



Mack Transmission Manual

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SECTION V

TRANSMISSION

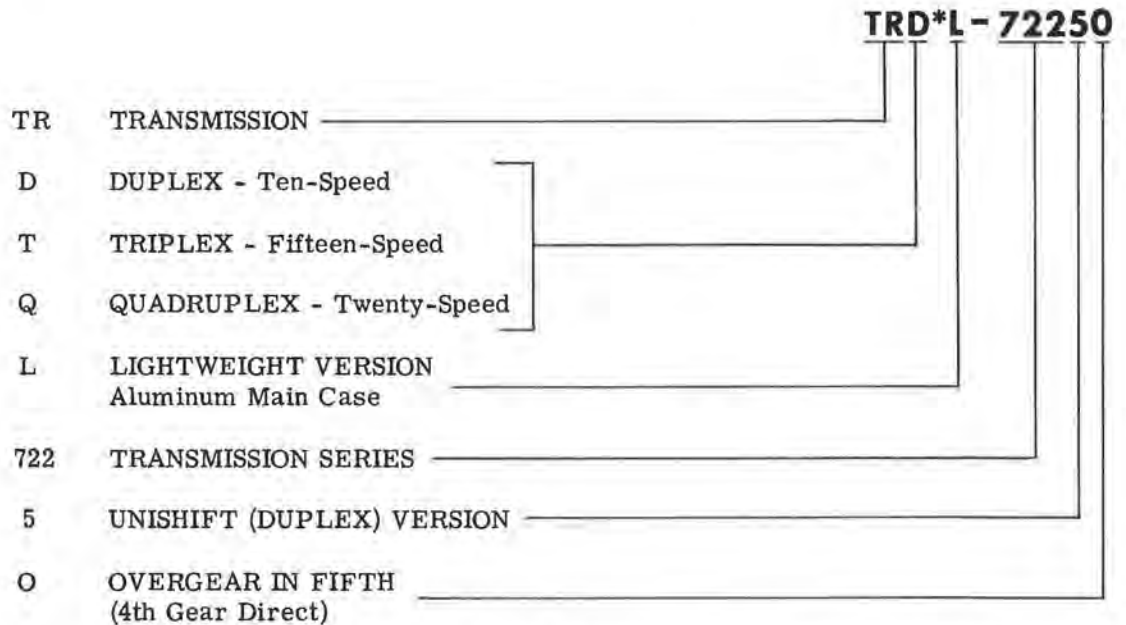
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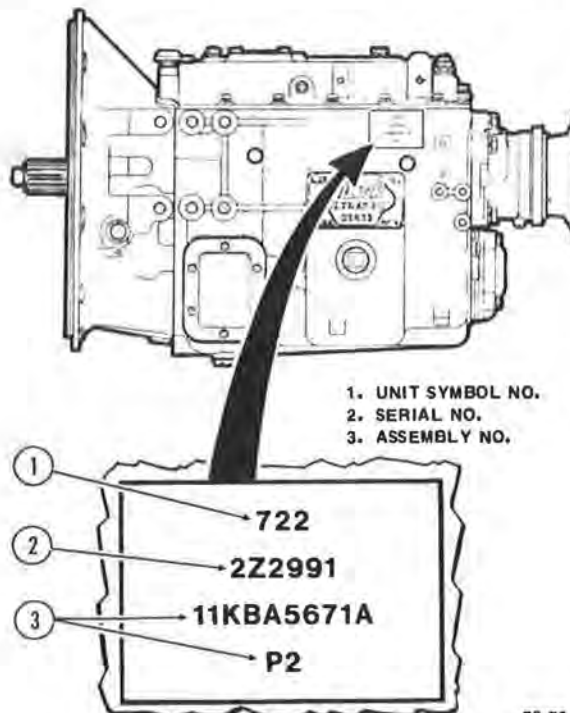
TR72 SERIES UNIT SYMBOLS

Explanation

The chart explains various letters and numbers used to specify transmission model and series. Absence of any letter or number indicates that the particular feature is not used in the transmission being considered. A transmission model without the "O" means it is a direct in fifth version. Basically all symbols are used in all series transmissions, -72 and -722, except that some series will not be available in Triplex and Quadruplex versions.



* "X" following D (TRDX) signifies extra low gear ratios for off-highway work.



TROUBLE SHOOTING

The chart is to acquaint the mechanic with condition and possible cause of some transmission malfunctions. Some difficulties reported as transmission malfunctions are actually due to improper gearshift linkage adjustments, or misalignment of transmission to engine. Check condition of engine and transmission mounts and alignment of transmission to engine before consulting trouble shooting chart.

Trouble Shooting Chart

Trouble & Symptom	Probable Cause
Noisy Transmission	Insufficient Lubricant Incorrect Grade of Lubricant Loose Mounting Bolts Misalignment of Transmission Worn Bearings Gears Worn, Pitted or Chipped Excessive Gear End-Play
Difficult Shifting	Improperly Operating Clutch Improper Linkage Adjustment Worn or Damaged Gears Sliding Clutch Gears Tight on Splines of Shaft Clutch Teeth Burred Over, Chipped or Badly Mutilated Due to Improper Shifting
Jumps out of Gear	Weak or Broken Shift Rail Poppet Springs Excessive Mainshaft or Countershaft End-Play, Due to Worn Bearings, Bearing Cups, etc. Shift Fork or Groove in Sliding Clutch Worn Excessively Worn Taper on Gear Clutch Teeth
Oil Leakage	Overfilled Transmission Damaged or Improperly Installed Gaskets Damaged or Defective Oil Seals Loose Drain Plug Restricted Transmission Breather Cracked Transmission Housing
Bearing Failures	Use of Incorrect Grade of Lubricant Improper Bearing Adjustments Lack of Cleanliness in Unit Overhaul Improper Shifting of Gear Lugging of Engine in Too High Gear

LUBRICATION SYSTEM

TR72 and TR722 Series

All Mack transmissions employ constant mesh helical gears which run free on the mainshafts and are brought into selective engagement by means of sliding gear type clutches. These free running or floating gears run on thin shell bushings which require lubrication. Pressure lubrication of these bushings is provided by oil delivered through rifle drilled passages in the mainshafts and supplied by a simple eccentric shuttle type pump built in the main driving pinion. See Figure 5-1. This pump has but one moving part -- a double ended reciprocating vane which dispenses with valves. Calculated leakage past the bronze nipple acting as a jumper tube which conducts oil from the pump to the drilled mainshafts supplies ample lubrication to the spigot bearings. Oil reaches the reverse cluster gear bearings through a rifle drilled connecting hole in the supporting shaft.

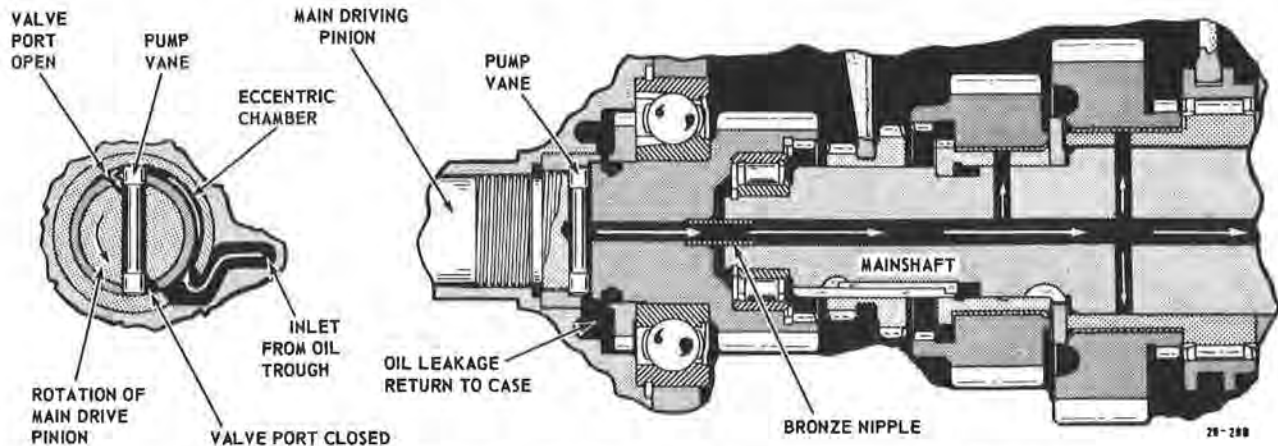


Figure 5-1. Sectional View of Typical Transmission Oil Pump and Mainshaft Drillings

All rotating and sliding parts are bathed in oil from gear throw-off when the engine is running, the countershaft being partially submerged in lubricant. To supply the pump, part of this gear throw-off is collected by a trough high on the right hand side of the case. Through a drilled connecting passage in the case this oil is led to the eccentric space between the driving pinion shaft and its bearing cover. See Figure 5-2. As the shaft turns, the pump vane reciprocates in its eccentric orbit and the vane ends pick up the oil and force it into the center passage through the bronze nipple to the mainshaft drillings.



Figure 5-2. Oil Flow to Eccentric Pump Housing in Main Driving Pinion Bearing Cover

Magnetic Oil Cleaner Plug

As viewed from the rear, the oil cleaner is located high inside the transmission case on the right-hand side above the level of the oil. See Figure 5-3. It is situated so that it receives the throw-off from the upper gears. The cleaner consists of an integral open trough and slanting baffle with a removable sheet metal cover. At the bottom

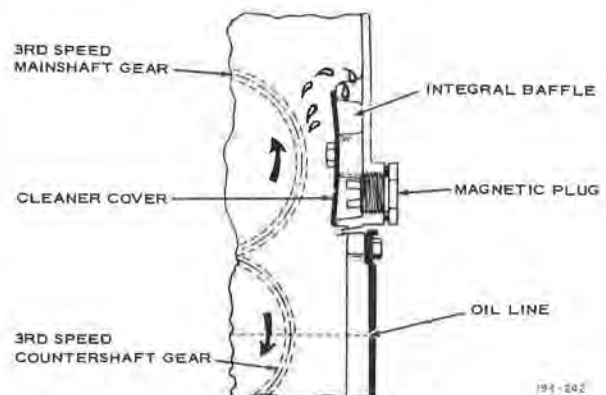


Figure 5-3. Sectional View Showing Oil Cleaner from Rear

of the slanting baffle, a tapped hole in the case accommodates a large hex plug with a powerful built-in magnet installed from outside. See Figure 5-4.



Figure 5-4. Typical R.H. Side of Case
Location of Magnetic Oil Cleaner Plug

The oil collected by the trough passes the magnetic plug which pulls all ferrous metal particles out of the oil and holds them. As these particles build up on the magnetic poles, they also form a filter capable of holding other foreign matter. Non-magnetic material not entrapped with the magnetic particles, collects in the cleaner sump.

After passing the magnet, clean and chip-free oil then rises to the outlet near the top of the trough which supplies the vane pump via a connecting drilled passage. See Figure 5-5.

Proper servicing of the oil cleaner on new and rebuilt units is especially important.

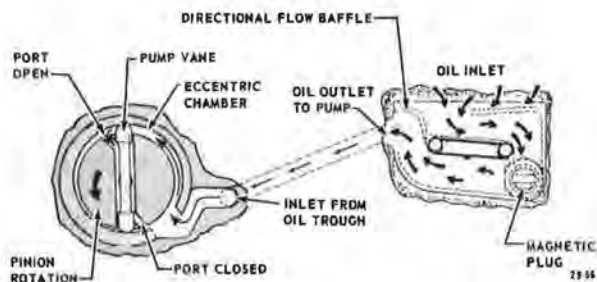


Figure 5-5. Schematic, Showing Oil Flow
From Oil Cleaner to Oil Pump

It is advisable to clean the plug and trough weekly during the first few weeks of operation.

The magnetic oil cleaner plug may be removed at any time without losing any oil or disturbing other parts of the transmission. When removed, it carries all foreign matter with it which is easily removed from the magnet simply by wiping it clean. Remove sludge from sump and then replace plug in the case. When changing oil in the large transmissions, the magnetic drain plugs should also be wiped clean and reinstalled in the case.

NOTE

ALL Mack-made transmissions have this oil cleaner arrangement with the removable magnetic plug located on the right side of the case, well above the transmission oil lever. Remember -- this is NOT a filler plug.

SHIFTER RAIL ROCKER ECCENTRIC PIVOT PIN

Description

The shifter mechanism of the TR72 and TR722 series transmissions includes a first and reverse speed shift rail rocker, carried by an adjustable eccentric pivot pin mounted in the transmission case cover. This arrangement not only shortens the shift into first speed and eliminates the awkward U-shift from first to second speed as in some shift patterns, but at the same time, equalizes the travel length of each shift by bringing all forward shifts into orderly progression in accordance with S. A. E. standards.

In overgeared-type transmissions, an additional rocker and pivot pin, to operate the fourth and fifth-speed sliding clutch, converts the shift pattern of these transmissions to that of the direct-drive boxes. Thus, either type of transmission has the same standard shift.

The purpose of the eccentric pivot pin is to provide a simple means of adjustment so that the shifter rocker can be centered in the most favorable working position.

Eccentric Pivot Pin Adjustment

With engine running at idle speed and with hand shifter lever in neutral position, loosen shift rail rocker pivot pin locknut, and adjust pin as follows:

NOTE

The pin is provided with a visible indexing mark to indicate the eccentric high point of the pin and a screwdriver slot is provided to facilitate turning.

1. Rotate pin to twelve o'clock position in one direction. If no gear clash is felt or heard reverse rotation of pin to six o'clock position in the opposite direction. If no gear clash is felt or heard in either extreme eccentric positions of the pin, reverse rotation of pin until INDEXING MARK is 90° to the transmission centerline and lock pin in this halfway position.

2. If gear clash is felt or heard in one direction and not in the twelve o'clock position in the opposite direction, move pin back to the midpoint between point of gear clash and the twelve o'clock position. Lock pin at this midpoint.

3. If gear clash is felt or heard in both directions, note position of indexing mark, position pin midway between points of gear clash and lock in this position.

NOTES

TR722 AND TRD722 SERIES TRANSMISSIONS (5 and 10 Speed)

DESCRIPTION

The Mack made TR722 series transmissions are available in five or ten forward speeds and are designed for extra heavy duty operation. The basic five-speed gearset TR722 (direct in fifth) and TR7220 (direct in fourth with fifth being an overgear) are housed in a rigid case with a separable bell housing. See Figure 5-6.

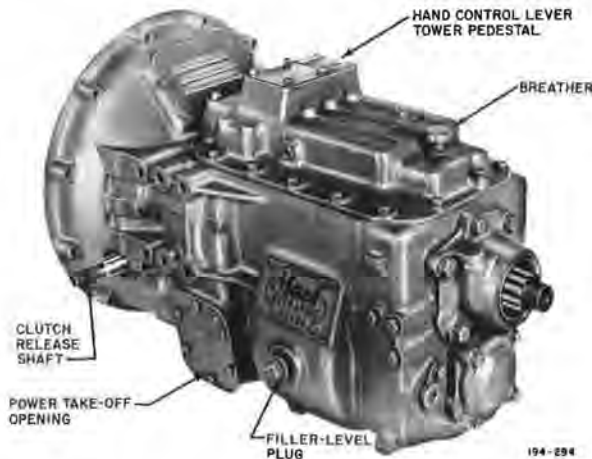


Figure 5-6. TR722/7220 Five-speed Transmission

For the ten-speed, (TRD(L) and TRDX) two lever duplex transmissions, the basic five-speed primary gearset and case is altered so that a two-speed compound gearset is integrated with the main gearset and the compound case is bolted to the main case to provide a single compact unit. See Figure 5-7.

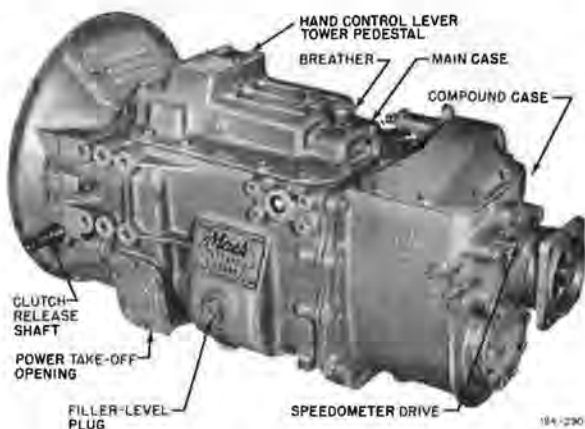


Figure 5-7. TRD722/7220 Ten-speed Transmission

The compound provides a direct and under-gear split for each ratio of the main gearset which results in ten useful forward speeds and a choice of two reverse speeds.

With the exception of the sliding reverse spur gear, all gears are of the helical type for quiet running and are in constant-mesh with the countershaft. Driving engagement for the five main box forward speeds is effected by means of sliding toothed clutches. Reverse is obtained by meshing the sliding reverse spur gear with the reverse cluster gear. When not engaged by a sliding clutch, the four constant-mesh gears float on the mainshaft.

Constant-mesh helical gearing is also used for the compound gear. The LO range gear floats on the compound mainshaft, freely rotating when not engaged by the sliding clutch.

LUBRICATION

A built-in vane type oil pump is incorporated in the main driving pinion and supplies oil under pressure to all floating gear bushings. All other working parts are lubricated by gear throw-off when the vehicle is in motion. Refer to sub-heading "LUBRICATION SYSTEM" for more complete description.

DISASSEMBLY

NOTE

Since this is a composite write-up, omit specified steps which do not apply to your transmission and continue with the next step. Steps which are not otherwise indicated apply to both transmissions.

1. After removing transmission from vehicle and cleaning externally, mount unit in a suitable overhaul stand. Remove hand brake parts, clutch release bearing assembly with return spring, clutch release shaft and yoke, P.T.O. and case cover(s). Remove any other clutch release linkage, etc.

Unless a complete overhaul is necessary, remove only those parts required to gain access to the faulty parts. Do not disturb parts having heavy press fits unless replacement is necessary. In that case, use proper press setups and pullers so that usable parts are not damaged.

2. Remove setscrews from shifters and shifter forks in case cover(s). Withdraw shifter rails from cover(s) and at the same time remove shifters and shifter forks.

WARNING

The spring-loaded balls over the shifter rails will fly out with **CONSIDERABLE FORCE** when released by withdrawing the rails. Therefore, it is advisable to hold a clean shop wiper over the holes while withdrawing the rails. Be sure to save the balls, springs and rail interlock pins for use at re-assembly.

3. Place transmission in any two gears which will lock up assembly to facilitate the removal of drive flange nut. Remove cotter pin from drive flange nut and then remove nut. Install standard puller and remove drive flange. Remove both rear bearing covers. (For ten-speed transmission, save countershaft rear bearing shim pack intact). Slide speedometer gear off of mainshaft. Also bearing thrust washer when five-speed unit.

4. (TEN-SPEED) Remove all case-to-case dowel bolts and capscrews. With a large enough nylon headed mallet, tap compound case and separate it and the enclosed parts from the main case. Disassemble on a clean bench.

5. (TEN-SPEED ONLY) Remove mainshaft rear bearing retainer capscrews and oil tube.

6. Remove countershaft rear bearing cone clamp plate. Remove main driving pinion bearing cover and countershaft front bearing cover. Carefully remove oil pump vane from pinion and save.

7. Remove main driving pinion assembly from case. Tap on gear end with nylon mallet if necessary to work it out of case. Remove oil tube carefully and save. Clamp gear end securely in large bench vise with soft jaws. Unstake bearing nut and with wrench, remove nut. The threads are left-handed. Remove ball bearing by pressing off or by tapping off. Turn pinion over and remove retaining snap ring and spigot bearing.

8. Remove mainshaft spigot bearing inner race retaining snap ring. With fourth/fifth-speed sliding clutch against bearing inner race, tap on clutch with nylon mallet and remove both parts from mainshaft. Pry key out of mainshaft spline. See Figure 5-8. With a small tool, rotate fourth/fifth-speed gear sleeve one spline and slide sleeve and fourth/fifth-speed gear off of mainshaft.



Figure 5-8. Removing Fourth or Fifth-Speed Gear Key

9. Butt a soft drift against forward end of mainshaft and with a hammer, drive mainshaft rearward to separate rear bearing from case.

10. Carefully slide gears, sleeve, thrust washer, splined sleeve and sliding clutch from mainshaft while withdrawing mainshaft from rear of main case. Remove sleeve Woodruff key from mainshaft.

11. (FIVE-SPEED ONLY) Remove mainshaft rear ball bearing and ball bearing thrust washer.

12. (TEN-SPEED ONLY) Clamp gear end of mainshaft securely in large bench vise with soft jaws. Remove thrust washer ring and first-speed gear split thrust washer segments. Press mainshaft out of rear bearing retainer and front bearing cone. Remove bearing cone spacer. Remove remaining bearing cone with segmented-type puller. From gear end, remove retaining snap ring and compound mainshaft spigot bearing.

13. Remove reverse gear shaft lock and with suitable puller, withdraw gear shaft from case. Remove cluster gear, bearings, bearing spacer and thrust washers from case.

14. (FIVE-SPEED ONLY) Insert jack-screws into tapped holes provided in countershaft rear bearing retainer and remove retainer with rear bearing cone. Remove rear bearing shim pack and save. Slide countershaft rearward and partially through rear bearing opening. Install segmented puller on remaining bearing cone and remove.

15. (TEN-SPEED ONLY) Slide Countershaft rearward and partially through rear bearing opening. Install segmented puller on inside bearing cone and remove both cones. Remove rear bearing cup from main case with a soft steel drift. When using a drift, be very careful not to damage part or case and apply alternate equal blows to opposite sides to prevent cocking of part in the case.

