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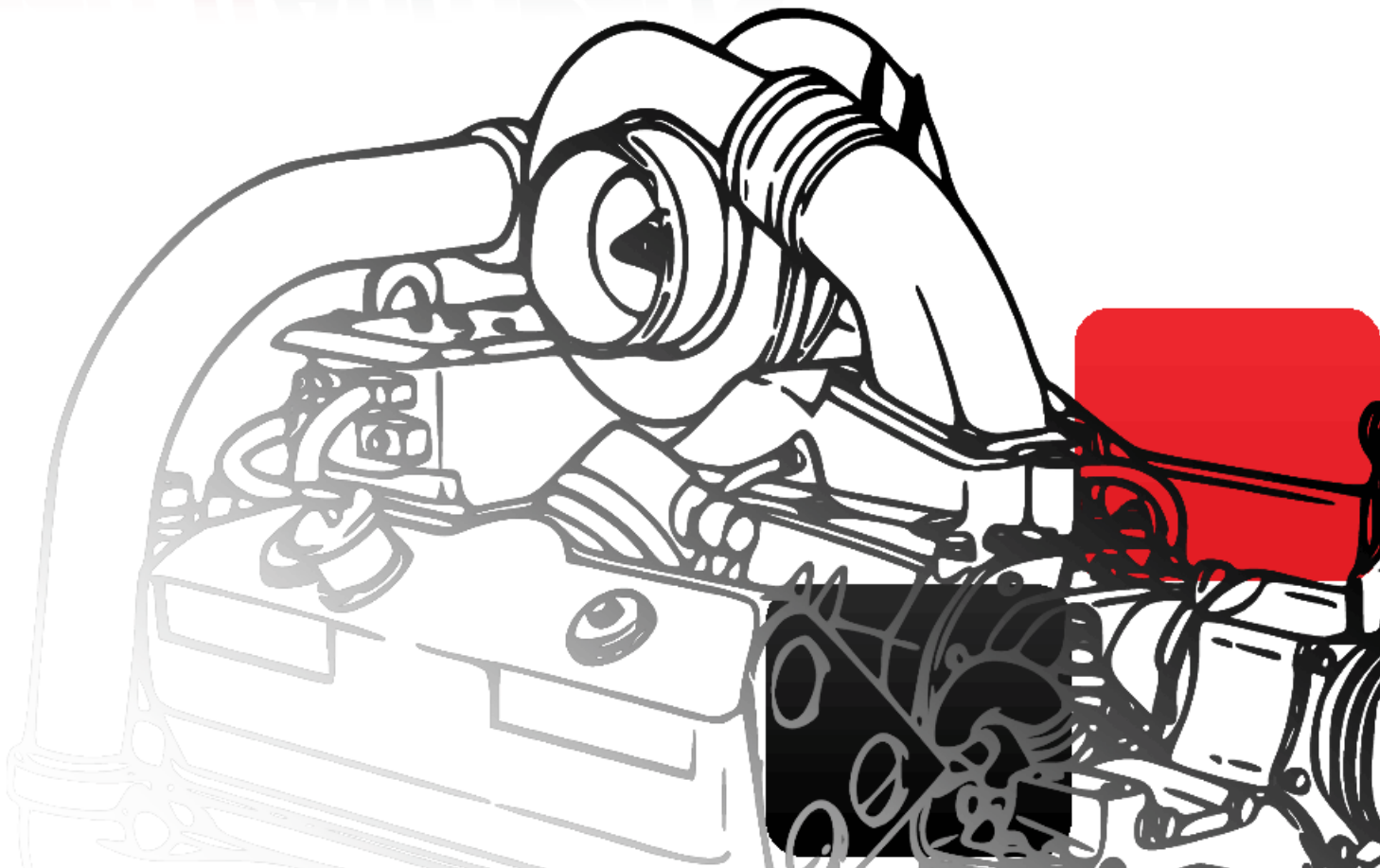

Automotive Repair Information: How to Become a Better “Engine Doctor”

Obtaining the auto repair information and automotive parts you need to fix a faulty engine requires you to accurately identify the problem behind it. However, when the problem is barely visible, this can be much harder than it sounds. In the initial stages of troubleshooting it is important to gain diagnostic direction, especially when you are dealing with hard to identify engine issues. By following the steps to properly identify engine problems, you will become a better diagnostician and save yourself time and energy in the long run. The following information will guide you in how to become a better engine doctor, allowing you to get your customers the answers they need faster.

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Motor Age outlines three tests you can perform that will indicate if the engine you are examining is having difficulties. These tactics may even help determine what is causing a particular problem. The first is an oldie but goodie – checking the manifold vacuum. Next we encourage you to use a relative compression test. And last but not least, you should try reading the secondary ignition pattern.

