

UPDATES TO THE FORD 6R80



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In this issue of *GEARS*, we're going to delve into the Ford 6R80 transmission and discuss some of the more recent and major changes that have taken place.

Ford began using the ZF6HP26 transmission in the 2005 Ford Expedition and Lincoln Navigator with the 5.4L engine. In subsequent years, this transmission, known as the 6R60/75/80, began showing up in Explorer, Mountaineer, F150, and Mustang vehicles.

The 6R60/75/80 automatic transmission provides six forward speeds using these components:

- a four-element torque converter which houses a multi-disc lockup clutch
- 3 driving clutches — clutches A, B, and E
- 2 brake clutches — clutches C and D
- a Lepelletier planetary geartrain

...and a valve body assembly fitted with a Mechatronic control unit, which controls all hydraulic functions through the electronic shift solenoids, to control garage shifting, shift timing, and shift feel. The Mechatronic module also includes an output shaft speed sensor (OSS), a turbine shaft speed sensor (TSS), a transmission fluid temperature sensor (TFT), and a transmission range sensor (TR).

In 2011, Ford revamped its engine lineup in the F150 series vehicles. Gone were the familiar 4.6L and 5.4L engines and instead, four new engines were offered:

- 3.5L Turbo V6
- 3.7L Ti-VCT V6 with twin independent variable camshaft timing
- 5.0L V8
- 6.2L V8

6R80 Clutch Application Chart

Clutch ID	Forward Clutch (A)	Direct Clutch (B)	Intermediate Clutch (C)	Low/Rev Clutch (D)	Overdrive Clutch (E)	Low DWC	TCC Clutch
Range				Applied			
P				Applied			
R		Applied		Applied			
N				^Applied			
D-1st	Applied					Hold	
D-2nd	Applied		Applied			Free	Applied*
D-3rd	Applied	Applied				Free	Applied*
D-4th	Applied				Applied	Free	Applied*
D-5th		Applied			Applied	Free	Applied*
D-6th			Applied		Applied	Free	Applied*

* TCC operation available in gears 2 through 6, dependant upon throttle position, transmission fluid temp and vehicle speed.

^ D clutch is applied until 3 mph, then it is released.

Figure 1

6R80 Solenoid Application Chart

Solenoid ID	SSE/SS1 ON/OFF	SSA/VFS1 (A) NL	SSB/VFS2 (B) NH	SSC/VFS3 (C) NL	SSD/VFS4 (D/E) NH	PCA/VFS5 NH	TCC/VFS6 NL
Range						X*	
P						X*	
R						X*	
N						X*	
D-1st		X	X		*X	X*	
D-2nd		X	X	X	X	X*	X*
D-3rd		X			X	X*	X*
D-4th	ON	X	X			X*	X*
D-5th	ON					X*	X*
D-6th	ON		X	X		X*	X*

X = Solenoid at high duty cycle approximately 850 mA

No "X" = Solenoid at low duty cycle is approximately 50 mA

X* = Modulated by the TCM used on engine load and driving conditions

*X = Solenoid at 50 mA then to 850 mA

(D Clutch is ON during engagement then it is released at 3mph)

NH = Normally High, solenoid is inversely proportionate in operation.

(When solenoid is inversely proportionate, high amperage exhausts clutch.)

NL = Normally Low, solenoid is proportionate in operation.

(When solenoid is proportionate, high amperage applies clutch.)

Figure 2

Along with these new engines, new features and changes were made to the 6R80. The biggest and most obvious change was the addition of a one-way clutch, designed to provide smoother 1-2 and 2-1 transitions, quicker downshifts, and improved fuel economy.



