Troubleshooting the 42-47RE Transmissions

ATRA's Powertrain eXPO 2006 SPEAKER

by Dave Skora

Figure 1

In the last issue of *GEARS* we looked at the electronic governor system that controls the shift on the 42-47RE transmissions. We saw that this transmission is basically hydraulically controlled, but uses a duty-cycled solenoid to create governor pressure.

In this issue, we're going to look at specific problems with this system, and learn how to diagnose them. The important thing to remember about these units is they're basically hydraulically-controlled transmissions; at least for the first three gear ranges. To put it simply: Governor pressure strokes the shift valves. Just like 350s, 400s, Powerglides, C-4s… all those oldies from 20-or-more years ago.

If a 42-47RE transmission doesn't shift properly from first through third gears, your first check is *always* governor pressure. Governor pressure should be zero at a stop, and rise about one PSI per MPH, up to about 40 MPH. After about 40 MPH, the system routes mainline pressure to the governor port, so the pressure won't vary with vehicle speed until the speed drops below 40 again.

While you can quick check the governor pressure system with a scan tool, always verify your pressure readings with a gauge. Remember, your scan tool only knows what the computer tells it. If there's a problem with transmission operation, connect a gauge to the governor pressure port and verify governor pressure. If it's okay, look elsewhere for the problem: The electronic controls are working fine; they aren't causing the shift problem. Look for sticking shift valves, burnt clutches… all the same things you'd have looked for on one of those old, hydraulically-controlled units.

If Governor Pressure Isn't Right…

So you connect a gauge to the governor port, and lo and behold, governor pressure isn't working right. Your next step might be to check for diagnostic trouble codes (DTCs)… but not this time. There are five codes related to the governor control system. Unfortunately, fixing governor-pressure problems by using the DTC diagnostic tree usually takes more time than fixing it based on the symptom.

We've assembled a list of diagnostic procedures to follow based on the symptom. Just find the symptom that most closely matches what you're observing, and follow the diagnostic procedure to troubleshoot the problem.

Transmission Doesn't Upshift; Stays in First Gear

- Connect your scan tool.
- Install a gauge in the governor pressure port.
- Go for a drive.
- Compare these three measurements:

1. Governor Desired Pressure (Computer Signal to the Governor Solenoid)
2. Governor Measured Pressure (Transducer Signal to the Computer)

If governor pressure is okay, look for a transmission problem, such as sticking shift valves, burnt clutches, etc.

3. Governor Gauge Pressure (Measured Pressure on your Gauge)

All three pressures should be equal, and should rise about 1 PSI per MPH, up to about 40 MPH. If governor pressure is okay, look for a transmission problem, such as sticking shift valves, burnt clutches, etc.

If there's no Governor Desired Pressure signal at all — or if the signal is extremely low — the computer isn't trying to create governor pressure. It may not realize the vehicle is moving. Check the Output Shaft Speed (OSS) sensor signal (figure 1). This is the signal the computer uses to determine vehicle speed.

- If there's *no* Output Shaft Speed signal: Check the Output Shaft Speed sensor and wiring between the sensor and computer. If you're receiving a signal to the computer but the computer isn't recognizing the signal, suspect a computer failure.
- If the Output Shaft Speed signal is okay: Check the signal from the Governor Pressure Transducer; a false pressure signal could fool the computer into thinking it's creating pressure when it isn't. If the transducer signal is correct, suspect a computer problem.

IMPORTANT: Always check all powers and grounds to the computer before condemning it, and always check all controlled circuits, such as solenoids and motors, before replacing the computer.