1. Using a Manifold Vacuum to Test Engine Health

1. Connect your vacuum gauge to an intake vacuum port as close to the intake manifold as you can.
    - *A running engine at idle should produce between 18 inches/Hg to 21 inches/Hg and the needle should remain steady.*
    - *Significantly lower readings or a gauge needle that bounces around are signs that further, more detailed tests should be done.*

2. Snap the throttle to wide open and release a few times while watching the gauge.
    - *The needle should drop to roughly 5 inches/Hg or less, rebound quickly and surge past the idle reading, then fall as quickly back to the idle reading.*
    - *Any delay in needle response can indicate a problem with airflow through the engine, usually in the exhaust.*

3. If this doesn't work, hold the throttle at a constant 2,500 rpm.
    - *The gauge should read near the idle reading and stay there.*
    - *Lowering vacuum readings while maintaining a steady rpm are another indicator of a restricted exhaust.*

2. Relying on Relative Compression Testing to Assess Engine Issues

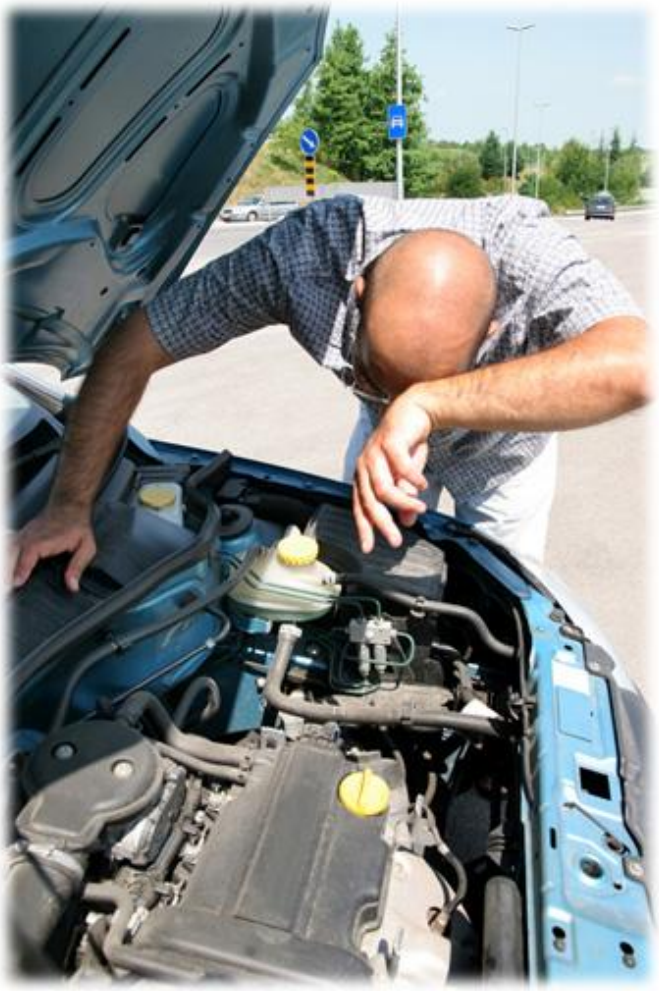
This test uses the digital storage oscilloscope (DSO) and a high amp clamp to measure starter amperage draw at a time base fast enough to see the impact each cylinder has on that draw.

1. Synch the pattern to a given cylinder and use the firing order of the engine to identify weak cylinder(s).

- A weak cylinder takes less effort to spin through than a strong one does, and that means it also takes less current, and that is displayed on the scope's screen.

2. Modern pressure transducers allow relative compression tests to be done via the exhaust pressure pulses leaving the tail pipe.
   - *Cylinders that are healthy will pass equal pressure pulses through the exhaust that the sensor can detect. A weak cylinder will show up as a weaker peak in the pattern.*

3. The pattern can be synched to help identify the bad cylinder(s). Here, though, the pulse displayed will be offset from the originating cylinder.
   - *When viewing these patterns, look for anomalies rather than specifics.*
   - *Some exhaust designs cause one bank to have a longer route to follow than the other, and this can reduce the amplitude of the pattern on all the cylinders for that bank.*



NOTE: If there is a weakness, the pressure transducer can determine if the fault is in the valve train or cylinder.

- Be sure to disable the fuel and ignition systems to avoid both over fueling the cylinders and accidental engine start.
- Remove the oil dipstick and put a rubber hose over the tube, connecting the sensor to the tube.
- Crank over the engine and watch the pattern. A pressure increase will be present each time a piston heads for bottom dead center.
  - *If the rings are sealing properly, the peaks will be uniform and the loss of compression you found has to be caused by the top end.*

3. Reading the Secondary Ignition Pattern to Solve Engine Mysteries

This takes some skill, but you can master it.

1. Look at the average of the firing lines (firing voltage demand) for all the cylinders.
   - *It's normal for the firing line of an individual cylinder to vary as conditions vary in the combustion process.*
   - *Any cylinder that has a consistently lower firing line is suspect.*

2. Watch the spark line closely.
   - *No compression in a cylinder will not only have a lower firing demand, but the spark (or burn) line will be flat and longer than the others.*

NOTE: When a valve doesn't seal, the pressures built up in the cylinder have a path to escape through. It shows up in the pattern as a series of peaks in what should otherwise be a relatively smooth slope. Some turbulence at higher engine speeds is normal, though, so don't confuse the two.

By following the three tests outlined above, you should be able to gain a better understanding of the problems the engine may be experiencing. With luck, you should be one step closer to providing your customer with the auto repair information they need.

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