In the last issue of GEARS, we looked at the basics of driveability. Remember, driveability affects the transmission’s operation. To continue this series, we’re going to reinforce the diagnostic process, and then we’ll start to examine the basic parts components that affect driveability.

Verify the Condition

As with transmission problems, the first thing you need to do is to verify the condition. Even if the MIL is on, it’s still best to take a test drive with the customer and verify the specific complaint. This initial road test is important. During the test drive, the vehicle owner can explain or demonstrate the problem. While it occurs, get the customer to agree with your description of the condition. This is an important step in any good diagnosis: It enables both of you to communicate about the same verified problem. You should also point out any other problems you notice that the customer might not be aware of. Offer to solve these problems too. If the customer refuses, at least he’s aware of them. That’ll give you a fighting chance later, when the customer comes back to complain about the new problem that suddenly showed up “ever since you…”

Sometimes a vehicle may operate normally during the initial road test. Don’t give up. Part of the diagnosis is identifying an intermittent problem. At this point, start asking questions. Try to learn what conditions are necessary for the problem to occur. You and the customer may need to recreate a specific set of driving conditions for the problem to appear. Even if the problem won’t appear during your road test, don’t give up yet.

In the old days, the next thing a mechanic would do is open the hood and look around. Was the carburetor dirty or were there signs of fuel leaking? Was the carburetor loose or had a linkage fallen off? Any plug wires cracked, or laying against the manifold? If the ignition was suspect, an old trick was to look at the exhaust manifold(s): A misfiring cylinder usually had oil stains or looked darker around the exhaust ports than the cylinders that were firing.

Things have changed a lot since then, but the principles of diagnosis remain much the same. So if you don’t feel the problem during a road test, your next step should still be to open the hood and take a look around. Look for anything obvious or out of the ordinary. Such as burnt or broken wires or vacuum hoses. Or a connector that’s become disconnected. Maybe you’ll want to pull the air inlet off and check the air horn and throttle plates; they still get dirty and carboned up, which can cause idle and performance problems.

While you probably won’t see an oily spot on the exhaust manifold, there’s an up-to-date, high-tech method of looking for a misfiring cylinder: Measure the exhaust temperature at each exhaust port with an infrared temperature gun. A misfiring cylinder will usually be considerably colder than the rest.

Still can’t isolate the problem? Okay, it happens. That’s why they call them intermittent. The good news is that the customer is sitting right there, not seeing the problem right along with you. This gives you the opportunity to explain that, while you’re willing to check further, there’s the distinct possibility that you won’t be able to isolate the problem. And since the customer is witnessing, first-hand, this lack of a problem, he’ll be hard pressed to argue.

At this point, the customer will either take the car back until the problem shows up again, or leave it with you for further diagnosis. And whether you’ve identified a specific problem, or are just fishing, your next step remains pretty much the same:

Check for Codes

Start making it a habit to check all computers as well as all areas of each computer for codes. This includes, present, history, freeze frame, codes from other modules, communication codes, etc. Write them all down.

Next, check for hard codes:
• Turn the engine off.
• Clear the codes.
• Turn the key on, engine off.
• Make sure the appropriate warning lights and MIL come on.
• Check for codes again.

Any codes that show up immediately are hard codes. Hard codes indicate problems that are there right now. Any
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codes that set as soon as you turn the key on indicate problems that you’ll have to check and repair right away, before you can start looking deeper into the system.

Remember, the term DTC stands for Diagnostic Trouble Code. It’s not a FTC (Fix-it Trouble Code). DTC codes only indicate what circuits or systems need to be examined further. Have you ever replaced a shift solenoid only to have the same code reappear? It happens far too often. To avoid it, use the code to direct your diagnosis. From there you’ll know what circuit to check, and what type of problem to look for.

If you find multiple codes, always diagnose and repair the lowest numbered code first. The reason is that the lowest numbered codes usually indicate problems that will have the greatest effect on driveability. For example, trouble codes between P0110-P0117 typically indicate a fault in an air or coolant temperature circuit. Obviously the computer needs to know the operating temperature to control idle speed and fuel mixture.

