



Light-Duty Trucks And Heavy-Duty Transmissions

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The title sounds like an oxymoron; you know, like "jumbo shrimp." Stay with us and we will prove our point.

Traditionally the truck market has been divided into three distinct divisions: light-, medium- and heavy-duty. With the intense competition for truck and SUV sales among the automakers, those distinctions are starting to blur.

With vehicles that are larger, more luxurious and more high-tech than ever before, the truck marketers are searching to fill any niche to build sales. Bigger engines and heavier GVW ratings require stronger transmissions.

Ford introduced the Super Duty series several years ago and brought the pickup truck up to the F-450 level. Equipped with a ZF S5-42 5-speed trans, these vehicles were serious trucks. The S5-42 evolved into the S5-47, a trans with

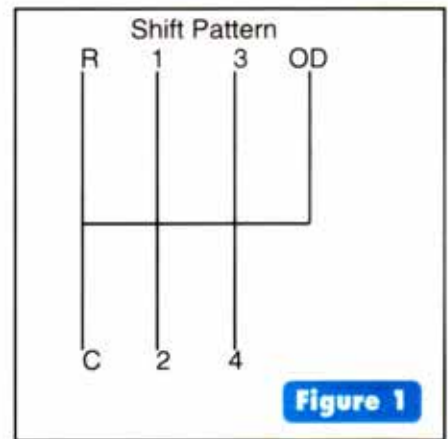
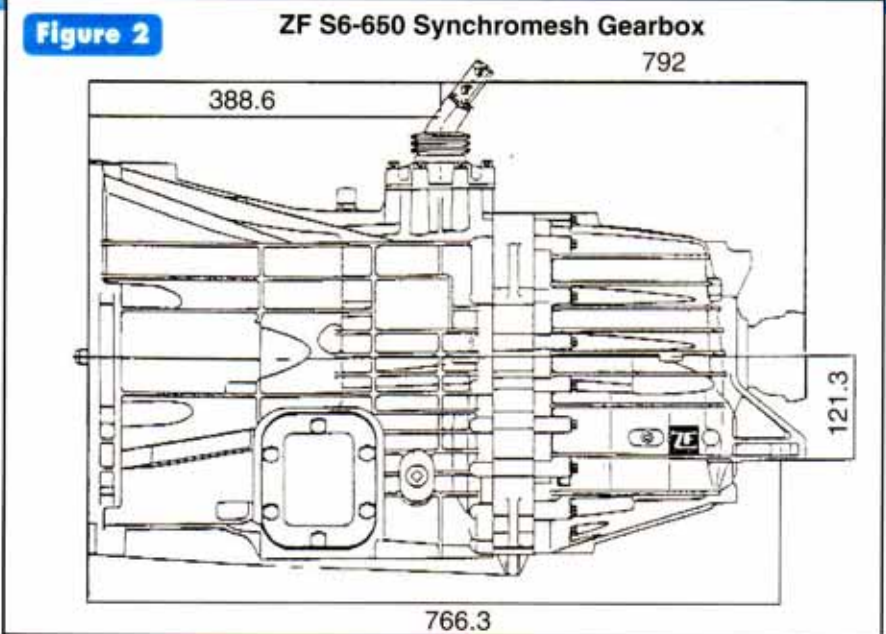


Figure 1

similar geartrain and a beefed-up case with higher torque rating to handle the demands of the "heavy-duty" trucks. Now Ford has raised the bar another notch and beefed up the Super Duty line again.

We now see F-250, F-350, F-450, F-550 and motorhome chassis equipped with a new 6-speed transmission. This ZF unit is designated the S6-650. ZF is no stranger to the medium- and heavy-duty market, having produced gearboxes that compete with Spicer and Fuller for the commercial-truck and bus market. This new 6-speed looks like something you would expect to see in a much larger truck.

