42RLE-VLPS

P0869 - LINE PRESSURE TO HIGH

COMPLAINT: A vehicle equipped with a 42RLE transmission using a variable line pressure solenoid (VLPS) comes in with code P0869 (Line Pressure High), stored in memory. A new VLP solenoid, pressure sensor and solenoid pack is installed yet P0869 remains. It is noticed that when the code is cleared, it immediately returns upon a 2-3 shift.

CAUSE: There has been several occasions where a defective TCM/PCM is the cause of code P0869 setting after a 2-3 shift.

Diagnosing this code is somewhat elusive as the theory of operation provided for this code is not as clear as it should be.

Theory of operation:
Line pressure is measured by the Line Pressure Sensor (LPS) and regulation is achieved by changing the duty cycle of the Pressure Control Solenoid (PCS or VLPS) controlled by the Transmission Control System. (5% duty cycle = solenoid off = Max line pressure, 62% duty cycle = solenoid on = Min line pressure). The Transmission Control System calculates the desired line pressure based on inputs from both the engine and transmission.

The Transmission Control System calculates torque input to the transmission and uses it as the primary input to the desired line pressure calculation. This is called Torque Based Line Pressure. In addition, the line pressure is set to a preset level 827 or 931 kPa (120 or 135 psi) during shifts and in Park and Neutral to ensure consistent shift quality. The desired line pressure is continuously being compared to the actual line pressure. If the actual line pressure is consistently higher than the highest desired line pressure ever used in the current gear, the line pressure high DTC P0869 will set.

A clearer theory of operation explanation:
The above explanation does makes it clear that the VLPS is used to lower line pressure when it duty cycles. It explains this by way of providing the duty cycle range. It's at 5% for max line pressure and 62% for minimum pressure. What it does not explain is,"When does it duty cycle"? Nor does it plot the percentage of duty cycle which is needed for a precise diagnoses.

Looking at the parameters in a scan tool for desired and actual line pressures can be helpful to a degree as the values of each are to near mirror themselves. When they don't, you know there is a problem with the system but you don't know if it is the solenoid, the sensor, or a bad computer.

The use of a scan tool can show when significant changes take place. For example, figure 1 shows desired and actual line pressure being around 135 psi in first gear. No change takes place when shifting into second gear (figure 2). But when a shift into 3rd took place, desired and actual line pressure dropped to approximately 85 psi (figure 3). It holds this pressure through the shift into 4th gear (figure 4). But once the converter clutch applies (*compare input speed with engine speed*), desired and actual line pressure dropped to 40 psi (figure 5).

A more definitive test is with a meter set to observe negative duty cycle which shows solenoid "On" time. In other words the more time the solenoid is being grounded, the more time it is on where it lowers line pressure.

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Figure 6 shows a basic overview of what will be observed with a good working system. When idling in drive and the brake applied, the solenoid is near off at 5% duty cycle. Once the vehicle begins to move, the duty cycle will increase slowly through first and second gears. Whether the duty cycle has increased to 10%, 15% or 20%, once the 2-3 shift occurs, duty cycle will jump to 25%. It's at this time the computer looks at the pressure sensor to see if the line pressure had dropped. If the sensor does not show a decrease in pressure, P0869 will set.

CORRECTION:

Seeing a 25% duty cycle upon the 2-3 shift confirms that the computer did its job. Having code P0869 set immediately afterwards means the cause can be one of a number of possibilities:

1. A mechanically failed VLPS
2. A mechanically failed pressure sensor
3. An electrical problem with the pressure sensor signal
4. A pressure regulator valve problem

If the computer fails to produce a 25% duty cycle upon the 2-3 shift yet it produces code P0869, a faulty computer would be suspect.

Additional notes and observations:

The following is approximate voltage values that was observed using a volt meter to view the activity for both the VLPS and pressure sensor. Checking the VLPS signal with a volt meter is not as clear as it is observing the duty cycle signal as you will see.

At idle in drive with the brake applied, VLPS voltage bounced between 13.7 to 14.3 volts. The pressure sensor in sync with the pressure bounced between 2.19 to 2.28 volts.

