



Technical Information...

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Transmission Diagnostics Using Pressure Gauges

A pressure gauge was once a tech's main diagnostic tool. Pressure gauges can check pump capability, line rise, pressure regulator & pressure boost valve operation, and minimum/max line pressure. You can see a crack in a filter neck on a pressure gauge without pulling the pan & with help from a pressure gauge, you can get an idea if non OEM frictions were used during a rebuild, causing harsh up shift!

Part of the reason that pressure gauges have been pushed to the back of a toolbox is that scan tools have become the diagnostic item most techs first reach for but some scan tools show a pressure command that's mistaken for pressure data from a transducer. Some Chrysler transmissions, like 45RFE, 545RFE, & 42RE-48RE series have pressure data from a transducer. Most other transmissions have no input to the PCM from a transducer. What you see is a command from the PCM to the EPC solenoid. This command should be the same as the pressure on the gauge. If it is, the EPC solenoid, pressure valves & pump are working correctly but just because you see commanded pressure on a scanner, don't assume pressure in the transmission will be the same.

A few transmissions do not have any pressure taps. The Mercedes 722.6 transmission is one example. Yet many manufacturers offer pressure taps for every clutch circuit. This is the best situation as you can isolate individual clutch circuits & compare them with line pressure to see if a clutch circuit has a leak. **Use a pressure gauge under the following conditions:** 1.) *When you feel slip or flair on engagement, take-off or shift & when you have delayed or harsh engagements/shifts.* 2.) *Some transmissions have converter charge & TCC release pressure taps which can be useful in finding converter clutch slip problems.* 3.) *On a good transmission to find out exactly what the pressures should look like.* 4.) *On older models with governors if you have a shift timing concern.*

Always use a gauge rated for more pressure than the max pressure you expect. When possible, pressures should be taken on a road test, not on a lift. There's no way a transmission can be loaded down on a lift like it is on road test conditions. Avoid bringing the pressure gauge in the vehicle. Tape it to the windshield or have an assistant hold it outside of the vehicle on the test drive (it's easier to wash the outside of the car if the gauge ruptures). Route gauge hose away from heat sources, (exhaust pipes & manifolds), & moving parts (drive shafts, axles, fan blades & linkage). When necessary to have hood ajar during a road test, secure safety catch by using a piece of rope/plastic tie to secure hood. Keep a pair of side cutters with you in case you need to open the hood quickly.

Let's talk about where pressure is coming from & the oil volume at the tap. Most line pressure taps don't have restrictions & oil is coming from the pressure side of the pump or directly off the pressure regulator valve. With no restriction before the tap, you can get a good idea of line pressure even if one of the clutch or band circuits has a leak. Most band & clutch circuit taps are located between the orifice that feeds the circuit & component that's being fed, meaning you have a finite amount of oil that can leak at this circuit. Oil circuit diagrams for the transmission type being tested will show location of pressure taps & restrictions or orifices in oil circuit. For example: you have a .065" orifice feeding a clutch & the clutch piston lip seal was cut during assembly. When the clutch circuit is fed (no matter how much pressure is feeding it), the clutch pressure gauge will read zero or close to zero because the leak is greater than the amount of oil being fed to the circuit. The line pressure gauge will show a small drop in pressure because the line pressure tap is supplied with a huge volume of oil compared to the volume of oil that can get through a .065" hole feeding clutch circuit. This is why clutch taps are so important! ***You'll know there's a leak in a clutch circuit, if pressure difference between the clutch circuit and line pressure is more than 10%.*** A small leak or difference in pressure is normal because sealing rings don't seal perfectly. The last time you air checked hydraulic components through the case before installing the valve body; did you hear a little air escaping during the check? What you heard was the "0 - 10% of normal leakage."

To check pump capability, check minimum line pressure, then max line pressure at fast idle. On electronically controlled transmissions disconnect the EPC solenoid. If pressure rise is controlled by linkage or cable, move it to max pressure position. If pressure rise is controlled by a vacuum modulator; disconnect the vacuum to get max pressure. No matter which system you have, once you create the conditions for max line you should see the maximum line pressure for that transmission at a fast idle.

Please note: "gauge fluctuation" is usually caused by one of two problems: 1.) a crack in a filter or air leak on suction side of pump resulting in a wildly fluctuating gauge because air compresses & fluid doesn't. When air is compressed by the pump, pressure goes down & when pump gets a gulp of ATF pressure goes up causing gauge to rapidly bounce. 2.) A broken pump vane ring causes pump vanes to move away from the slide under heavy demand. Both of these situations are usually accompanied by a whining noise.

When using a gauge to find harsh shift problems, watch line pressure leading up to harsh shift. If pressure is normal until *after* shift is commanded, there's a leak in the component that's applying, or the wrong (non OEM), frictions or fluid have been used. Not all frictions have the same characteristics; one brand may apply quicker than another. It's best to use OEM brand frictions & correct fluid type. Many vehicles use the PCM to monitor time it takes for gear ratio to change during shift. When gear ratio doesn't change in time expected, the PCM jacks up line pressure to get clutch or band on. On the other hand, if pressure is high before shift is commanded, suspect pressure control system or bad input to PCM is causing high line. The key is to look at PCM command. If pressure is being commanded high look outside of transmission. If command is for normal pressure, look inside transmission.

When checking governor pressure for timing, use a 0 to 100 PSI gauge. Other gauges aren't sensitive enough to let you see lower pressures in governor oil circuit with accuracy. Most transmissions have about 1 lb. of governor pressure for every mile per hour of speed. There are exceptions, Mercedes and many diesel engine vehicles are different. Check specs for the vehicle you're working on.

Some transmissions need special adapters to attach a pressure gauge. Dodge 45RFE and 545RFE require an adapter for a gauge and a spot to install transducer too, so the PCM doesn't go to failsafe without transducer in the loop. Many imports need an adapter to attach a pressure gauge. An import transmission pressure adapter kit is inexpensive & can be purchased through your parts supplier.

Using a pressure gauge can help you diagnose hydraulic problems quickly, saving you time, money and aggravation. Let's dig out that pressure gauge and hook it up to some transmissions and make pressure testing part of your diagnostic routine!

"We Build Them So You Don't Have To."