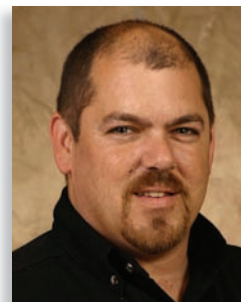


The 4L30E Grows Up... and Gets a PWM TCC



by Larry Frash

Non-PWM Bellhousing



Figure 1

PWM Bellhousing



Figure 1A

One thing to keep in mind is that when a non-PWM 4L30E is installed in a PWM vehicle, lockup will totally disengage during or slightly after the 3-4 upshift.

Like many other automatic transmissions, the 4L30E began its life with an *on-off* style lockup. In the 2000 Trooper, the 4L30E was redesigned to use a PWM (pulse width modulated) lockup, allowing for smoother applies throughout its operation. In this edition of *Transmission Therapy*, we'll cover these changes and some of the problems that we're seeing in these applications. We'll also look at what each valve does to create a proper lockup apply.

To convert the 4L30E transmission to a PWM lockup, changes were made in the bellhousing (figure 1), wear plate (figure 2), pump body (figure 3), and the TCC solenoid (figure 4). These PWM parts aren't interchangeable with non-PWM parts. But you can

bolt a complete bellhousing and pump assembly to a non-PWM transmission to convert it to a PWM TCC, as long as you install a PWM solenoid.

Electrical Operation

The 2000-up Trooper PCM creates a different signal to control lockup apply. Instead of turning the TCC fully on for lockup, the 2000-up Trooper PCM creates a duty-cycled signal to apply the converter clutch slowly. It's not uncommon to see a duty cycle as low as 30-40% at slow speeds under light throttle operation, and 40-80% at high speeds and heavy throttle operation. The duty cycle will also be low during a 3-4 upshift. The converter will be allowed to slip during the upshift to soften the shift; think of it as sort of a

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Non-PWM Wear Plate



Figure 2

PWM Wear Plate



Figure 2A

Non-PWM Pump body



Figure 3

PWM Pump body

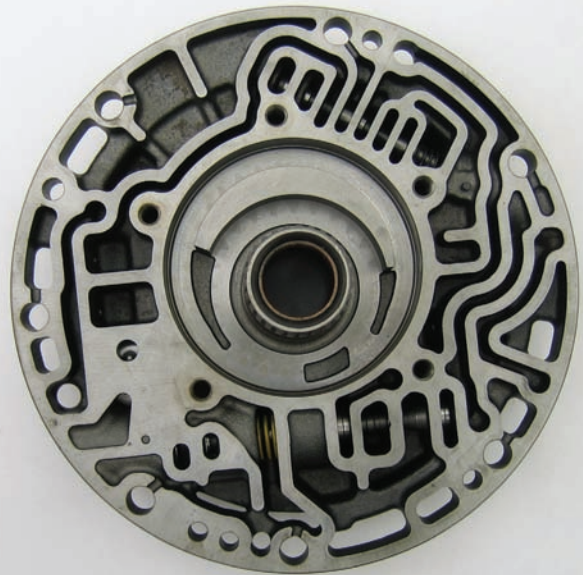


Figure 3A

partial lockup.

One thing to keep in mind is that when a non-PWM 4L30E is installed in a PWM vehicle, lockup will totally disengage during or slightly after the 3-4 upshift. This can create what feels like a 3-4 flare. This is one reason you should never install a non-PWM 4L30E in a PWM vehicle.

Valve Changes

When the 4L30E was converted to a PWM TCC, they made several changes to the pump body; it now holds four valves (figure 5) instead of the earlier

two. We'll look at the function of these valves later, in the hydraulic section of this article. For now let's look at a few things to check during a rebuild.

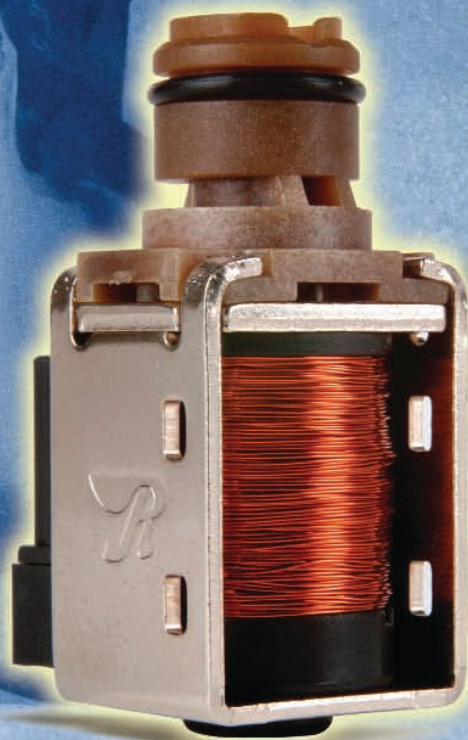
The end plug for the lockup valve has an o-ring to seal TCC solenoid pressure. Always replace this o-ring during the rebuild. If this plug leaks, TCC solenoid pressure can leak, causing the TCC to slip or preventing it from applying at all.