16. Tilt forward end of countershaft upward and remove entire assembly from case. Remove countershaft front bearing inner race and gear snap ring. For shops having a small capacity hydraulic press, press off one countershaft gear at a time. For shops having a large capacity hydraulic press, place countershaft assembly in press, slide length of heavy tubing over countershaft integral gears to engage third-speed gear and remove all gears in one operation.

CLEANING AND INSPECTION

Cleaning

Clean case, covers and all other parts of transmission thoroughly, using a suitable cleaning solvent to remove all grease and foreign matter. Dry parts with moisture-free compressed air.

Soak bearings in a suitable cleaning solvent to loosen all hardened grease and foreign matter. Strike bearings (FLAT) against block of wood several times and again immerse in the cleaning solvent turning races slowly. Repeat these operations until bearings are clean and then blow them dry with filtered moisture-free compressed air.

CAUTION

Do not spin bearings with compressed air as damage to the bearing may result.

Inspection

Bearings

Check bearings for flaking, cracks and fractures, cavities and indentations, staining, measurable wear, brinelling, fretting, corrosion, seizing, galling, scoring, nicking and cage failures. If any of these are apparent in any amount they should be replaced.

Mainshaft tapered bearings in the ten-speed transmission are set up with an end-play condition. If the end-play exceeds the specified limits, refer to charts, they are to be readjusted or if any of the above conditions are apparent, they are to be replaced.

Bushings and Shafts

Check bushing clearance. Replace bushings when running clearances specified on charts are exceeded due to bushing wear. Replace all bushings that have turned out of the staking notches. New bushings must be properly staked and sized for specified clearance. Bushing end should be recessed (.040 to .050 inch) in gear.

Gear Bushing I. D.

First Speed

Floating Gear ---- 3.1289 to 3.1294

Second and Third Speed

Floating Gear ---- 3.5043 to 3.5048

Fourth/Fifth Speed

Floating Gear ---- 2.8433 to 2.8438

Compound Mainshaft (10-speed)

Floating Gear ---- 2.8433 to 2.8438

Shafts and sleeves should be replaced if they show ridging, galling or wear of the journal area in excess of .003 inch.

Gears

Replace gear if teeth show any sign of abrasive wear, scratching, ridging, scoring, surface fatigue, pitting, spalling, corrosive wear, digging in and cracking. Gears may also be checked by Magnaflux or similar system for cracks which would not otherwise be visible.

Check gear end-play. Gear end-play must not exceed specified limits shown on chart.

NOTE

After bearing end-play, bushing clearance, thrust washer thickness and gear end-play have been established, disassemble mainshaft and compound mainshaft and set aside for reassembly.

Shifter Fork, Sliding Clutch and Shift Rail

Replace forks and/or clutches if side clearance in groove is in excess of specified limits, shown on chart.

Replace shift rails if cracked in either the poppet or stake screw holes. In the case of wear whereby, the clearance between the shift rail and the mating housing bore exceeds .010 inch maximum, check to determine which member is worn before replacing same. Shaft wear may be checked by comparing shaft diameter at an "unwearing" point as against the wear point.

Replace poppet springs that have lost their tension.

Vane Oil Pump

Renew pump parts only if they are scored or chipped or if vane is loose in its mating bore in excess of .006 inch.

Pressure of the pump is low and therefore difficult to measure. A functional check should be made on the pump, prior to installing the transmission cover. This can be accomplished by pouring oil into the pump pickup trough, while revolving the main driving pinion. If the pump is functioning, oil will appear at various outlets along the mainshaft. This practice will also insure initial prime to the pump.

Housing

Check housing for cracks and conditions of threaded holes. Check all mating surfaces for flatness. Be sure all old gasket material is removed from flanges. Check flanges for flatness, bolt and dowel holes for elongation. Check studs for torque, thread damage and straightness.

REASSEMBLY

NOTE

ALL parts, especially the bearings, should be generously coated with SAE-30 oil while the transmission is being assembled. This will assure immediate lubrication when first starting and will prevent seizing of these parts. As moving parts are assembled, check frequently to see that they move freely.

So that the same instructions do not have to be repeated for every operation, we will state here that ALL new cover gaskets at final assembly are to be coated on BOTH sides with a good gasket sealer. When the attaching capscrews are tightened to their recommended torque values, the sealer will assure leak-proof joints between the covers and the case. The metal shell of oil seals that contact whatever retains them, should also be coated lightly with a good gasket sealing compound before installation.

In most cases, it is easier to coat the metal parts rather than the gasket. The dry gasket can be placed in position on the transmission case since the sealing compound is adhesive enough to hold the gasket until the cover is attached over it and fastened by capscrews.

As a further measure against oil leakage, additional sealing compound should be applied around the entire joint of each cover under which there is either a shim pack or a gasket.

NOTE

Bushing clearance, gear end-play, thrust washer thickness, bearing end-play, etc., must be inspected and corrected per specification charts before reassembly. Also refer to specification charts for correct screw torques during reassembly.

1. Insert gear key in countershaft and press gears on one at a time. These gears have an interference fit and can be pressed on cold but for best results, the gears should be shrunk-fitted on shaft. With a heat lamp or hot oil, heat gears 270 to 300°F. for a period of not more than 1/2 hour. Oil shaft for each gear. Install gear snap ring. Then install front bearing inner race on spigot.

2. Install countershaft front bearing in case, then install bearing cover and gasket.

3. (FIVE-SPEED ONLY) Install tapered roller bearing cone, with large end of rollers facing gear, on rear end of countershaft. Place countershaft assembly in case. Install countershaft rear bearing retainer and gasket in case. Install countershaft rear bearing shim pack next to bearing. Install countershaft tapered roller bearing cone, with small end of rollers next to shim pack, and secure with clamp plate. Install countershaft rear bearing cover and gasket on case.

4. (TEN-SPEED ONLY) Place countershaft assembly in case with small end extending out of rear bearing opening. Install rear bearing cup in case. Install tapered roller bearing cones back-to-back on rear end of countershaft and secure with clamp plate. Position countershaft in front bearing.

5. (TEN-SPEED ONLY) Press bearing cup in front end of compound countershaft constant-mesh gear and rear bearing cone on rear end. Push countershaft rear bearing cup in compound case. Install rear bearing cup dowel lock pin in slots provided in bearing cup and case to secure rear bearing cup, except for Unishift. Install shim pack and bearing cover on rear bearing cup. Temporarily assemble compound countershaft, case-to-case gasket and compound case to the main case and countershaft.

6. Preload countershaft bearings as follows: Lubricate all bearings with SAE 30 oil. Wrap a string around countershaft second-speed gear (largest integral gear) several times. Attach a spring scale to looped free end of string and with a steady pull, rotate the assembly SLOWLY. See Figure 5-9. Repeat this operation and adjust thickness of rear bearing shim pack until recommended rolling-drag is read on the scale.

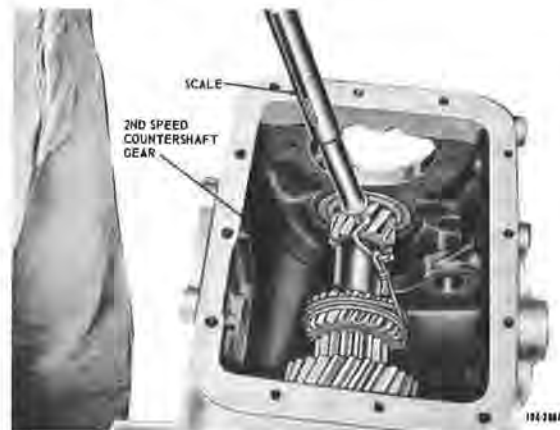


Figure 5-9. Checking Countershaft Bearing Preload

(TEN-SPEED ONLY) When correct shim pack thickness is established, remove compound case and compound countershaft from main case.

7. Position reverse cluster gear shaft so that slot in end of shaft will permit shaft lock to engage it. Start shaft into case. Assemble roller bearings and spacer in cluster gear. Position assembled gear in case with gear thrust washer in place, and with nylon hammer, tap shaft into case, thrust washers and gear. Install shaft lock and cap-screw, tighten cap screw to specified torque. Lock cap screw with soft iron wire after tightening.

8. (FIVE-SPEED ONLY) On bench, slide mainshaft rear ball bearing thrust washer on rear end of mainshaft, then install mainshaft rear ball bearing. Install third-speed thrust washer Woodruff key in shaft.

9. (TEN-SPEED ONLY) On bench, install compound mainshaft spigot roller bearing in end of mainshaft (compound driving pinion) and retain with snap ring.

10. (TEN-SPEED ONLY) Place gear end of mainshaft in vise with soft metal jaws. Install rear bearing cone, bearing retainer with two cups, bearing cone spacer, front bearing cone and bearing split thrust washer. Press or drive positioning ring over split washer. Install third-speed thrust washer Woodruff key in shaft.

11. Start mainshaft in case through rear bearing hole. As mainshaft is advanced into working position, slide parts on mainshaft as follows: first-speed gear, reverse gear splined sleeve, reverse gear, second-speed gear, third-speed splined sleeve and sliding clutches, third-speed gear and third-speed gear thrust washer with Woodruff key. Install sleeve in fourth/fifth-speed gear and install assembly on mainshaft. With a small tool, rotate fourth/fifth-speed sleeve one tooth so that inner teeth align with mainshaft splines. Install key in deepened spline root and install fourth/fifth-speed sliding clutch on splines and over inlaid key. At this point the mainshaft rear bearing retainer or rear bearing for five-speed should be seated in main case.

12. (TEN-SPEED ONLY) Install mainshaft rear bearing retainer cap screws and lock heads together with soft iron wire.

13. Install inner race of spigot bearing on front end of mainshaft and retain with snap ring.

14. Assemble mainshaft spigot bearing in gear end of main driving pinion and retain with snap ring. Turn pinion over and place in vise with soft metal jaws. Install pinion ball bearing and bearing nut. Tighten nut, (left-hand thread) then positive stake lip of nut to pinion in slot provided. Install oil tube in pinion gear end. Position outer race of ball bearing so that the filler notch will be in the six o'clock position and install pinion assembly in transmission case. Be very careful not to damage spigot bearing when inner race on mainshaft enters the rollers. Install oil pump vane in pinion and install bearing cover. Tighten cover cap screws.

15. (TEN-SPEED ONLY) At this point, the main case should be positioned in a vertical position with the pinion pointing downward.

16. (TEN-SPEED ONLY) Assemble compound mainshaft as follows: Press spigot bearing inner race on spigot end of shaft. Slide compound LO-split floating gear on shaft. Press inner rear bearing cone on shaft with large end of rollers facing LO-split gear. Install bearing spacer next to bearing. Install sliding clutch on splines of compound mainshaft.

17. (TEN-SPEED ONLY) Install interconnecting oil tube in end of mainshaft and carefully engage spigot of assembled compound mainshaft with oil tube and spigot bearing in end of mainshaft. Be very careful not to damage oil tube as it engages compound mainshaft spigot. Place compound countershaft (assembled earlier) on countershaft rear bearing cone and make sure all gears are properly meshed.

18. (TEN-SPEED ONLY) Paint end of main case with a good gasket sealer compound and install case-to-case gasket. Carefully lower compound case down over assembled parts and see that bearings are properly seated. Install and tighten case-to-case cap screws and dowel bolts. Install double-row rear bearing cup in compound case. Install rear bearing cone.

19. Install speedometer drive gear on shaft. Also bearing thrust washer when five-speed. Apply gasket sealer to case and gasket and install rear bearing retainer gasket. Install retainer and capscrews with lock-washers. Tighten capscrews. Apply sealer compound to metal parts of drive flange oil seal and install seal in rear bearing cover. Oil lip of seal, install drive flange and nut. Return transmission to normal position. Check sliding gear and all sliding clutches for proper engagement.

20. Lock up gear train by engaging sliding gear and sliding clutches. Tighten flange nut to recommended torque. Then install nut cotter pin.

21. Position main case cover in bench vise with soft metal jaws. Install transmission case breather and toggle shifter levers.

22. Starting with first and reverse speed shifter rail, start rail in cover and first and reverse shifter. Install spring and poppet ball in cover and with a blunt tool compress detent ball, push rail over compressed ball, through first and reverse speed rocker shifter and into neutral position. Install large interlock pin next to rail.

23. (DIRECT ONLY) Start second and third-speed rail in cover. Install second and third-speed shifter on rail. Install spring and poppet ball in cover and with a blunt tool compress detent ball, push rail over compressed ball, through second and third-speed fork and into neutral position. Install small interlock pin in second and third-speed rail then install large interlock pin next to rail. Install SHORT first and reverse speed rail with first and reverse speed fork in cover. Start fourth and fifth-speed rail in cover. Advance rail through fourth and fifth-speed fork and shifter. Install and compress spring and detent ball, then pass rail over compressed ball and into working position.

24. (OVERGEAR ONLY). Start second and third-speed rail in cover. Advance rail through fourth and fifth-speed fork and second and third-speed shifter. Install spring and poppet ball in cover, and with a blunt tool compress detent ball, push rail over compressed ball, through second and third-speed fork and into neutral position. Install small interlock pin in second and

third-speed rail, then install large interlock pin next to rail. Install SHORT first and reverse speed rail with first and reverse speed fork in cover. Start fourth and fifth-speed rail in cover. Advance rail through fourth and fifth-speed rocker shifter. Install and compress spring and detent ball, then pass rail over compressed ball and into working position.

25. Install shifter and fork setscrews, tighten, then lock each setscrew to its rail with soft iron wire. Install new Welch plugs in shifter rail openings. Remove cover from vise.

26. (TEN-SPEED ONLY) Place compound case cover in vise with soft metal jaws. Dip new rail oil seal in oil and install in cover. Start compound rail in cover. Install and compress spring and detent ball, then pass rail over compressed ball and into neutral position. Install fork on end of rail. Install fork setscrew, torque, then lock setscrew to its rail with soft iron wire. Remove cover from vise.

NOTE

Check interlock for proper function. Make sure only one rail of any group can be moved to the engaged position at one time.

27. Apply gasket sealer compound to case openings and cover gaskets and install gaskets on cases. Position sliding gear and all sliding clutches in neutral position. Install both assembled covers and make sure the shifter forks engage the grooves in their mating parts. Install cover capscrews with lockwashers and torque.

28. Apply sealer compound to all other cover gaskets and install covers and capscrews with lockwashers. Check for proper shifting and free rotation of gears. Install clutch release shaft, yoke bearing, return spring and any other external part that was removed for disassembly. Recheck all fasteners for correct torques and locking means. Install all plugs, then remove transmission from stand.

NOTE

After transmission is installed in vehicle, adjust rocker(s). Refer to sub-heading "SHIFTER RAIL
ROCKER ECCENTRIC PIVOT PIN."

SPECIFICATIONS

GEARSET, Make	-----	MACK
Model	-----	TR722, 7220
		TRD(L)722, 7220
		TRDX7220
Type, TR	-----	Five-speed
TRD(L), TRDX	-----	Ten-speed Duplex
Control, TR	-----	Selective, 1-lever, manual, constant-mesh
	TRD(L), TRDX -----	Selective, 2-lever, manual, constant-mesh
Speeds, Forward,		
TR	-----	Five
TRD(L), TRDX	-----	Ten
Reverse,		
TR	-----	One
TRD(L), TRDX	-----	Two
BELL HOUSING, Type	-----	Separable
Opening	-----	SAE #1 Shallow or deep
LUBRICATION	-----	Pump feed through rifle-drilled passages to all free-running floating gears
PUMP, Type	-----	Built-in reciprocating vane
CASE, Material, TR722 and		
TRD722 Series	-----	Cast iron
TRDL722 Series	-----	Aluminum with cast iron compound case
PTO, Openings and Type	-----	(2) SAE, special depth
OIL CAPACITY, pts.,		
TR(Five-speed)	-----	22
TRD(L), TRDX(Ten-speed)	-----	28

TR-72, 722 SERIES 5 AND 10-SPEED, DUPLEX TRANSMISSIONS (MANUAL SHIFT)

BUSHING CLEARANCES, BEARING ADJUSTMENTS & SCREW TORQUE CHART

ALL FORKS IN SLIDING CLUTCHES			
	MIN.	MAX.	MAX. *
	NEW	NEW	WEAR
SIDE CLEARANCE	.005	.020	.050

*NOTE - IF UNIT HAS EXPERIENCED DISENGAGEMENT, SIDE CLEARANCE MUST NOT EXCEED .030 MAX.

BEARING SPACER PART NUMBER	THICKNESS
I 28-KD-139-P270 THRU 28-KD-139-P334 (USE (I) AS REQUIRED)	.270 THRU .334
K 28-KD-140-P306 THRU 28-KD-140-P361 (USE (I) AS REQUIRED)	.306 THRU .361

BEARING SHIM PART NUMBER	THICKNESS
L 74-KC-229A-P1 P2 P3 P4 (10-SPEED DUPLEX MODELS)	.005 .007 .020 1/32
M 55-KH-15-P1 P2 P3 P4 (5-SPEED MODELS)	.003 .005 .020 .062

SCREW TORQUES IN LBS. FT.

SCREW	LUBRICATED
1	60 80
2	45 65
3	125 155
4	225 255
5	145 175

CAPSCREWS WHICH ARE COATED OR DIPPED WITH PERMATEX OR OTHER SEALANT ARE TO BE CONSIDERED LUBRICATED.

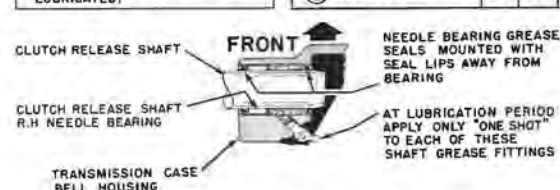
FLOATING GEAR	GEAR END-PLAY			BUSHING CLEARANCE		
	MIN. NEW	MAX. NEW	MAX. WEAR	MIN. NEW	MAX. NEW	MAX. WEAR
A 4TH / 5TH SPEED	.003	.007	.015	.0036	.0046	.0076
B 3RD. SPEED	.004	.008	.015	.0043	.0053	.0080
C 2ND. SPEED	.004	.008	.015	.0043	.0053	.0080
D 1ST. SPEED	.006	.011	.015	.0039	.0049	.0079
E COMPOUND	.005	.009	.015	.0036	.0046	.0076

THRUST WASHER	AVAILABLE THICKNESSES
X 3RD. SPEED GEAR USE (I) AS REQUIRED	.271 .291
Y 1ST. SPEED GEAR SELECT AS REQUIRED FOR TIGHT FIT IN GROOVE (10-SPEED DUPLEX ONLY)	.365 .390 .395 .400 .405 .410 .415 .420 .425

RECOMMENDED TORQUES FOR CAPSCREWS NOT ILLUSTRATED

BELL HOUSING-TO-MAIN CASE CAPSCREWS **4** SEE CHART
MAIN CASE-TO-COMPOUND CASE DOWEL BOLT CAPSCREWS (B) **5** **5**

MAINSHAFT BEARING ADJUSTMENT			
	MIN. NEW	MAX. NEW	MAX. WEAR
END-PLAY AT J	.001	.005	.015
END-PLAY AT K	.003	.007	.017

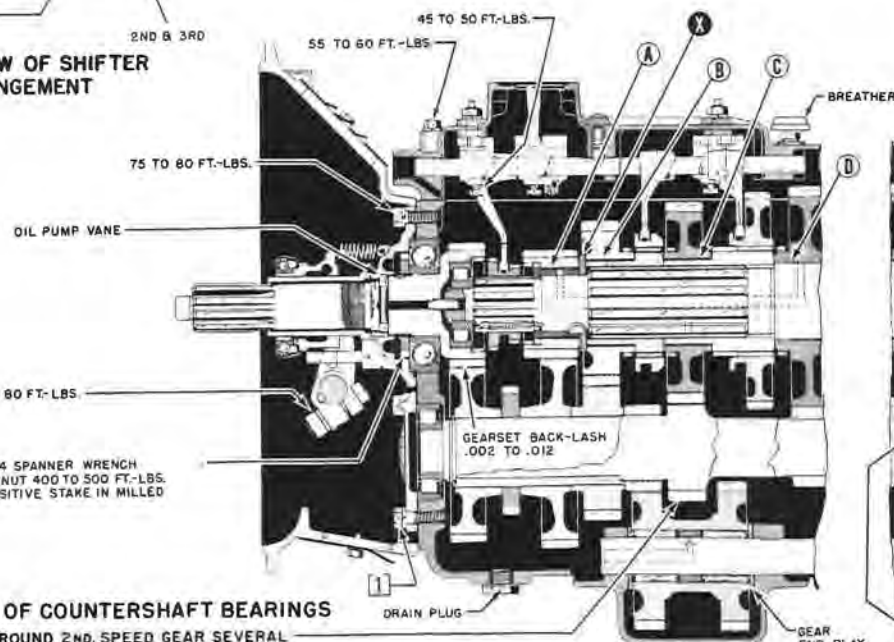
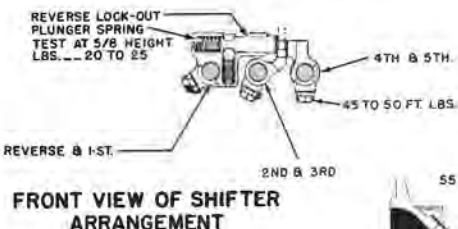


R.H. MOUNTING ARRGT. OF CLUTCH RELEASE SHAFT

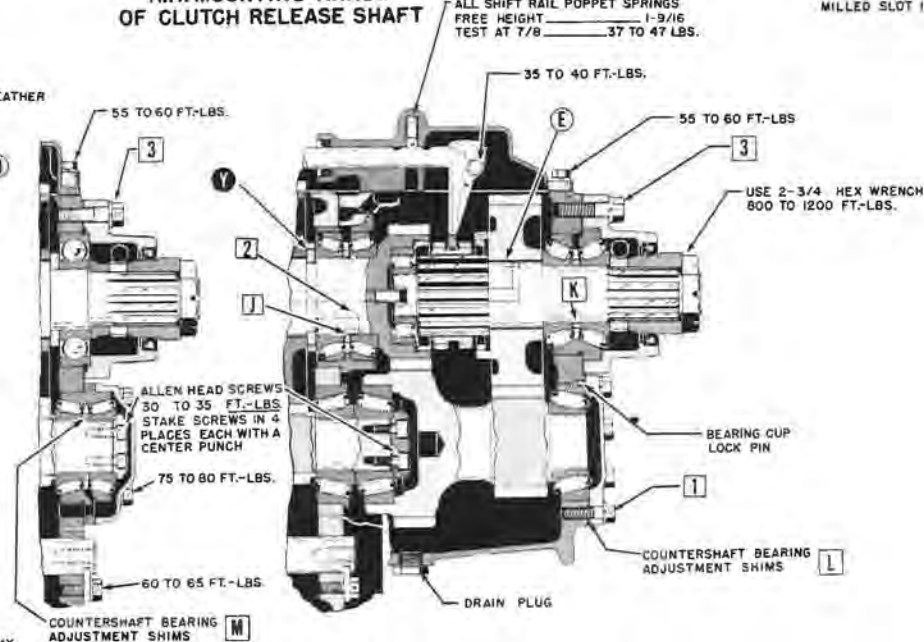
ALL SHIFT RAIL POPPET SPRINGS: FREE HEIGHT 1-9/16 TEST AT 7/8 37 TO 47 LBS.



