The More You Know About The 10R80… The Better Off You Are!

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Most of us have either seen or heard of the new 10-speed transmission Ford is offing behind the 2.3L EcoBoost, 2.7L V6, 3.5L EcoBoost, 5.0L gas, and 3.0L Power Stroke Diesel engines.

It’s been on the road for a few years, and we’re starting to see some common failures for this unit. Before we get started, let’s cover the basics.

The 10R80 transmission is a 10-speed, rear-wheel-drive transmission that is controlled by a PCM or a TCM. Ford is currently using this unit in the following vehicles:

- 2017- Ford F-150
- 2018- Ford Mustang
- 2018- Ford Expedition
- 2018- Lincoln Navigator
- 2019- Ford Ranger
- 2019- Ford Everest

The 10R80 has ten forward speeds, one reverse speed produced through the following components:

- Four planetary gear sets
- One mechanical One-Way Clutch (OWC)
- Six friction clutches
- A two-piece valve body with eight solenoids
- An external PCM or TCM

Shift Solenoids

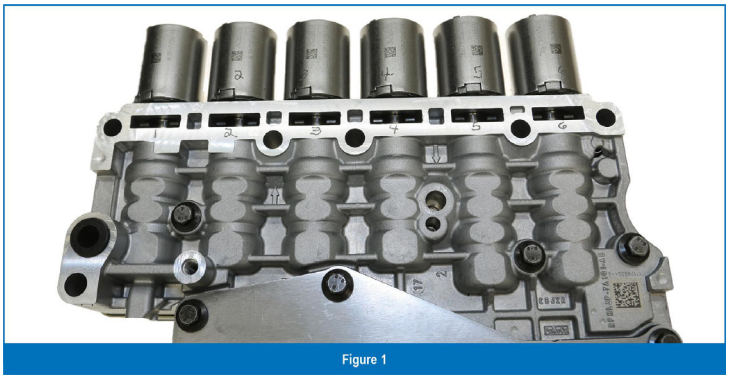
Figure 1

The 10R80 utilizes six shift solenoids that are listed by the factory as A-F and are linear force solenoids (Figure 1). You can scribe numbers on them from 1-6 if you choose for a quick reminder of their location. Unlike previous shift solenoids, they are mechanical in nature in that no transmission fluid passes through them (Figure 2).

The solenoids are calibrated from the factory and are not all the same. The *CIDAS* (Casting Integrated Direct Acting Solenoid) are all normally low solenoids. The solenoids can be replaced separately, but only with the same type of solenoid.

The replacement solenoid band number must match the band number of the solenoid being replaced. The band number is printed on the solenoids in the location shown and will be a 1, 2, 3, 4, or 5 (Figure 3).

Each clutch is controlled by a corresponding shift solenoid A-F. These solenoids are directly proportional in that zero current equals zero pressure, and maximum current equals maximum pressure.

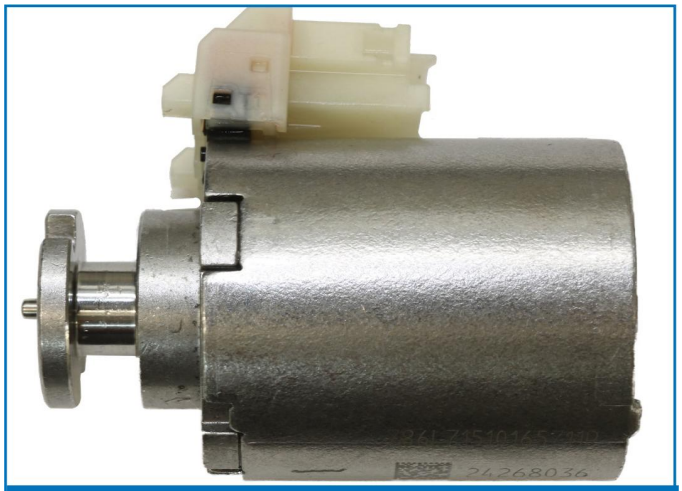
Figure 2

If the power circuit to the transmission solenoids fails open, then all solenoids are failed electrically off. None of the clutch packs can engage, and there is no fail-safe operation.

Upshift Gear Sequence:

At times the 10-speed transmission may skip gears when the vehicle starts from a complete stop. This is a normal and desired behavior. Ford describes their two different shift strategies as single and double step shifts.

At part pedal, when acceleration is brisk, single-step upshifts would result in very frequent shift events (a very short time in gear). Double-step (skipping a gear) upshifts results when a longer time is spent in gear. However, at light pedal or road load, single-step upshifts will occur.

The small 10-speed gear steps allow the engine speed to drop to lower values than it would in the 6-speed transmission, providing for the best fuel economy. In contrast, when the 10-speed transmission is at heavy or max throttle, the small steps keep the engine closer to the horsepower peak for the best performance.

Downshift Gear Sequence:

At times the 10-speed transmission may skip gears when the vehicle downshifts to a complete stop. This is a normal and desired behavior. The same shift strategy that is used for the upshift may be applied during a downshift.

