TECHELP
The Automotive & Smog Training Center

Tech Tip

2006 Ford Ranger

3.0 Liter V6

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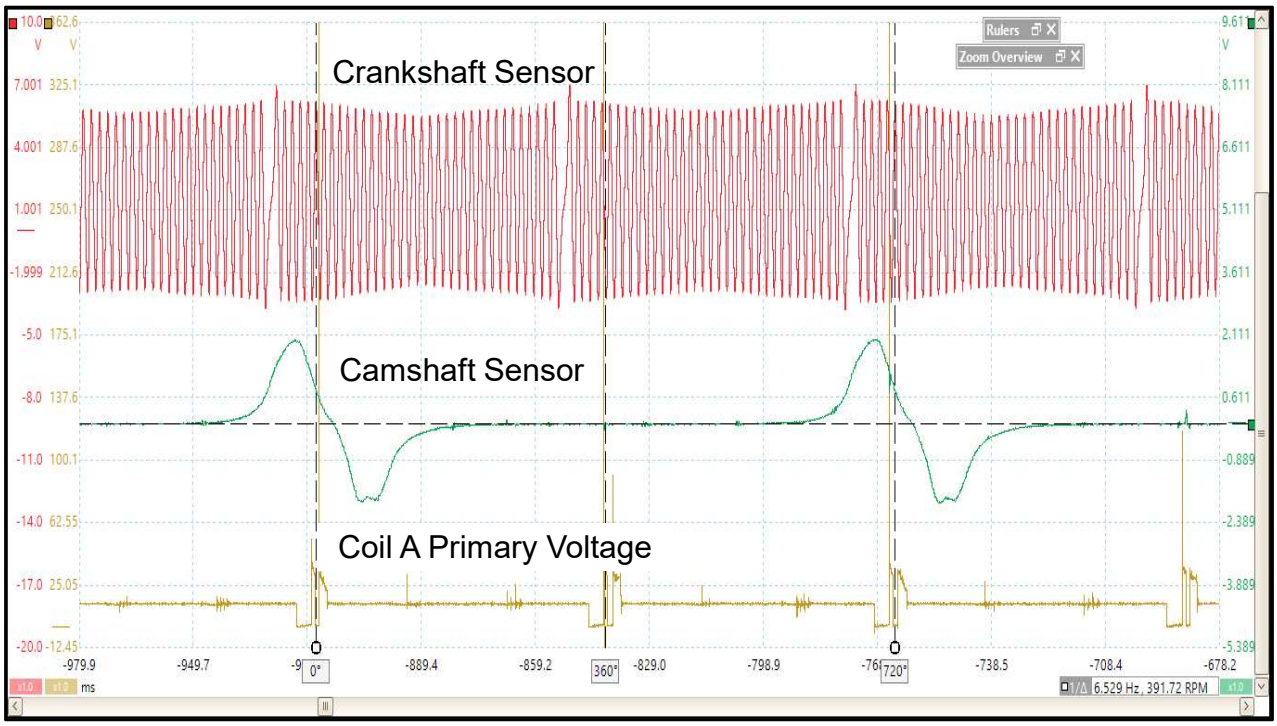
This Ford Ranger's engine was replaced due to a cylinder with low compression. After the replacement engine was installed the vehicle exhibited a "Tip In Hesitation". The MIL (Check Engine Light) was not illuminated and there were no codes stored in the ECM.

I'd like to thank Larry & Edla Russell and their team in Rocklin California for the opportunity to assist with this diagnosis.

