TRANSMISSION—ZF S5-42—(M5OD HD)— TROUBLESHOOTING GUIDE—SERVICE TIPS	Article No. 90-15-11

FORD: 1987-1991 BRONCO, E SERIES, F-150-350 SERIES
1988-1991 F SUPER DUTY

ISSUE

A troubleshooting guide for the ZF S5-42 manual transmission has been put together to assist service technicians in diagnosing transmission related symptoms.

ACTION

Use the transmission noise evaluation procedure and troubleshooting guide on the following pages of this TSB article. Also refer to the latest Light Truck Shop Manual, Transmission Section for additional service information.

EVALUATION OF NOISES UNDER DIFFERENT LOAD CONDITIONS

It is important to get an accurate description of the complaint from the customer. Ask questions as to whether it occurs hot or cold, during shifting, driving at a particular speed or in a particular gear. If possible have the customer demostrate the concern.

Cold Transmission

- Drive the truck in all gears (1-5 and reverse gears).
- Evaluate the noise in neutral. Check if there are any noise changes in a particular gear, i.e. 4th gear. In 4th gear the countershaft is not under load.
- Check if the noise increases when the transmission is warming up.
- See if the noise is related to engine speed, road speed or gear selection.

Warm Transmission

- Check all gears plus reverse gear and make note of any noise changes in a particular gear.
- Check noise in neutral while parked. Check if the noise disappears at a certain engine RPM or with the clutch pedal depressed.
- Drive in the gear in which the noise is most noticeable. Press in the clutch and leave the gear engaged. If the noise changes or disappears, the noise may be amplified by the vibration of the engine.
- Drive under the same condition again. Press the clutch pedal in and shift into neutral. Release the clutch while the truck is coasting down the road. Evaluate the noise, as the drive axle turns the transmission mainshaft.

ADDITIONAL TESTING FOR 4X4 TRUCKS (Non-Electronic Shift)

- Check for any noise change when shifting the transfer case between 4x2, 4 high, 4 low or into neutral.
- With the truck at a complete stop and the transfer case in neutral, shift through all the the gears and evaluate noise at different engine RPM. Check for any noises in neutral at different engine RPM.

Once you have identified the area that the noise is coming from, refer to the troubleshooting guide for concern resolution.

NOTE

THE LATEST LIGHT TRUCK SHOP MANUAL, TRANSMISSION SECTION HAS UPDATED SERVICE INFORMATION AND DIAGNOSTIC PROCEDURES THAT APPLY 1987 AND LATER MODEL YEAR TRUCKS.

Article No. 90-15-11 Cont'd.

PART NUMBER	PART NAME
E9TZ-7210-G	Shift Lever
FOTZ-7124-D	Synchronizer 1/2
FOTZ-7124-E	Synchronizer 3/4
FOTZ-7124-C	Synchronizer 5/Reverse
E8TZ-7E218-A	Detent Spring
E6AZ-19582-B	MERCON
D8AZ-19554-A	Sealant
E2AZ-19562-B	Anaerobic Sealer

TROUBLESHOOTING GUIDE (In Neutral & Parked)		
CONDITION	**POSSIBLE CAUSE**	**ACTION**
Noise present with clutch pedal fully depressed.	Engine noise	Refer to shop manual for these areas.
	Clutch release bearing failure.	
	Pilot bearing failure.	
	Misaligned transmission.	
Noise disappears when engine RPM exceeds 1500 without depressing clutch pedal	Neutral rollover is caused by the engine firing pulses transmitted through the gear set. Some neutral rollover is normal on the 7.5L application. The dual mass flywheel on the 7.3L Diesel and the two stage clutch on the 4.9L & 5.8L should eliminate this concern on these engines.	Check engine idle quality and speed. A rough or low idle will aggravate this concern.
Noise present at engine speeds above idle.	Insufficient lubrication.	Drain oil (when required) and fill with the correct oil, conforming to Ford's specification ESP M2C 166H. Type "H" or MERCON (Motorcraft).
	Damaged tapered roller or needle bearing.	Inspect bearings for failure. Pay special attention to the mainshaft front bearing (pocket bearing), located between the input and mainshaft. Turn the gears on the mainshaft to check for needle bearing failure by feeling for roughness.
	Scuffed gear tooth contact surfaces.	Disassemble transmission and check gear tooth contact surfaces. Replace gears as required.
Noise on PTO equipped transmissions. Remove the PTO and install a cover plate. Evaluate for noise without PTO.	Incorrect PTO gear mesh due to: Wrong model PTO, incorrect installation, defective PTO.	Check the mating teeth on transmission countershaft gear and also on the input shaft gear for damage. If any parts are damaged, replace damaged transmission parts. Contact PTO supplier/manufacturer to verify model usage, shimming and PTO quality.