USE ROUND-NOSED PUNCH TO STAKE METAL LIP OF NUT INTO MILLED SLOT IN SHAFT



SECTIONAL VIEW OF BASIC 5-SPEED TRANSMISSION



REAR BEARINGS OF 5-SPEED BOX

COMPOUND SECTION OF 10-SPEED DUPLEX TRANSMISSION

PRELOADING OF COUNTERSHAFT BEARINGS

WRAP STRING AROUND 2ND. SPEED GEAR SEVERAL TIMES. ATTACH SPRING SCALE TO LOOPED FREE END AND WITH A STEADY PULL, ROTATE ASSEMBLY SLOWLY. ADJUST REAR BEARING SHIM PACK UNTIL ROLLING-DRAG IS:

NEW TAPERED BEARINGS 8 TO 11 LBS. PULL, USED OR RUN-IN TAPERED BEARINGS 4 TO 5-1/2 LBS. PULL.

NOTES

TRT(L)-72 AND TRT(L)-722 TRIPLEX TRANSMISSIONS (15 Speed)

DESCRIPTION

TRT(L)-72 and TRT(L)-722 triplex transmission series provides fifteen forward speeds and three reverse speeds. These compact heavy-duty transmissions, consist of a primary gear-set of one reverse and five forward speeds plus an integrated three-speed compound gearset which provides a direct through-drive, an undergear and an overgear splitter range for each ratio in the main gearset. Capscrews and dowel bolts secure the compound case to the main case to form a single compact unit. See Figure 5-10.

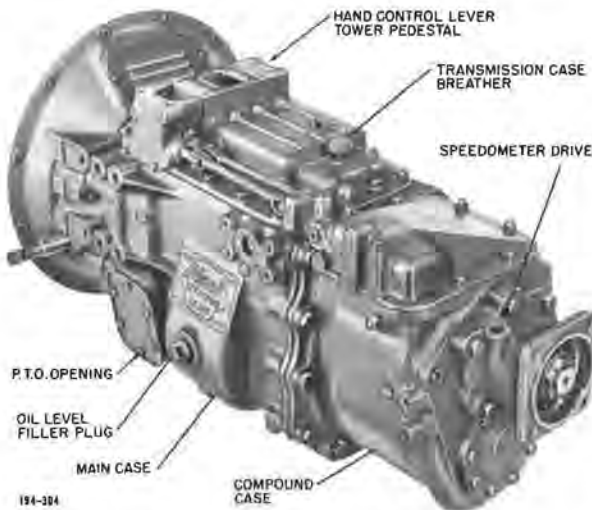


Figure 5-10. TRT722/7220 Fifteen-speed Transmission

With the exception of the sliding reverse spur gear, all other gears in the main box are of helical type for quiet running and in constant-mesh with the countershaft gears. Driving engagement for the five forward speeds in the main box is effected by means of sliding toothed clutches splined directly and indirectly to the mainshaft. Reverse is obtained by meshing the sliding reverse spur gear with the reverse cluster gear. When not engaged by a sliding clutch, the four bushed mainshaft gears float on the mainshaft, freely rotating at their various speeds.

Constant-mesh helical gearing is also used for the compound gears. The HI- and LO-split range gears float on their compound shafts, freely rotating at their various speeds when not engaged by a sliding clutch.

Two gear shifter hand control levers, one for each gearset, are located side by side in individual shifter towers at the forward end on top of the main box cover and shifter rail housing. The levers engage shifters carried by the shifter and fork rails mounted in each case cover. Conventional forks spanning the sliding spur gear and sliding clutches, move these parts in response to movement of the selective gear shifter hand control levers.

Spring-loaded balls above the detented shifter rails hold the rails in the selected speed while the interlock pin arrangements between the rails, preclude the possibility of any two speeds becoming engaged at the same time.

The main driving pinion is supported by a case-mounted maximum-type ball bearing. A pair of face-to-face tapered roller bearings retained at the rear of the main case, support the mainshaft and a similar arrangement at the rear of the compound case, supports the compound mainshaft. Straight roller bearings mounted in the gear ends of the main driving pinion and the mainshaft (compound mainshaft driving pinion) carry the front ends of the mainshafts in spigot arrangement. The mainshaft bearing pairs are adjusted for end-play by altering the shim pack thickness between the face-to-face tapered roller bearing of each pair.

These transmissions have integrated compound gearing. Case-mounted tapered roller bearings, back-to-back, carry the countershaft rear end which also supports the front end of the compound countershaft. Thus, the compound countershaft is straddle-mounted by a bearing on the main countershaft and a single case-mounted tapered roller bearing at the rear of the compound case. A case-mounted straight roller bearing supports the front end of the countershaft. The countershaft tapered roller bearings are preloaded by altering the thickness of the shim pack under the rear bearing cover.

In constant-mesh with the countershaft, the reverse cluster gear revolves on two roller bearings mounted on a shaft locked in the case.

LUBRICATION

A built-in vane type oil pump is incorporated in the main driving pinion and supplies oil under pressure to all floating gear bushings. All other working parts are lubricated by gear throw-off when the vehicle is in motion. Refer to sub-heading "LUBRICATION SYSTEM" for more complete description.

DISASSEMBLY

NOTE

Unless a complete overhaul is necessary, remove only those parts required to gain access to the faulty parts. Do not disturb parts having heavy press fits unless replacement is necessary. In that case, use proper press setups and pullers so that usable parts are not damaged.

1. After removing transmission from vehicle and cleaning externally, mount unit in a suitable overhaul stand. Remove hand brake parts, clutch release bearing assembly with return spring, clutch release shaft and yoke, P.T.O. and case cover(s). Remove any other clutch release linkage, etc.

Through top of compound case remove compound LO-split rocker, rocker arm pivot pin, rail and fork.

2. Remove setscrews from shifters and shifter forks in case cover(s). Withdraw shifter rails from cover(s) and at the same time remove shifters and shifter forks.

WARNING

The spring-loaded balls over the shifter rails will fly out with CONSIDERABLE FORCE when released by withdrawing the rails. Therefore, it is advisable to hold a clean shop wiper over the holes while withdrawing the rails. Be sure to save the balls, springs and rail interlock pins for use at re-assembly.

3. Place transmission in any two gears which will lock up assembly to facilitate the removal of drive flange nut. Remove cotter pin from drive flange nut and then remove nut. Install standard puller and remove drive flange. Remove both rear bearing covers. Save countershaft rear bearing shim pack intact. Slide speedometer gear off of mainshaft.

4. Remove all case-to-case dowel bolts and capscrews. With a large enough nylon headed mallet, tap compound case and separate

it and the enclosed parts from the main case. Disassemble on a clean bench.

5. Remove mainshaft rear bearing retainer capscrews and oil tube.

6. Remove countershaft rear bearing cone clamp plate. Remove main driving pinion bearing cover and countershaft front bearing cover. Carefully remove oil pump vane from pinion and save.

7. Remove main driving pinion assembly from case. Tap on gear end with nylon mallet if necessary to work it out of case. Remove oil tube carefully and save. Clamp gear end securely in large bench vise with soft jaws. Unstake bearing nut and with wrench, remove nut. The threads are left-handed. Remove ball bearing by pressing off or by tapping off. Turn pinion over and remove retaining snap ring and spigot bearing.

8. Remove mainshaft spigot bearing inner race retaining snap ring. With fourth/fifth-speed sliding clutch against bearing inner race, tap on clutch with nylon mallet and remove both parts from mainshaft. Pry key out of mainshaft spline. See Figure 5-11. With a small tool, rotate fourth/fifth-speed gear sleeve one spline and slide sleeve and fourth/fifth-speed gear off of mainshaft.



Figure 5-11. Removing Fourth or Fifth-speed Gear Sleeve Key

9. Butt a soft drift against forward end of mainshaft and with a hammer, drive mainshaft rearward to separate rear bearing from case.

10. Carefully slide gears, sleeve, thrust washer, splined sleeve and sliding clutch from mainshaft while withdrawing mainshaft from rear of main case. Remove sleeve Woodruff key from mainshaft.

11. Clamp gear end of mainshaft securely in large bench vise with soft jaws. Remove thrust washer ring and first-speed gear split thrust washer segments. Press mainshaft out of rear bearing retainer and front bearing cone. Remove bearing cone spacer. Remove remaining bearing cone with segmented-type puller. From gear end, remove retaining snap ring and compound mainshaft spigot bearing.

12. Remove reverse gear shaft lock and with suitable puller, withdraw gear shift from case. Remove cluster gear, bearings, bearing spacer and thrust washers from case.

13. Slide countershaft rearward and partially through rear bearing opening. Install segmented puller on inside bearing cone and remove both cones. Remove countershaft case-mounted bearing parts with a soft steel drift. When using a drift, be very careful not to damage part or case and apply alternate equal blows to opposite sides to prevent cocking of part in the case.

14. Tilt forward end of countershaft upward and remove entire assembly from case. Remove countershaft front bearing inner race and gear snap ring. For shops having a small capacity hydraulic press, press off one countershaft gear at a time. For shops having a large capacity hydraulic press, place countershaft assembly in press, slide length of heavy tubing over countershaft integral gears to engage third-speed gear and remove all gears in one operation.

CLEANING AND INSPECTION

Cleaning

Clean case, covers and all other parts of transmission thoroughly, using a suitable cleaning solvent to remove all grease and foreign matter. Dry parts with moisture-free compressed air.

Soak bearings in a suitable cleaning solvent to loosen all hardened grease and foreign matter. Strike bearings (FLAT) against block of wood several times and again immerse in the cleaning solvent turning races slowly. Repeat these operations until bearings are clean and then blow them dry with filtered moisture-free compressed air.

CAUTION

Do not spin bearings with compressed air as damage to the bearing may result.

Inspection

Bearings

Check bearings for flaking, cracks and fractures, cavities and indentations, staining, measurable wear, brinelling, fretting, corrosion, seizing, galling, scoring, nicking and cage failures. If any of these are apparent in any amount they should be replaced.

Mainshaft tapered bearings are set up with an end-play condition. If the end-play exceeds the specified limits, refer to charts, they are to be readjusted or if any of the above conditions are apparent, they are to be replaced.

Bushings and Shafts

Check bushing clearance. See Figure 5-12. Replace bushings when running clearances specified on charts are exceeded due to bushing wear. Replace all bushings that have turned out of the staking notches. New bushings must be properly staked and sized for specified clearance. Bushing end should be recessed 0.040 to 0.050 inch in gear.

Gear Bushing I. D.

First Speed

Floating Gear ---- 3.1289 to 3.1294

Second & Third Speed

Floating Gear ---- 3.5043 to 3.5048

Fourth/Fifth Speed

Floating Gear ---- 2.8433 to 2.8438

Hi-Split

Floating Gear ---- 3.0043 to 3.0048

Lo-Split

Floating Gear ---- 2.2531 to 2.2536



Figure 5-12. Method of Checking Gear Bushing to Mainshaft Clearance

Shafts and sleeves should be replaced if they show ridging, galling or wear of the journal area in excess of .003 inch.

Gears

Replace gear if teeth show any sign of abrasive wear, scratching, ridging, scoring, surface fatigue, pitting, spalling, corrosive wear, digging in and cracking. Gears may also be checked by Magnaflux or similar system for cracks which would not otherwise be visible.

Check gear end-play. See Figure 5-13. Gear end-play must not exceed specified limits shown on chart.



Figure 5-13. Method of Checking Gear End-play

NOTE

After bearing end-play, bushing clearance, thrust washer thickness and gear end-play have been established, disassemble mainshaft and compound mainshaft and set aside for reassembly.

Shifter Fork, Sliding Clutch and Shift Rail

Replace forks and/or clutches if side clearance in groove is in excess of specified limits, shown on chart.

Replace shift rails if cracked in either the poppet or stake screw holes. In the case of wear whereby, the clearance between the shift rail and the mating housing bore exceeds .010 inch maximum, check to determine which member is worn before replacing same. Shaft wear may be checked by comparing shaft diameter at an "unwearing" point as against the wear point. Replace poppet springs that have lost their tension.

Vane Oil Pump

Renew pump parts only, if they are scored or chipped or if vane is loose in its mating bore in excess of .006 inch.

Pressure of the pump is low and therefore difficult to measure. A functional check should be made on the pump, prior to installing the transmission cover. This can be accomplished by pouring oil into the pump pickup trough, while revolving the main driving pinion. If the pump is functioning, oil will appear at various outlets along the main shaft. This practice will also insure initial prime to the pump.

Housing

Check housing for cracks and conditions of threaded holes. Check all mating surfaces for flatness. Be sure all old gasket material is removed from flanges. Check flanges for flatness, bolt and dowel holes for elongation. Check studs for torque, thread damage and straightness.

REASSEMBLY

NOTE

ALL parts, especially the bearings, should be generously coated with SAE-30 oil while the transmission is being assembled. This will assure immediate lubrication when first starting and will prevent seizing of these parts. As moving parts are assembled, check frequently to see that they move freely.

So that the same instructions do not have to be repeated for every operation, we will state here that ALL new cover gaskets at final assembly are to be coated on BOTH sides with a good gasket sealer. When the attaching capscrews are tightened to their recommended torque values, the sealer will assure leak-proof joints between the covers and the case. The metal shell of oil seals that contact whatever retains them, should also be coated lightly with a good gasket sealing compound before installation.

In most cases, it is easier to coat the metal parts rather than the gasket. The dry gasket can be placed in position on the transmission case since the sealing compound is adhesive enough to hold the gasket until the cover is attached over it and fastened by capscrews.

As a further measure against oil leakage, additional sealing compound should be applied around the entire joint of each cover under which there is either a shim pack or a gasket.

NOTE

Bushing clearance, gear end-play, thrust washer thickness, bearing end-play, etc., must be inspected and corrected per specification charts before reassembly. Also refer to specification charts for correct screw torques during reassembly.

1. Insert gear key in countershaft and press gears on one at a time. These gears have an interference fit and can be pressed on cold but for best results, the gears should be shrunk-fitted on shaft. With a

heat lamp or hot oil, heat gears 270 to 300°F. for a period of not more than 1/2 hour. Oil shaft for each gear. Install gear snap ring. Then install front bearing inner race on spigot.

2. Install countershaft front bearing in case, then install bearing cover and gasket.

3. Place countershaft assembly in case with small end extending out of rear bearing opening. Install rear bearing cup in case. Install tapered roller bearing cones back-to-back on rear end of countershaft and secure with clamp plate. Position countershaft in front bearing.

4. Assemble compound countershaft as follows: Position LO-split sliding clutch in toothed end of HI-split gear and lay on clean bench face down. Install three spacers in holes provided in gear. Position fork sliding sleeve on three spacers. Apply Loctite Grade B to threaded surfaces of the three capscrews and Molykote Grade #2 to the tapered area surface. Install the three capscrews and tighten finger-tight.

Place assembly in vise with soft jaws and tighten capscrews. Press bearing cup in base of compound countershaft main drive helical gear. Remove assembly from vise and press on splined end of compound countershaft. Install gear retaining snap ring in groove provided in shaft splines. Install LO-split gear thrust washer ring on shaft and make sure cutout clears snap ring. Slide LO-split floating gear in place and press rear bearing cone on end of shaft. Install rear bearing cone clamp plate and torque capscrews. Wire heads together with soft iron safety wire. Push compound countershaft rear bearing cup in compound case. Install shim pack and bearing cover on rear bearing cup. Temporarily assemble the compound case and countershaft to the main case and main countershaft.

5. Preload countershaft bearings as follows: Lubricate all bearings with SAE30 oil. Wrap a string around countershaft's second-speed gear (largest integral gear) several times. Attach a spring scale to looped free end of string and with a steady pull, rotate the assembly SLOWLY. Repeat this operation and adjust thickness of rear bearing shim pack until recommended rolling-drag is read on the scale. When correct shim pack thickness is established, remove compound case and compound countershaft from main case.

6. Position reverse cluster gear shaft so that slot in end of shaft will permit shaft lock to engage it. Start shaft into case. Assemble roller bearings and spacer in cluster gear. Position assembled gear in case with gear thrust washer in place, and with nylon hammer, tap shaft into case, thrust washers and gear. Install shaft lock and capscrew, tighten capscrew to specified torque. Lock capscrew with soft iron wire after tightening.

7. On bench, install compound mainshaft spigot roller bearing in end of mainshaft (compound driving pinion) and retain with snap ring.

8. Place gear end of mainshaft in vise with soft metal jaws. Install rear bearing cone, bearing retainer with two cups, bearing cone spacer, front bearing cone and bearing split thrust washer. Press or drive positioning ring over split washer. Install third-speed thrust washer Woodruff key in shaft.

9. Start mainshaft in case through rear bearing hole. As mainshaft is advanced into working position, slide parts on mainshaft as follows: first-speed gear, reverse gear splined sleeve, reverse gear, second-speed gear, third-speed splined sleeve and sliding clutches, third-speed gear and third-speed gear thrust washer with Woodruff key. Install sleeve in fourth/fifth-speed gear and install assembly on mainshaft. With a small tool, rotate fourth/fifth-speed sleeve one tooth so that inner teeth align with mainshaft splines. Install key in deepened spline root and install fourth/fifth-speed sliding clutch on splines and over inlaid key. At this point the mainshaft rear bearing retainer or rear bearing for five-speed should be seated in main case.

10. Install mainshaft rear bearing retainer capscrews and lock heads together with soft iron wire.

11. Install inner race of spigot bearing on front end of mainshaft and retain with snap ring.

Assemble mainshaft spigot bearing in gear end of main driving pinion and retain with snap ring. Turn pinion over and place in vise with soft metal jaws. Install pinion ball bearing and bearing nut. Tighten nut, (left-hand thread) then positive stake lip of nut to pinion in slot provided.

Install oil tube in pinion gear end. Position outer race of ball bearing so that the filler notch will be in the six o'clock position and install pinion assembly in transmission case. Be very careful not to damage spigot bearing when inner race on mainshaft enters the rollers. Install oil pump vane in pinion and install bearing cover. Tighten cover capscrews.

13. At this point, the main case should be positioned in a vertical position with the pinion pointing downward.

14. Pre-assemble compound mainshaft as follows: Press spigot bearing inner race on spigot end of shaft, slide HI-split floating gear in place, install gear key in shaft and then press LO-split fixed gear on shaft and over positioning key.

Press rear bearing cone on compound mainshaft. Install bearing spacer next to bearing. Install HI-split clutch on its fixed clutch.

15. Install interconnecting oil tube in end of mainshaft and carefully engage spigot of assembled compound mainshaft with oil tube and spigot bearing in end of mainshaft. Be very careful not to damage oil tube as it engages compound mainshaft spigot. Place compound countershaft (assembled earlier) on countershaft rear bearing cone and make sure all gears are properly meshed.

16. Paint end of main case with a good gasket sealer compound and install case-to-case gasket. Carefully lower compound case down over assembled parts and see that bearings are properly seated. Install and tighten case-to-case capscrews and dowel bolts. Install double-row rear bearing cup in compound case. Install rear bearing cone.

Through top of compound case install LO-split shifter fork, and engage fork in sliding clutch fork groove. Install LO-split rail in compound case and fork. Install rocker arm pivot-pin. Install LO-split rocker on pin, and at the same time align rocker arm in slot provided in rail.

17. Install speedometer drive gear on shaft. Also bearing thrust washer when five-speed. Apply gasket sealer to case and gasket and install rear bearing retainer gasket. Install retainer and capscrews with lock-washers. Tighten capscrews.

Apply sealer compound to metal parts of drive flange oil seal and install seal in rear bearing cover. Oil lip of seal, install drive flange and nut. Return transmission to normal position. Check sliding gear and all sliding clutches for proper engagement.

18. Lock up gear train by engaging sliding gear and sliding clutches. Tighten flange nut to recommended torque. Then install nut cotter pin.

19. Position main case cover in bench vise with soft metal jaws. Install transmission case breather and toggle shifter levers.

20. Starting with first and reverse speed shifter rail, start rail in cover and first and reverse shifter. Install spring and poppet ball in cover and with a blunt tool compress detent ball, push rail over compressed ball, through first and reverse speed rocker shifter and into neutral position. Install large interlock pin next to rail.