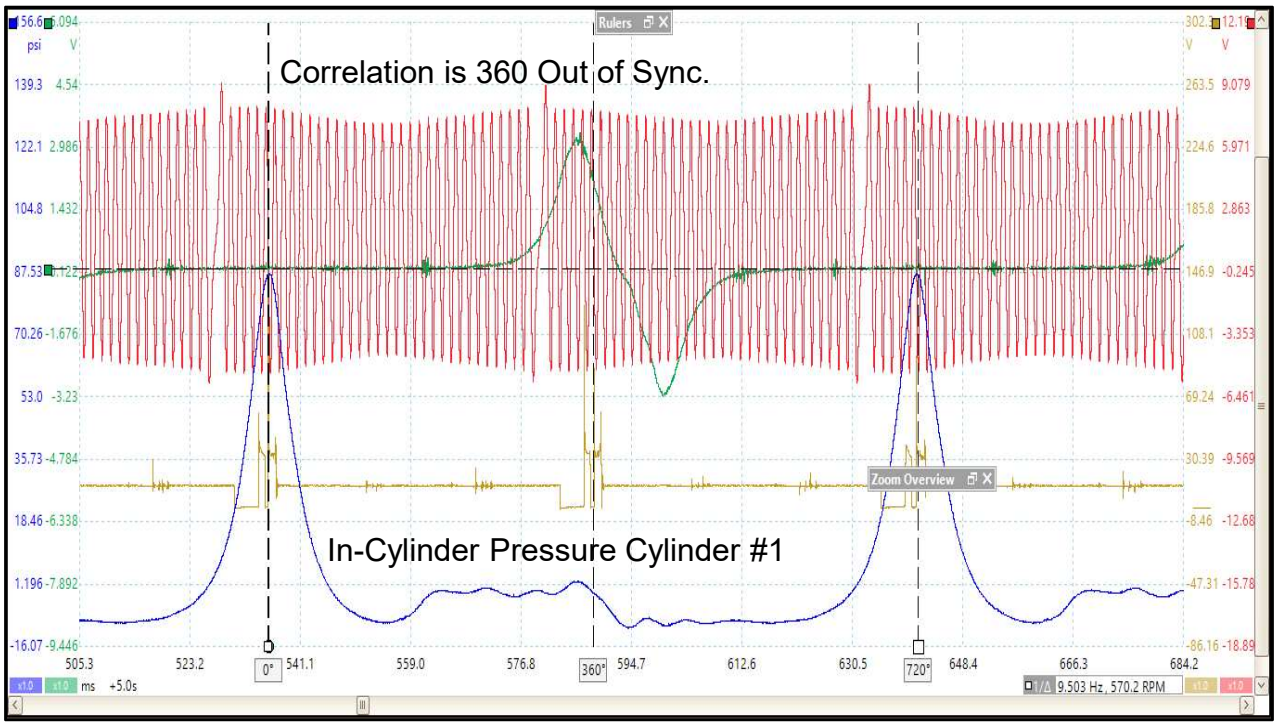


This particular engine uses a 36 – 1 Tooth Crankshaft Reluctor (35 pulses, each representing 10 degrees of crankshaft rotation). The two wire permanent magnet type sensor creates an A/C Sine Wave and missing tooth on Ford's V6 engines represents 60 degrees before Top Dead Center Compression Cylinder #1 and Cylinder #5 (meaning in two revolutions of the crankshaft the anomaly will show itself twice).

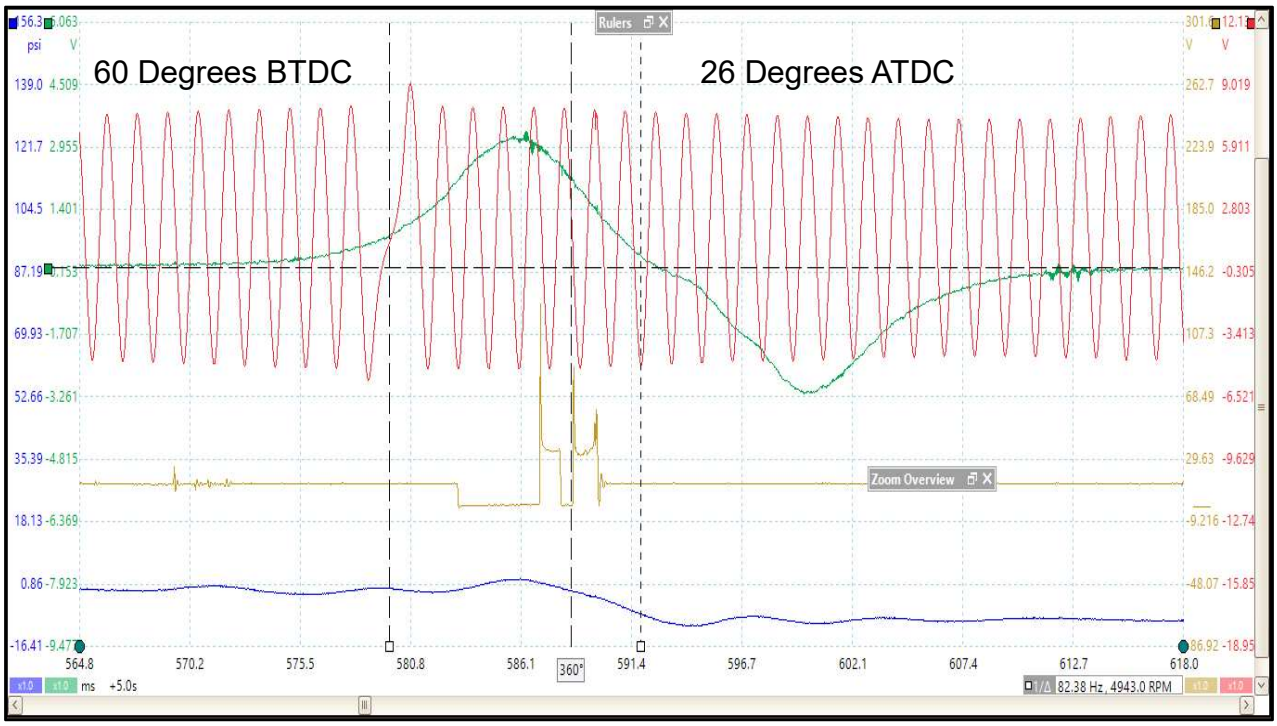
The Camshaft Sensor's pulse is supposed to happened 26 degrees After Top Dead Center Cylinder #1. So the question: is the Camshaft Sensor / Crankshaft Sensor timed correctly.

