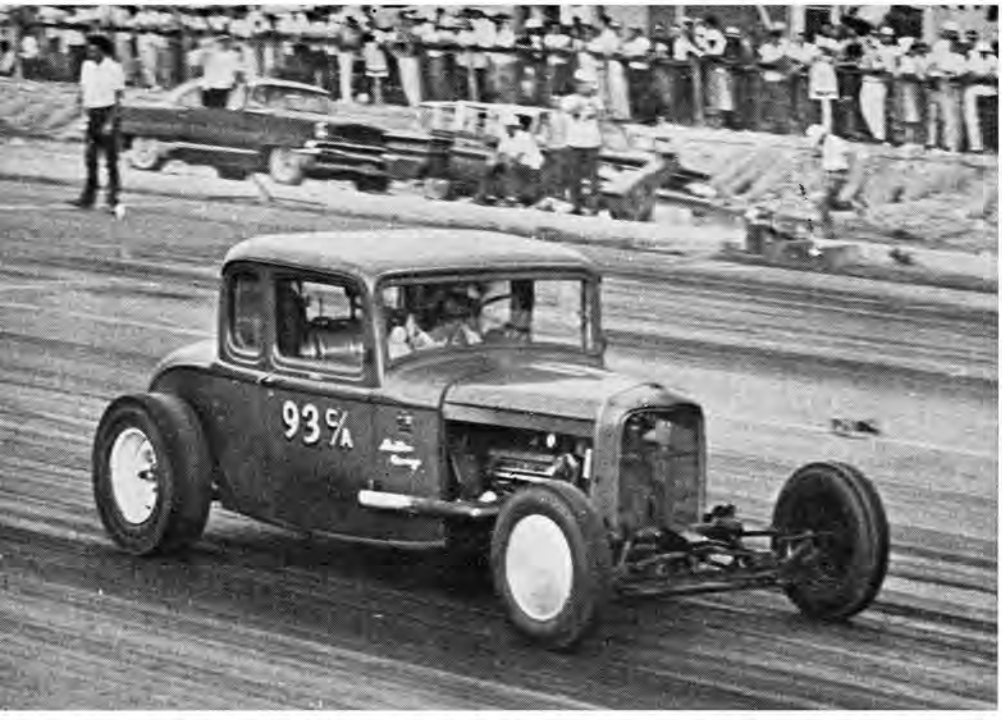
Ignorance may be bliss, but not on a drag strip or a race track, especially if you've just been nosed out because of this ignorance. If you are measuring your valve clearances with a feeler gauge, you may be one of the blissful. You just can't get the kind of valve lash accuracy you need by this old "feel" method. If you end up with clearances within .002" of the setting you want, you are virtually accomplishing the impossible.

Recently a survey was conducted during which the valve clearances were checked on 200 engines, the majority of which were regularly running in drag competition. Not one single engine (of those "lashed" in with a feeler gauge) had all valves set within ±.002" of the desired clearance! In most cases, the valves ran from .002" too tight to .004" too loose. Of the engines checked, only 38 had all valves within .003" of the desired settings. On 36 of the engines checked, some of the valves were off as much as .012", but of course this does not mean that all valves were set this tight or loose. On the best jobs most of the valves were within .002" of the desired settings; then too, some were way off. It goes without saying that the cars with the most accurate lash generally had the best times and speeds. This accuracy is vital to a racing engine. You simply can't have sloppy lash settings without losing power and performance and ending up with a higher e.t. or lower speed. Any change in valve clearance causes a change in valve timing and duration. More about this later.

There is only one way to set valve

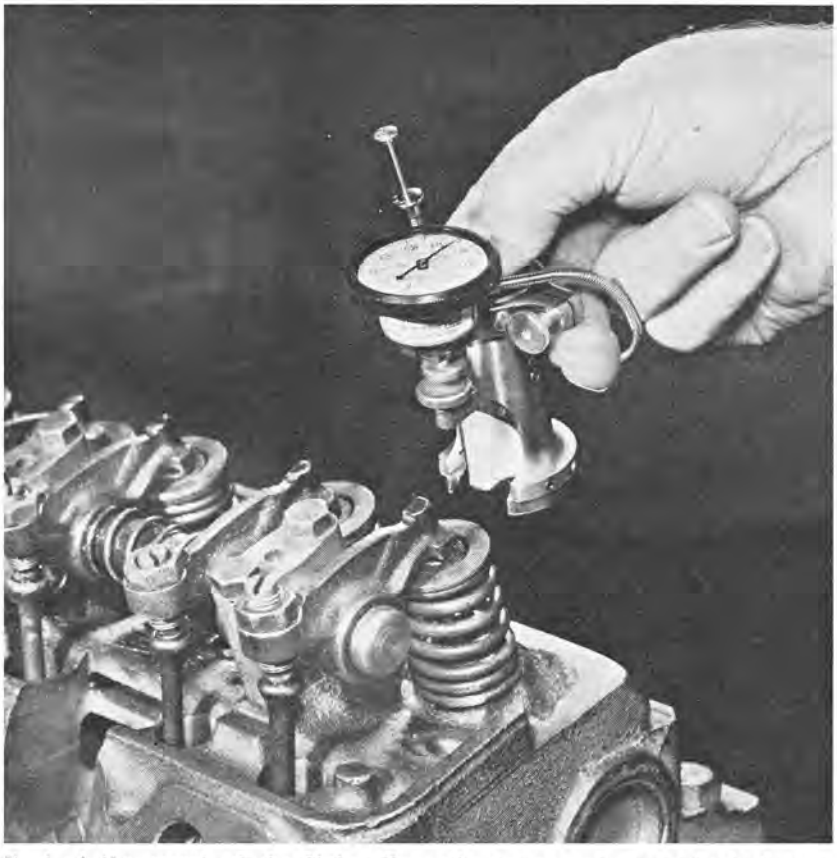
(Continued on following page)

