Taking Control of Lockup on Ford's Torqshift Transmission

It's been a few years now and we're becoming more familiar with Ford's Torqshift transmission. Early on we were told that it was suppose to be called a 5R110; after awhile the boys at Ford changed their minds and told us that now and forever more it'll be called a Torqshift.

In this edition of Fun with Transmissions, we'll look at the lockup system: how it works, and what we can do to find out what's going on when it doesn't work correctly.

The two basic issues are:
1. the converter won't lock up, or…
2. the converter is locked up all the time and kills the engine when you put the transmission in gear.

In the case of no converter lockup, we first need to road test the truck to make sure the computer is commanding lockup. Your scan tool must be able to communicate with the CAN bus system. If your scan tool isn’t adapted to communicate with the CAN bus system, the information you get may be incomplete or altogether wrong. For more information about CAN systems and how they operate, refer to the August 2004 edition of GEARS Magazine.

With the scan tool connected, check the amount of TCC slip the computer is reading. Some scan tools may have a parameter that reads TCCMACT. This translates to Torque Converter Clutch Modulated Actual. This is Ford's designation for TCC slip. Some scan tools may read TC_SLIP. When the computer commands lockup, look for the slip number to go down as the TCC_PSI parameter goes up. The TCC_PSI parameter on the scan tool isn’t really a pressure reading; the transmission doesn’t have a sensor to read actual pressures. Rather, the TCC_PSI parameter is actually a calculated value, based on the amount of current the computer is sending to the TCC solenoid.

This particular scan tool only provides TCC_PSI. Different types of scan tools may display the current to the TCC solenoid. If that’s the case, current should vary from 0.01 to 1.0 amp. The higher the current, the more the converter should be locked up.

Back to the Road Test

The truck I used for this article achieved lockup at about 41 MPH just about every time. Some people say it may be a few MPH higher; others say a few MPH lower. But in general, lockup should occur between 35 and 45 MPH.

Figure 1 shows lockup starts at 0 TCC_PSI at 41 MPH and ramps up to about 111 TCC_PSI — where the TC_slip is 0 RPM — at 43 MPH. It may seem as though 2 MPH is a long delay for the transmission to achieve full lockup, but at that speed it only takes a couple of seconds to get there, and the TCC apply feel is nice and smooth.

So that’s how it goes when all is working well. In fact, I highly recommend that everyone out there in transmission land take a ride in a vehicle that’s working properly, so you know what the unit should feel like.

| (-)12 RPM................. | 1613 | TRANS DATA VSS (MPH)........ | 41 |
| OSS_SRC.................. | 2205 | TCC_PSI....................... | 0  |
| TC_SLIP................... | 390  | TSS_SRC.................... | 1572 |
| (-) 02 RPM................. | 1613 | TRANS DATA VSS(MPH)........ | 43 |
| OSS_SRC.................. | 2268 | TCC_PSI....................... | 56 |
| TC_SLIP................... | 0    | TSS_SRC.................... | 1613 |
| 009 RPM................... | 1658 | TRANS DATA VSS(MPH)........ | 44 |
| OSS_SRC.................. | 2306 | TCC_PSI....................... | 111 |
| TC_SLIP................... | 1    | TSS_SRC.................... | 1661 |
What to Do If All Goes Wrong

During the road test, this 2004 F450 6.0L diesel works fine in all the forward ranges, but the driver can’t feel lockup. As with all electronically-controlled transmissions, you need to determine whether the problem is inside or outside the transmission.

On this particular unit the technician replaced all the solenoids, including the TCC solenoid, so chances are the solenoid isn’t the problem.

A road test with scan tool shows the TCC_PSI goes up to about 111 PSI at about 43 MPH, but the TC_slip doesn’t go down much, if at all.

Right about now many technicians would be guessing the torque converter is at fault, and would start removing the unit on a guess.

How’s It Work?

Before we go any further, let’s look at exactly how the lockup system works.

The lockup valve begins in the off,

![Figure 2](image-url)
To Lockup or Not to Lockup, that is the question.

The lockup solenoid receives line pressure from the manual valve whenever the engine is running. Because the lockup solenoid is normally closed, the oil is blocked from reaching the lockup valve.

When the computer energizes the lockup solenoid, fluid flows to the lockup valve (Figure 3). This causes the valve to stroke and dump converter release oil, allowing lockup to take place. It's really just that simple.

Here's a quick method for testing the pump and converter at the same time, using a tool you can build in 3 easy steps, from an old TCC solenoid:

Step 1: Bend the 4 tabs back with a screwdriver (figure 4).
Step 2: Remove the solenoid parts (figure 5). It isn’t necessary to remove the allen screw and spring from the tip.
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If the engine stalls with the test tool in place, the converter clutch and lockup valve are working properly.

Now you’re ready to put your new tool to work on the transmission:
• Drop the pan down and replace the TCC solenoid with the tool (figure 8).
• Replace the pan and the fluid….and you’re ready to go.

I’ve done this procedure and it takes only 20 minutes, if that.
CAUTION: This will engage the TCC all the time, and in all ranges. If the torque converter and pump are operating properly, the transmission will kill the engine as soon as you put it in gear. Engaging the transmission with the TCC applied will be very hard on the TCC lining, so keep your testing to a minimum.

If the engine stalls with the test tool in place, the converter clutch and lockup valve are working properly. We already know the computer signals are correct. At this point, there’s one likely problem: The brand new TCC solenoid isn’t functioning correctly. But then, who’s ever heard of a brand new solenoid failing?

What if the engine doesn’t stall with the test tool in place? That leaves very few possibilities: Either the lockup valve is completely stuck or is installed incorrectly, or the torque converter has a serious internal problem.

Another possibility I’ve heard about — but only once! — is a small piece of debris can fall into the solenoid feed orifice (figure 9) and block fluid from reaching the solenoid. In this case, the converter will never lock up, even with the tool, because there’s no fluid to the solenoid. Be sure to check and clean the orifice to prevent this from happening.

The Engine Stalls in Any Gear

This is the exact opposite of the first problem and, once again, we can use an old TCC solenoid to make a test tool. But this time we don’t have to disassemble the TCC solenoid completely:
Step 1: Remove the end cap (figure 10).

Step 2: Use a 4mm allen wrench to remove the screw and spring from the tip of the solenoid (figures 11 & 12).

Step 3: Install checkballs into the solenoid snout to block the solenoid; then reinstall the allen screw (figure 13).

The idea is to block the valve in the solenoid. This will physically shut off fluid flow to the TCC valve in the pump.

Just as before, drop the pan and replace the TCC solenoid with the modified solenoid. If the engine still stalls when put into gear, the problem is internal. The converter may be seized up internally or the valve in the pump would have to be completely stuck in the lockup position. Either way, the transmission has to come out of the truck.

Torque converter clutch problems do occur from time to time and it helps to have the tools to make a positive diagnosis so you know for sure you’re making good use of your precious time. Once you know what’s going on and are moving in the right direction, it becomes easy to have Fun with Transmissions!

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