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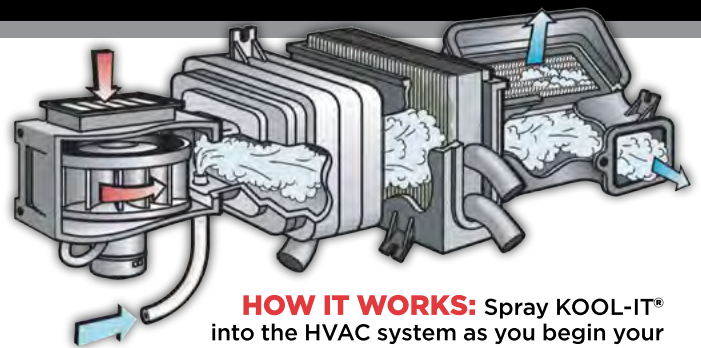
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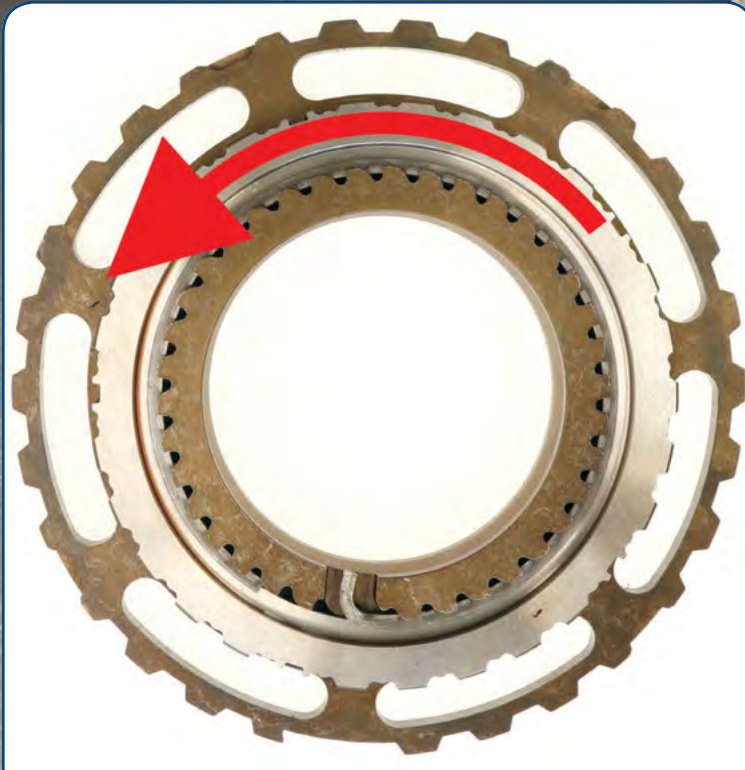


Figure 3

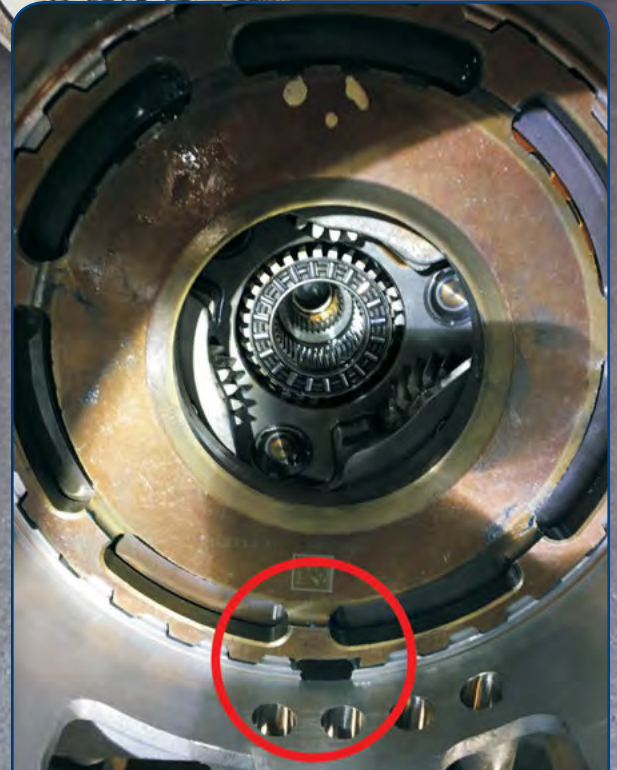


Figure 4

A new feature which might not be as obvious is the Automatic SelectShift capability, which shifts the vehicle automatically during normal operation, provides a progressive range select mode, and gives the driver complete manual control when desired. For progressive range select mode, a toggle on the shift lever lets the driver reduce the number of available gears in drive.

When the driver taps the toggle switch in the selector lever down into *range select* mode, an LCD screen in the dash indicates the available gears and highlights the current gear. This allows the driver to limit the use of upper gears when the vehicle is heavily loaded or while towing up and down grades.