21. (DIRECT ONLY) Start second and third-speed rail in cover. Install second and third-speed shifter on rail. Install spring and poppet ball in cover and with a blunt tool compress detent ball, push rail over compressed ball, through second and third-speed fork and into neutral position. Install small interlock pin in second and third-speed rail then install large interlock pin next to rail. Install SHORT first and reverse speed rail with first and reverse speed fork in cover. Start fourth and fifth-speed rail in cover. Advance rail through fourth and fifth-speed fork and shifter. Install and compress spring and detent ball, then pass rail over compressed ball and into working position.

22. (OVERGEAR ONLY). Start second and third-speed rail in cover. Advance rail through fourth and fifth-speed fork and second and third-speed shifter. Install spring and poppet ball in cover, and with a blunt tool compress detent ball, push rail over compressed ball, through second and third-speed fork and into neutral position. Install small interlock pin in second and third-speed rail, then install large interlock pin next to rail. Install SHORT first and reverse speed rail with first and reverse speed fork in cover. Start fourth and fifth-speed rail in cover. Advance rail through fourth and fifth-speed rocker shifter. In-

stall and compress spring and detent ball, then pass rail over compressed ball and into working position.

23. Install shifter and fork setscrews, tighten, then lock each setscrew to its rail with soft iron wire. Install new Welch plugs in shifter rail openings. Remove cover from vise.

24. Place compound case cover in vise with soft metal jaws. Oil compound shifter rail oil seals and install in cover. Install and compress spring and detent ball in cover then pass LO-split rail over ball and into working position. Install interlock pin. In a like manner, install and compress spring and detent ball in cover, then pass HI-split rail over ball through fork and into working position. Install pipe plug in pin hole. Install fork set screw, torque, then lock set screw to its rail with soft iron wire. Remove cover from vise.

NOTE

Check interlock for proper function. Make sure that not more than one rail of any group can be moved to the engaged position simultaneously.

25. Apply gasket sealer compound to case openings and cover gaskets and install gaskets on cases. Position sliding gear and all sliding clutches in neutral position. Install both assembled covers and make sure the shifter forks engage the grooves in their mating parts. Install cover capscrews with lockwashers and torque.

26. Apply sealer compound to all other cover gaskets and install covers and capscrews with lockwashers. Check for proper shifting and free rotation of gears. Install clutch release shaft, yoke bearing, return spring and any other external part that was removed for disassembly. Recheck all fasteners for correct torques and locking means. Install all plugs, then remove transmission from stand.

NOTE

After transmission is installed in vehicle, adjust rocker(s). Refer to sub - heading 'SHIFTER RAIL ROCKER ECCENTRIC PIVOT PIN.

SPECIFICATIONS

<p> Gearset, Make ----- Mack Model ----- TRT(L)-72 Series TRT(L)-722 Series Type ----- 15 Speed, Triplex Control ----- Selective, 2 lever, Manual, Constant-Mesh Speeds, Forward ----- Fifteen Reverse ----- Three Bell Housing, Type ----- Separable Opening ----- SAE #1, 2, shallow, deep </p>	<p> Lubrication----- Pump feed through rifle- drilled passages in both mainshafts to all free- running floating gears Pump, Type --- Built-in Reciprocating Vane Case, Material ---- Aluminum or Cast Iron PTO, Openings & Type ----- (2) SAE Special Depth Oil Capacity, pts. ----- 30 </p>
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POSITIVE STAKING METHOD
USE ROUND-NOSED PUNCH TO STAKE
METAL LIP OF NUT INTO MILLED SLOT
IN SHAFT

THRUST WASHER	AVAILABLE THICKNESSES	
X 3-RD SPEED GEAR..... USE (I) AS REQUIRED	.271	.291
Y 1-ST SPEED GEAR..... SELECT AS REQ'D. FOR TIGHT FIT IN GROOVE.	.365 .390 .400 .410 .420	.370 .395 .405 .415 .425
Z COMPOUND COUNTER- SHAFT LO-SPLIT GEAR	.363	.371

BEARING SPACER PART NUMBER	THICK- NESS
J 28 KD 139 - P270..... THRU 28 KD 139 - P334..... USE (I) AS REQUIRED	.270 THRU .334
K 28 KD 140 - P305..... THRU 28 KD 140 - P361..... USE (I) AS REQUIRED	.305 THRU .361

BEARING SHIM PART NUMBER	THICK- NESS
L 741 KC 229A-P1.....	.005
" " P2.....	.007
" " P3.....	.020
" " P4.....	1/32

FLOATING GEAR	GEAR END-PLAY			BUSHING CLEARANCE		
	MIN. NEW	MAX. NEW	MAX. WEAR	MIN. NEW	MAX. NEW	MAX. WEAR
A 4-TH/5-TH SPEED...	.003	.007	.015	.0036	.0046	.0076
B 3-RD SPEED.....	.004	.008	.015	.0043	.0053	.0080
C 2-ND SPEED.....	.004	.008	.015	.0043	.0053	.0080
D 1-ST SPEED.....	.006	.011	.015	.0039	.0049	.0079
E COMPOUND HI-SPLIT.	.005	.009	.015	.0048	.0058	.0080
F COMPOUND LO-SPLIT.	.005	.009	.015	.0031	.0041	.0071

TORQUES FOR FASTENERS NOT ILLUSTRATED
MAIN CASE-TO-COMPOUND CASE, DOWEL BOLT & CAPSCREWS..... **2**

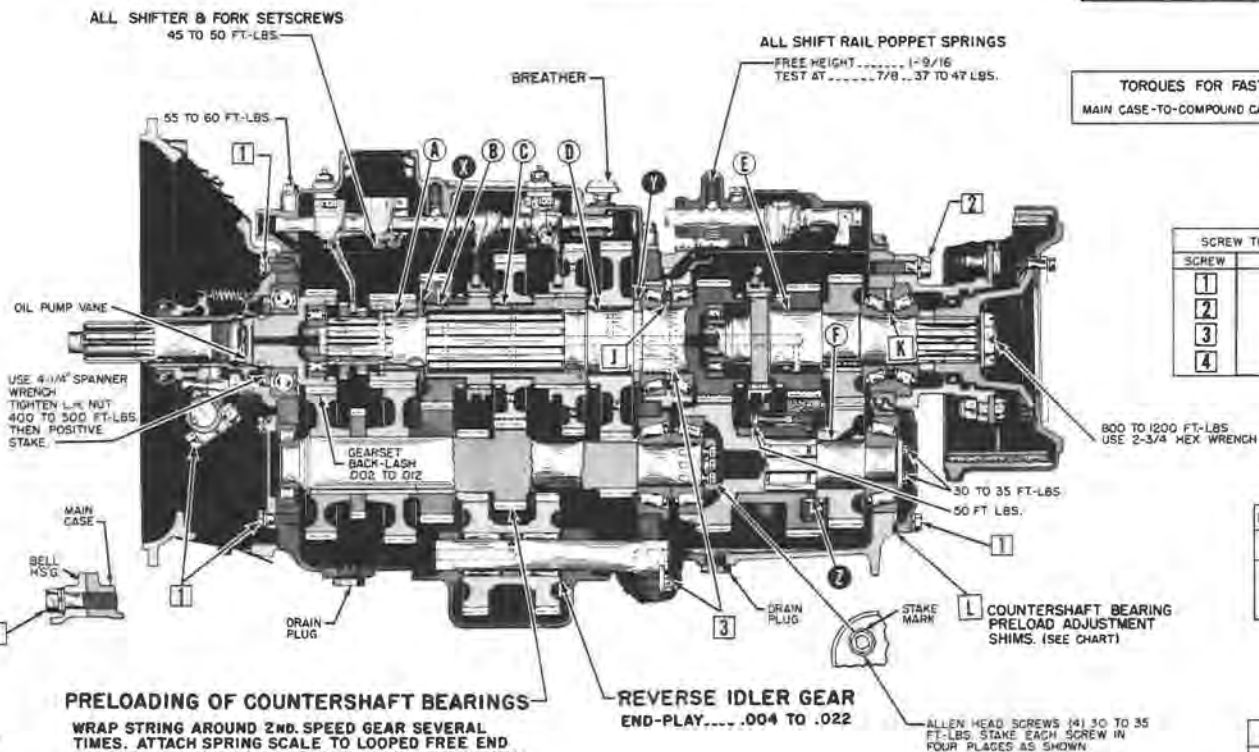
SCREW TORQUES IN FT. LBS.		
SCREW	LUBRICATED	
1	60	80
2	125	155
3	45	65
4	225	255

MAINSHAFT BEARING ADJUSTMENT			
	MIN. NEW	MAX. NEW	MAX. WEAR
END-PLAY AT J	.001	.005	.015
END-PLAY AT K	.003	.007	.017

ALL FORKS IN SLIDING CLUTCHES			
	MIN. NEW	MAX. NEW	MAX. WEAR
SIDE CLEARANCE	.005	.020	.050

* NOTE - IF UNIT HAS EXPERIENCED DIS-ENGAGEMENT,
SIDE CLEARANCE MUST NOT EXCEED .050 MAX.

78 770



PRELOADING OF COUNTERSHAFT BEARINGS

WRAP STRING AROUND 2ND. SPEED GEAR SEVERAL
TIMES. ATTACH SPRING SCALE TO LOOPED FREE END
AND WITH A STEADY PULL, ROTATE ASSEMBLY SLOWLY.
ADJUST REAR BEARING SHIM PACK UNTIL ROLLING -
DRAG IS:

NEW TAPERED BEARINGS.... 8 TO 11 LBS. PULL.
USED OR RUN-IN TAPERED BEARINGS.... 4 TO 5-1/2 LBS. PULL

REVERSE IDLER GEAR

END-PLAY..... .004 TO .022

ALLEN HEAD SCREWS (4) 30 TO 35
FT.-LBS. STAKE EACH SCREW IN
FOUR PLACES AS SHOWN

800 TO 1200 FT.-LBS.
USE 2-3/4 HEX. WRENCH

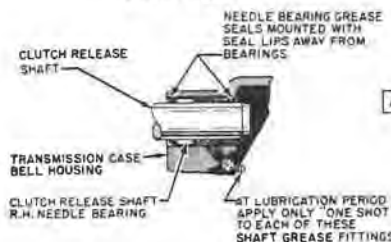
30 TO 35 FT.-LBS.
50 FT. LBS.

ALLEN HEAD SCREWS (4) 30 TO 35
FT.-LBS. STAKE EACH SCREW IN
FOUR PLACES AS SHOWN



**DETAIL OF SHIFTER & REVERSE
LOCKOUT ARRANGEMENT AS
VIEWED FROM THE FRONT**

FRONT



**R.H. MOUNTING ARRANGEMENT
OF CLUTCH RELEASE SHAFT**

NOTES

TRQ-72 AND TRQ-722 QUADRUPLEX TRANSMISSIONS (20 Speed)

DESCRIPTION

TRQ-72 and TRQ-722 quadruplex transmission series provides twenty forward and four reverse speeds. United in one rigid two-part assembly, the transmission comprises two separate gearsets, the main five-speed set at the front and an integrated four-speed compound set at the rear. See Figure 5-14. For each ratio in the main gearset, the compound gearing provides a HI split, a direct or straight-through drive, a LO split and where creeper speeds are needed, the LO-LO split is available. This adds up to twenty usable forward speeds plus four reverse speeds.

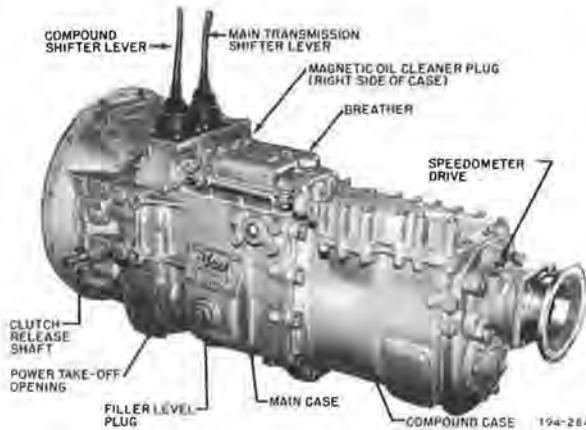


Figure 5-14. TRQ-7220 Twenty-speed Transmission

With the exception of the sliding reverse spur gear, all other gears in the main box are of the helical type for quiet running and in constant-mesh with the countershaft gears. Driving engagement for the five forward speeds in the main box is affected by means of sliding toothed clutches splined directly and indirectly to the mainshaft. Reverse is obtained by meshing the sliding reverse spur gear with the reverse cluster gear. When not engaged by a sliding clutch, the four bushed mainshaft gears float on the mainshaft, freely rotating at their various speeds.

Constant-mesh helical gearing is also used for the compound gears. The HI, LO and LO-LO range gears float on the compound mainshaft, freely rotating at their various speeds, when not engaged by a sliding clutch.

Two gear shifter hand control levers, one for each gearset, are located side by side in individual shifter towers at the forward end on top of the main box cover and shifter rail housing. The levers engage shifters carried by the shifter and fork rails mounted in each case cover. Conventional forks spanning the sliding spur gear and sliding clutches, move these parts in response to movement of the selective gear shifter hand control levers.

Spring-loaded balls above the detented shifter rails hold the rails in the selected speed while the interlock pin arrangements between the rails, preclude the possibility of any two speeds becoming engaged at the same time.

The main driving pinion is supported by a case-mounted maximum-type ball bearing. A pair of face-to-face tapered roller bearings retained at the rear of the main case, support the mainshaft and a similar arrangement at the rear of the compound case, supports the compound mainshaft. Straight roller bearings mounted in the gear ends of the main driving pinion and the mainshaft (compound mainshaft driving pinion) carry the front ends of the mainshafts in spigot arrangement. The mainshaft bearing pairs are adjusted for end-play by altering the shim pack thickness between the face-to-face tapered roller bearing cones of each pair.

These transmissions have integrated compound gearing. Case-mounted tapered roller bearings, back-to-back, carry the countershaft rear end which also supports the front end of the compound countershaft. Thus, the compound countershaft is straddle-mounted by a bearing on the main countershaft and a single case-mounted tapered roller bearing at the rear of the compound case. A case-mounted straight roller bearing supports the front end of the countershaft. The countershaft tapered roller bearings are preloaded altering the thickness of the shim pack under the rear bearing cover.

In constant-mesh with the countershaft, the reverse cluster gear revolves on two roller bearings mounted on a shaft locked in the case.

LUBRICATION

A built-in vane type oil pump is incorporated in the main driving pinion and supplies oil under pressure to all floating gear bushings. All other working parts are lubricated by gear throw-off when the vehicle is in motion. Refer to sub-heading "LUBRICATION SYSTEM" for more complete description.

DISASSEMBLY

NOTE

Unless a complete overhaul is necessary, remove only those parts required to gain access to the faulty parts. Do not disturb parts having heavy press fits, unless replacement is necessary. In that case, use proper press setups and pullers so that usable parts are not damaged.

1. After removing transmission from vehicle and cleaning externally, mount unit in a suitable overhaul stand. Remove hand brake parts, clutch release bearing assembly with return spring, clutch release shaft and yoke, P.T.O. and case cover(s). Remove any other clutch release linkage, etc.

2. Remove setscrews from shifters and shifter forks in case cover(s). Withdraw shifter rails from cover(s) and at the same time remove shifters and shifter forks.

WARNING

The spring-loaded balls over the shifter rails will fly out with **CONSIDERABLE FORCE** when released by withdrawing the rails. Therefore, it is advisable to hold a clean shop wiper over the holes while withdrawing the rails. Be sure to save the balls, springs and rail interlock pins for use at re-assembly.

3. Place transmission in any two gears which will lock up assembly to facilitate the removal of drive flange nut. Remove cotter pin from drive flange nut and then remove nut. Install standard puller and remove drive flange. Remove both rear bearing covers. Save countershaft rear bearing shim pack intact. Slide speedometer gear off of mainshaft.

4. Remove all case-to-case dowel bolts and capscrews. With a large enough nylon headed mallet, tap compound case and separate it and the enclosed parts from the main case. Disassemble on a clean bench.

5. Remove mainshaft rear bearing retainer capscrews and oil tube.

6. Remove countershaft rear bearing cone clamp plate. Remove main driving pinion bearing cover and countershaft front bearing cover. Carefully remove oil pump vane from pinion and save.

7. Remove main driving pinion assembly from case. Tap on gear end with nylon mallet if necessary to work it out of case. Remove oil tube carefully and save. Clamp gear end securely in large bench vise with soft jaws. Unstake bearing nut and with wrench, remove nut. The threads are left-handed. Remove ball bearing by pressing off or by tapping off. Turn pinion over and remove retaining snap ring and spigot bearing.

8. Remove mainshaft spigot bearing inner race retaining snap ring. With fourth/fifth-speed sliding clutch against bearing inner race, tap on clutch with nylon mallet and remove both parts from mainshaft. Pry key out of mainshaft spline. See Figure 5-15. With a small tool, rotate fourth/fifth-speed gear sleeve one spline and slide sleeve and fourth/fifth-speed gear off of mainshaft.



Figure 5-15. Removing Fourth or Fifth-speed Gear Sleeve Key

9. Butt a soft drift against forward end of mainshaft and with a hammer, drive mainshaft rearward to separate rear bearing from case.

10. Carefully slide gears, sleeve, thrust washer, splined sleeve and sliding clutch from mainshaft while withdrawing mainshaft from rear of main case. Remove sleeve Woodruff key from mainshaft.

11. Clamp gear end of mainshaft securely in large bench vise with soft jaws. Remove thrust washer ring and first-speed gear split thrust washer segments. Press mainshaft out of rear bearing retainer and front bearing cone. Remove bearing cone spacer. Remove remaining bearing cone with segmented-type puller. From gear end, remove retaining snap ring and compound mainshaft spigot bearing.

12. Remove reverse gear shaft lock and with suitable puller, withdraw gear shift from case. Remove cluster gear, bearings, bearing spacer and thrust washers from case.

13. Slide countershaft rearward and partially through rear bearing opening. Install segmented puller on inside bearing cone and remove both cones. Remove countershaft case-mounted bearing parts with a soft steel drift. When using a drift, be very careful not to damage part or case and apply alternate equal blows to opposite sides to prevent cocking of part in the case.

14. Tilt forward end of countershaft upward and remove entire assembly from case. Remove countershaft front bearing inner race and gear snap ring. For shops having a small capacity hydraulic press, press off one countershaft gear at a time. For shops having a large capacity hydraulic press, place countershaft assembly in press, slide length of heavy tubing over countershaft integral gears to engage third-speed gear and remove all gears in one operation.

CLEANING AND INSPECTION

Cleaning

Clean case, covers and all other parts of transmission thoroughly, using a suitable cleaning solvent to remove all grease and foreign matter. Dry parts with moisture-free compressed air.

Soak bearings in a suitable cleaning solvent to loosen all hardened grease and foreign matter. Strike bearings (FLAT) against block of wood several times and again immerse in the cleaning solvent turning races slowly. Repeat these operations until bearings are clean and then blow them dry with filtered moisture-free compressed air.

CAUTION

Do not spin bearings with compressed air as damage to the bearing may result.

Inspection

Bearings

Check bearings for flaking, cracks and fractures, cavities and indentations, staining, measurable wear, brinelling, fretting, corrosion, seizing, galling, scoring, nicking and cage failures. If any of these are apparent in any amount they should be replaced.

Mainshaft tapered bearings are set up with an end-play condition. If the end-play exceeds the specified limits, refer to charts, they are to be readjusted or if any of the above conditions are apparent, they are to be replaced.

Bushings and Shafts

Check bushing clearance. See Figure 5-16. Replace bushings when running clearances specified on charts are exceeded due to bushing wear. Replace all bushings that have turned out of the staking notches. New bushings must be properly staked and sized for specified clearance. Bushing end should be recessed 0.040 to 0.050 inch in gear.

Gear Bushing I. D.

First Speed

Floating Gear ---- 3.1289 to 3.1294

Second & Third Speed

Floating Gear ---- 3.5043 to 3.5048

Fourth/Fifth Speed

Floating Gear ---- 2.8433 to 2.8438

HI-Split

Floating Gear ---- 3.0043 to 3.0048

LO-Split

Floating Gear ---- 3.5043 to 3.5048

LO-LO

Floating Gear ---- 3.0043 to 3.0048



Figure 5-16. Method of Checking Gear Bushing to Mainshaft Clearance

Shafts and sleeves should be replaced if they show ridging, galling or wear of the journal area in excess of .003 inch.

Gears

Replace gear if teeth show any sign of abrasive wear, scratching, ridging, scoring, surface fatigue, pitting, spalling, corrosive wear, digging in and cracking. Gears may also be checked by Magnaflux or similar system for cracks which would not otherwise be visible.

Check gear end-play. See Figure 5-17. Gear end-play must not exceed specified limits shown on chart.



Figure 5-17. Method of Checking Gear End-play

NOTE

After bearing end-play, bushing clearance, thrust washer thickness and gear end-play have been established, disassemble mainshaft and compound mainshaft and set aside for reassembly.

Shifter Fork, Sliding Clutch and Shift Rail

Replace forks and/or clutches if side clearance in groove is in excess of specified limits, shown on chart.

Replace shift rails if cracked in either the poppet or stake screw holes. In the case of wear whereby, the clearance between the shift rail and the mating housing bore exceeds .010 inch maximum, check to determine which member is worn before replacing same. Shaft wear may be checked by comparing shaft diameter at an "unwearing" point as against the wear point.

Replace poppet springs that have lost their tension.

Vane Oil Pump

Renew pump parts only, if they are scored or chipped or if vane is loose in its mating bore in excess of .006 inch.

Pressure of the pump is low and therefore difficult to measure. A functional check should be made on the pump, prior to installing the transmission cover. This can be accomplished by pouring oil into the pump pickup trough, while revolving the main driving pinion. If the pump is functioning, oil will appear at various outlets along the main shaft. This practice will also insure initial prime to the pump.