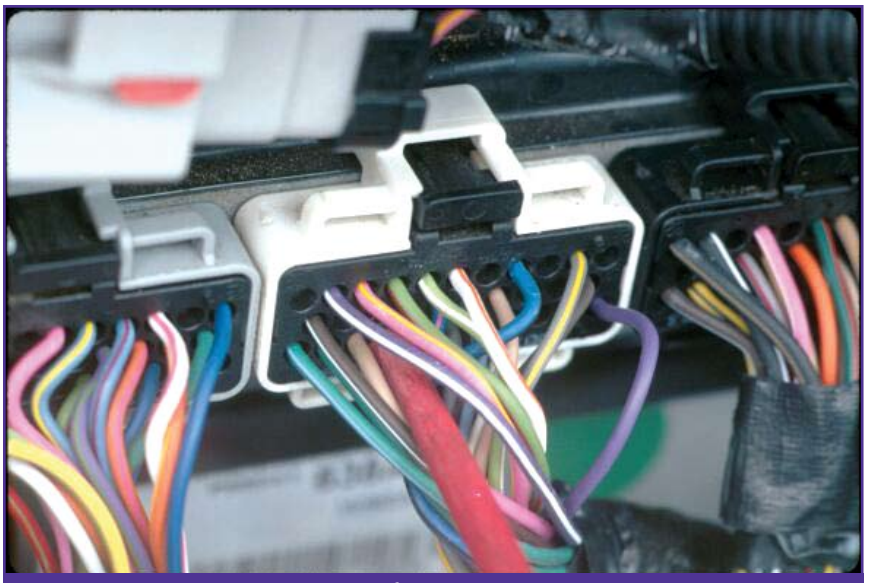

Figure 2A

42-47re Governor & Solenoid PCM Terminal Id & Voltage Chart

1996-2003 Dodge RWD with Gas Engine

PIN	Wire Color	Circuit	Voltage
B1	Violet	Temp. Signal	@ 4.5-1.0 V
B8	Violet/White	Gov. Sol. Control	@ 1 amp for zero psi
B11	Org/Black	TCC Sol. Control	*0.0 V when ON
B21	Brown	OD Sol. Control	*0.0 V when ON
B25	Dr Blue/Black	OSS Ground	0.0 V
B28	Lt Grn/Black	OSS Signal	@ 3.0 VAC at 30 mph
B29	Lt. Grn/White	Gov. Transducer	.60-.66 V at zero psi
B29	"	"	@ 3.0 V at 60 psi
B29	"	"	@ 4.5 V at 110 psi
B30	Pink	Trans. Relay Control	0.0 V Running, No Codes
B31	Orange	Reference 5 Volt	5 V Ignition ON

*---Also no volts when in limp mode. In normal operation, there will be @ 12 V when ignition on, but not energized.

Figure 2B

If the Governor Desired signal is okay, but there's no Actual or Gauge pressure, look for a faulty governor solenoid, or a blockage in the circuit, either in the pressure feed to the solenoid, or between the solenoid and the governor pressure circuit.

Limp Mode; 3rd Gear Starts

Limp Mode, or Failsafe, is the mode the computer enters when it detects a problem that would prevent it from controlling governor pressure accurately. In Limp Mode, the computer de-energizes the Governor Solenoid. This opens the solenoid all the way, allowing full mainline pressure into the governor circuit. This causes the transmission to start in 3rd gear.

Keep in mind that Limp Mode usually indicates a computer system problem. It is possible to have a problem that causes 3rd gear starts without the system being in Limp Mode. These conditions include crossleaks in the governor circuit and sticking shift valves, to name the more common ones.

While the specific situation is different, the conditions may appear identical: Both will cause 3rd gear starts. But it's an important difference: The computer will only go into Limp Mode if it sets a code or loses power.

Let's look at a few of these conditions that will enable you to help isolate or identify what's causing the system to go into Limp Mode.

Key On, Engine Off: Condition Occurs Immediately

Governor related codes that reset as soon as you turn the key on, engine off usually indicate a hard electrical problem; that is, a constant problem that's there right now. Check all connections and make sure the transducer circuit is properly grounded. Use the Voltage Chart to verify the reference voltage, ground and signal voltage (figure 2a & b).

Engine Running, Selector in Park, Reverse or Neutral

If the computer sets a governor-related code with the engine running and the gear selector in Park, Reverse or Neutral, suspect a hard electrical failure, such as a shorted solenoid. Use the Voltage Chart to verify the reference voltage, ground and signal voltage for the circuit indicated by the code.

Another possibility is a hydraulic problem; that is, a crossleak in the valve body or governor body. To check for crossleaks, install a gauge in the governor pressure tap. There shouldn't be any governor pressure in Park, Reverse or Neutral; the manual valve closes the passage that feeds the governor circuit in these ranges. If you have pressure at the governor circuit in any of these ranges, look for crossleaks in the case, valve body or governor body.

Engine Running; Selector in Drive

You start the engine and check the governor pressure. It's at zero PSI in Park, Reverse and Neutral. Then, the moment you put the selector in Drive, you get governor pressure. No wonder it's starting in 3rd gear!

The problem can be hydraulic or electrical:

Hydraulic — There may be a crossleak in the governor body or the governor solenoid itself. A loose or warped governor body is a common problem.