For full manual control, the driver simply moves the selector lever into the M-range for manual mode and taps the toggle switch to select the gear up or down.

Let's take a look at these changes and features to see how they've impacted this transmission.

The addition of the one-way clutch required multiple changes to the transmission case, the C and D support and all of its components, and the rear planetary assembly. Changes were also made in the valve body, the molded lead frame, and the wiring harness, plus changes to the computer strategy for control of the D clutch.

In previous models there were a number of complaints of harsh 1-2 and 2-1 shifts which Ford tried to solve by updating the PCM calibration. In this unit, Ford added a one-way clutch to the rear planetary assembly to provide smoother



Figure 5

transitions from 1-2 and 2-1.

Adding the one-way clutch required changing the strategy for application of the D clutch and solenoid D (figures 1 and 2). In previous models without the one-way clutch, the D clutch applies throughout first gear. In the 2011-later models with the one-way clutch, the D clutch only applies until about 3 MPH; then the D clutch releases (figure 2).

In earlier models without the one-way clutch, SSD or VFS4 D/E clutch solenoid didn't energize until 2nd gear. In the 2011-later models with the one-way clutch, the solenoid turns on at about 3 MPH.

The SSD or VFS4 D/E clutch solenoid is a *normally high* solenoid. This means the solenoid receives low current



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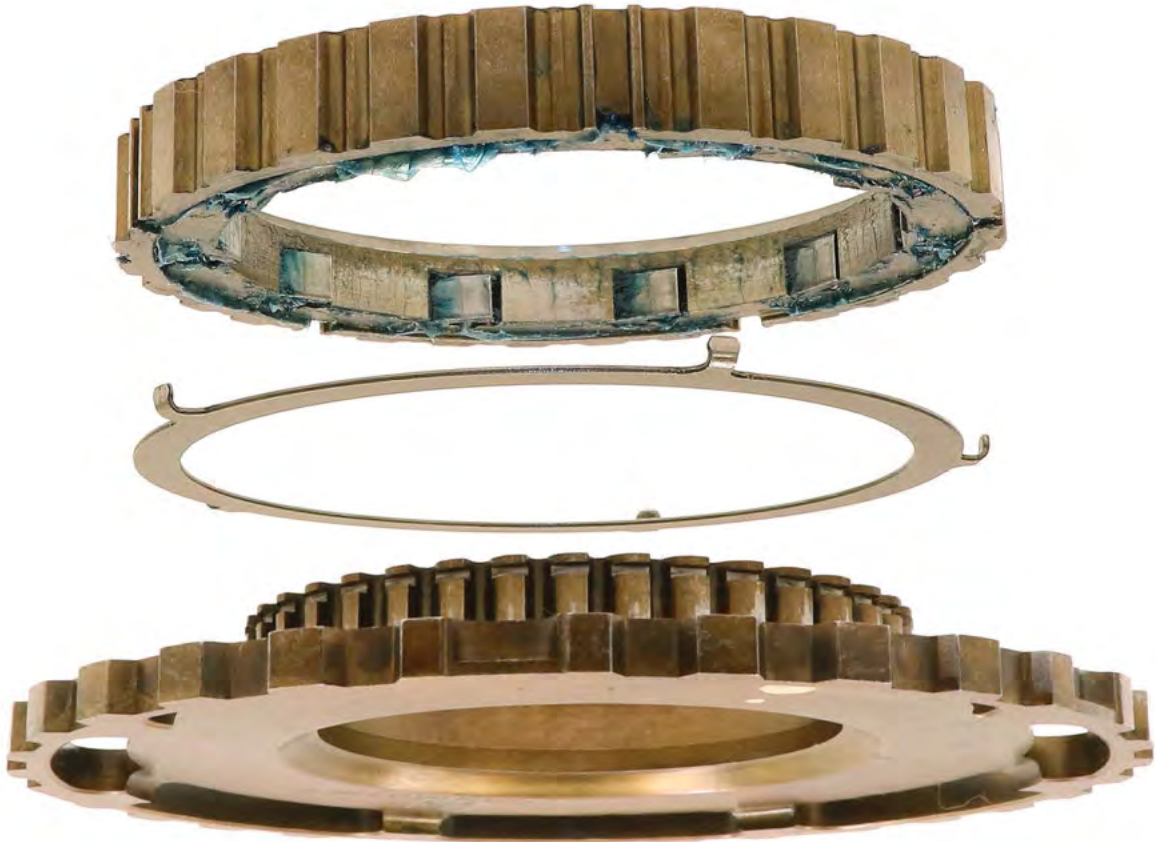


Figure 6

to apply the D clutch; about 50 mA. It releases the D clutch when the current is high; about 850 mA.