Extremely accurate valve lash settings are just as important as all other clearances in a racing engine. The P & G Valve Gapper is shown in place on a Ford V8 engine. With the valve at full closed position the gapper is installed, hook used to lift rocker for the readings.



Texan Billie Rasmussen won his fourth consective class trophy at the National Championship Drags and attributes a great deal of his success to the proper valve train clearances. Billie is an old hand at tuning a racing engine but found that more exacting valve clearances gave added power.

HOW'S YOUR VALVE LASH? continued



Part of the secret of the Valve Gapper's accuracy is the dial indicator. The outer case fits against valve spring retainer, spring loaded inner barrels fits under end of rocker. When maximum clearance is reached, a push on the attached cable brake locks indicator needle for an easy reference.

clearances accurately, and that's with a dial indicator. To our knowledge, there is only one instrument made for valve clearance adjustment that utilizes a dial indicator as the measuring device. This is commonly known as the P & G Valve-Gapper. This instrument is easy to use, and fast. You actually see the lash on the indicator dial before, during, and after adjustment. It can be used with the engine stopped or running, depending upon the type of adjustment in the valve train and the speed at which the engine can be idled.

Worn or grooved rocker arms are a cinch to increase errors when using a feeler gauge, the feeler gauge bridges the groove, making accurate measurement impossible. Even assuming you have a perfect feel, you will have an error equal to the depth of the depression in the rocker arm.

With the Valve-Gapper, the dial indicator is set at zero while the valve is open, or while the rocker arm is held against the valve stem by upward pressure on the push rod end. As the valve closes and the tappet reaches the flank of the cam, or when the upward pressure is released, the rocker arm is lifted (by spring pressure in the Gapper) as far away from the valve stem as the slack, or lash, in the valve train will permit. This distance is registered on the dial indicator and is the true lash, whether the rocker arm is worn or not. (And it's surprising how quickly a competition engine will develop 1 or 2 thousandths wear.) As adjustment is made, the dial indicator registers the clearance as it changes.

A special indicator brake, applied manually by a camera-type cable release, stops and holds the needle at the clearance point when the adjustment is made with the engine idling.

In the survey mentioned above, the only engines on which all valves were set ±.001" of the desired clearance were those which had been adjusted with the aid of the Valve-Gapper. Of these 16 engines, 12 were right on the money. The other 4 had some valves which were off .001" either too tight or too loose. But, these engines had made 2 or 3 trial runs after adjustment. With the tremendous load placed on an engine at a drag race, clearances are bound to change and should be reset as often as necessary to maintain accuracy.

Everyone knows that valve timing and duration make a tremendous difference in the performance of an engine. Use of special grind cams will probably do more to soup-up an engine than any other single modification. What does a special cam do? It gives you faster valve action, but it also gives you high-performance valve timing, duration, and overlap. Now, let's

see what *valve clearance* does to valve timing.

In many camshafts, a change of .001" in clearance will change the valve timing 3° to 3½° of crankshaft rotation. The valve opens only after all of the lash is removed. If the valve clearance is set .001" loose the crankshaft must turn approximately 3° to 3½° and the camshaft 1½° or 1¾° to take out extra slack. Now, let us suppose we have a camshaft on which .001" changes valve timing 3°. Figure 1 shows the timing and duration we would have with a clearance of .018". This is 35, 35, and 75, 75. With this clearance, the intake valve would open at 35° before TDC, and close at 75° after BDC, giving a valve duration of 290°. The exhaust valve would open 75° before BDC, and close 35° after TDC, giving a duration of 290°, and a 70° valve overlap.

But, suppose we use a feeler gauge and the clearance is .003" too wide on both the intake and exhaust. We now have a timing of 26, 26, and 66, 66. The cam will open the intake valve at 26° before TDC and close at 66° after BDC, giving a valve duration of 272°! The exhaust valve opens at 66° before BDC and closes 26° after TDC, with a duration of 272°. And we have a 52° valve overlap! (Figure 2.) Now, if all valve clearance adjustment errors were one way or the other, tight or loose, it wouldn't be so bad. By trial and error we'd find the best setting. But suppose, as so often happens, the intake valve is set too loose, and the exhaust valve too tight. Now what happens to timing and overlap? Multiply this error by up to 8 cylinders, and it is easy to see why accuracy in valve clearance is so critical.