Housing

Check housing for cracks and conditions of threaded holes. Check all mating surfaces for flatness. Be sure all old gasket material is removed from flanges. Check flanges for flatness, bolt and dowel holes for elongation. Check studs for torque, thread damage and straightness.

REASSEMBLY

NOTE

ALL parts, especially the bearings, should be generously coated with SAE-30 oil while the transmission is being assembled. This will assure immediate lubrication when first starting and will prevent seizing of these parts. As moving parts are assembled, check frequently to see that they move freely.

So that the same instructions do not have to be repeated for every operation, we will state here that ALL new cover gaskets at final assembly are to be coated on BOTH sides with a good gasket sealer. When the attaching capscrews are tightened to their recommended torque values, the sealer will assure leak-proof joints between the covers and the case. The metal shell of oil seals that contact whatever retains them, should also be coated lightly with a good gasket sealing compound before installation.

In most cases, it is easier to coat the metal parts rather than the gasket. The dry gasket can be placed in position on the transmission case since the sealing compound is adhesive enough to hold the gasket until the cover is attached over it and fastened by capscrews.

As a further measure against oil leakage, additional sealing compound should be applied around the entire joint of each cover under which there is either a shim pack or a gasket.

NOTE

Bushing clearance, gear end-play, thrust washer thickness, bearing end-play, etc., must be inspected and corrected per specification charts before reassembly. Also refer to specification charts for correct screw torques during reassembly.

1. Insert gear key in countershaft and press gears on one at a time. These gears

have an interference fit and can be pressed on cold but for best results, the gears should be shrunk-fitted on shaft. With a heat lamp or hot oil, heat gears 270 to 300°F. for a period of not more than 1/2 hour. Oil shaft for each gear. Install gear snap ring. Then install front bearing inner race on spigot.

2. Install countershaft front bearing in case, then install bearing cover and gasket.

3. Place countershaft assembly in case with small end extending out of rear bearing opening. Install rear bearing cup in case. Install tapered roller bearing cones back-to-back on rear end of countershaft and secure with clamp plate. Position countershaft in front bearing.

4. Insert gear key in compound countershaft and press gears on one at a time. These gears have an interference fit and can be pressed on cold but for best results, the gear should be shrunk-fitted on shaft. With a heat lamp or hot oil, heat gears 270 to 300°F. for a period of not more than 1/2 hour. Oil shaft for each gear. Press bearing cup in front end of compound countershaft constant-mesh gear and bearing cone on rear end. Push the countershaft rear bearing cup in compound case and install shim pack and bearing cover. Temporarily assemble the compound countershaft, case-to-case gasket and compound case to the main case and countershaft.

5. Preload countershaft bearings as follows: Lubricate all bearings with SAE 30 oil. Wrap a string around countershaft second-speed gear (largest integral gear) several times. Attach a spring scale to looped free end of string and with a steady pull, rotate the assembly SLOWLY. Repeat this operation and adjust thickness of rear bearing shim pack until recommended rolling-drag is read on the scale. When correct shim pack thickness is established, remove compound case and compound countershaft from main case.

6. Position reverse cluster gear shaft so that slot in end of shaft will permit shaft lock to engage it. Start shaft into case. Assemble roller bearings and spacer in cluster gear. Position assembled gear in case with gear thrust washer in place,

and with nylon hammer, tap shaft into case, thrust washers and gear. Install shaft lock and capscrew, tighten capscrew to specified torque. Lock capscrew with soft iron wire after tightening.

7. On bench, install compound mainshaft spigot roller bearing in end of mainshaft (compound driving pinion) and retain with snap ring.

8. Place gear end of mainshaft in vise with soft metal jaws. Install rear bearing cone, bearing retainer with two cups, bearing cone spacer, front bearing cone and bearing split thrust washer. Press or drive positioning ring over split washer. Install third-speed thrust washer Woodruff key in shaft.

9. Start mainshaft in case through rear bearing hole. As mainshaft is advanced into working position, slide parts on mainshaft as follows: first-speed gear, reverse gear splined sleeve, reverse gear, second-speed gear, third-speed splined sleeve and sliding clutches, third-speed gear and third-speed gear thrust washer with Woodruff key. Install sleeve in fourth/fifth-speed gear and install assembly on mainshaft. With a small tool, rotate fourth/fifth-speed sleeve one tooth so that inner teeth align with mainshaft splines. Install key in deepened spline root and install fourth/fifth-speed sliding clutch on splines and over inlaid key. At this point the mainshaft rear bearing retainer or rear bearing for five-speed should be seated in main case.

10. Install mainshaft rear bearing retainer capscrews and lock heads together with soft iron wire.

11. Install inner race of spigot bearing on front end of mainshaft and retain with snap ring.

12.) Assemble mainshaft spigot bearing in gear end of main driving pinion and retain with snap ring. Turn pinion over and place in vise with soft metal jaws. Install pinion ball bearing and bearing nut. Tighten nut, (left-hand thread) then positive stake lip of nut to pinion in slot provided. Install oil tube in pinion gear end. Position outer race of ball bearing so that the filler notch will be in the six o'clock position and install pinion assembly in trans-

mission case. Be very careful not to damage spigot bearing when inner race on mainshaft enters the rollers. Install oil pump vane in pinion and install bearing cover. Tighten cover capscrews.

13. At this point, the main case should be positioned in a vertical position with the pinion pointing downward.

14. Clamp compound mainshaft in vise with soft metal jaws or improvised holding device and assemble as follows: Slide HI-split floating gear and fixed clutch on front end of shaft, install clutch nut and tighten. Then positive stake lip of nut to shaft in slot(s) provided. Install inner race of bearing on shaft spigot.

Slide LO-split floating gear on fixed clutch and install both parts on rear end of compound mainshaft. Install sliding clutch on fixed clutch. Install LO-LO-split gear sleeve on shaft, then slide LO-LO floating gear on sleeve. Press inner rear bearing cone on shaft next to sleeve. Install HI-split clutch on its fixed clutch.

15. Install interconnecting oil tube in end of mainshaft and carefully engage spigot of assembled compound mainshaft with oil tube and spigot bearing in end of mainshaft. Be very careful not to damage oil tube as it engages compound mainshaft spigot. Place compound countershaft (assembled earlier) on countershaft rear bearing cone and make sure all gears are properly meshed.

16. Paint end of main case with a good gasket sealer compound and install case-to-case gasket. Carefully lower compound case down over assembled parts and see that bearings are properly seated. Install and tighten case-to-case capscrews and dowel bolts. Install double-row rear bearing cup in compound case. Install rear bearing cone.

17. Install speedometer drive gear on shaft. Also bearing thrust washer when five-speed. Apply gasket sealer to case and gasket and install rear bearing retainer gasket. Install retainer and capscrews with lock-washers. Tighten capscrews. Apply sealer compound to metal parts of drive flange oil seal and install seal in rear bearing cover. Oil lip of seal, install

drive flange and nut. Return transmission to normal position. Check sliding gear and all sliding clutches for proper engagement.

18. Lock up gear train by engaging sliding gear and sliding clutches. Tighten flange nut to recommended torque. Then install nut cotter pin.

19. Position main case cover in bench vise with soft metal jaws. Install transmission case breather and toggle shifter levers.

20. Starting with first and reverse speed shifter rail, start rail in cover and first and reverse shifter. Install spring and poppet ball in cover and with a blunt tool compress detent ball, push rail over compressed ball, through first and reverse speed rocker shifter and into neutral position. Install large interlock pin next to rail.

21. (DIRECT ONLY) Start second and third-speed rail in cover. Install second and third-speed shifter on rail. Install spring and poppet ball in cover and with a blunt tool compress detent ball, push rail over compressed ball, through second and third-speed fork and into neutral position. Install small interlock pin in second and third-speed rail then install large interlock pin next to rail. Install SHORT first and reverse speed rail with first and reverse speed fork in cover. Start fourth and fifth-speed rail in cover. Advance rail through fourth and fifth-speed fork and shifter. Install and compress spring and detent ball, then pass rail over compressed ball and into working position.

22. (OVERGEAR ONLY). Start second and third-speed rail in cover. Advance rail through fourth and fifth-speed fork and second and third-speed shifter. Install spring and poppet ball in cover, and with a blunt tool compress detent ball, push rail over compressed ball, through second and third-speed fork and into neutral position. Install small interlock pin in second and third-speed rail, then install large interlock pin next to rail. Install SHORT first and reverse speed rail with first and reverse speed fork in cover. Start fourth and fifth-speed rail in cover. Advance rail through fourth and fifth-speed rocker shifter. Install and compress spring and detent ball, then pass rail over compressed ball and into working position.

23. Install shifter and fork setscrews, tighten, then lock each setscrew to its rail with soft iron wire. Install new Welch plugs in shifter rail openings. Remove cover from vise.

24. Place compound case cover in vise with soft metal jaws. Oil compound shifter rail oil seals and install in cover. Install and compress spring and detent ball in cover, then pass LO-split rail over ball, through fork and into working position. Install interlock pin. In a like manner install and compress spring and detent ball in cover, then pass HI-split rail over ball, through fork and into working position. Install pipe plug in pin hole. Install fork set screws, torque, then lock set screws to rail with soft iron wire. Remove cover from vise.

NOTE

Check interlock for proper function. Make sure that not more than one rail of any group can be moved to the engaged position simultaneously.

25. Apply gasket sealer compound to case openings and cover gaskets and install gaskets on cases. Position sliding gear and all sliding clutches in neutral position. Install both assembled covers and make sure the shifter forks engage the grooves in their mating parts. Install cover capscrews with lockwashers and torque.

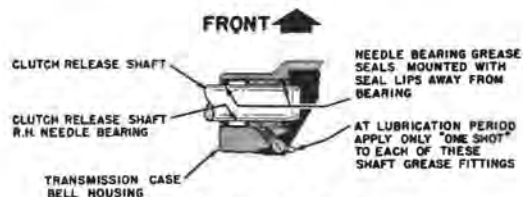
26. Apply sealer compound to all other cover gaskets and install covers and capscrews with lockwashers. Check for proper shifting and free rotation of gears. Install clutch release shaft, yoke bearing, return spring and any other external part that was removed for disassembly. Recheck all fasteners for correct torques and locking means. Install all plugs, then remove transmission from stand.

NOTE

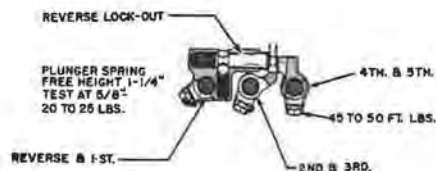
After transmission is installed in vehicle, adjust rocker(s). Refer to sub-heading 'SHIFTER RAIL ROCKER ECCENTRIC PIVOT PIN.

SPECIFICATIONS

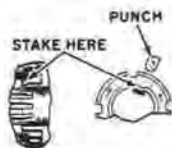
Gearset, Make -----	Mack	Lubrication -----	Pump feed through rifle-
Model -----	TRQ-72 Series		drilled passages in both
	TRQ(L)-722 Series		mainshafts to all free-
	TRQ-7210		running floating gears
Type -----	20 Speed, Quadruplex	Pump, Type ---	Built-in Reciprocating Vane
Control -----	Selective, 2 lever,		
	Manual, Constant-Mesh	Case, Material ----	Aluminum or Cast Iron
Speeds, Forward -----	Twenty	PTO, Openings & Type	(2) SAE
Reverse -----	Four		Special Depth
Bell Housing, Type -----	Separable	Oil Capacity, pts. -----	36
Opening -----	SAE #2, shallow		
	SAE #1, shallow		
	SAE #1, deep		



R.H. MOUNTING ARRGT. OF CLUTCH RELEASE SHAFT



FRONT VIEW OF SHIFTER ARRANGEMENT



POSITIVE STAKING METHOD
USE ROUND-NOSED PUNCH TO STAKE METAL LIP OF NUT INTO MILLED SLOT IN SHAFT

PRELOADING OF COUNTERSHAFT BEARINGS

WRAP STRING AROUND 2ND. SPEED GEAR SEVERAL TIMES. ATTACH SPRING SCALE TO LOOPED FREE END AND WITH A STEADY PULL, ROTATE ASSEMBLY SLOWLY. ADJUST REAR BEARING SHIM PACK UNTIL ROLLING - DRAG IS:

NEW TAPERED BEARINGS... 8 TO 11 LBS. PULL
USED OR RUN-IN TAPERED BEARINGS... 4 TO 5-1/2 LBS.

MAINSHAFT BEARING ADJUSTMENT			
	MIN. NEW	MAX. NEW	MAX. WEAR
END-PLAY AT <input type="checkbox"/>	.001	.005	.015
END-PLAY AT <input type="checkbox"/>	.003	.007	.017

THRUST WASHER		AVAILABLE THICKNESSES	
1	3RD. SPEED GEAR USE (1) AS REQUIRED	.271	.291
2	1 ST. SPEED GEAR SELECT AS REQUIRED FOR TIGHT FIT IN GROOVE	.368 .380 .400 .410 .420	.370 .395 .405 .415 .425

SCREW TORQUES IN FT.-LBS.		
SCREW	LUBRICATED	
1	60	80
2	125	155
3	45	65
4	225	255

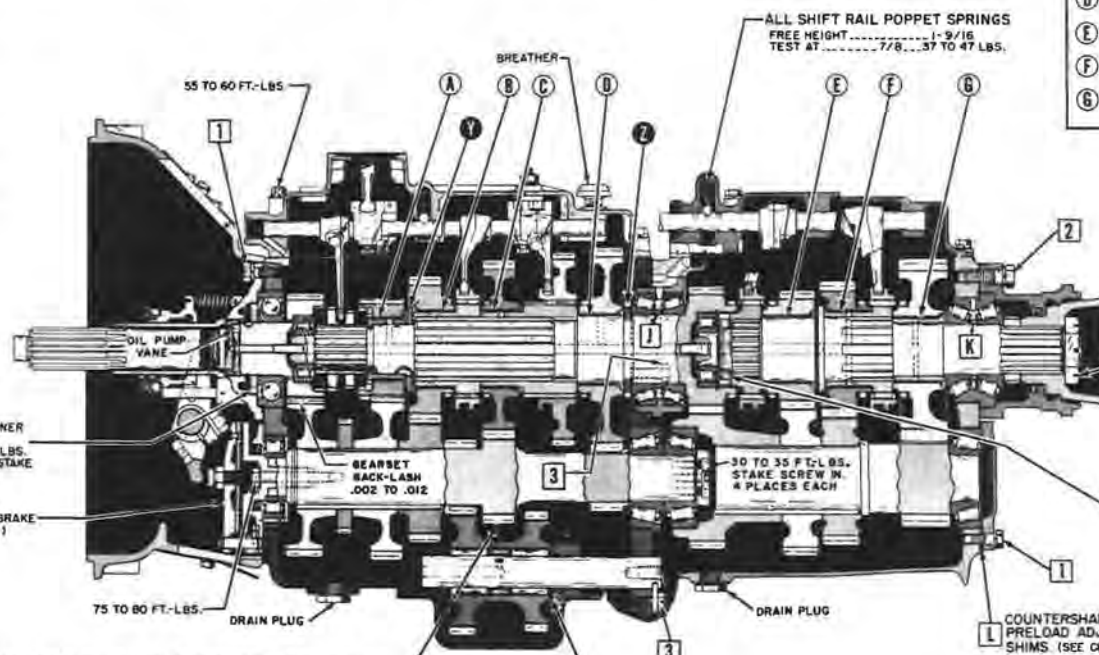
FLOATING GEAR	GEAR END-PLAY			BUSHING CLEARANCE		
	MIN. NEW	MAX. NEW	MAX. WEAR	MIN. NEW	MAX. NEW	MAX. WEAR
A 4-TH/5-TH SPEED	.003	.007	.015	.0036	.0046	.0076
B 3-RD. SPEED	.004	.008	.015	.0043	.0053	.0080
C 2-ND. SPEED	.004	.008	.015	.0043	.0053	.0080
D 1-ST. SPEED	.006	.011	.015	.0039	.0049	.0078
E COMPOUND HI-SPLIT	.005	.009	.015	.0048	.0058	.0080
F COMPOUND LO-SPLIT	.005	.009	.015	.0043	.0053	.0080
G COMPOUND LO-LO SPLIT	.005	.009	.015	.0053	.0063	.0080

BEARING SPACER PART NUMBER	THICKNESS
J 28 KD 139-P270 THRU 28 KD 139-P354 (USE (1) AS REQUIRED)	.270 THRU .334
K 28 KD 140-P306 THRU 28 KD 140-P361 (USE (1) AS REQUIRED)	.306 THRU .361

BEARING SHIM PART NUMBER	THICKNESS
L 74 KG Z29A-P1	.005
" P2	.007
" P3	.020
" P4	1/32

ALL FORKS IN SLIDING CLUTCHES			
	MIN. NEW	MAX. NEW	MAX. WEAR
SIDE-CLEARANCE	.005	.020	.050

* NOTE - IF UNIT HAS EXPERIENCED DISENGAGEMENT SIDE CLEARANCE MUST NOT EXCEED .050 MAX.



REVERSE IDLER GEAR
END-PLAY... .004 TO .022

RECOMMENDED TORQUES FOR CAPSCREWS NOT ILLUSTRATED
BELL HOUSING-TO-MAIN CASE CAPSCREWS... 4
MAIN CASE-TO-COMPOUND CASE DOWEL BOLT AND CAPSCREWS... 2

5-SPEED MAIN BOX GEAR SET

4-SPEED COMPOUND BOX GEAR SET

NOTES

TR107 SERIES (MAXITORQUE) UNIT SYMBOLS

Explanation

This chart explains the various letters and numbers used to specify transmission model and series. The absence of any letter or number indicates that the feature indicated is not used.

TR	TRANSMISSION
L	LIGHTWEIGHT (Aluminum Cases)
D	DUPLEX
T	TRIPLEX (Front and Rear Compound)
X	EXTENDED RANGE
G	SEVEN SPEED SERIES
107	TRANSMISSION SERIES
6	TWO REAR COUNTERSHAFTS
8	THREE REAR COUNTERSHAFTS
1	EXTRA LOW RANGE
0	OVERGEAR
A	AIR SHIFTED REAR COMPOUND

NOTES

MAXITORQUE TRANSMISSION 5 Speed (Early Style with Mack Clutch)

DESCRIPTION

The TRL107 is a triple countershaft transmission providing five forward speeds and one reverse speed. Short in length, light in weight and easy to service, this new transmission is designed for use in over the road trucks and tractors particularly in long distance operation on varied terrain.

The five speed gearset is housed in a high strength aluminum case which is constructed in two pieces for maximum convenience of disassembly and reassembly. See Figures 5-18 and 5-19.

unique design is that the mainshaft gears are self centered among the three countershafts, eliminating the need for gear bushings. The mainshaft gears are connected to the mainshaft only when engaged by a sliding clutch.

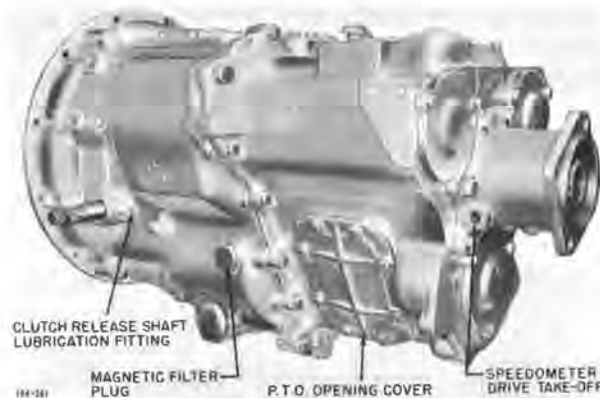


Figure 5-18. Left Rear View of Transmission

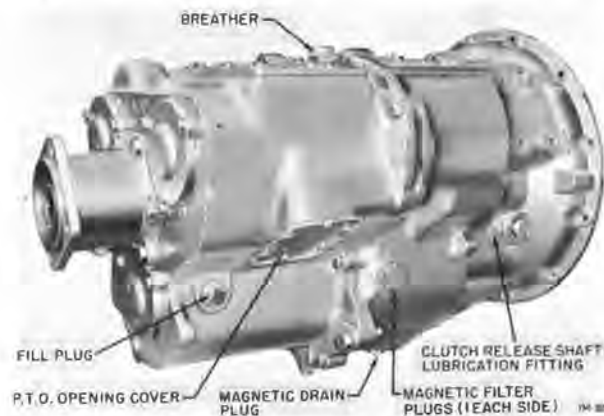


Figure 5-19. Right Rear View of Transmission

Steel liners are cast in aluminum case at all shaft bearing locations and in rear case support web. These steel liners assure maximum service life plus the advantages of lightweight construction.

Unlike conventional transmissions, three countershafts are equally spaced around the input shaft. See Figure 5-20. This design provides extremely high capacity in the shortest overall length. By distributing the load equally among three shafts, normal deflection is reduced to a minimum. Another

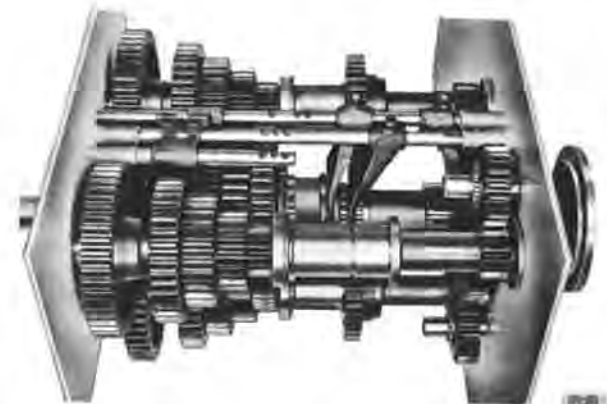


Figure 5-20. Skeletal View of Transmission in Support Plates

All gears of the gearset are of the spur type design and with the exception of reverse speed sliding gear, are in constant mesh with the countershaft gears. Other than reverse, driving engagement for the five forward speeds is effected by means of sliding clutches. Reverse is obtained by engaging reverse sliding spur gear with the three individually mounted idler gears. Conventional forks spanning the sliding clutches and reverse gear, move these parts in response to the movement of the gear shifter hand control lever by the driver.

