Updating the ZF S6-650 Transmission

By Mike Weinberg Contributing Editor

The current drive for market share has driven the automakers to produce a greater variety of pickup trucks and sport/utility vehicles. Along these lines, the manufacturers have produced much heavier-duty light trucks than previously available. Ford has expanded the Super Duty line to include models from the F-350 to the F-450, F-550 and stripped-chassis vehicles up to 26,000 lbs. gross combined weight.

To make these trucks live up to their promise, ZF Industries developed a new 6-speed heavy-duty transmission. We wrote about the S6-650, which was introduced during the 1998 model year, in Transmission Digest in April 1999. ZF has just released the parts for this series of units to the aftermarket, and some updates and technical changes along the way now are available. After a short review of this unit, we will list the technical changes for you, as these transmissions will be showing up in repair shops around the country.

The S6-650 is manufactured in both 2WD and 4WD versions. It has six forward speeds, and all gears are synchronized. The unit is equipped with a "creeper" low gear, and 5th gear is overdrive. This is a large unit, capable of handling 530 lb.-ft. of torque. The gearbox weighs 230 pounds. A unique feature of this unit is an internal oil pump for lubrication and cooling. The gerotor-style oil pump in the front-case housing is driven from the front of the countershaft. Cooling lines run from the transmission to the oil cooler at the radiator, similar to those we are familiar with in automatic

transmissions. The unit uses 5.5 liters of synthetic MERCON ATF. Trucks with the S6-650 have been on the road long enough to be out of warranty, and the following updates and engineering changes will help you upgrade to the latest specs.

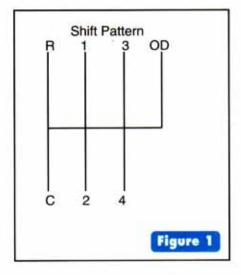
S6-650 Technical Changes

Intermediate-Housing Update (Center Support)

A relief groove was added in the main shift-rail bore of the intermediate housing, for clearance of the main shift rail. Without the relief groove in the housing, the main shift rail could become hydraulically locked and cause gear hop-out in 1st, 3rd and 5th gears. This change began with serial number 8217647, which was made on 3/23/00. The redesigned center support (intermediate housing) is now ZF part number 1319-301-047.

Update on 5th-Synchronizer Assembly

The 5th-gear synchro assembly is one-sided, as there is no gear. A snap ring is situated on the back of the synchro assembly as a guard to prevent excessive travel of the synchronizer keys (pressure pieces). The original-design snap ring had a large gap between the ends, which under the vibration of the diesel engines and heavy loads encountered in normal use could cause the ring to rotate to a point where one of the synchro keys no longer was covered. This could lead to a dislocation of the key, and notchy, dragging shifts into



5th gear. The snap ring was redesigned to be longer with only a small opening between the ends, so that the keys could not fall out through the opening. This fix was introduced with serial number 8129616 on 12/10/98. The new ZF part number for the improved snap ring is 0501-317-729.

Update on Main Detent Guide Bushing

A larger oil-relief groove was machined into the guide bushing that controls axial play for the main shift rail. Before the larger groove was installed, it was possible for the main shift rail to become hydrostatically locked during shifts into creeper low and reverse. Oil collecting in the bushing bore had no place to go and would prevent the shift rail from moving, as the fluid is not compressible. This engineering change was introduced with serial number 8141212 on 4/1/99. The new ZF part number for the guide bushing is 1319-306-050.

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up to standards

Updated Clutch Components for the \$6-650

The clutch fork has been redesigned, and Ford recommends changing to the updated clutch fork on ALL repairs. The Ford part number for the updated clutch fork is YC3Z-7515-BB.

A steel sleeve has been added to the throwout bearing (release bearing) to prevent premature wear.

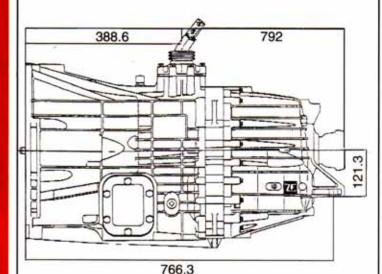
The updated release bearing is Ford part number FB1Z-7548-AC, and previous throwout bearings should be upgraded to the new part number on any repairs that require transmission removal.

Because of the intended heavy-duty use of these vehicles, there has been continuous upgrading of the clutch components. The latest disc was redesigned to

prevent cracking at the disc retainer. The new Ford part number for the improved clutch disc is YC3Z-7550-DA.

Figure 2

ZF S6-650 Synchromesh Gearbox



The ZF S6-650 Synchromesh gearbox was developed for light- and medium-duty trucks with a GCW of up to 26,000 lbs.

Listed below are the principal features:

- · Synchronized in all gears.
- · Low shift forces.
- · Tight shift pattern.
- Quiet high-contact ratio gears.
- Aluminum housing.
- Internal oil pump for lubrication and cooling

Installation Options:

- SAE or special clutch housings.
- Left ISO/SAE 6-bolt PTO.
- Output flange or voke.
- Direct-mount shifter with optional remote shift.

Illustration courtesy of ZF Industries Inc.

Revised Service Schedules

The following guidelines for service are based on "normal" driving conditions.

- Change transmission fluid every 30,000 miles.
- Lube requirement is MERCON XT-2 QDX or DDX equivalent.

Extreme driving conditions require oil changes every 15,000 miles. Extreme conditions are described as:

- Operating in hot weather (90° F.)
- Carrying heavy loads and driving hilly or mountainous terrain
 - · Operating a transmission-mounted PTO
- Operating at maximum loads on a daily basis
 - Sandy, dusty conditions.

Note: Driving in the normal stop-and-go traffic in major metropolitan areas should be considered extreme driving conditions.

THE BOTTOM LINE:

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- 87 Useful information.
- 88 Not useful information.
- 89 We need more information.

Input Torque (lbft.)								Mass (lbs.) with integral clutch Bellhousing	On
0.0	1st Gear	2nd Gear	3rd Gear	4th Gear	5th Gear	6th Gear	Reverse Gear	230	5.5
530 lb-ft.	5.79	3.30	2.10	1.31	1.00	0.72	5.23	1	1200