When driving, voltages fluctuate while slightly decreasing as it goes through first into second gear. When the transmission shifts into third gear, VLPS voltage bounced between 11.8 to 11.1 volts. The pressure sensor in sync with the pressure bounced between 1.56 to 1.28 volts.

Once in fourth gear with the converter clutch applied, VLPS voltage bounced between 10.89 to 10.32. The pressure sensor in sync with the pressure bounced between 1.14 to 1.08 volts.

A final observation is that non-VLPS transmissions, whether it is a 41TE or 42RLE, the fixed line pressure in first and second gears is 120 to 145 psi. When a shift into third takes place, Overdrive solenoid oil is also routed to the pressure regulator valve to lower line pressure down to 75 to 95 psi for third and fourth gear.

This is now being achieved with the VLPS and not Overdrive Solenoid oil. The reduction in pressure through third and fourth gear as well as when the converter clutch applies is to provide increased fuel economy.

The 62% duty cycle that occurred quickly during a 2-1 downshift (figure 6) is a driveability feature. It assists in providing a smooth coast downshift into first gear rather than a harsh bump which was and still is a big complaint with non-VLPS units.

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Figure 1

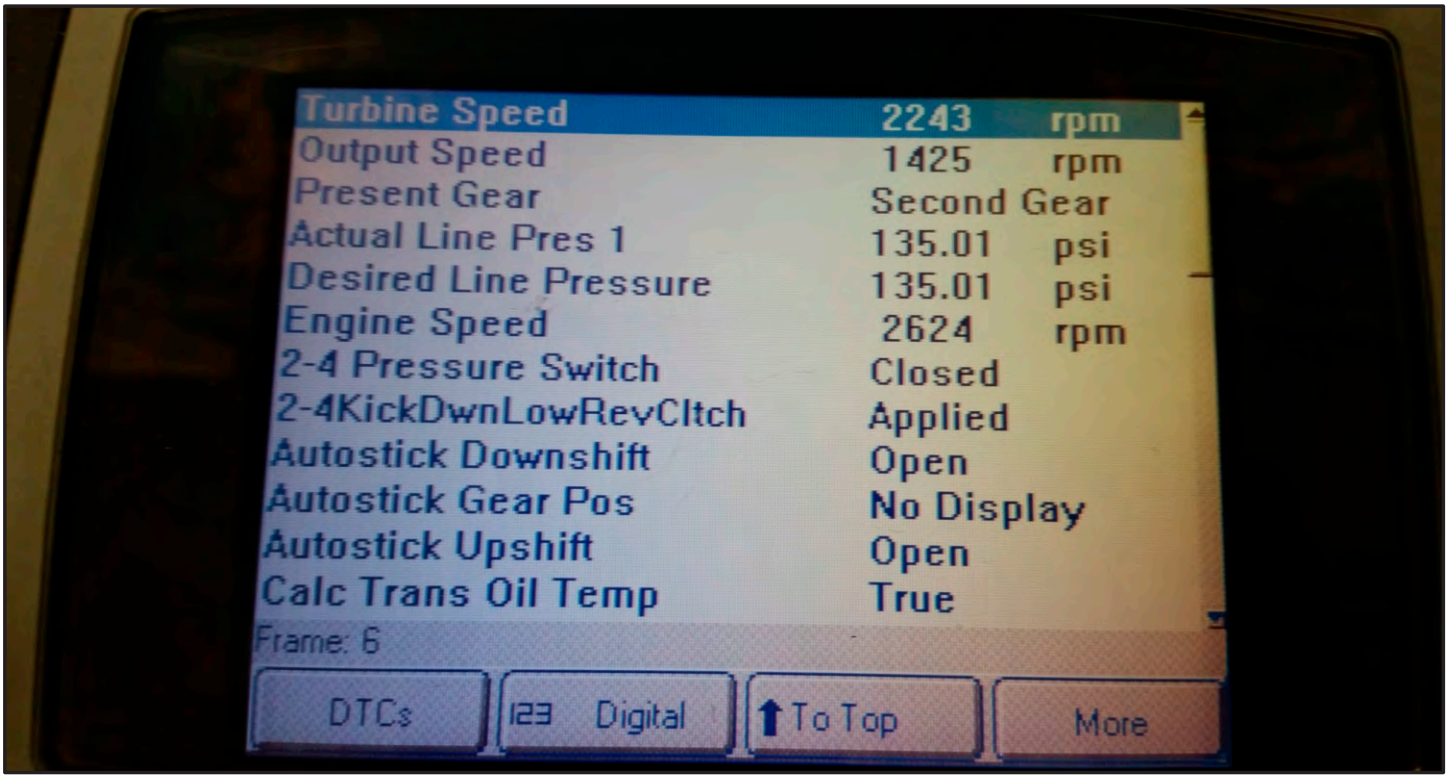

Figure 2

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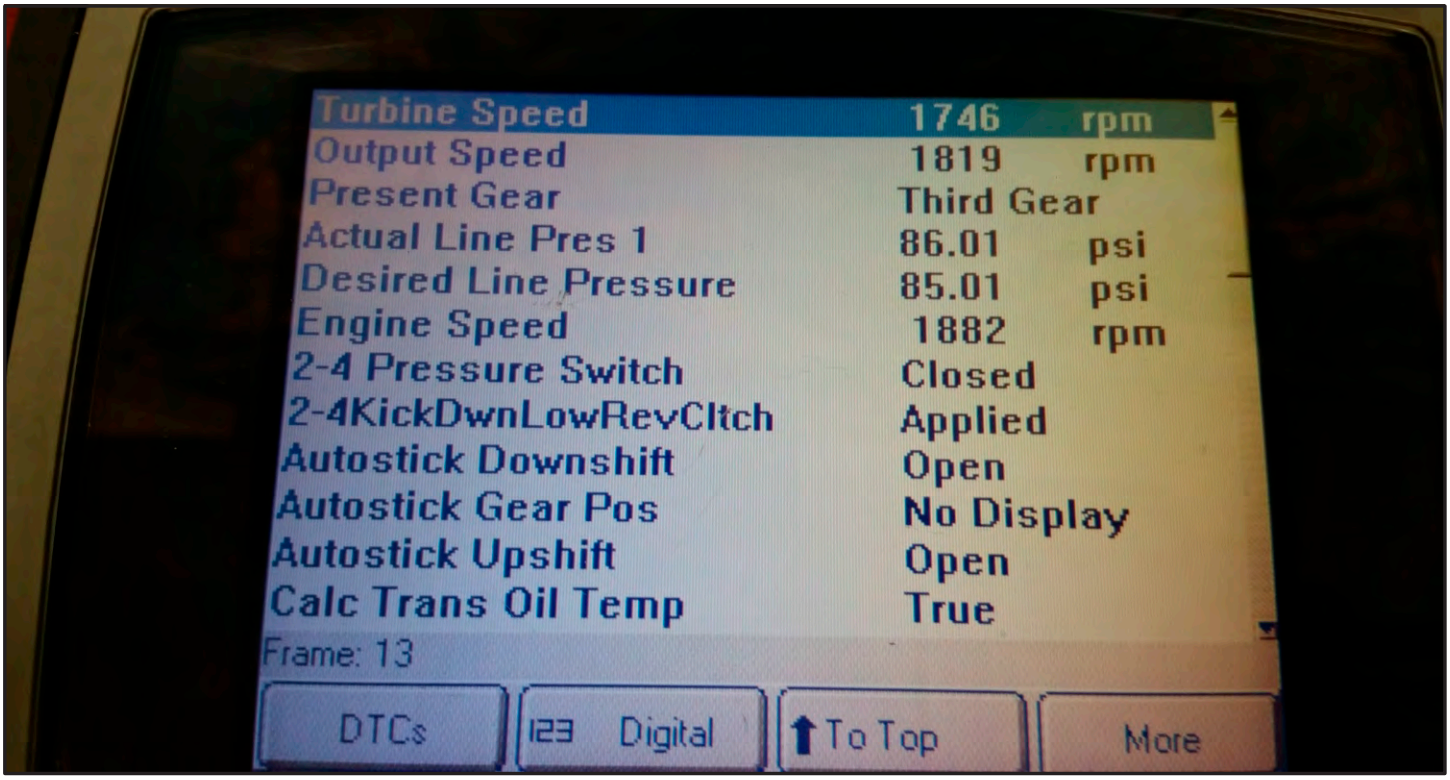