The engine is equipped with Waste Spark Ignition so the ignition coil fires two spark plugs at the same time and the ignition coil fires twice during two revolutions of the crankshaft.

Using the Ignition Coil's Primary Voltage to "Sync" the Camshaft Sensor signal doesn't work.

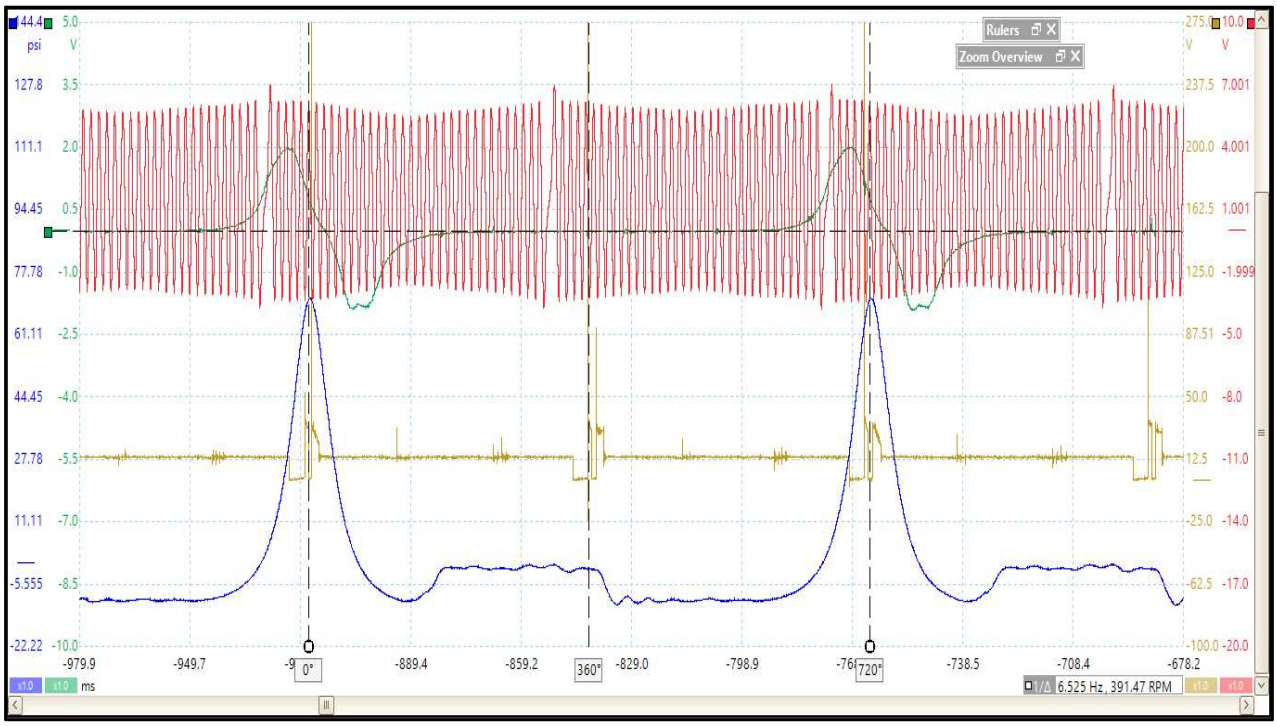


An In-Cylinder Pressure Transducer was added to Cylinder #1 (blue trace). The above waveform shows the Camshaft Sensor signal is 360 degrees “Out of Time”. When the technician installed the synchronizer, Cylinder #1 was at Top Dead Center Exhaust (meaning Cylinder #5 was at Top Dead Center Compression).