It's common for the TCC regulator valve sleeve to wear; when that happens, it can cause converter clutch apply pressure to go either high or low.

If the pressure fails high, it will cause a harsh converter clutch apply. But the more common problem is when the converter clutch apply pressure fails low. This can cause the converter clutch to slip excessively, setting converter slip codes and damaging the torque converter.

Hydraulic Function

Let's look at the components that make up the PWM TCC system for these units, and see how each one works to control the converter clutch operation.



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Non-PWM TCC Solenoid



PWM TCC Solenoid



Figure 4

PWM Solenoid

The PWM TCC solenoid is normally closed, and opens when energized. It's a flow-through solenoid, so TCC apply pressure increases as duty cycle increases.

Solenoid resistance is just 9–14 ohms, as opposed to the earlier, on-off solenoid, which had 17-24 ohms resistance. It's important to be sure you're using the right one for the unit and vehicle you're working on.

Mainline Regulator Valve

The mainline regulator valve regulates line pressure (figures 6 and 7). When the valve is regulating it supplies oil to the converter charge circuit. This oil is supplied to the TCC enable valve

and the lockup valve.

TCC Enable Valve

When the TCC enable valve is in the non-lockup position (figure 6), it supplies converter charge pressure between the deepest part of the bore and land number 4 of the lockup shift valve. This prevents the lockup shift valve from upshifting into the lockup position. When the TCC solenoid begins to supply pressure to the circuit, one of the things this pressure does is to shift the TCC enable valve into the TCC enabled position (figure 7). This exhausts the pressure that prevents the lockup shift valve from going into the lockup position. It's not uncommon for this valve to stick, so always remove it during the rebuild.

TCC Regulator Valve

When the TCC solenoid is off and supplying zero pressure to the circuit, land number 1 of the TCC regulator valve blocks line pressure from entering the TCC regulator valve (figure 6). As TCC solenoid pressure increases, it supplies pressure between the deepest part of the bore and land number 2 of the isolator valve. This forces the TCC regulator valve to a position that allows line pressure to enter the circuit (figure 7).

The valve has a small hole that delivers this pressure between land number 1 of the TCC regulator valve and the deepest part of the TCC regulator sleeve. This pressure pushes the valve back to block line pressure from entering the circuit and makes the valve regulate TCC apply pressure.

The higher the TCC solenoid pressure is, the higher the TCC apply pressure becomes. So the higher the TCC solenoid duty cycle is, the higher the TCC apply pressure will be.

Lockup Shift Valve

In the non-lockup position, the lockup shift valve supplies converter charge pressure to the converter clutch release circuit (figure 6). From there, the oil is sent to the area between the converter clutch and the front cover of

