**ANALYZING THE ALTERNATOR TACH SIGNAL**

Occasionally I get a customer asking how to connect his aftermarket tachometer to his alternator. He then hands me the accompanying chart which explains how to calibrate his tach. Some tachs require calibration with a potentiometer and a reference tach, others have DIP switches which are set according to the number of rotor pole pairs and pulley ratios. Still others require you to do the calculations yourself and then enter the number of pulses per revolution.

Electronic tachs take signals from various sources, such as main output ripple of an alternator, signal from a stator/rectifier terminal brought to a terminal on the outside of an alternator, ignition coil negative, electronic ignition feed, etc.

To explain how the number of rotor poles, rpm, alternator phase output, and pulses per revolution are related, I used a Ford 2G alternator as shown in Figure 1 (Lester 7735), which has a rotor with six pole pairs (Figure 2).

There are 12 poles or six north-south pole pairs on the 2G rotor (Figure 2).

Taking a scope signal from the S terminal of the BBS output plug, I obtained this waveform (Figure 3) from a stator/rectifier terminal brought to a terminal on the outside of an alternator, ignition coil negative, electronic ignition feed, etc.

For example, suppose the crankshaft pulley is eight inches in diameter. The alternator pulley is 2.5 inches in diameter. The alternator's rotor has six north-south pole pairs. This means that at a given phase, and for every rotation of the rotor, we would get six waves. We don't need to figure out rpm here, nor the pulse duration, since we only want to know what happens in one engine turn.

Let's do the math: 8 / 2.5 X 6 = 19.2 pulses per engine revolution.

You'll notice the two dashed vertical lines. These are the cursors I used to measure the duration of one ripple which is 0.43 milliseconds (Figure 4), change that to Hz using the formula: 1/0.00043 = 2325.6 Hz.

Then we divide by six because there are six of these ripples in one wave of a phase output: 2325.6 / 6 = 388 Hz, same as before.

This shows that you can use the same formula as in the first calculation.

If you are installing a tach terminal on an alternator, it has to be connected to one of the phases and not the wye neutral (see Figure 5). (As an aside, this is true of trio diodes as well). Some alternators have the wye neutral rectified to boost output by about ten percent. You can usually tell because the rectifier will have at least eight power diodes in it. Incidentally, this changes the shape of the main output ripple somewhat under load, but not its frequency. The “phase” output frequency is also unaffected by the wye neutral diodes.

One word of caution here: There is no industry standard to describe the phase terminal that connects to a stator/rectifier junction.

I've seen R, S, P, Sta, Tach, AC tap, and there may be more, but you do need to know what that designation means on a given alternator. Lester has a plug code reference online or in their DVD that you can refer to.

For example, S refers to the sense function, not the phase output.

To conclude then, since most retrofit tachs I've seen connect to a phase/rectifier terminal brought out to the case of the alternator, make sure you don’t use the wye neutral instead — it may be rectified. To calibrate the tach for engine rpm, you may need to know the number of rotor pole pairs.

You can see the difference in shape and frequency.

Also, the S terminal in most alternators refers to the sense function, not the phase output.