TROUBLESHOOTING GUIDE (In Gear & Driving)		
CONDITION	**POSSIBLE CAUSE**	**ACTION**
Noise is present in all or several gears. Noise occurs at high and low engine speeds and may vary with engine speed.	Worn or rough mainshaft rear bearing.	Disassemble transmission and install new rear bearing on mainshaft.
	Needle bearing under mainshaft gears damaged.	Replace bearing, gear and mainshaft as required.
	Wrong preload on main or cluster shaft bearings.	Disassemble transmission and correct preload.
	PTO installed wrong.	Check PTO installation.
"Rattle" noise when taking off from a stop and driving at less than 1000 RPM.	"Lugging Rattle".	Operate truck without "lugging". Condition will not shorten the life of the transmission.
"Clunking" noise when shifting or speeding up or slowing down. Condition is worse on bumpy surfaces.	Freeplay in the system (clutch through axle and fuel injector shutoff timing). Some clunk is normal with the 4.9L & 5.8L engines.	Check for excessive axle backlash. Clunk cannot be corrected by repairing transmission unless a transmission defect is evident.
	Loose yoke nut.	See TSB 90-5-9
Noise while driving in one gear increases with road speed.	Worn, imperfect or chipped gear teeth on the affected gear.	Replace affected mating gears.
"Whining" noise at high engine RPM in 3rd and 5th gear.	Worn input shaft gear and countershaft drive gear.	Check noise level in 4th gear under same engine conditions. If noise level is less, replace the input shaft and countershaft. Inspect and replace other gears as required.
Shift lever "buzz" present while driving, not present during a neutral engine run up while parked.	Upper shift lever damaged or loose.	Change shift lever. If "buzz" is still present, see in which gear the buzz occurs. Disassemble and inspect specific gear. Check guide pieces for clearance.
	Lower shift lever defective.	Replace lower shift lever. Shift lever E9TZ-7210-G is less sensitive to vibration than earlier design.

TROUBLESHOOTING GUIDE (In Gear & Driving)		
CONDITION	**POSSIBLE CAUSE**	**ACTION**
Shift lever "rattle" in neutral engine run up, primarily diesel 4x4.	Transfer case shift lever may not have plastic bushing at the pivot.	Check by temporarily removing the transfer case shift lever. Replace if the noise is gone.
	Transmission lever boot incorrectly installed.	Lever boot must make air tight seal to shift lever. Replace boot if stretched or sealing surface is damaged.
Moan or vibration on F-Super Duty at road speeds greater than 50 MPH.	Aftermarket modifications to frame or driveshaft.	Non-factory driveshafts should be inspected for: Driveshaft size 0 to 51″ long - 3″ diameter tube is OK. Up to 55″ long - 3 1/2″ diameter tube is required. Up to 59″ long - 4″ diameter tube is required. Working angles greater than 1/2° but less than 3°. System balanced to within 0.4 in/oz at the ends and 0.8 in/oz at the center support bearing.
Hard shift (particularly 1st, 2nd & reverse).	Clutch not releasing completely.	See clutch procedure at the end of this TSB.
	Operator not fully depressing clutch.	Interview operator.
	Dash panel flexing.	Repair dash panel.
	Clutch hydraulic line routed too close to exhaust manifold.	Move line or shield it.
	Air/water in clutch hydraulic line.	Bleed clutch system.
	Insufficient synchronizer reserve (a defective clutch system can result in premature loss of synchronizer reserve).	Replace synchronizer and corresponding gear, if required.

TROUBLESHOOTING GUIDE (Shift Concerns)		
CONDITION	**POSSIBLE CAUSE**	**ACTION**
Notchy shifting	Some notchiness is normal (especially in 3rd gear).	Replace with revised synchronizers: 1/2 FOTZ-7124-D 3/4 FOTZ-7124-E 5/R FOTZ-7124-C
"Grinding" noise during shifting	Synchronizer taper too smooth (after a few thousand miles).	Do 3 to 5 hard shifts with high engine RPM. If noise is still present, disassemble and check for damage (burning marks OK). See TSB 90-2-11.
	Synchronizer ring defective.	Change synchronizer assembly.
	Insufficient wear limit of synchronizer ring.	Change synchronizer assembly.

