

Crankshaft Position Sensor Fundamentals

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More times than I care to think about we will get a phone call that says my engine won't start or we have a strange miss or erratic run ability issues. Since the beginning of writing bulletins over the years I have written about many different crankshafts for various different engines and manufacturers. But I don't believe that I have ever written about watching out for damaged "as cast" Reluctor rings, and how they can affect the operation of the Crankshaft Position Sensor.

Before we talk about this issue you need to understand why it is that this circuit of the powertrain control module (PCM) is so critical. It triggers the crankshaft position sensor used on engines with distributorless ignition systems. The crankshaft position sensor (CPS) serves the same purpose as the ignition pickup and trigger wheel in an electronic distributor. It generates a signal that the PCM needs to determine the position of the crankshaft and the number one cylinder.

This information is necessary to control ignition timing and the operation of the fuel injectors. The signal from the crank sensor also tells the PCM how fast the engine is running (engine rpm) so ignition timing can be advanced or retarded as needed. On some engines, a separate camshaft position sensor is also used to help the PCM determine the correct firing order. The engine will not run without this sensor's input. In 1996, with government mandate for all vehicles sold in the USA to be OBD-II, General Motors added a feature in the computers called Cylinder Misfire. The computer would judge from the amount of time it took the crank position sensor to trigger from one fire event to the next. When a cylinder misfire's the crank speeds up in that one position, where it is slower or normal speed the rest of the cycle. If the engine repetitively does this, a code is tripped causing your check engine light to illuminate.

There are two basic types of crankshaft position sensors: Magnetic Field (Variable Reluctance) and Hall Effect (**Figure 1**). The magnetic type uses a magnet to sense notches in the crankshaft or harmonic balancer. As the notch passes underneath, it causes a change in the magnetic field that produces an alternating current signal. The frequency of the signal gives the PCM the information it needs to control timing. The Hall Effect crank sensor uses notches or shutter blades on the crank, cam gear or balancer to disrupt a magnetic field in the Hall Effect sensor window. This causes the sensor to switch on and off, producing a digital signal that the PCM reads to determine crank position and speed.

If a crank position sensor fails, the engine will die. The engine may still crank but it will not start. Most problems can be traced to faults in the sensor wiring harness. A disruption of the sensor supply voltage (Hall Effect types), ground or return circuits can cause a loss of the all-important timing signal, just as a crankshaft with a damaged or missing cog/tooth in the trigger wheel of the as cast Reluctor ring (**Figure 2**) will cause problems. This can also give you a bad or no signal situation that can result in a no start or misfire.

There are many crankshafts with as-cast Reluctor rings that have one of the notches machined to identify number 1 cylinder at TDC. Because they are part of the iron casting, these machined areas are very fragile. Remember, cast iron is brittle and has very little elasticity. Extreme caution should be exercised when handling engines with these Reluctor rings on them once they have been removed from the PPT environmentally friendly shipping pod. A crank trigger can be damaged just by laying an engine down on a hard surface or even during the installation process. It is always advisable to mount a long block engine to be “dressed” prior to installation on an engine stand to avoid any inadvertent damage.

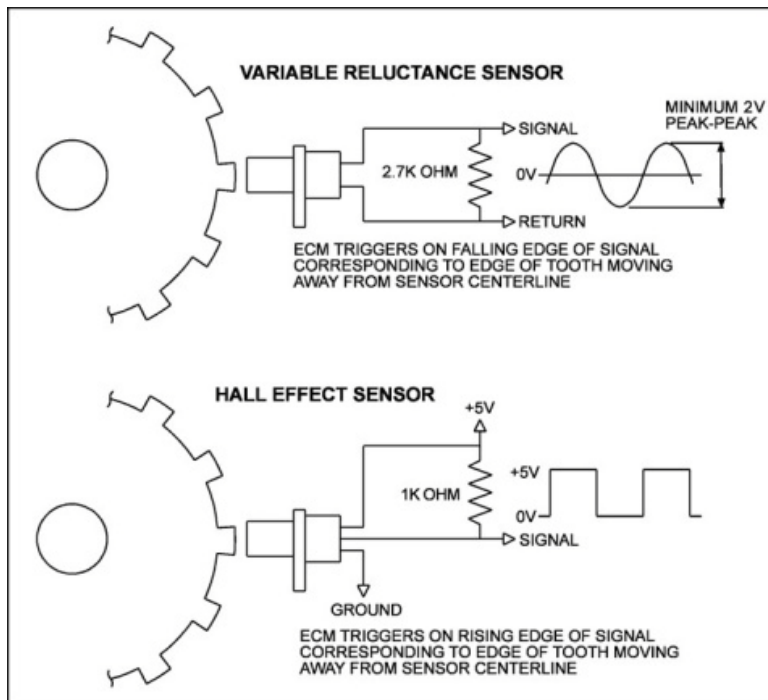


Fig 1 The differences in the signal and electrical operation between the magnetic field sensor and Hall Effect type CPS (Crank Position Sensors)

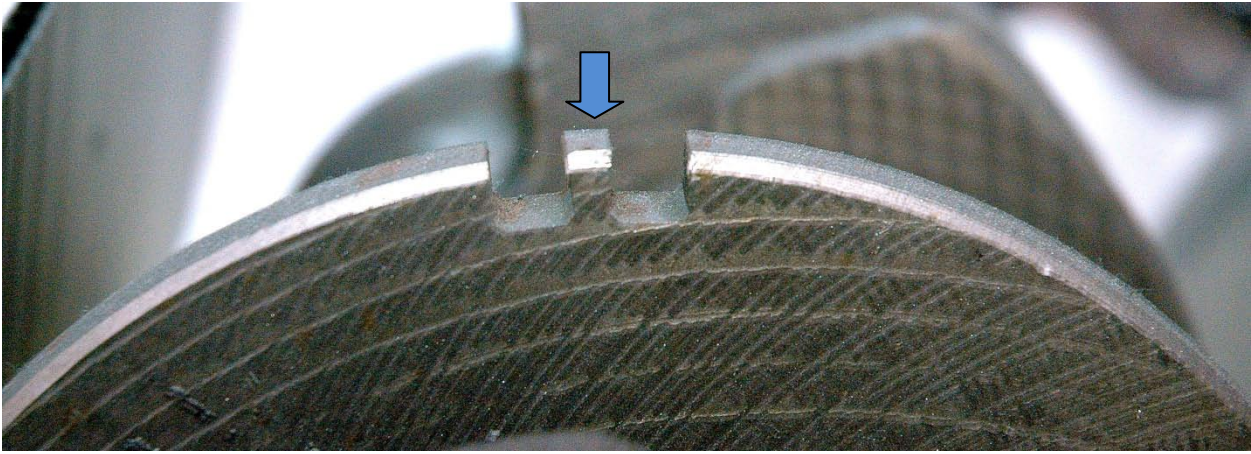


Fig 2 Note how narrow the “as cast” piece of the crankshaft Reluctor ring can be and how easy that it could be damaged especially being cast which is very brittle