Modulating the D clutch release allows the one-way clutch to be the holding member. This helps cushion the 1-2 shift, since there's no clutch release during the shift. It also helps minimize 2-1 coastdown feel since the D clutch doesn't come back on until the vehicle is almost at a full stop.

The one-way clutch direction of rotation goes like this (figure 3): with the outer race facing upward, the outer race will freewheel counterclockwise and will lock clockwise.

Notice the lugs on the one-way clutch (inside the red circle) (figure 4): There's one missing lug on the inner race, which sits at the 6 o'clock position in the case. This area of the case is also the seat where the bias spring goes; more about that in a later issue.

If you disassemble the one-way clutch (figure 5, 6, 7), you'll need to install the springs and diodes into the outer race and hold them in place with assembly lube so the diodes compress the springs; otherwise it'll be difficult to assemble and install the inner race in the outer race.

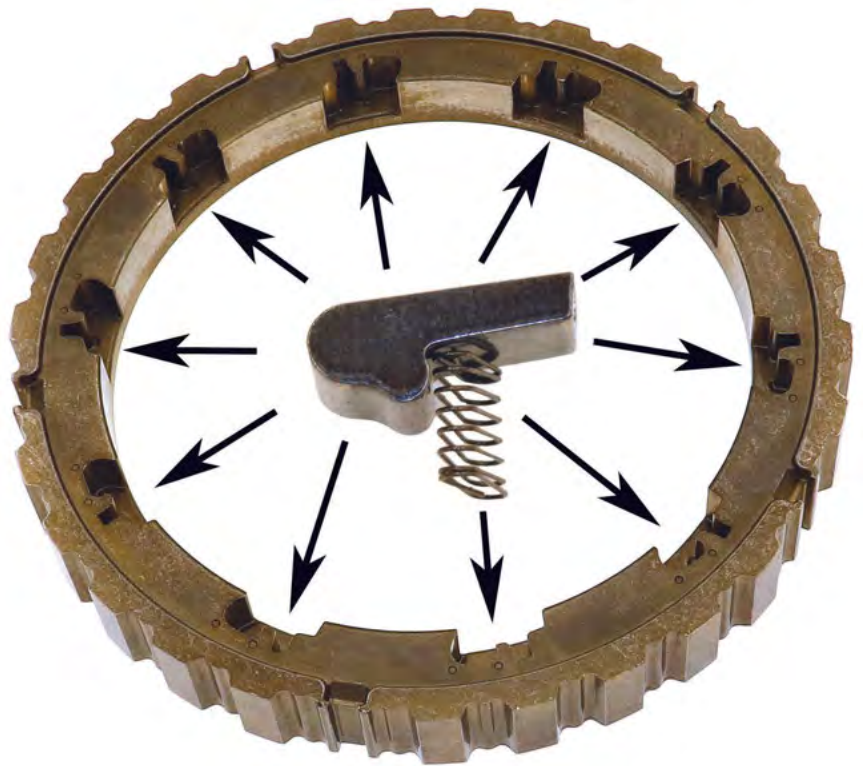


Figure 7

WITH One-Way Clutch



No One-Way Clutch



Figure 8

The one-way clutch also created the need for another dimensional change in the rear planetary carrier assembly (figure 8). Notice the difference in the height of the lugs between the two planetary carriers: The early planetary carrier *without* a one-way clutch had longer lugs; the late planetary carrier

with one-way clutch has shorter lugs, to provide room for the planetary carrier.

So far we've been looking at the 2011-later 6R80E. We've covered why changes were made and some of the dimensional changes that were required to outfit this transmission with a one-way clutch. We also covered some

of the strategy changes in clutch-and-solenoid application. In the next issue we'll cover the rest of the hydraulic and electronic changes; stay tuned!



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