Electrical — There are several possible electrical problems that could cause high governor pressure and 3rd gear starts. Most of these will appear on your scan tool:

- Indicated Gear Range: Indicated Gear Range should be Drive. If the indicated gear range is anything other than Drive, the computer will leave the governor solenoid de-energized. Then, when you put the selector in Drive, the de-energized solenoid will send full line pressure to the governor circuit.
- OSS Signal: OSS signal should read 0 MPH when the vehicle's stopped. If there's any AC signal or EMI (Electromechanical Interference) bleeding into the circuit, the computer will misinterpret that as a speed signal, and assume the vehicle is moving. The computer will then adjust the Governor Solenoid based on that improper road speed signal.
- Incorrect Governor Solenoid Command: If the computer identifies a system failure it will set a diagnostic trouble code and put the system in Limp Mode. This will shut the Governor Solenoid off, sending full mainline pressure to the governor circuit. Or a faulty computer can cause the Governor Solenoid to open when it should be closed.
- Actual Governor Pressure Measures Low: When stopped, the computer raises the duty cycle signal to the Governor Solenoid just enough to close it off, lowering the pressure to zero PSI. If the Governor Transducer is out of specs, it can fool the computer into thinking the Governor Solenoid is closed, when it's actually still delivering governor pressure.
- Voltage Lost at Case Connector Pin 1: Pin 1 at the transmission case connector supplies power to the transmission solenoids. It should have system voltage whenever the key is on. If Pin 1 loses power, it puts the system into Limp Mode, and sends full mainline pressure to the governor circuit.

Sometimes the system will operate normally when you first start the engine, and then set a code and go into Limp Mode while you're driving.

Goes Into Limp While Driving

Sometimes the system will operate normally when you first start the engine, and then set a code and go into Limp Mode while you're driving. If the code sets at low speeds, connect a pressure gauge to the governor tap. Connect your scan tool and compare Desired, Actual and gauge pressures.

- If the pressure gauge follows the *Desired* pressure until the codes sets, suspect a bad transducer.
- If the pressure gauge follows the *Actual* pressure, suspect a bad governor solenoid, a warped valve body adaptor, or an internal leak.

If the code sets while the transmission is in 3rd or 4th gear, watch Governor Actual pressure in 3rd or 4th gear while driving at WOT. If the scan tool displays more than 105 PSI, suspect excessively high line pressure or the governor transducer is bad.

NOTE: The computer normally turns the governor solenoid off when the vehicle reaches about 40 MPH. That's because above 40 MPH, the computer uses the OD solenoid to shift the transmission into 4th gear and the Actual governor pressure becomes line pressure. So the governor transducer sensor is really watching line pressure while you're driving in 4th gear. You can confirm this with your pressure gauge in the governor pressure tap.

Temperature Sensor Operation

These transmissions use a temperature sensor to monitor fluid temperature and the computer adjusts its shift strategy based on those temperature readings. The temperature sensor is a thermistor: a semiconductor whose resistance changes based on temperature.

The computer sends a 5-volt signal to the temperature sensor; the sensor grounds the circuit, pulling the voltage down based on sensor resistance. The computer measures the voltage change to determine fluid temperature. Use the Voltage Chart to identify the sensor values at different temperatures.

Early systems all used Negative Temperature Coefficient (NTC) thermistors; as temperatures go up, resistance goes down. Starting in 1999, some vehicles began using a Positive Temperature Coefficient (PTC) thermistor; as the temperature goes up, resistance goes up. If the temperature appears to be going the wrong way — that is, hot when you first start the engine and then cooling off as the vehicle is being driven — someone probably installed the wrong thermistor.

While the 42-47RE transmission is fairly simple to diagnose, it does have certain idiosyncrasies in the way it operates. The key to diagnosing this system is to have a clear understanding of how the system works, and to take the time to examine all the operating conditions carefully. Once you have a clear view of the conditions, any diagnosis should be easy to deal with.

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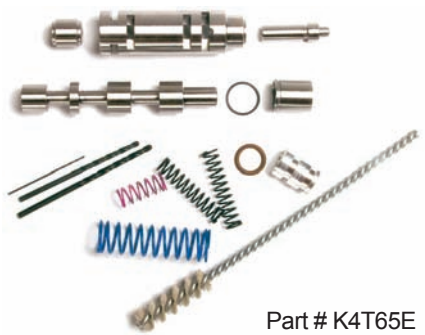

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