A single row ball bearing supports the main driving pinion. The mainshaft is supported by a roller spigot bearing at the front end and ball bearing at the rear. The countershafts are carried by a ball bearing and roller bearing combination. Ball bearings which are the snap ring type provide shaft location, while the roller bearing is located adjacent to the more heavily loaded low range gears. In constant mesh with the countershafts, each of the three reverse idler gears revolves on a roller bearing mounted on a shaft.

LUBRICATION

All rotating and sliding parts of the transmission are bathed in oil from gear throw-off when the engine is operating.

However, the sliding clutches and mainshaft gears require more positive provision for lubrication, and for this reason, pressure lubrication of the clutches and gears is provided by a simple eccentric shuttle type pump built in the main driving pinion. As the pinion rotates, the pump vane reciprocates in its eccentric housing, thus forcing lubricant under pressure through rifle-drilled holes in the mainshaft to the sliding clutches and mainshaft gears. To supply the pump, oil from gear throw-off is collected by a trough located above the main driving pinion and is then gravity fed to the pump.

Removal of all foreign metallic particles within the transmission is accomplished by a magnetic oil filter on the side of the case. The filter consists of an integral open trough and baffle arrangement with a removable sheet metal cover. At the bottom of the baffle, a tapped hole in the case accommodates a large hex plug with a powerful built-in magnet installed from outside.

The oil from gear throw-off is collected by the filter and is made to pass the magnetic plug which pulls all ferrous metal particles out of the passing oil and holds them. After passing the magnet, clean and chip-free oil then rises to the outlet near the top of the filter and drops down into the transmission case. A magnetic drain plug is also provided at the bottom of the case.

When the oil is hot, as when coming in from a run, the oil level of the transmission should be checked with the vehicle on level ground. To add oil, remove plug on the right side of the case and fill. The level should not be above the filler-plug hole. Check level at interval specified.

At every check or change, remove, clean and reinstall magnetic plug on side of case.

To change oil, remove magnetic drain plug and drain oil from case while hot. If necessary, also flush case with flushing oil and drain thoroughly.

NOTE

Earlier production transmissions used two magnetic filter plugs, one on either side of the main compound.

CLUTCH BRAKE

In any unsynchronized transmission, the rapidity with which an upshift can be made is limited by the time it takes for the free-spinning clutch disc and countershaft assemblies to slow down to the slower rotating speed of the transmission mainshaft. In order to reduce this time element to a minimum, Mack clutch brake which is standard equipment, is employed.

The brake is assembled on the transmission lower countershaft, and since the countershaft is always connected to the clutch disc through the constant mesh driving pinion, action of the brake will overcome the tendency of the discs to continue to rotate at high speed when the clutch is disengaged.

Adjustments - See Figure 5-21.

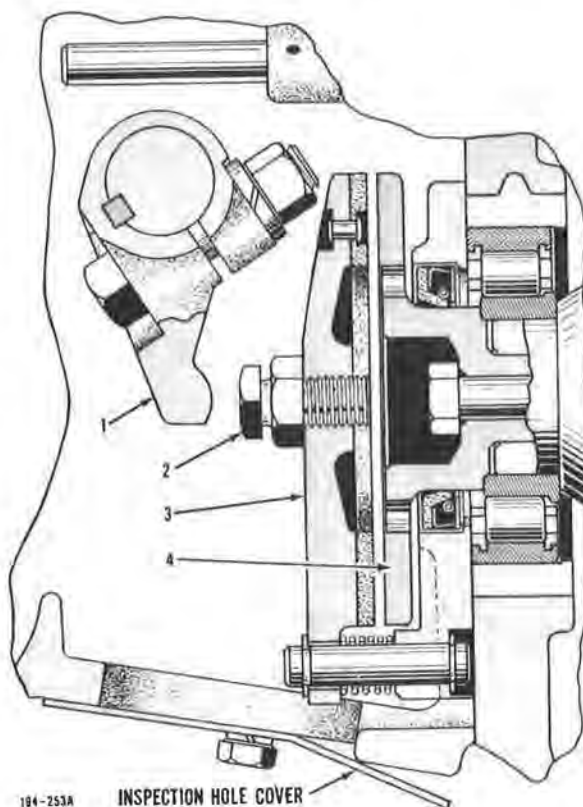


Figure 5-21. Sectional View of Clutch Brake

To adjust the clutch brake, remove inspection hole cover on bottom of bell housing. Loosen setscrew locknut. Depress clutch pedal to within $\frac{1}{2}$ to 1 inch of the end of its travel. Adjust setscrew (2) so that brake pressure plate and lining assembly (3) firmly contact flange (4). Lock setscrew with locknut and install inspection hole cover.

NOTE

It must be remembered that each time a clutch adjustment is made to provide the 1/8 to 3/16 release bearing clearance, setscrew (2) which pushes the clutch brake pressure plate and lining assembly (3) must also be adjusted to suit location of clutch throwout lever (1). When the initial wear on clutch driven disc assembly has been used up and the spacers on CL-50 series clutch are to be removed, first move setscrew (2) in to allow sufficient clearance with lever (1); then remove adjusting spacers. When clutch cover is tightened down, readjust release bearing and clutch brake.

SPECIFICATIONS

Gearset

Make Mack (Three countershafts)
Model TRL107
Type Five speed
Control Selective, single lever,
manual

Speeds, Forward Five
Reverse One

Bell Housing, Type Separable

Lubrication . . . Gear throw-off and pump
feed through rifle drilled
passages in mainshaft to
sliding clutches and main-
shaft gears.

Pump, Type . . . Built-in reciprocating vane
Case, Material Aluminum

P. T. O. Openings

Left Side Std. SAE 8 hole

Right Side Std. SAE 6 hole

Oil Capacity, Pts. 22

DISASSEMBLY

Main Components

NOTE

Unless a complete overhaul is necessary, remove only those parts required to gain access to the faulty parts. Do not disturb parts having heavy press fits unless replacement is necessary. In that case, use proper press setups and pullers so that usable parts are not damaged.

1. After draining lubricant and removing transmission from vehicle, clean externally and mount unit in a suitable overhaul stand. Remove hand brake parts, clutch release bearing assembly with return spring, clutch release shaft and yoke.

2. Remove clutch brake pressure plate snap rings as shown in Figure 5-22, then remove pressure plate and springs. See Figure 5-23.



Figure 5-22. Removing Clutch Brake Pressure Plate Retaining Snap Rings



Figure 5-23. Removing Clutch Brake Pressure Plate

3. Remove clutch brake flange screw (left-hand thread). Using tool J23067, remove clutch brake flange. See Figure 5-24.

4. Remove transmission case top opening covers. Cautiously remove shifter rail poppet ball cover (cover is spring loaded), pins and springs. See Figure 5-25. Poppet balls may be removed with a magnet.

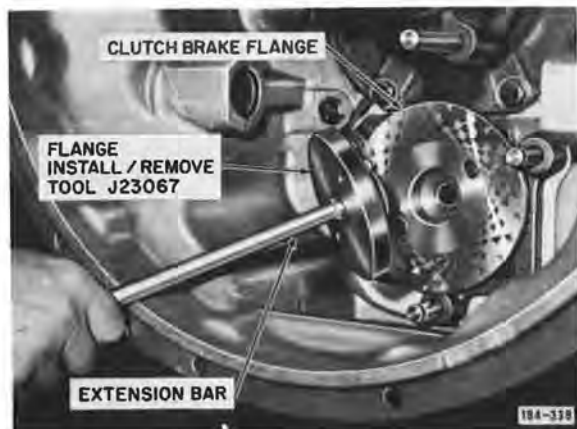


Figure 5-24. Removing Clutch Brake Flange

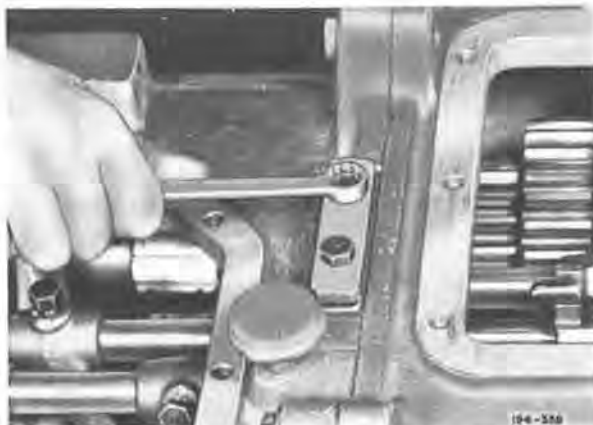


Figure 5-25. Removing Shifter Rail Poppet Ball Cover

5. Remove setscrews from shifters and shifter forks except second and third. Remove reverse speed shifter fork front snap ring. Withdraw shifter rails from case and at the same time remove shifters and shifter forks. Slide reverse shifter fork snap ring forward, then slide fork forward to be able to slide rear snap ring rearward. While moving rail forward, alternately move front and rear snap rings rearward until rail is out of case.

NOTE

It is recommended that rear welsh plug be removed to withdraw the second and third shift rail. This can be accomplished by tapping on the shifter to drive rail rearward. Then remove

setscrew from second and third shifter and remove rail, fork and shifter from case.

6. Place transmission in two gears which will lock up assembly to facilitate the removal of the drive flange nut. Remove drive flange nut. Install standard puller and remove drive flange from mainshaft splines. Remove mainshaft rear bearing cover, then slide speedometer gear off of mainshaft.

7. Remove main driving pinion bearing cover capscrews and cover. See Figure 5-26. Remove oil pump vane carefully and save. Tap on gear end of main driving pinion with a nylon mallet if necessary and remove assembly from case.



Figure 5-26. Removing Main Driving Pinion Bearing Cover

8. Remove fourth/fifth speed sliding clutch from mainshaft. See Figure 5-27.

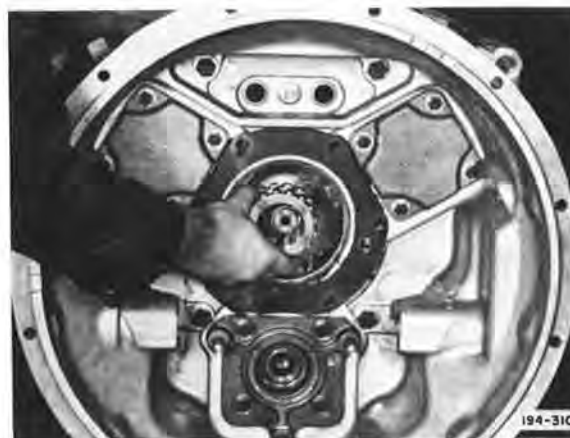


Figure 5-27. Removing Fourth/Fifth Speed Sliding Clutch

9. Pry key out of mainshaft spline using a small tool. See Figure 5-28.



Figure 5-28. Removing Fourth Speed Gear Thrust Washer Key

10. Using a small tool, rotate fourth speed gear thrust washer one spline tooth and slide washer off of mainshaft. See Figures 5-29 and 5-30.

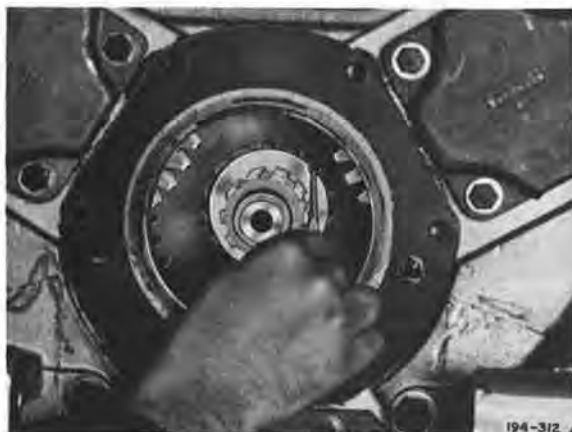


Figure 5-29. Disengaging Fourth Speed Gear Thrust Washer for Removal



Figure 5-30. Removing Fourth Speed Gear Thrust Washer

11. Carefully withdraw mainshaft from case through rear bearing opening. See Figure 5-31.



Figure 5-31. Removing Mainshaft

12. Remove fourth speed gear through transmission case top cover opening. See Figure 5-32.



Figure 5-32. Removing Fourth Speed Gear

13. Remove countershaft rear bearing cover capscrews and covers. Remove power take-off cover capscrews and covers. Through power take-off cover openings, remove the lower and right-hand rear countershaft power take-off gear front snap rings. See Figure 5-33.

14. Remove the three rear countershafts from case through rear bearing cover openings. While withdrawing the lower and right-hand countershafts, at the same time, slide the power take-off gears with its front snap ring off of shaft. See Figure 5-34.



Figure 5-33. Removing Rear Countershaft P. T. O. Gear Front Snap Ring



Figure 5-35. Removing First Speed Sliding Clutch



Figure 5-34. Removing Rear Countershafts



Figure 5-36. Removing Front Countershafts

15. Place transmission in a vertical position. Remove all case-to-case dowel bolts and capscrews. With a nylon headed mallet, tap rear case and separate it from the front case. Remove rear case and place on bench.

16. With transmission front case still in a vertical position, remove mainshaft sliding clutches and gears from case. See Figure 5-35.

17. Place transmission in a horizontal position, and remove countershaft front bearing cover capscrews and covers. Remove snap rings from outer race of countershaft front bearings.

18. Position transmission vertically, then remove the three front countershaft assemblies from case. See Figure 5-36.

SUB-ASSEMBLIES

Main Driving Pinion

Clamp gear end securely in large bench vise with soft jaws. Unstake pinion bearing nut and with a wrench remove left-hand threaded nut. Remove ball bearing by pressing or tapping off. Turn pinion over and remove retaining snap ring and spigot bearing. Remove oil tube.

Mainshaft

Remove mainshaft rear ball bearing positioning snap ring then press shaft out of rear ball bearing. Remove ball bearing spacer from shaft. Place mainshaft in vise having soft metal jaws and remove spigot bearing retaining snap ring and bearing inner race.

Rear Case

With a suitable puller withdraw the three idler gear shafts from case. Remove idler gears, bearings, thrust washers, and reverse speed gear from case. Remove countershaft roller bearing retaining snap rings and bearings from case.

Rear Countershafts

Remove countershaft rear bearing retaining snap ring and positioning snap ring, then press countershafts out of rear ball bearing.

Front Countershafts

Remove left and right-hand countershaft front bearing retaining snap ring. Remove countershafts front bearing and gear retaining snap ring. Turn countershafts over and remove roller bearing inner race from shafts.

For shops having a small capacity hydraulic press, press off one countershaft gear at a time. For shops having a large capacity hydraulic press, place countershaft assembly in press, slide length of heavy tubing over integral gear to engage the second speed gear and remove all gears in one operation.

INSPECTION

Clean case, covers and all other parts of transmission thoroughly, using a suitable cleaning solvent to remove all grease and foreign matter. Dry parts with moisture-free compressed air.

Bearings - Soak bearings in a suitable cleaning solvent to loosen all hardened grease and foreign matter. Strike bearings flat against block of wood several times and again immerse in cleaning solvent turning races slowly. Repeat these operations until bearings are clean and then blow them dry with filtered moisture-free compressed air.

CAUTION

Do not spin bearings with compressed air as damage to the bearing may result.

Bearings - Check bearings for flaking, cracks and fractures, cavities and indentations, measurable wear, brinelling, fretting, corrosion, seizing, galling, scoring, nicking and cage failures. If any of these are apparent in any amount they should be replaced.

Gears - Replace gear if teeth show any sign of abrasive wear, scratching, ridging, scoring, surface fatigue, pitting, spalling, corrosive wear, digging in and cracking. Gears may also be checked by Magnaflux or similar system for cracks which would not otherwise be visible.

Shifter Fork, Sliding Clutch and Shift Rail - Replace forks and/or clutches if side clearance in groove is in excess of specified limits, shown on "Screw Torques and Adjustment Chart." Replace shift rails if cracked in either the poppet or stake screw holes. In the case of wear whereby the clearance between the shift rail and the mating housing bore exceeds .010 inch maximum, check to determine which member is worn before replacing same. Shaft wear may be checked by comparing shaft diameter at an "unwearing" point as against the wear point.

Vane Oil Pump Parts - Renew pump parts only if they are scored or chipped or if vane is loose in its mating bore in excess of .006 inch.

Oil Seals - Check main driving pinion, lower countershaft front cover, mainshaft rear bearing cover, and shifter rail oil seals. Replace seals found to be damaged.

NOTE

If main drive pinion oil seal is replaced, pump sleeve must also be replaced as an assembly. When installing pump sleeve, apply Loctite grade B to O. D. to prevent rotation.

Replace cases found to be cracked. Check all other parts for wear and damage. Replace all parts as required. Replace all gaskets, O-rings, staked nuts and any part that shows mutilation. Replace poppet springs that have lost their tension. Clean up any threads that show mutilation.

Measuring Oil Pump Pressure - Pressure of the pump is low and therefore difficult to measure. A functional check should be made on the pump prior to installing the transmission cover. This can be accomplished by pouring oil into the pump pick-up trough while revolving the main driving pinion clockwise. If the pump is functioning, oil will appear at various outlets along the mainshaft. This practice will also insure initial prime to the pump.

REASSEMBLY

NOTE

Refer to "Screw Torques and Adjustment Chart" for fits and limits.

SUB-ASSEMBLIES

NOTE

All working parts, especially the bearings, should be coated with SAE oil while the transmission is being assembled. This will insure immediate lubrication when first starting and will prevent seizing of these parts. As moving parts are assembled, check frequently to see that they move freely.

Main Driving Pinion

Assemble mainshaft spigot bearing in gear end of main driving pinion and retain with snap ring. Turn pinion over and place in vise with soft metal jaws. Install pinion ball bearing with outer race snap ring toward pilot end of pinion. Install bearing nut and tighten (left-hand thread) to recommended torque. Then positive stake lip of nut to pinion in slot provided. Install new oil tube in pinion assembly.

Mainshaft

Install bearing inner race on mainshaft spigot and retain with snap ring. Position mainshaft in arbor press with spigot end down. Slide ball bearing spacer on shaft then press bearing on shaft. Install positioning snap ring in outer race of ball bearing.

Rear Case

Install roller bearing snap ring in inner retaining groove of case countershaft bores. Install and seat roller bearings against inner snap rings, then install outer snap ring in groove provided to retain bearings. Through top cover hole of case, install reverse speed gear (shifter groove of gear forward).

Position reverse idler gear shafts so that flats on end of shaft are pointing towards center line of countershaft bore. Start shafts

into case. Assemble roller bearing in idler gear. Position assembled gear in case (rounded teeth of idlers forward) with thrust washers at each end, and with a nylon hammer, tap shaft into case through thrust washers and gear. For final seating of idler gear shafts, see Figure 5-37.

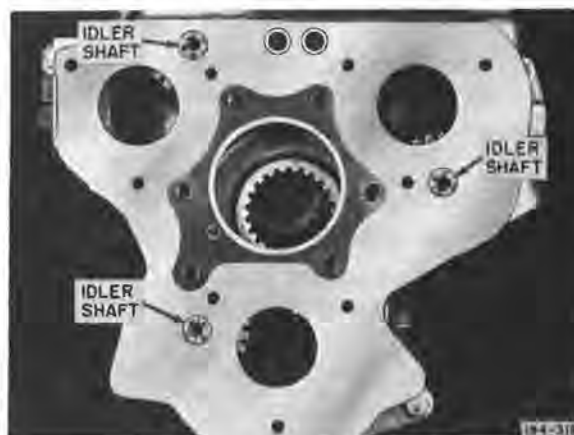


Figure 5-37. Final Seating of Idler Gears

NOTE

Apply sealer around idler gear shafts before final seating.

Rear Countershafts

Install lower and right-hand countershaft power take-off gear inner snap ring in groove provided. Press rear ball bearing on end of countershafts and retain with snap ring. Install positioning snap ring in outer race of bearings.

Front Countershafts - See Figure 5-38.

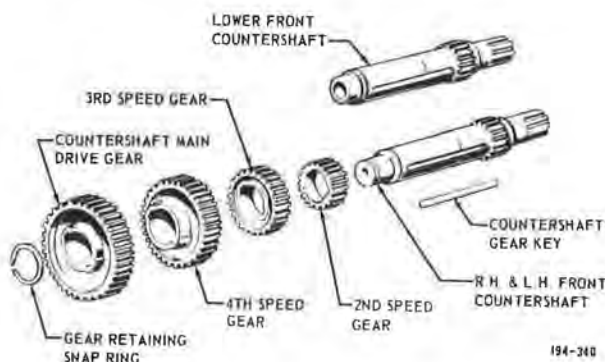


Figure 5-38. Front Countershaft Assembly

Press roller bearing inner race on rear end of countershafts. Insert gear key in countershafts and press gears on one at a time. These gears have an interference fit and can be pressed on cold, but for best results, the gears should be heated. With a heat lamp or hot oil, heat gears 270 to 300° F. for a period of not more than 1/2 hour. Oil shaft for each gear. Install gear snap ring, then press ball bearings on end of shafts. For the left and right-hand countershafts, install ball bearing retaining snap rings.