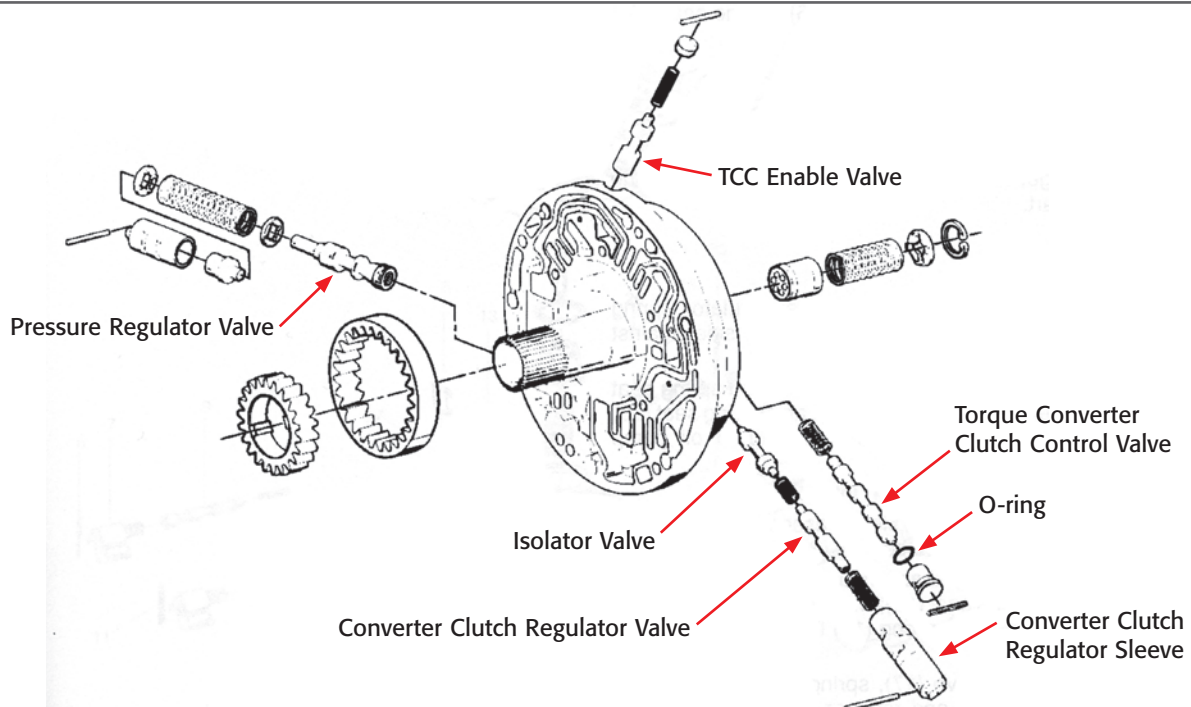


Figure 5



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the converter. This oil prevents the converter clutch from applying. Then the oil is forced back through the converter apply circuit, through the lockup shift valve, to the cooler. When TCC solenoid pressure is high enough, the lockup shift valve will move into the lock-up position (figure 7). In this position, three things happen:

1. The converter release circuit flows past land number 4 of the lockup shift valve and exhausts through the TCC enable valve. This allows the converter clutch to apply.

2. Converter clutch apply pressure applies between land 1 and 2 of the lockup shift valve to the converter apply circuit. This pressure goes to the apply side of the converter clutch. Remember, the TCC regulator valve controls the apply pressure: The higher the TCC solenoid duty cycle is, the higher the converter clutch apply pressure becomes, so the firmer lockup apply will be.

3. Converter charge oil is sent between lands 2 and 3 of the lockup shift valve to feed the cooler and lube circuit.

As you can see by the hydraulic diagrams, this system is similar to the 4L80E lockup system. There are a lot of things that must go right for lockup to operate properly. The valves are prone to sticking and the TCC regulator valve sleeve tends to

wear. Because of this, always remove each valve for inspection during the rebuild.

Finally, be very careful replacing parts: If you mismatch anything, you'll create your own lockup problems.

Well that's it for this edition of *Trans Therapy*. I hope this cleared up any questions you may have had on the 4L30E PWM lockup system.