What does a faulty coolant sensor signal have to do with the transmission? Well, if the computer thinks the coolant is really cold, it could assume the transmission fluid is cold, too. So the computer may force line pressure high to compensate, causing a harsh shift. Or the computer may simply have a different operating strategy for cold performance, and a coolant sensor signal problem may alter the transmission shift pattern.

Another reason for diagnosing and repairing a low numbered code (like a coolant temperature sensor) is that you may directly or indirectly clear other codes.

The only exceptions to checking low codes first are computer or network codes; that is, codes that indicate a specific problem with the computer itself, or a communication problem between the vehicle’s computers.

The reason you’ll want to check these codes first is that a computer or network failure can cause false codes for other circuits. A computer that isn’t operating properly may not be able to read a coolant sensor signal, so it might set a code for the coolant sensor. There may be nothing wrong with the coolant sensor circuit, but since the computer isn’t working right, it can’t read the signal, so it sets a code.

Your scan tool may display “no communication,” a P0700 or U-type codes. These codes refer to communication problems between one or more modules on the vehicle. To diagnose these problems, you may need more than a wiring diagram. Sometimes it requires an OEM scan tool to communicate with all these modules.

From here, the steps for diagnosing driveability and transmission problems are very similar. In the next issue of GEARS, we’ll discuss how to determine whether you’re looking at an engine problem or a transmission problem. For now, let’s go over some electrical devices.

### The Battery

All too often, technicians ignore the battery when diagnosing an electrical problem. Just because the engine starts doesn’t mean the battery is good. Many driveability and transmission problems are caused by the battery. We aren’t going to cover battery testing in this article; there are plenty of excellent articles, books and training programs that cover batteries and how to test them. A few things you should remember about batteries:

- A fully charged battery should produce 12.66 volts at rest.
- Minimum rest voltage for most circuits to work is 12.2 volts.
- Dirty connections can cause voltage problems that will affect computer system operation.
- Never try to service any battery without wearing protective eyewear and work gloves.
- Batteries produce hydrogen gas; a spark anywhere near the battery can cause it to explode.

You will also need accurate test equipment for diagnosing electrical system problems. This equipment should include:

- Digital Volt-Ohmmeter/Digital Multimeter
- LED Test Light
- Battery Load or Capacity Tester
- Inductive Amp Probe
- …and possibly a scope and a timing light. You must also know how to use them.

### Switches

The simplest electrical device is a switch. A typical switch opens or closes a circuit. Ignition and inhibitor switches are examples of mechanically-controlled switches. The pressure switch assembly in a 4L60E or pressure switches in a 41TE solenoid pack are pressure-controlled switches.

Other switches are controlled by temperature. Relays are a type of switch operated by an electromagnet, which opens or closes a set of contacts. A circuit breaker can also act like a switch; it opens if too much current passes through it.

What’s important to know about switches is how they’re supposed to work; from there, diagnosis is usually pretty easy.

Take a look at a typical ignition switch schematic. Depending on the switch’s position, one or more circuits will be open or closed.

The odd thing about switches is that they don’t always fail completely, so during testing, they may appear to be okay. But later the customer will experience the problem again. So what do you do, replace every switch you suspect? Not a great idea. A better choice is to understand the conditions taking place during the failure, and then stress the switch while duplicating those conditions. This gives you a better chance of duplicating the failure. Here’s how:

If you’re testing a voltage supply type (ignition) switch, make sure the supply side voltage is good. On a grounding switch, make sure the ground is good. Now, backprobe the controlled side of the circuit with your voltmeter, and monitor the signal for a voltage drop. Cycle the switch and watch the voltage for any abnormal voltage changes.

If the switch is good, the controlled side of the circuit should match the voltage of the part attached to the supply side. Or, if the switch completes the circuit to ground, the voltage should drop to zero when the switch closes. You’ll probably have to stress the switch by cycling it several times, twisting it, or heating or cooling it to get it to act up.

Next time we’ll look at diagnosing engine vs. transmission problems. Then we’ll cover testing relays, sensors, coils and solenoids.

**Vote YES on Driveability**

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