MAIN COMPONENTS

NOTE

All working parts, especially the bearings, should be coated with SAE 30 oil while the transmission is being assembled. This will insure immediate lubrication when first starting and will prevent seizing of these parts. As moving parts are assembled, check frequently to see that they move freely.

1. Position transmission front case vertically and install the three front countershaft assemblies in case. See Figure 5-39.



Figure 5-39. Installing Front Countershaft Assembly

2. Position transmission front case horizontally. Install front countershaft ball bearing positioning snap rings in outer race of bearings, then tap countershaft assemblies rearward until positioning snap ring seats against case.

3. Position O-ring in lower countershaft front bearing cover assembly. Position O-ring in left and right-hand countershaft front bearing covers. Install covers with O-rings and capscrews. Tighten capscrews to recommended torque.

4. Place transmission front case in a vertical position. Install mainshaft third speed gear so that the three alignment "O" marks on face of gear mate with the alignment "O" marks on the countershafts third speed gears. See Figure 5-40.



Figure 5-40. Installing Mainshaft Third Speed Gear

5. Install second/third speed sliding clutch and engage with third speed gear clutch teeth. See Figure 5-41.



Figure 5-41. Installing Second/Third Speed Sliding Clutch

6. Install second speed gear (clutch teeth to the rear) over second/third speed sliding clutch and engage with the countershaft second speed gears. See Figure 5-42.



Figure 5-42. Installing Second Speed Gear

7. Install first speed gear (clutch teeth to the rear) and engage with countershaft first speed gears. See Figure 5-43.



Figure 5-43. Installing First Speed Gear

8. Position first speed sliding clutch on second/third speed sliding clutch. See Figure 5-44.

9. Paint end of front case with a good gasket sealer compound and install case-to-case gasket. Paint rim of gasket with sealer and lower rear case assembly over assembled countershafts. Tap case into position so that bearings are seated properly then install case-to-case capscrews and dowel bolts and tighten to recommended torque.



Figure 5-44. Installing First Speed Sliding Clutch

NOTE

The following step will include the installation of all three rear countershafts. The only exception will be that the upper left-hand countershaft does not require a power-take-off gear.

10. Position transmission horizontally. Start rear countershaft through rear bearing opening in case. While advancing countershaft, position power take-off gear and gear retaining front snap ring on shaft. See Figure 5-45.



Figure 5-45. Installing P. T. O. Gear on Rear Countershaft

11. Observe timing "O" marks on front and rear countershaft splines. See Figure 6-46. Align timing "O" marks on rear countershaft with timing "O" marks on front countershaft and continue advancing shaft until the countershaft rear bearing positioning snap ring seats against case.

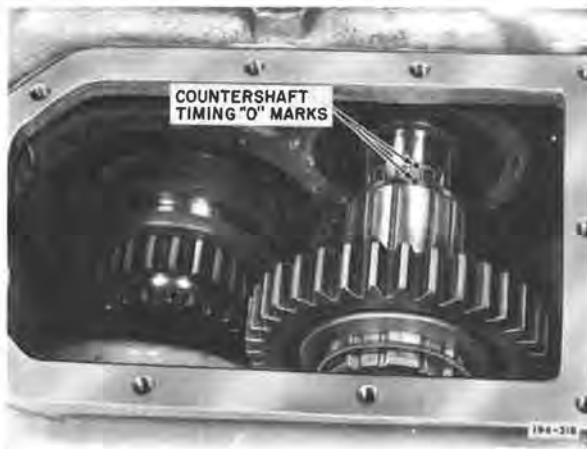


Figure 5-46. Aligning Timing "O" Mark on Rear Countershaft with Front Countershaft

12. Position power take-off gear on countershaft splines, then install gear front snap ring in groove provided to retain gear. See Figure 5-47.



Figure 5-47. Installing P. T. O. Gear Front Snap Ring

13. Install O-rings in countershaft rear bearing covers. Install covers with capscrews and washers, then tighten capscrews to recommended torque.

14. Engage reverse speed sliding gear with the reverse idler gears. Install fourth speed gear in case (clutch teeth forward) and engage with countershaft gears. See Figure 5-48.



Figure 5-48. Installing Fourth Speed Gear

15. Start mainshaft in case through gear bearing opening. See Figure 5-49. Advance shaft through reverse speed gear, second and third speed sliding clutch and fourth speed gear until rear bearing positioning snap ring seats against case. Install speedometer drive gear on shaft. Apply sealer compound and install rear bearing cover gasket and cover. Install cover capscrews and tighten to recommended torque. Oil lip of cover oil seal, and install drive flange and nut.



Figure 5-49. Installing Mainshaft

16. Place transmission in two gears which will lock up assembly. Tighten flange nut to recommended torque.

17. Install fourth speed gear thrust washer on mainshaft. See Figure 5-50.

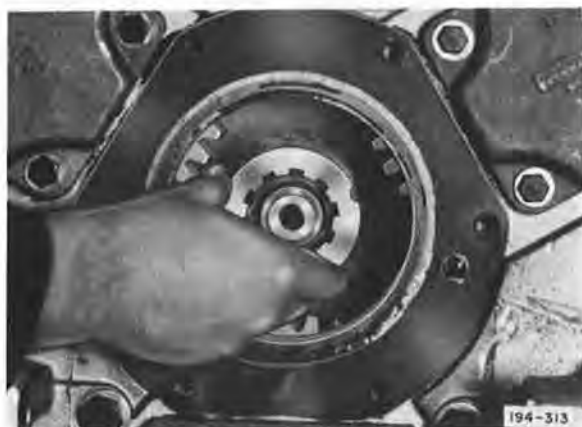


Figure 5-50. Installing Fourth Speed Gear Thrust Washer

18. Using a small tool, move thrust washer one tooth so that the inner teeth align with mainshaft splines. See Figure 5-51.



Figure 5-51. Aligning Fourth Speed Gear Thrust Washer Internal Teeth with Mainshaft External Teeth

19. With two feeler gages, check between third and fourth speed gear for recommended end-play. See Figure 5-52. Refer to "Screw Torques and Adjustment Chart" for selective thrust washers to obtain recommended end-play.

20. Install washer key in deepened spline root and slide fourth and fifth speed sliding clutch on splines, over inlaid key, and engage with fourth speed gear. See Figure 5-53.



Figure 5-52. Checking Mainshaft Gear End-Play



Figure 5-53. Installing Fourth/Fifth Speed Sliding Clutch

21. Position the drive pinion assembly into place being careful not to damage spigot bearing. See Figure 5-54.



Figure 5-54. Installing Main Driving Pinion

22. Install oil pump vane in pinion. See Figure 5-55. Vane should be flush with the R.H. side of the pinion shaft and protruding slightly from the left side (as observed from the front of the transmission). This will insure alignment of vane with eccentric bore in cover during assembly. Apply sealer compound and install pinion cover gasket and cover. Install cover capscrews and tighten to recommended torque.



Figure 5-55. Installing Oil Pump Vane

23. Install reverse speed fork on reverse speed sliding gear and install first speed fork on first speed sliding clutch. See Figures 5-56 and 5-57.



Figure 5-56. Installing Reverse Speed Shifter Fork



Figure 5-57. Installing First Speed Shifter Fork

24. Install first and reverse speed shifter rail through front of case and first and reverse speed shifter. See Figure 5-58. Advance rail through intermediate bore of case, first speed fork, front snap ring, reverse speed fork and rear snap ring until rail reaches neutral position. Install fork and shifter setscrews and tighten to recommended torque.



Figure 5-58. Installing First and Reverse Shifter

NOTE

Assemble snap rings with rounded edge of rings against shifter fork. After assembling snap rings, rotate 30 degrees to assure rings are properly seated.

25. Start second and third speed shifter rail through hole provided in rear of case. Engage second and third speed fork with second and third speed sliding clutch, see Figure 5-59. Advance rail through hub of fork and intermediate bore of case.



Figure 5-59. Installing Second and Third Speed Shifter Fork

26. Install second and third speed shifter on rail, see Figure 5-60, and continue advancing rail into front support until it reaches neutral position. Install fork and shifter set screw and tighten to recommended torque.



Figure 5-60. Installing Second and Third Speed Shifter

27. Start fourth and fifth speed shifter rail in hole provided in front of case. Engage fourth and fifth speed fork with fourth and fifth speed sliding clutch. See Figure 5-61.



Figure 5-61. Installing Fourth and Fifth Speed Shifter Fork

Advance rail through hub of fork and intermediate bore until rail reaches neutral position. Install fork set screw and tighten to recommended torque. At this point make sure that the two shift rail oil seals and one welsh plug are installed at the front of the case and the two shift rail welsh plugs are in place at the rear of the case.

28. Install shift rail poppet balls, springs and pins in holes provided at top of case. See Figures 5-62, 5-63, and 5-64.



Figure 5-62. Installing Shift Rail Poppet Ball



Figure 5-63. Installing Shift Rail Poppet Ball Spring



Figure 5-64. Installing Shift Rail Poppet Ball Pins

29. Install poppet ball cover with capscrews and tighten capscrews to recommended torque. See Figure 5-65.



Figure 5-65. Tightening Shift Rail Poppet Ball Cover Capscrews

30. Apply sealer compound to transmission case top cover gaskets and install on case, then install covers with capscrews and tighten to recommended torque. Apply sealer compound to surface of power take-off covers. Install covers with capscrews and tighten.

31. Using tool J23067, install clutch brake flange as shown in Figure 5-66, then install flange screw (left-hand thread).

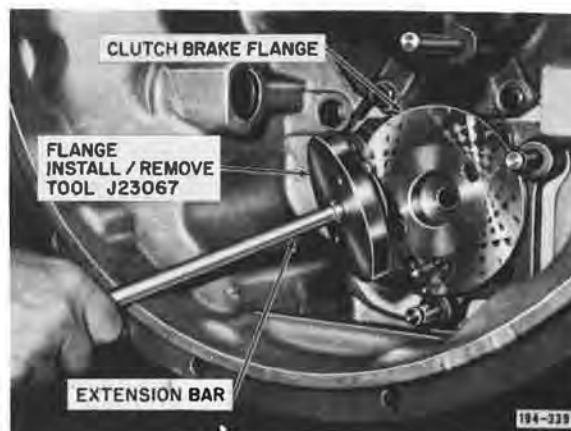


Figure 5-66. Installing Clutch Brake Flange

32. Install clutch brake flange springs on cover pins, then install clutch brake pressure plate. See Figure 5-67.

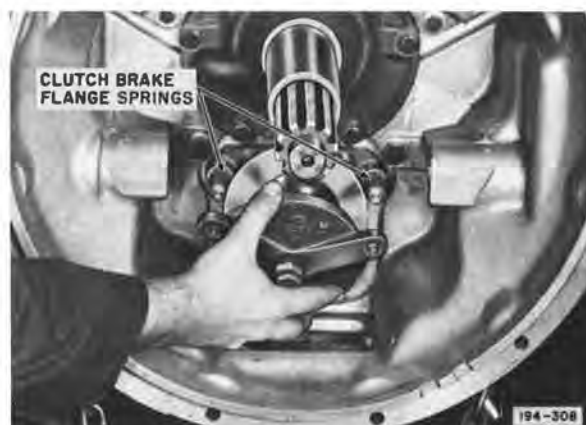


Figure 5-67. Installing Clutch Brake Pressure Plate

33. Retain clutch brake pressure plate by installing three snap rings as shown in Figure 5-68.

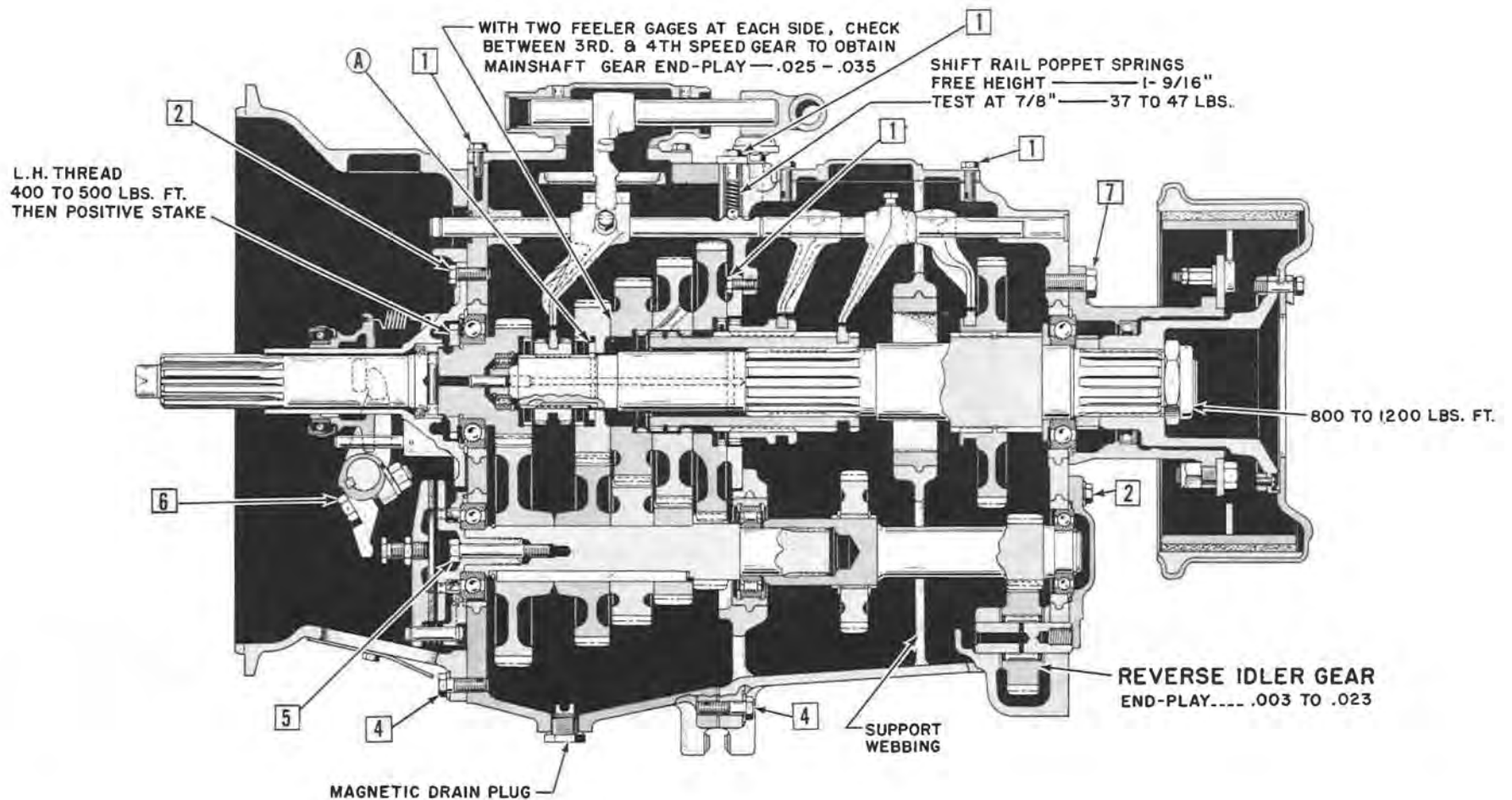
34. Install clutch release shaft with needle bearings and grease seals, yoke, bearing return spring and any other external part that was removed for disassembly. Recheck all fasteners for correct torque. Then remove transmission from stand.

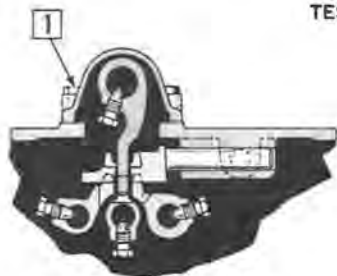


Figure 5-68. Installing Clutch Brake Pressure Plate Retaining Snap Rings

TRL - 107 5 - SPEED TRIPLE COUNTERSHAFT TRANSMISSION

SCREW TORQUES & ADJUSTMENT CHART





FRONT VIEW OF
SHIFTER DETAIL

FORK INTERLOCK BALL SPRING
FREE HEIGHT $1-1/4"$
TEST AT $1-1/8"$ 38 TO 42 LBS.



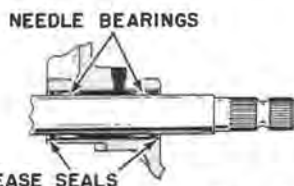
DETAIL OF SHIFTER FORK
INTERLOCK SPRING-LOADED
BALL AND DETENT ARRANGEMENT

ALL FORKS IN SLIDING CLUTCHES			
	MIN. NEW	MAX. NEW	MAX.* WEAR
SIDE-CLEARANCE...	.005	.020	.050

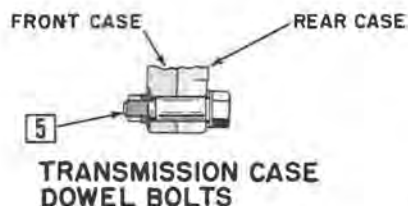
* NOTE - IF UNIT HAS EXPERIENCED DISENGAGEMENT
SIDE CLEARANCE MUST NOT EXCEED .030 MAX.



POSITIVE STAKING METHOD
USE ROUND-NOSED PUNCH TO STAKE
METAL LIP OF NUT INTO MILLED SLOT
IN SHAFT

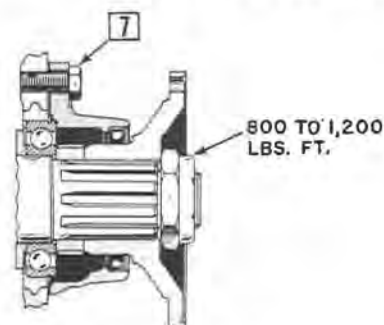


CLUTCH RELEASE SHAFT ARRANGEMENT
AS VIEWED FROM FRONT OF TRANSMISSION



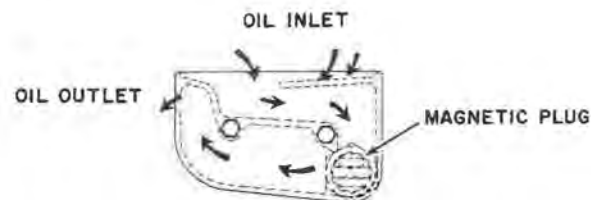
VIEW SHOWING COUNTERSHAFT
WITHOUT CLUTCH BRAKE

OUT-PUT FLANGE WITHOUT
PARKING BRAKE



THRUST WASHER	AVAILABLE THICKNESSES
(A) 4TH. SPEED GEAR SELECT FOR TIGHT- EST FIT IN GROOVE TO OBTAIN .025 - .035 MAINSHAFT GEAR END-PLAY	.267-.269 .257-.259 .247-.249 .237-.239 .227-.229 .217-.219 .207-.209 .197-.199

(B) IMPORTANT - BE SURE WELCH PLUGS
ARE IN PLACE BEFORE INSTALLING
UNIT IN CHASSIS (2 REAR - 1 FRONT)



VIEW SHOWING MAGNETIC OIL
FILTER ON INSIDE WALL OF
TRANSMISSION CASE

SCREW TORQUES IN LBS. FT.		
SCREWS		LUBRICATED
1	—	18 TO 28
2	—	30 TO 40
3	—	35 TO 45
4	—	65 TO 75
5	—	55 TO 75
6	—	115 TO 145
7	—	95 TO 125

MAXITORQUE TRANSMISSION
TRL1076 and TRL1078
5 Speed (Current Production)

DESCRIPTION

The TRL1076 and TRL1078 are triple countershaft transmissions providing five forward speeds and one reverse speed. Short in length, light in weight and easy to service, this new transmission is designed for use in over the road trucks and tractors particularly in long distance operation on varied terrain. Both transmissions are identical except for the elimination of the upper left hand rear countershaft in the TRL1076.

The five speed gearset is housed in a high strength aluminum case which is constructed in two pieces for maximum convenience of disassembly and reassembly. See Figures 5-69 and 5-70.

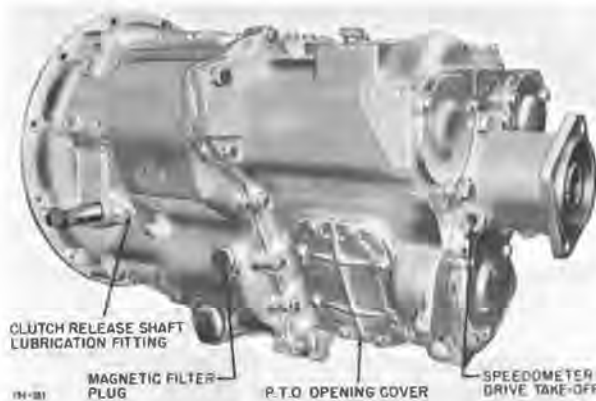


Figure 5-69. Left Rear View of Transmission

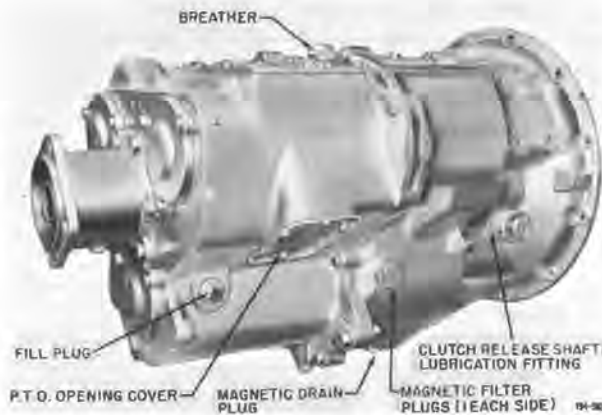


Figure 5-70. Right Rear View of Transmission

Cast iron liners are cast in aluminum case at all shaft bearing locations. These liners assure maximum service life plus the advantages of light weight construction.