Figure 3

There are five main inputs the vehicle uses for transmission shift strategy, they are:

1. Engine speed: Directly affects shift scheduling, Torque Converter Clutch (TCC) control, line pressure, and transmission diagnostics. Indirectly affects shift pressure control.

2. Engine torque estimate: Directly affects shift pressure control, TCC control, and transmission diagnostics. Indirectly affects shift scheduling and TCC scheduling
3. Accelerator pedal position: Directly affects shift scheduling, TCC scheduling, and transmission diagnostics. Indirectly affects TCC control and shift control.
4. Commanded engine torque: Directly affects shift scheduling, TCC scheduling, and transmission diagnostics. Indirectly affects shift control.
5. Brake pedal position: Directly affects shift scheduling and TCC scheduling

Adaptive Strategy

The Adaptive Learning Drive Cycle must be performed after any of the following procedures are performed:

- Transmission rebuild or replaced
- TCM replaced or reprogrammed
- Major engine work performed
- Air/fuel management adaptive values reset

Perform the adaptive learning drive cycle on a level road surface as follows:

1. Record, and then clear any DTC's
2. Drive the vehicle until the engine and transmission reach normal operating temperature.
3. Accelerate from a stop with light throttle (15%), ensuring that upshifts 1st through 8th occur at engine speeds between 1300-1600 rpm.
4. Continue to accelerate (may apply slightly more throttle after 7-8 upshift at 32-38 mph (51-61 km/h) until you achieve 55 mph (88 km/h) and the 8-9 and 9-10 shifts complete.
5. Brake very gently to a complete stop and hold the foot brake for five (5) seconds.
6. Shift the transmission to Neutral. Wait 1 second.
7. Shift the transmission to Reverse. Wait 2 seconds.
8. Shift the transmission to Neutral. Wait 1 second.
9. Shift the transmission to Drive. Wait 2 seconds.
10. Repeat Steps 3 through 9 six (6) additional times.

After the final step, place the vehicle in park and cycle the ignition key off. Wait 3-5 minutes before driving. Given the complexity of the TCM control strategy, the engineers made every effort to allow for partial operation of the unit under most failure conditions. When diagnosing this unit, it is very important to realize that the failure management programs built into the powertrain system may be a direct reflection of the customer's drivability complaint.

With this in mind, there are (3) major groups of failure management strategies that are used when certain diagnostic trouble codes are present. They are listed as Type A, Type B, and Type C diagnostic trouble codes.

Type "A" or "B" DTC Strategy:

The following drivability conditions will be present when this type of DTC is stored.

- Autostart / Autostop function disabled (if equipped)
- Grade braking disabled
- Manual Shift mode disabled
- Neutral Idle mode disabled
- Powertrain (engine) braking disabled

- Tap Up/Tap Down function disabled
- TCC Control disabled
- Transmission Adaptive Pressure Control and adaptive shift values Frozen

For a type “A” code, the MIL will illuminate after one drive cycle with the malfunction present. This is an immediate DTC that effects emissions. For a type “B” code, the fault must be present after two consecutive ignition cycles, otherwise, the MIL will not illuminate (however, a pending code will store). For both types A and B, a freeze-frame record will be stored in memory if the MIL illuminates.

Type “C” DTC Strategy:

The following drivability conditions will be present when this type of DTC is stored.

- Manual Shift mode disabled

When other diagnostic trouble codes are present, there can be different, specific drivability concerns caused by the failure management program. Concerns can range from any of the following:

- High line pressure (harsh shifts and engagements)

- No TCC command
- Early TCC command (harsh shifts)
- Limited shift range, skipping gears
- Reduced power mode

These drivability concerns can be mistaken for transmission malfunctions. *It's extremely important to scan all modules for codes and address those codes first!*

Let's talk about some of the concerns and fixes we have been seeing.

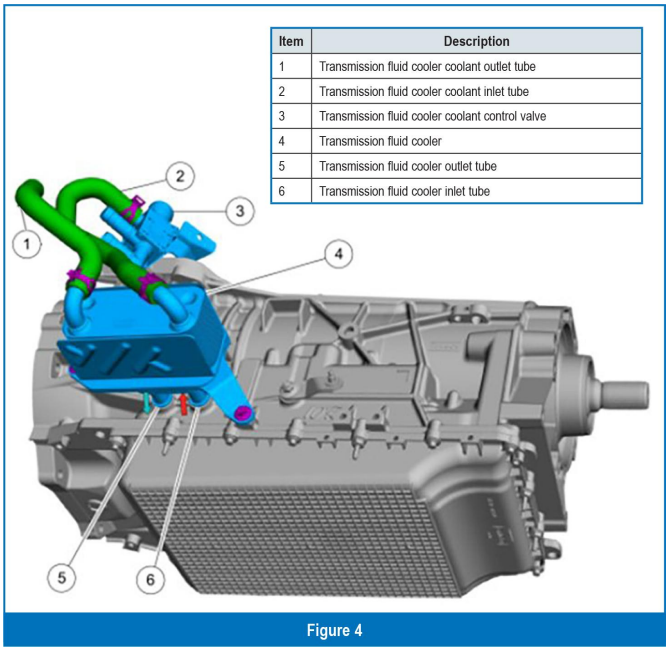

Figure 4

Transmission Warmer Failure

In 2018 and later models with the transmission warmer mounted to the transmission, there can be a concern with coolant leaking under the vehicle. The complaint is usually associated with the vehicle sitting for a while (after it has been running at operating temperature).

