In the last two issues of GEARS, we looked at how solenoids can be used to control pressures. We examined the signals that control those solenoids, and learned that the signals can be measured by duty cycle, voltage or amperage.

In this, the last of the series, we’ll cover the specific test procedures for diagnosing pressure control solenoids, and see which test is better — if indeed any one test is better than the others.

So let’s start with a specific test procedure, and see if it provides enough information for a diagnosis.

**Current Testing**

A late model GM vehicle comes into the shop with what appears to be high pressures. Since GM’s procedure recommends measuring current flow, you connect your ammeter to the pressure control circuit (figure 1).

The current flow at idle is supposed to be around 1.1 amps. But on this car, the current is high; about 1.4 amps.

Terrific… you found the problem. Or did you? Well, you found a problem. But what is it? What’s causing the current to run high? There are several possibilities:

- Solenoid resistance is too low, because the solenoid is bad or the wrong one for the vehicle.
- Voltage level is too high, because of excessive charging voltage.
- The ground circuit isn’t pulling all the way down to zero volts.

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Figure 1: You can measure the amperage anywhere in the circuit. But remember, amperage will vary depending on the power feed, ground, circuit resistance, and signal duty cycle.

Figure 2: You can use the voltage signal to check the signal, but that could also vary depending on applied voltage, ground level, the condition of the solenoid, and signal duty cycle.
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Diagnosing Pressure Control Circuits

opposite of the condition you’re dealing with. But you did find a problem… now all you have to do is figure out exactly what it is.

So measuring current flow isn’t the be-all, end-all of pressure control solenoid diagnosis. You can learn something from it, but definitely not everything you need to know.

Voltage Testing

Let’s look at another car… a Ford this time, because Ford recommends checking signal voltage for monitoring their pressure control signal.

According to the Ford manual, this unit should have about 7 volts on the signal wire at idle, and it should drop off to almost zero at heavy loads. But on this car the voltage is low at idle; only about 5 volts (figure 2).

So what’s wrong with the system? Once again, there are several possibilities:

• Apply voltage is too low, because of low charging voltage or unwanted resistance elsewhere in the circuit.

• The solenoid is partially shorted to ground, and is pulling the voltage down during the signal off-time.

• Signal on-time is too long, because of a faulty computer signal or a bad computer.

Once again, you found a problem, but finding the problem will require more testing than just a basic voltage monitor.

Duty Cycle Measurement

Well, we’re 2 for 2 in diagnosing pressure control systems, but we can’t go wrong with duty cycle, can we? After all, that’s how these systems create the voltage and amperage changes in the first place.

So we’ll try it… this time back to the GM. We connect the meter to the solenoid control wire, set it to read negative duty cycle, and put the transmission through its paces (figure 3). Sure enough, the computer is providing a duty cycle signal. It’s about 60% at idle, and drops below 10% on a hard throttle.

So that’s working just right, isn’t it?

Well, we know the computer is creating a duty cycle signal, so that’s good. And we know it’s varying in the proper directions, based on engine load. That’s good too.

What we don’t know is whether those changes are on specs, because GM doesn’t provide specs for duty cycle. We could do the math and work out the duty cycle, based on the current spec, applied voltage level and solenoid resistance; then we’d know if the duty cycle signal was correct. But even that doesn’t tell us everything we need to know about the circuit. For example, we still don’t know if the solenoid resistance is in specs, or the applied voltage is correct. Or if we have a ground problem.

So, while a varying duty cycle proves the signal is going through the motions correctly, we can’t offer a comprehensive diagnosis from that one measurement.

A Better Testing Procedure

What we’ve established so far is that there’s no test that’ll provide all the information you need to diagnose a pressure control solenoid system.

Not one single test…

But what if we put a couple of those tests together?

Start With a Voltage Test

To begin with, is the circuit receiving the proper voltage level, and is the ground pulling all the way down to zero volts? If not, there’s probably unwanted resistance somewhere in the circuit.

Here’s how to check these circuits for unwanted resistance:

1. Connect your meter’s ground lead to a good chassis ground, as close to the solenoid as possible.

2. Energize the circuit. You may have to start the engine, put the vehicle...
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in gear, and may even have to drive the vehicle for the pressure control solenoid to energize properly.