TROUBLESHOOTING GUIDE (Shift Concerns)		
CONDITION	**POSSIBLE CAUSE**	**ACTION**
Gear cannot be engaged.	Clutch not releasing (see hard shift)	Check clutch per procedure at the end of this TSB article.
	Interlock shifting plate jammed in transmission.	If bent or damaged, replace the interlocking shifting plate.
	Damage to teeth on sliding collar or improper installation. (dog teeth worn)	Replace or correct synchronizer package. Check for damage on the corresponding mainshaft gear in clutch teeth area. Replace as required.
	Jammed pressure pieces in synchronizer unit.	Remove and disassemble transmission and replace pressure pieces.
	Shift rails out of proper position.	Replace all shift rails, detents and interlock shifting plate.
Sticking in gear	Clutch not releasing (see hard shift above)	Check clutch per procedure at the end of this TSB article
	Interlock shifting plate jammed in transmission.	If bent or damaged, replace the interlocking shifting plate.
	Sliding collar tight on splines. (dog teeth damaged)	Remove and disassemble transmission and replace affected parts.
Stuck in gear.	Shift rails out of proper position.	Replace all shift rails, detents and interlock shifting plate.

TROUBLESHOOTING GUIDE (Shift Concerns)		
CONDITION	**POSSIBLE CAUSE**	**ACTION**
Walking or jumping out on rough roads.	Interference or resistance in the mechanism preventing full engagement of the sliding collar.	Remove and disassemble transmission and check profile of internal grooves in the sliding sleeve.
	If sliding collar has been shifted completely into position, some other malfunction could move sliding collar and shift lever out of its proper location.	Check for shift lever interference. The stub lever, gear shift finger or shift forks could be worn. Remove transmission and replace damaged parts.
Note whether the unit walks out of gear under drive or on a coast load. Also, does the "walkout" occur on smooth or only on rough roads. A number of items that would prevent full engagement of gears are:	Worn or loose engine mounts.	Check engine mounts.
	Shift fork pads or groove in sliding collar worn excessively.	Remove and disassemble transmission and replace damaged parts.
	Transmission and engine out of alignment either vertically or horizontally.	Make sure transmission is tightly bolted to the engine.
Walk or jump out on rough roads.	Use of heavy shift lever extentions.	Use original equipment shift lever. Install heavy duty detent springs, (E8TZ-7E218-A).
	Shift rail detent springs broken or missing.	Remove sealing cap on detent and replace springs.
	Detent spring cap not pressed in properly.	Replace with new cap and press in 1mm (3/64″).
	No preload in drive gear, mainshaft or countershaft, caused by worn bearings.	Remove and disassemble transmission and replace defective bearings (necessary to reset bearing preload).
	Grated selector teeth.	Change snychronizer package and gear.

TROUBLESHOOTING GUIDE (Shift Concerns)		
CONDITION	**POSSIBLE CAUSE**	**ACTION**
High shift efforts.	Lack of lubricant or wrong lubricant used, causing build-up of sticky and sludgy deposits on splines of sliding collar.	Inspect through the PTO openings. If sludge is present, remove and clean the transmission.
	Input shaft pilot bearing rough, or dragging.	Place transmission in 4th gear and rotate the output shaft by hand while the clutch is depressed. If a roughness is felt, remove the transmission and replace the input shaft pilot bearing.
	Damaged mainshaft (pocket) bearing.	Install a new input shaft and bearing. (Necessary to reset bearing preload).
High shift effort in one gear only.	Sliding sleeve tight on splines.	Remove transmission and replace affected synchronizer assembly.
	Synchronizer teeth chipped or badly mutilated.	Remove and disassemble transmission and replace damaged parts.
	Binding or interference of shift lever with other objects or rods inside the cab.	Check shift operation in cab.
	Mainshaft gears, seized or galled on either the thrust face or diameters.	Remove and disassemble transmission, replace synchronizer package.
	Synchronizer failure (wear limit too low, fractures).	Remove and disassemble transmission, replace synchronizer package.
	Synchronizer cone smoothness.	Make 3 to 5 hard shifts with high engine RPM.
High shift efforts in cold weather, all gears.	Incorrect, hi-viscosity fluid.	Install Type H or MERCON fluid. Road test the truck to identify possible damage caused by the wrong fluid. Synthetic MERCON E6AZ-19582-B will improve cold weather shiftability.