Inspect the warmer for damage and related lines for leaks (Figure 4). Note, all models will have a warmer. The location of the warmer and the routing of the hoses can vary widely. Most of the larger displacement applications will have an auxiliary oil-to-air cooler in the system as well. If the warmer is not mounted to the transmission, refer to factory information to locate it.

TCC Codes and/or TCC Failure

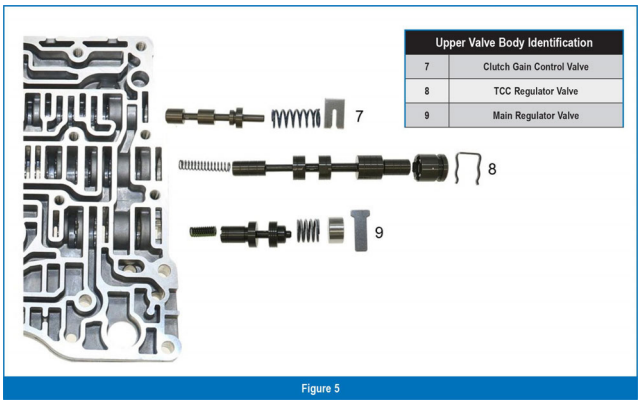

Figure 5

While working on a 2017-2018 Ford F150/Raptor, 2018 Expedition, Mustang, and Lincoln Navigator equipped with a 10R80 transmission, you may experience erratic TCC operation, or a TCC shudder concern. Codes P0741 or P1744 may or may not set in the PCM or TCM (depending on application).

These concerns may be caused by a sticking TCC Regulator Valve (Figure 5). You might run into a lack of valve body repair options. If that's the case, the valve body will have to be replaced to correct these concerns. If the transmission fluid is discolored or has evidence of debris in the fluid, it would be recommended to replace the torque converter and flush the system to complete this repair.

Erratic Shift Complaints, Valve Body Replacement

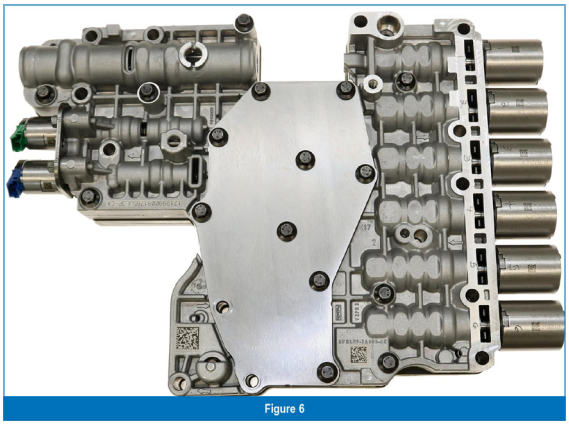
Figure 6

Complaints of erratic shifting, poor shift quality, missed shifts, and other shifting and TCC control complaints are becoming more common with these units. As these units accumulate more mileage, these concerns may become more frequent. There may or may not be codes associated with these complaints. The complaints may be difficult to duplicate.

First, check for updated programming for the TCM strategy. *About 80% of issues are cured by updating the programming*. After programming, perform the Adaptive Learning Drive Cycle and reevaluate the vehicle.

If concerns are still present, it may be necessary to service or replace the valve body assembly (Figure 6). Sticking valves and sticking CIDAS solenoids are becoming more common concerns with these units.

Pump Drive Gear Failure

A more recent issue with these units is pump drive gear failure (Figure 7). For now, the bulk of reported cases are related to diesel vehicles.

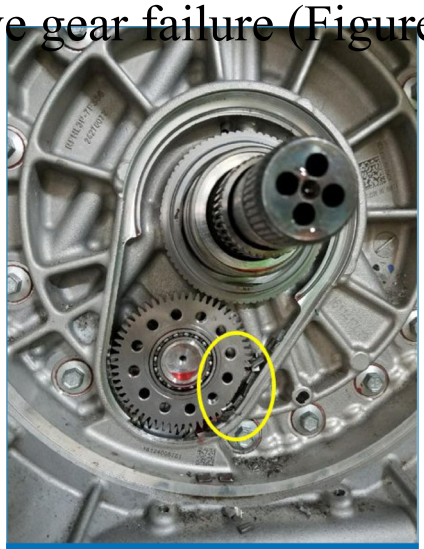
Figure 7

Note, some customers may complain of a converter type whine noise coming from the transmission. *Ford considers this to be a normal condition!*Since these are straight cut gears, they will tend to be somewhat noisy.

Always inspect the sump for possible evidence of debris that could indicate the pump drive gears could be failing.

As the 10 speeds continue to make their way into our shops, keep in mind the more you know about them, the better off you'll be.