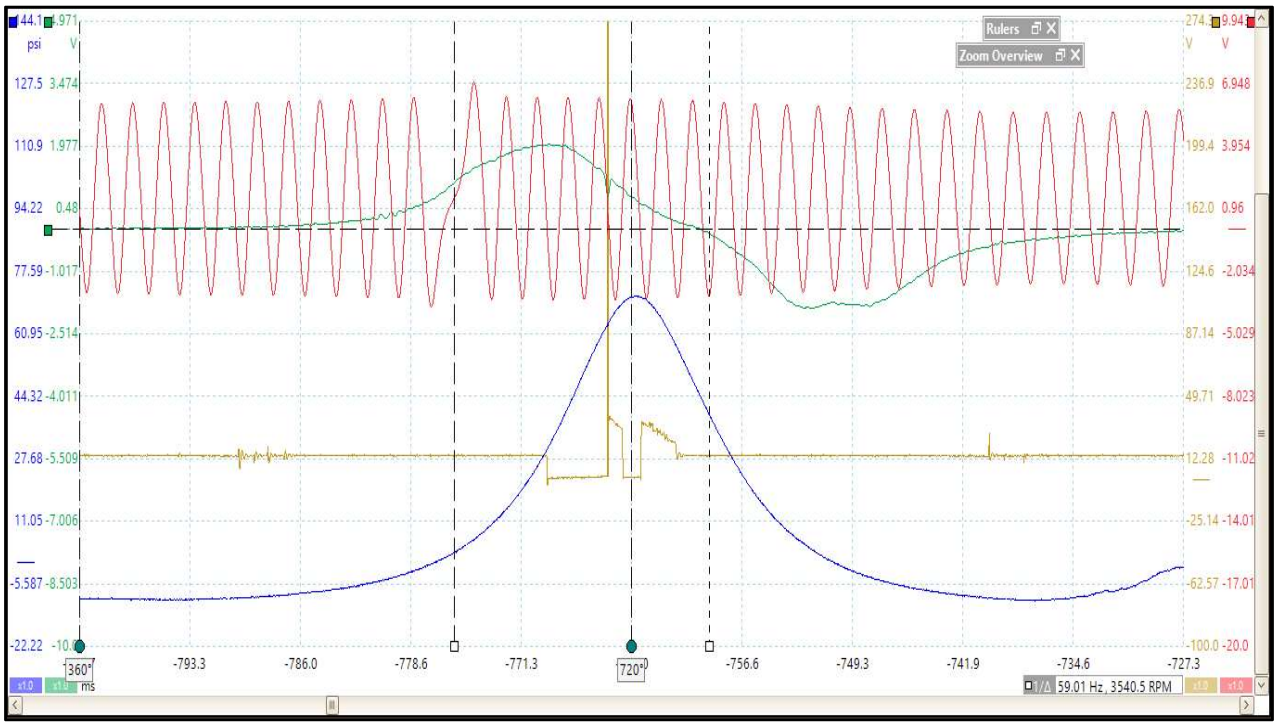


Zooming into the waveform the Crankshaft / Camshaft Correlation can be measured. Because with Ford we know the missing tooth represents 60 Degrees Before Top Dead Center we can count over 8 1/2 Teeth to check the correlation.

Although the sensor was installed incorrectly (because it's installed 360 Degrees out of Phase) the alignment is correct (8 1/2 teeth over from the anomaly) which is why there was no MIL Illuminated.



Now the Synchronizer has been moved to its correct position 26 Degrees After Top Dead Center Compression Cylinder #1.



To confirm its correct position a zoomed image was taken to confirm its correlation. The Camshaft Sensor transitions from high (+ voltage) to low (- voltage) at 26 Degrees After Top Dead Center Compression.

A test drive of the pickup showed the “Tip In Hesitation” was gone and the vehicle was returned to the customer.

Thank you for taking the time to read this article.

T = Together
E = Everyone
A = Achieves
M = More

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