Figure 3

Figure 4

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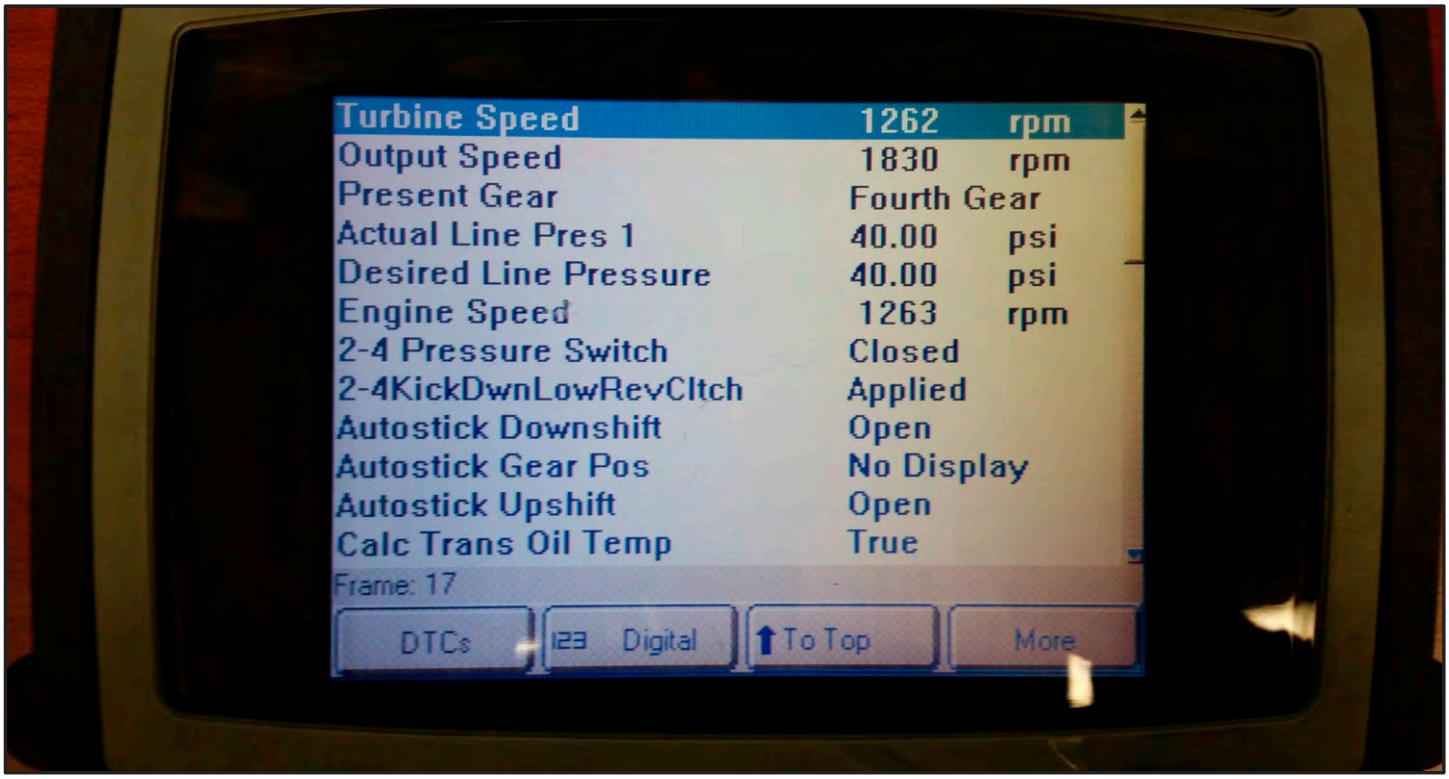

Figure 5

In drive with the brake applied approximately 5 % duty cycle is observed.	Duty cycle increases slowly with speed as it shifts through first and second gear then jumps to 25% duty cycle upon the 2-3 shift.	Approximately 30 % duty cycle and above can be seen while driving in 4th gear with TCC applied	Under certain driving conditions, duty cycle went as high as 62% during a 2-1 coast downshift

Note: Meter is set to observe negative duty cycle which shows solenoid "On" time

Figure 6