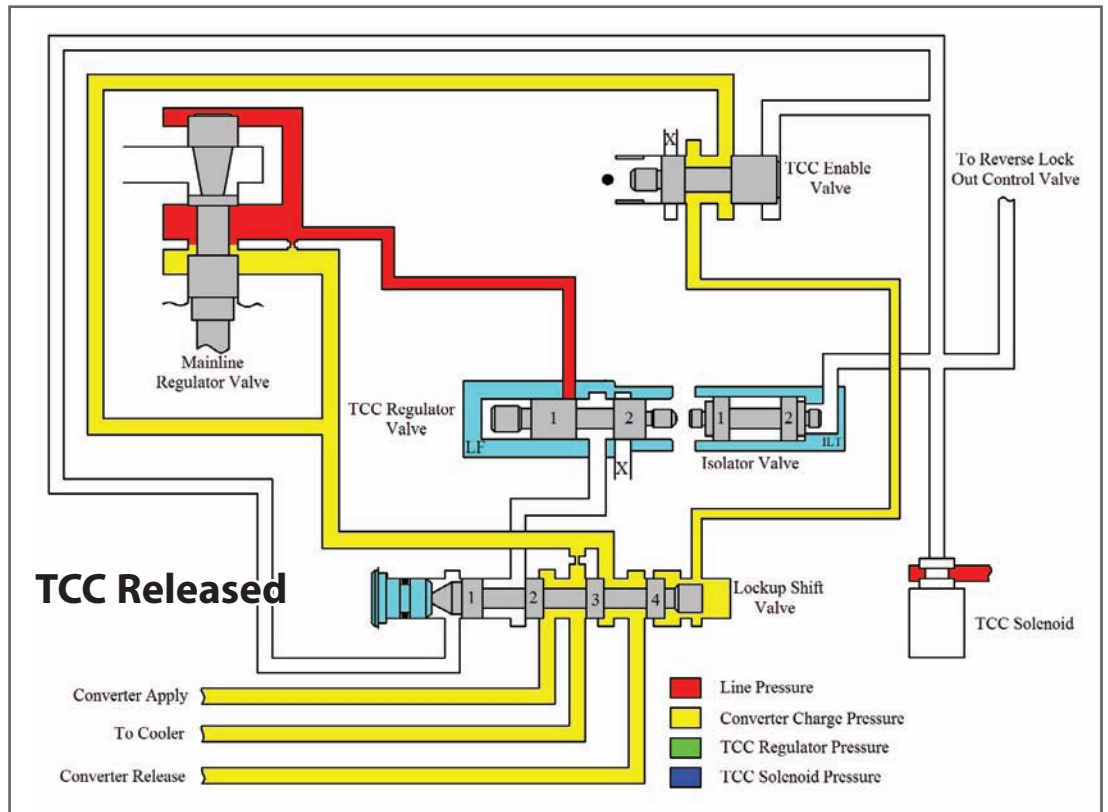


Figure 6

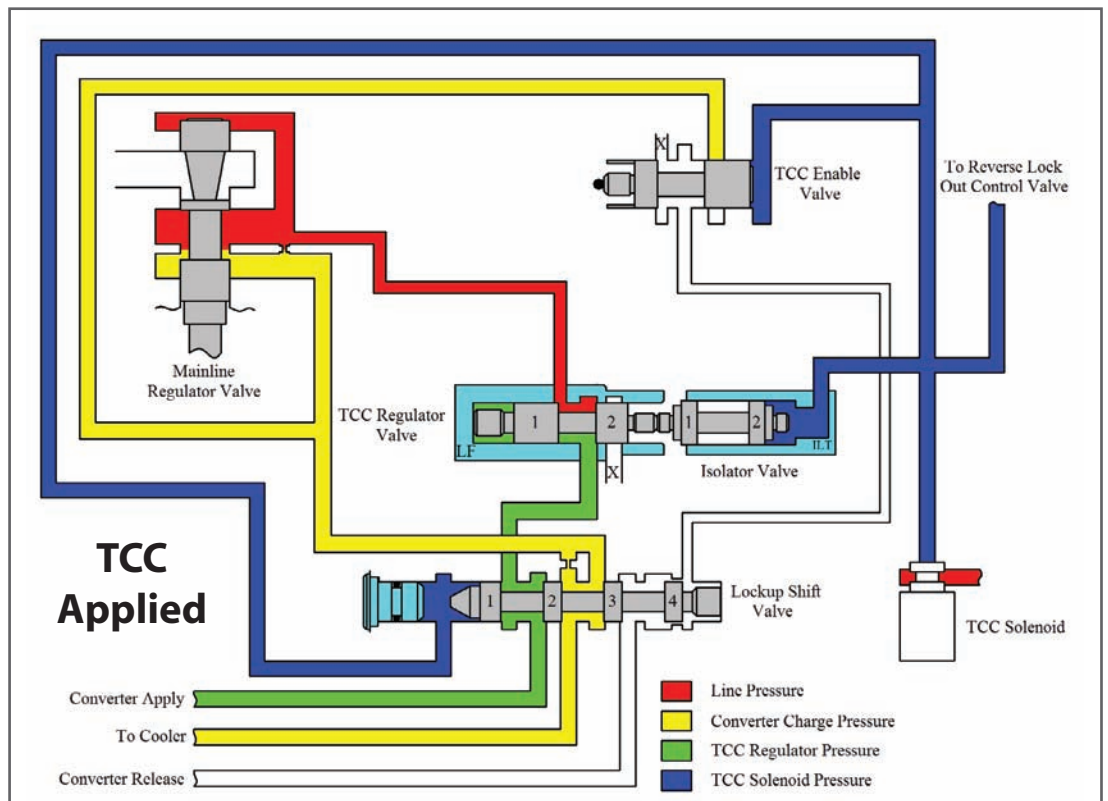



Figure 7

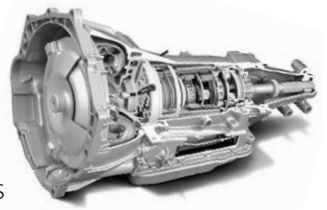


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