Just what does valve clearance and valve timing accuracy mean as far as horsepower and performance on the drag strip are concerned? Let's give two examples from the survey. The first involves a 1960 Chevrolet Corvette with the fuel injection engine; the second one involves Billie Rasmussen's "The Going Goat" of Fort Worth, Texas.

The Corvette was a beautifully customized job owned by Cal Drake of Portland, Oregon. The clearances had been adjusted with a feeler gauge by a competent mechanic. The car was tied down on a Clayton dynamometer at Blackie Blackburn's shop in Portland, and a full power check made. The engine was cut back to a slow idle, and the clearances checked with the Valve-Gapper and reset to .012" and .018". The feeler gauge settings ran as follows: Intake valves — .017, .011, .013, .012, .019, .018, .025 and .024; exhaust valves—.022, .018, .019, .021, .029, .024, .023 and .026. (We'll admit these were extremely sloppy settings, but Chevy owners know how tricky these rocker arms are, especially on the left bank of the F.I.)

After the clearances were set accurately, another full power run was made with a gain of 62 horsepower! Cal Drake started to run away from all the other Corvettes at the local drags until they, too, got wise to the Valve-Gapper.

Because Billie Rasmussen is so well known (having won the last NHRA National meet at Detroit for C/A Coupe & Sedan Class for the fourth straight year), we thought it might be well to pass along his report. The major part of a recent letter from him follows, and should convince even the most skeptical that valve clearance accuracy can be the difference between winning or losing.

"On Saturday, September 3, during the time trials, I made three runs. The e.t. and mph were as follows:

	1st Run	*2nd Run*	*3rd Run*
e.t.	14.00	13.61	13.40
mph	104.16	103.68	104.28

I borrowed a dial indicator Valve-Gapper on Saturday evening. Using it, I checked my valve clearance. I had spent considerable time on Friday night before the time trials adjusting the lash with a feeler gauge to .018". The Valve-Gapper showed that I actually had the following clearances:

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Intake	21	21	22	25	22	22	22	15
Exhaust	23	23½	22	23	26	19	20	21

I then readjusted the clearance with the Valve-Gapper, setting them all at exactly .018" in less than half the time it had taken me with the feeler gauge.

On Sunday morning, September 4, without any other time trials, I went into the eliminations. On the first run I had such a great increase in horsepower that I could not drive the car properly; I had to get used to it. I ran the first elimination with an elapsed time of 13.56 and 101.35 mph. On my second run, I ran with an elapsed time of 12.97 and 106.13 mph. Then on my last race, after finding out how to use the added horsepower, I had an elapsed time of 12.96 and 108.30 mph."

Naturally, valve timing can be juggled, by changing valve clearance, to meet certain conditions as they come up. It is not practical to change cams for different temperatures, humidities, tracks, and surfaces. You can get more torque in the lower range, and less in the top range (and vice versa) by slight changes in valve clearance. The benefits of juggling valve timing by altering tappet clearances is certainly no deep secret. Much has been written on this subject, and full information is available from camshaft manufacturers. Ed Iskenderian's book "Valve Timing for Maximum Output" goes into the subject thoroughly. However, to be effective, the timing alteration (lash adjustment) must be accurate. How're your valve settings?

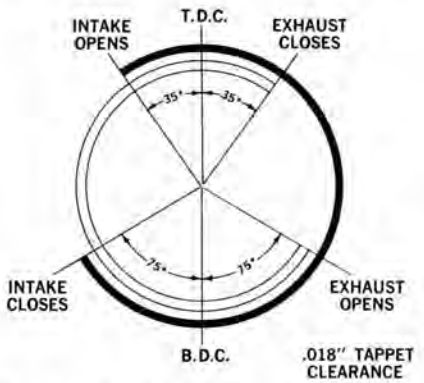


Fig. 1 — A slight change in valve lash will directly affect valve timing, oftimes greatly. In this illustration, the clearance is set exactly at 18 degrees.

Different component parts are necessary when using the instrument on different engines. Gapper may be used on an engine whether it is stopped or idling.

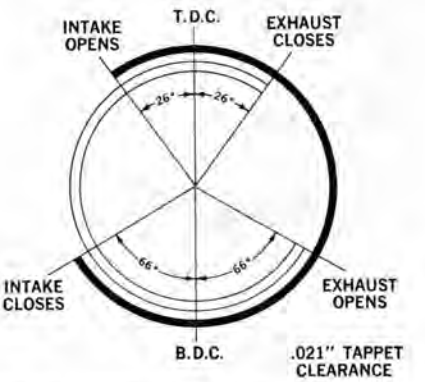


Fig. 2 — Note that if the lash settings are just .003-inch too wide on intake and exhaust, the valve timing is changed drastically, not always desirable.