3. Backprobe the feed wire to the solenoid with the circuit energized (figure 4). On a feed-controlled solenoid, you may have to enable MIN MAX or use a scope to measure the full voltage signal, because the signal normally pulses.

Applied voltage should equal system voltage on a ground-controlled solenoid. On a feed-controlled solenoid, the Maximum voltage should rise to system voltage.

4. If the solenoid has a ground wire, backprobe that and check for voltage (figure 5). On a ground-controlled solenoid, you may have to enable MIN MAX or use a scope to check ground, because the ground normally pulses.

The ground should drop all the way to zero when the circuit’s energized. On a ground-controlled solenoid, the Minimum voltage should drop to zero.

Anything over 0.1 volt variation from system voltage or ground indicates extra resistance in that part of the circuit. Trace that back and repair the problem before going on.

Once you’re sure the applied voltage and ground are okay, you’re ready to move on to the next test...

**Check the Solenoid Resistance**

Resistance measurements usually involve an ohmmeter. And that’s a good start:

- Isolate the circuit by disconnecting the solenoid connector from the harness.
- Zero your ohmmeter to adjust for any resistance in the leads (figure 6).

- Connect your ohmmeter positive lead to the solenoid feed wire.
- Connect your ohmmeter negative lead to the solenoid ground wire. Or, if the solenoid grounds through the case, connect the ground lead to the transmission case, as close to the solenoid as possible (figure 7).
- Compare the reading on your ohmmeter to the factory specs.

Keep in mind, resistance varies with temperature. If the transmission is hot, the solenoid resistance will be higher than normal. Always try to take your measurement while the unit is close to the temperature listed in the specification.

That’s one way to measure solenoid resistance. Unfortunately, it measures the resistance on a dead circuit.

**Figure 5:** After you’re sure you have system voltage to the circuit, make sure you have a good ground. Anything more than about 0.1 volts indicates resistance in the ground circuit.

**Figure 6:** Most EPC solenoids are low resistance solenoids. To measure the resistance accurately, you must first zero the leads.

**Figure 7:** One way to check the solenoid windings is with a basic resistance check. But a better way is to test the live circuit with an amperage check.
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That’s actually the least accurate way to measure resistance, because it doesn’t account for any of the changes that a dynamic load will create in the circuit.

A better way to check solenoid resistance is with an ammeter. Keep in mind, since amperage is constant throughout the circuit, it doesn’t matter whether you measure on the positive side of the circuit or the negative side. Whichever is easier… or possible.

On a feed-controlled circuit, you’ll probably have to connect your ammeter to the feed wire. On a ground-controlled circuit, you may want to use a jumper wire to ground the solenoid, and provide power through the ammeter.

• Use a fused jumper to provide power to the ammeter.
• Set your meter for amps, and move the leads as necessary.
• Connect your meter’s negative lead to the solenoid feed wire.
• Momentarily energize the circuit through your meter, by touching the positive meter lead to the fused jumper.

CAUTION: Most pressure control solenoids are low resistance. Never keep them energized for more than a second or so. Sustained power can damage or destroy the solenoid. To capture the reading, take advantage of your meter’s MIN MAX function.

The amperage reading on your meter is a more accurate measurement of the solenoid’s condition. Compare it to factory specs to see if the solenoid is okay.

Don’t have factory solenoid amperage specs? Sure you do! Ohm’s Law, remember? System voltage divided by the resistance spec equals the amperage. So, if the solenoid resistance spec is 3.3 ohms…

\[
12.6 \text{ volts} \div 3.3 \text{ ohms} = 3.8 \text{ amps}
\]

Keep in mind, these tests just check the solenoid electrically; they don’t provide any information about whether the solenoid is actually operating or not. If the circuit checks out electrically but the pressures still aren’t adjusting properly, suspect a mechanical problem with the solenoid or circuit.

Check the Signal

Once you know the power and grounds are good, and the solenoid resistance is within specs, it doesn’t matter which way you measure the solenoid signal. Use any of the procedures covered in the last issue of GEARS to connect your meter and measure duty cycle, voltage or amperage.

Since you know the circuit and solenoid are in good condition electrically, any variation in the signal has to be due to either an improper computer input, or a bad computer itself.

Pressure control solenoids: They can be a bit daunting at first, but if you understand their control system — and the principles of electricity — diagnosis becomes a matter of simple logic.