The S6-650 has a "granny low" gear and an overdriven 6th speed. Figure 1 shows the shift pattern. The S6-650 is synchronized in all gears, with the synchros designed to minimize shift effort. The



geartrain is designed for quiet operation. The case is aluminum with an integral bellhousing, a center support and an extension housing. The unit uses 5.5 liters of

synthetic Mercon ATF and is equipped with an internal pump for pressurized lubrication and an external cooler to keep the internal

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Up To Standards

temperatures low for increased durability.

The S6-650 is rated at a serious 530 ft./lbs. of torque, and the unit weighs 230 lbs. (It comes with an HMO discount card good for one hernia operation.) All kidding aside, the size and weight of this trans demand careful attention to handling to prevent personal injury. The unit comes in two- and four-wheel drive and is provided with a power takeoff (See Figure 2).

Ratios are as follows:

- 1st gear 5.79-1 (creeper low)
- 2nd gear 3.30-1
- 3rd gear 2.10-1
- 4th gear 1.31-1
- 5th gear 1.00-1 (direct drive)
- 6th gear 0.72-1 (overdrive)
- Reverse 5.23-1

The geartrain is supported by tapered bearings, and, as usual, endplay and preload are critical.

The aluminum case will expand at a different rate from that of the steel components, and if you put one of these together on the loose side it will be really loose when the trans reaches working temperatures.

Do not use silicone to seal the mating parts of the cases. Ford Gasket Maker (part #E2AZ-19562-B) or the Loctite equivalent is used to join the cases. As in the past, life will be easier if you heat the gears and bearings during assembly (See Figure 3). You need a bearing heater (which could be a toaster oven with an accurate temperature adjustment) that will heat the parts accurately to 250° to 320° F. When this is done properly, the parts will fall into place. (You'll need a set of oven gloves to handle them.)

The S6-650 trans is no more

complicated to repair than the rest of the ZF line. You will need some essential tools to pull off the gears and bearings, a bearing heater and the service manual. For those shops not used to working with medium- and heavy-duty units, you will need some kind of lifting device to handle the unit and the assembled geartrain and center support. An overhead chain hoist, a cherry picker or even one arm of a lift will do. Be careful when handling heavy components; gravity is a bitch, and you need all your fingers and toes. Heavy-duty has come to light trucks. **TD**

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

Figure 3

Specifications

Mounting Temperatures		
Description	Temperature	
	C	F
Tapered Roller Bearing Inner Race	130	250
Synchronizer Bodies	130	250
Thrust Washer	130	250
Needle Bearing Inner Race	130	250
Bearing Outer Race in Cover	130	250
Ball Bearing Sleeve in Cover	130	250

Lubricant Refill Capacities			
Description	Liters	U.S. Qts.	Imp. Qts.
Synthetic Motorcraft MERCON® ATF XT-2-QDX or MERCON Equivalent	3.2	3.4	2.8

Torque Specifications			
Description	N-m	lb/ft	lb/in
End Yoke to Mainshaft	270	200	—
Shift Tower Cover to Main Case	23	17	—
PTO Cover Plate	46	33	—
Idler Shaft Retention	22	16	—
Shift Rail Plate	10	7	84
Oil Pump Guide Tube	23	17	—

Torque Specifications			
Description	N-m	lb/ft	lb/in
Shift Cover to Tower Cover	10	—	84
Backup Lamp Switch	20	15	—
Upper Shift Lever	22-33	16-24	—
Shift Lever Boot Retainer to Housing	10	7	—
Transmission to Engine Bolts	53-72	39-53	—
Case to Extension Housing	23	17	—
Fill Plug 35	—	—	—
Drain Plug	35	—	—
Transmission Support Crossmember	60-80	45-60	—
Insulator and Retainer Nut	68-94	50-70	—
Transmission to Engine Block	54-68	40-50	—

General Specifications	
Item	Specification
Anaerobic Sealant E3AZ-19554-A	WSK-M2GA9
Gasket Maker E2AZ-19562-B	WSK-M2G348-A5