TROUBLESHOOTING GUIDE (Leak Concerns)		
CONDITION	**POSSIBLE CAUSE**	**ACTION**
Leak at shift tower.	Re-used or damaged gasket.	Replace with new gasket. Never Use RTV.
Leak at drain or fill plug.	Taper threaded plugs used in transmissions with an E7TA or E8TA prefix may require thread sealant.	Use Ford sealant D8AZ-19554-A. Torque plugs to 37 lb.ft (50 N•m).
	Sealing ring missing from plug. (transmissions with an E9TA prefix or later have a sealing surface machined on the housing).	Install a new sealing ring.
Leak at PTO side plate.	Bolts loose or damaged gasket.	Replace gasket, tighten bolts to 28 lb.ft. (38 N•m).
Leak at shift detent plug.	Re-used or damaged plugs.	Use new plugs when reassembling. Do not deform case around plug to retain.
Leak at large welch plug inside clutch housing. Look for cracks around the hole.	Improper assembly.	Reseal, using anaerobic sealant, (E2AZ-19562-B). If cracked, replace housing.
Leak at input shaft bearing oil passage plug. (Inside clutch housing w/7.5L & 7.3L engines and on left side w/4.9L & 5.8L engines).	Improper assembly.	Reseal, using anaerobic sealant, (E2AZ-19562-B). If cracked, replace housing.
Leak at output shaft seal.	Output yoke nut loose or improperly staked (4x2).	Replace seal, using a new nut. Torque to 184 lb.ft. (250 N•m) and stake. See TSB 90-5-9.
Leak at input shaft seal.	Improper assembly. Seal lip may have rolled during assembly.	Replace seal using extreme caution that input shaft does not contact the seal during reassembly. (If the seal lip is rolled, leaking may not occur for several hundred miles.

TROUBLESHOOTING GUIDE (Leak Concerns)		
CONDITION	**POSSIBLE CAUSE**	**ACTION**
Leak between quill pipe and clutch housing.	Damaged o-ring during assembly.	Remove quill pipe, inspect sealing surfaces and replace o-ring. Lubricate o-ring prior to assembly to prevent damage.
Leak at case joint.	Damaged case mating surfaces or assembly error.	Repair or replace damaged case. Reseal with anaerobic sealant, E2AZ-19562-B. Make sure proper bolt torque. (16 lb.ft. 22 N•m.
	Use of RTV on a previous repair.	Never use RTV on this transmission.

TROUBLESHOOTING GUIDE (Misc. Concerns)		
CONDITION	**POSSIBLE CAUSE**	**ACTION**
Cracked clutch housing.	Drivetrain vibration:	
	Caused by assembly error.	Check the integrity of driveshaft attachment.
	Vehicle modification. (driveshaft lengthened or shortened).	Non-factory driveshafts should be inspected for: Driveshaft size 0 to 51″ long - 3″ diameter tube is OK. Up to 55″ long - 3 1/2″ diameter tube is required. Up to 59″ long - 4″ diameter tube is required. Working angles greater than 1/2° but less than 3°. System balanced to within 0.4 in/oz at the ends and 0.8 in/oz at the center support.
Cracked rear engine mount transmission attachment ears.	Broken front engine mounts.	Replace front engine mounts.
	Vibration caused by a driveline imbalance.	See cracked clutch housing.
	Rear mount upper flange not flat.	Replace rear mount.

NOTE

THE SERVICE LIFE OF MOST TRANSMISSIONS IS GOVERNED BY THE LIFE OF THE BEARINGS. THE MAJORITY OF BEARING FAILURES CAN BE RELATED TO VIBRATION OR CONTAMINATION OF THE FLUID. SOME OF THE BIGGEST REASONS FOR BEARING FAILURES ARE:

TROUBLESHOOTING GUIDE - BEARING FAILURE	
CAUSE	**ACTION**
Extended start-up idle in extreme cold may lead to mainshaft bearing wear.	Synthetic MERCON (E6AZ-19582-B) provides improved lubrication when transmission temperatures remain below minus 20° F for extended periods.
Operation at or above GCW in high ambient temperatures and steep grades can affect all bearings.	Heat build-up may cause break down of the ATF. Synthetic MERCON can withstand higher operating temperatures. Additional lubricants are under investigation for this operating condition.
Pocket bearing not lubricated due to missing, damaged or misinstalled input shaft oil dam.	Replace damaged components and make sure of proper oil dam installation per the Light Truck Shop Manual. Check for proper installation of the snap ring on the mainshaft next to the oil dam.
Pocket bearing not lubricated due to damaged oil baffle in the input bearing shim pack.	Replace damaged components making sure the tin oil baffle is not damaged during reassembly.
Damage due to towing a vehicle greater than 50 miles or at speeds exceeding 35 MPH with the driveshaft installed. Mainshaft tapered bearing and needle caged bearings are especially susceptible to damage.	Provide correct towing procedures to tow operator.

TROUBLESHOOTING GUIDE - BEARING FAILURE	
CAUSE	**ACTION**
Vibration break-up of retainer and brinelling of races-fretting corrosion.	Refer to driveshaft restrictions in MISC. CHART of this TSB.
Incorrect preload causes faster wearing of the bearings, due to imcomplete contact area.	Be sure to follow pre-load setting procedure in Shop Manual.
Lack of lubricant or wrong type.	Check for leaks and repair as required. Replace with correct fluid.
Acid etch of bearing due to water in lube.	Identify and correct source of water entry.
Worn out due to other part failure.	Remove, disassemble and clean the transmission then replace damaged parts. (necessary to reset bearing pre-load if any tapered bearings are replaced).

TROUBLESHOOTING GUIDE - CLUTCH CONCERNS

TO ISOLATE CLUTCH CONCERNS FROM TRANSMISSION CONCERNS, OPERATE THE TRANSMISSION AT NO-LOAD. ON 4X4 MODELS, PLACE THE TRANSFER CASE IN NEUTRAL. REMOVE THE DRIVESHAFT ON 4X2 MODELS. RUN ENGINE AT 3000 RPM AND OPERATE TRANSMISSION THROUGHOUT RANGES WITH THE CLUTCH ENGAGED. IF HARD SHIFTING CONCERN (POWER TO TRANSMISSION) DISAPPEARS, THE CONCERN MAY BE IN THE CLUTCH SYSTEM.

AN IMPROPERLY OPERATING CLUTCH CAN RESULT IN HARD SHIFTING THAT IS MOST NOTICEABLE IN 1st, 2nd AND REVERSE. IT IS IMPORTANT THAT THE HYDRAULIC RELEASE MECHANISM IS WORKING PROPERLY. CONTINUED OPERATION WITH A DEFECTIVE CLUTCH SYSTEM MAY RESULT IN PREMATURE SYNCHRONIZER WEAR OR DAMAGE.

Hard shifting or difficulty engaging the transmission gears may be the result of improper clutch function. Check the release system travel. Minimum travel for the concentric slave cylinder bearing (4.9L, 5.0L and 5.8L engines) and the external system slave cylinder push rod (7.3L diesel and 7.5L engines) is **11 mm.** If system travel is less than 11 mm, refer to TSB 88-18-10 for release system concern diagnosis. Possible concerns include excessive flexing of the dash panel or cracked dash panel reinforcement at the clutch master cylinder mounting and air/water in the hydraulic line.

If the release system travel is greater than 11 mm, and the clutch is suspected, check for clutch reserve as follows:

1. Set the parking brake and put the transmission in neutral.
2. With the clutch pedal fully depressed, shift into reverse, then shift half way between reverse and neutral to defeat the transmission synchronizer.
3. Allow the clutch pedal to fully return and adjust the shift lever position to obtain light contact between the transmission gear teeth. A slight grind will occur.

4. Slowly depress the clutch pedal until gear contact grinding stops. Measure the clutch pedal travel from this pedal position to the full down position.

This clutch reserve dimension should be at least 1 1/2″. If the reserve is less than 1 1/2″, and there are no hydraulic control system concerns, remove the transmission and check for excessive clutch wear. On the 7.3L diesel and 7.5L engines, check for release bearing contamination and binding on the bearing retainer. Replace the clutch and/or release bearing as required.

OTHER APPLICABLE ARTICLES: 88-18-10, 90-5-9
SUPERSEDES: 88-26-13
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