Unlike conventional transmissions, three countershafts are equally spaced around the input shaft. This design provides extremely

high capacity in the shortest overall length. By distributing the load equally among three shafts, normal deflection is reduced to a minimum. Another unique design is that the mainshaft gears are self centered among the three countershafts, eliminating the need for gear bushings. The mainshaft gears are connected to the mainshaft only when engaged by a sliding clutch.

All gears of the gearset are of the spur type design and with the exception of reverse speed sliding gear, are in constant mesh with the countershaft gears. Other than reverse, driving engagement for the five forward speeds is effected by means of the sliding clutches. Reverse is obtained by engaging reverse sliding spur gear with the three individually mounted idler gears. Conventional forks spanning the sliding clutches and reverse gear, move these parts in response to the movement of the gear shifter hand control lever by the driver.

LUBRICATION

All rotating and sliding parts of the transmission are bathed in oil from gear throw-off when the engine is operating.

Removal of all foreign metallic particles within the transmission is accomplished by a magnetic oil filter on the side of the case. The filter consists of an integral open trough and baffle arrangement with a removable sheet metal cover. At the bottom of the baffle, a tapped hole in the case accommodates a large hex plug with a powerful built-in magnet installed from outside.

The oil from gear throw-off is collected by the filter and is made to pass the magnetic plugs which pull all ferrous metal particles out of the passing oil and holds them. After passing the magnet, clean and chip-free oil then rises to the outlet near the top of the filter and drops down into the transmission case. A magnetic drain plug is also provided at the bottom of the case.

When the oil is hot, as when coming in from a run, the oil level of the transmission should be checked with the vehicle on level ground. To add oil, remove plug on the right side of the case and fill. The level should not be above the filler-plug hole. Check level at interval specified.

At every check or change, always remove, clean and reinstall magnetic plugs on right and left side of case.

To change oil, remove magnetic drain plug and drain oil from case while hot. If necessary, also flush case with flushing oil and drain thoroughly. Clean and replace magnetic drain plug. Remove fill plug and fill with recommended gear oil to level of filler plug hole at the intervals specified. Reinstall filler plug. Follow schedule instructions closely and if operation requires it, make checks and changes more often.

NOTE

Earlier production transmissions used two magnetic filter plugs, one on either side of the main compound.

SPECIFICATIONS

Gearset, Make..Mack (Three countershafts)
Model..... TRL1076, 1078
Type..... Five Speed
Control... Selective, single lever,
manual
Speeds, Forward..... Five
Reverse..... One
Bell Housing, Type..... Separable
Lubrication..... Gear throw-off
Case, Material..... Aluminum
P. T. O. Openings
Left Side..... Std. SAE 8 hole
Right Side..... Std. SAE 6 hole
Oil Capacity, Pts. 22

DISASSEMBLY

Main Components

NOTE

Unless a complete overhaul is necessary, remove only those parts required to gain access to the faulty parts. Do not disturb parts having heavy press fits unless replacement is necessary. In that case, use proper press setups and pullers so that usable parts are not damaged.

1. After draining lubricant and removing transmission from vehicle, clean externally and mount unit in a suitable overhaul stand.
2. Remove hand brake parts, clutch release shaft and yoke.
3. Remove transmission case top opening covers. Cautiously remove shifter rail poppet ball cover (cover is spring loaded), pins and springs. See Figure 5-71. Poppet balls may be removed with a magnet.

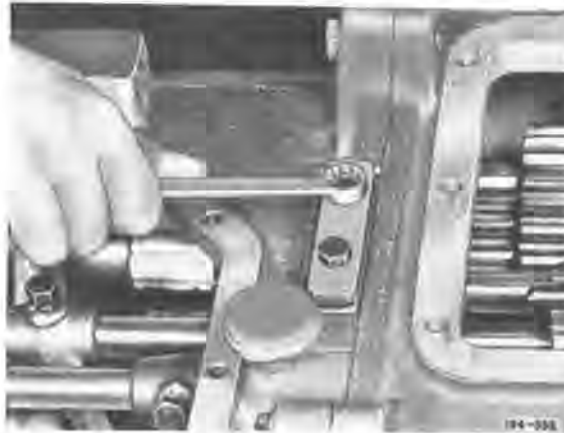


Figure 5-71. Removing Shifter Rail Poppet Ball Cover

4. Remove setscrews from shifters and shifter forks except second and third. Remove reverse speed shifter fork front snap ring. Withdraw shifter rails from case and at the same time remove shifters and shifter forks. Slide reverse shifter fork snap ring forward, then slide fork forward to be able to slide rear snap ring rearward. While moving rail forward, alternately move front and rear snap rings rearward until rail is out of case.

NOTE

It is recommended that rear expansion plug be removed to withdraw the second and third shift rail. This can be accomplished by tapping on the shifter to drive rail rearward. Then remove setscrew from the second and third shifter and remove rail, fork and shifter from case.

5. Place transmission in two gears which will lock up assembly to facilitate the removal of the drive flange clamp plate screw. Remove drive flange clamp plate screw and clamp plate. Install standard puller and remove drive flange from mainshaft splines. Remove mainshaft rear bearing cover, then slide speedometer gear off of mainshaft.

6. Remove main driving pinion bearing cover capscrews and cover. See Figure 5-72. Tap on gear end of main driving pinion with a nylon mallet if necessary and remove assembly from case.



Figure 5-72. Removing Main Driving Pinion Bearing Cover

7. Remove fourth/fifth speed sliding clutch from mainshaft. See Figure 5-73.



Figure 5-73. Removing Fourth/Fifth Speed Sliding Clutch

8. Through main driving pinion bearing opening, remove fourth speed gear selective thrust washer retaining snap ring. See Figure 5-74. Slide fourth speed gear selective thrust washer off of mainshaft. See Figure 5-75.

9. Carefully withdraw mainshaft from case through rear bearing opening. See Figure 5-76.



Figure 5-74. Removing Thrust Washer Retaining Snap Ring



Figure 5-75. Removing Fourth Speed Gear Selective Thrust Washer



Figure 5-76. Removing Mainshaft

10. Remove fourth speed gear and thrust washer through transmission case top cover opening. See Figure 5-77.



Figure 5-77. Removing Fourth Speed Gear

11. Remove countershaft rear bearing cover capscrews and cover. Remove power-take-off cover capscrews and covers. Remove the lower and right-hand rear countershaft oil slinger front snap rings, or power-take-off gear front snap ring when incorporated. See Figure 5-78.

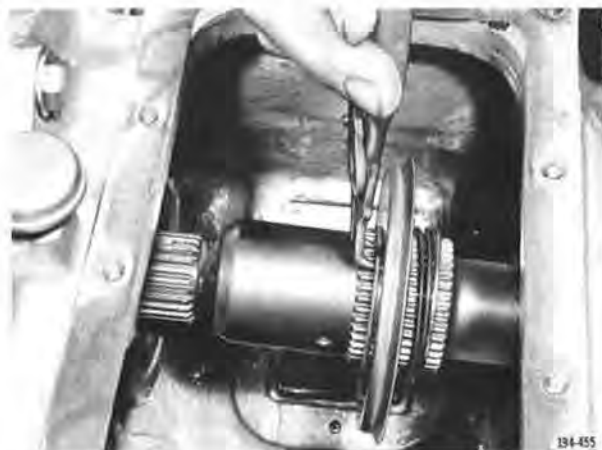


Figure 5-78. Removing Rear Countershaft Oil Slinger Front Snap Ring

12. Remove the three rear countershafts from case through rear bearing cover openings. While withdrawing the lower and right-hand countershafts, at the same time slide oil slinger and oil slinger retaining spring with its front snap ring off of shaft. Where power-take-off gear is incorporated instead of oil slinger, slide power-take-off gear with its front snap ring off of shaft.

13. Place main case in a vertical position. Remove all case-to-case dowel bolts and cap-screws. With a nylon headed mallet, tap rear case and separate it from the front case. Remove rear case and place on bench.

14. Remove front countershaft thrust washer retaining snap ring, then remove thrust washer from countershafts. See Figures 5-79 and 5-80.



Figure 5-79. Removing Thrust Washer Retaining Snap Ring



Figure 5-80. Removing Countershaft Thrust Washer

15. Remove mainshaft sliding clutches and gears with thrust washers from case. See Figures 5-81 and 5-82.



Figure 5-81. Removing First Speed Sliding Clutch



Figure 5-82 . Removing First Speed Gear

16. Place transmission in a horizontal position and remove countershaft front bearing cover capscrews and covers. Remove snap rings from outer race of countershaft front bearings.

17. Position transmission vertically, then remove the three front countershaft assemblies from case. See Figure 5-83.



Figure 5-83 . Removing Front Countershafts

SUB-ASSEMBLIES

Main Driving Pinion

Remove bearing retaining spirolox snap ring. See Figure 5-84. Remove the ball bearing by pressing or tapping off. Turn pinion over and remove retaining snap ring and spigot bearing.



Figure 5-84 . Removing Pinion Bearing Retaining Spirolox Snap Ring

Mainshaft

Remove mainshaft rear ball bearing positioning snap ring then press shaft out of rear ball bearing. Place mainshaft in vise having soft metal jaws and remove spigot bearing retaining snap ring and bearing inner race. Remove reverse stop snap ring from shaft.

Rear Case

Using a sharp tool, punch a hole in idler shaft expansion plug and pry out. With a suitable threaded puller withdraw the three idler gear shafts from case. Remove idler gears, bearings, thrust washers, and reverse speed gear from case. Remove countershaft roller bearing retaining snap rings and bearings from case.

Rear Countershafts

Remove countershaft rear bearing retaining snap ring and positioning snap ring, then press countershafts out of rear ball bearing.

Front Countershafts

Remove countershafts front bearing retaining snap ring. Remove countershafts front bearing and gear retaining snap ring. Turn countershafts over and remove roller bearing inner race from shafts.

NOTE

(TRL-1076 only) Remove the rear roller bearing inner race retaining snap ring from the upper left hand countershaft before removing inner race.

For shops having a small capacity hydraulic press, press off one countershaft gear at a time. For shops having a large capacity hydraulic press, place countershaft assembly in press, slide length of heavy tubing over integral gear to engage the second speed gear and remove all gears in one operation.

INSPECTION

Clean case, covers and all other parts of the transmission thoroughly using a suitable cleaning solvent to remove all grease and foreign matter. Dry parts with moisture-free compressed air.

Bearings - Soak bearings in a suitable cleaning solvent to loosen all hardened grease and foreign matter. Strike bearings flat against block of wood several times and again immerse in cleaning solvent turning races slowly. Repeat these operations until bearings are clean and then blow them dry with filtered moisture-free compressed air.

CAUTION

Do not spin bearings with compressed air as damage to the bearing may result.

Bearings - Check bearings for flaking, cracks and fractures, cavities and indentations, measurable wear, brinelling, fretting, corrosion, seizing, galling, scoring, nicking and cage failures. If any of these defects are apparent in any amount, replace bearings.

Gears - Replace gear if teeth show any sign of abrasive wear, scratching, ridging, scoring, surface fatigue, pitting, spalling, corrosive wear, digging in and cracking. Gears may also be checked by Magnaflux or similar system for cracks which would not otherwise be visible.

Shifter Fork, Sliding Clutch and Shift Rail -

Replace forks and/or clutches if side clearance in groove is in excess of specified limits, shown on "Screw Torques and Adjustment Chart." Replace shift rails if cracked in either the poppet or stake screw holes. In the case of wear, whereby the clearance between

the shift rail and the mating housing bore exceeds .010 inch maximum, check to determine which member is worn before replacing same. Shaft wear may be checked by comparing shaft diameter at an "unwearing" point as against the wear point.

Oil Seals - When a complete overhaul is required, replace all oil seals.

Replace cases found to be cracked. Check all other parts for wear and damage. Replace all parts as required. Replace all gaskets, O-rings, and any part that shows mutilation. Replace poppet springs that have lost their tension. Clean up any threads that show mutilation.

REASSEMBLY

NOTE

Refer to "Screw Torques and Adjustment Chart" for fits and limits.

Sub-Assemblies

NOTE

All working parts, especially the bearings, should be coated with SAE 30 oil while the transmission is being assembled. This will insure immediate lubrication when first starting and will prevent seizing of these parts. As moving parts are assembled, check frequently to see that they move freely.

Main Driving Pinion

Assemble mainshaft spigot bearing in gear end of main driving pinion and retain with snap ring. Turn pinion over and install pinion ball bearing with outer race snap ring toward pilot end of pinion. Install bearing retaining spirollox snap ring. See Figure 5-85.

Mainshaft

Install bearing inner race on mainshaft spigot and retain with snap ring. Position mainshaft in arbor press with spigot end down and press ball bearing on shaft. Install positioning snap ring in outer race of ball bearing. Install reverse stop snap ring on shaft.



Figure 5-85. Installing Pinion Bearing Retaining Spirolox Snap Ring

Rear Case

Install roller bearing snap ring in inner retaining groove of case countershaft bores. Install and seat roller bearings against inner snap rings, then install outer snap ring in groove provided to retain bearings.

Position reverse idler gear shafts so that flats on end of shaft are pointing towards center line of countershaft bore. Start shafts into case. Assemble roller bearing in idler gear. Position assembled gear in case (rounded teeth of idlers forward) with thrust washers at each end, and with a nylon hammer, tap shaft into case through thrust washers and gear. For final seating of idler gear shafts, see Figure 5-86.

NOTE

Apply sealer around idler gear shafts before final seating. Then install expansion plugs.

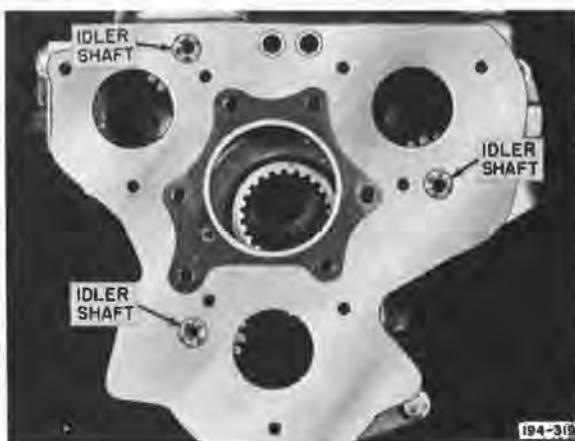


Figure 5-86. Final Seating of Idler Gears

Through top cover hole of case, install reverse speed gear (shifter groove of gear forward).

Rear Countershafts

Install lower and right-hand countershaft power-take-off gear inner snap ring in groove provided. Press rear ball bearing on end of countershafts and retain with snap ring. Install positioning snap ring in outer race of bearings.

Front Countershafts - See Figure 5-87.

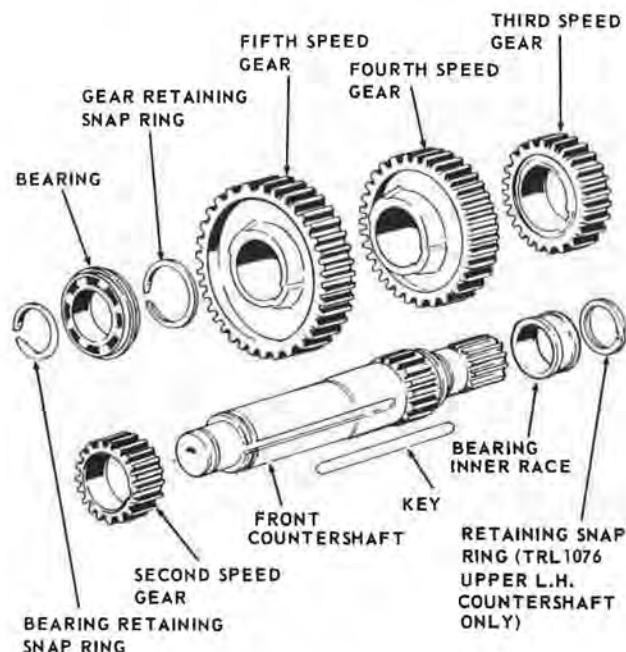


Figure 5-87. Front Countershaft Assembly

Press roller bearing inner race on rear end of countershafts.

NOTE

(TRL-1076 only) On the upper left hand countershaft install rear roller bearing inner race retaining snap ring.

Insert gear key in countershafts and press gears on one at a time. These gears have an interference fit and can be pressed on cold, but for best results, the gears should be heated. With a heat lamp or hot oil, heat gears 270 to 300° F. for a period of not more than 1/2 hour. Oil shaft for each gear. Install gear snap ring, then press ball bearings on end of shafts. Install ball bearing retaining snap rings.

MAIN COMPONENTS

NOTE

All working parts, especially the bearings, should be coated with SAE 30 oil while the transmission is being assembled. This will insure immediate lubrication when first starting and will prevent seizing of these parts. As moving parts are assembled, check frequently to see that they move freely.

1. Position transmission front case vertically and install the three front countershaft assemblies in case. See Figure 5-88.



Figure 5-88. Installing Front Countershaft Assembly

2. Position transmission front case horizontally. Install front countershaft ball bearing positioning snap rings in outer race of bearings, then tap countershaft assemblies rearward until positioning snap ring seats against case.

3. Position O-ring in countershaft front bearing covers. See Figure 5-89. Install covers with O-rings and capscrews. Tighten capscrews to recommended torque.

4. Place transmission front case in a vertical position. Install mainshaft third speed gear so that the three alignment "O" marks on face of gear mate with the alignment "O" marks on the countershaft third speed gears. See Figure 5-90.

5. Install second/third speed sliding clutch and engage with third speed gear clutch teeth. See Figure 5-91.



Figure 5-89. Installing Bearing Cover O-Ring

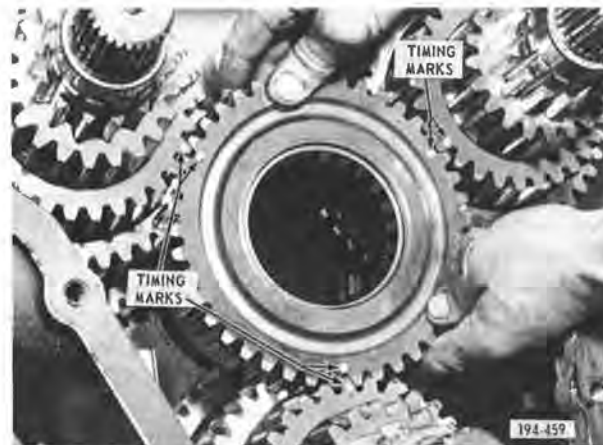


Figure 5-90. Installing Mainshaft Third Speed Gear



Figure 5-91. Installing Second/Third Speed Sliding Clutch

6. Apply a light coat of grease to thrust surface of second and first speed gear. Then place thrust washer on front face of gear hub. See Figure 5-92.

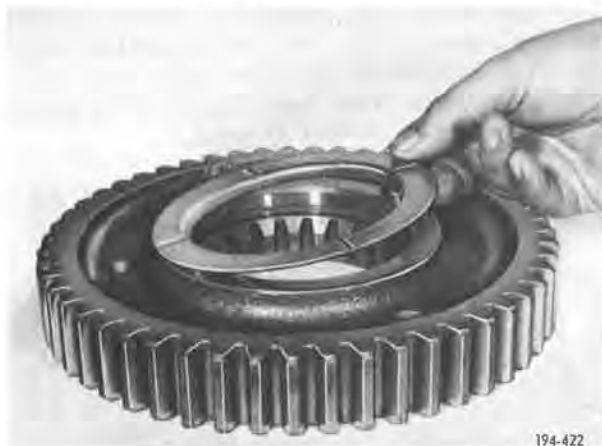


Figure 5-92 . Installing Gear Thrust Washer on Gear

7. Install second speed gear (clutch teeth to the rear) with thrust washer over second/third speed sliding clutch and engage with the countershaft second speed gears. See Figure 5-93.

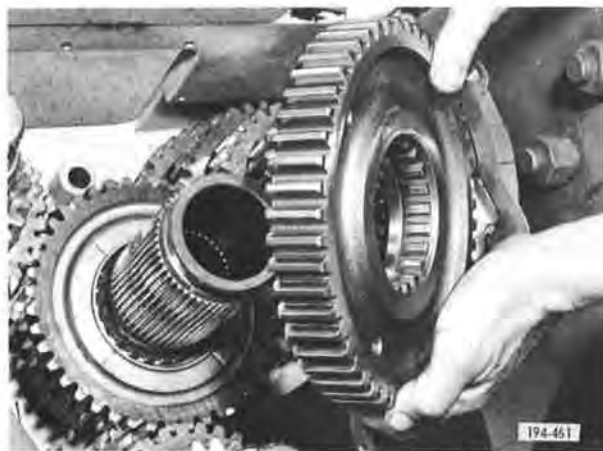


Figure 5-93 . Installing Second Speed Gear

8. Install first speed gear (clutch teeth to the rear) with thrust washer and engage with countershaft first speed gears. See Figure 5-94.

9. Position first speed sliding clutch on second/third speed sliding clutch. See Figure 5-95.

10. Install thrust washer on each front countershaft and retain with snap ring. See Figures 5-96 and 5-97.



Figure 5-94 . Installing First Speed Gear



Figure 5-95 . Installing First Speed Sliding Clutch



Figure 5-96 . Installing Countershaft Thrust Washer



Figure 5-97. Installing Thrust Washer Retaining Snap Ring

11. Paint end of front case with a good gasket sealer compound and install case-to-case gasket. Paint rim of gasket with sealer and lower rear case assembly over assembled countershafts. Tap case into position so that bearings are seated properly, then install case-to-case capscrews and dowel bolts and tighten to recommended torque.

NOTE

The following step will include the installation of all three rear countershafts. (Two countershafts for TRL1076) The only exception in the TRL1078 will be that the upper left-hand countershaft does not require a power-take-off gear or an oil slinger.

12. Position the transmission horizontally. Start rear countershaft through rear bearing opening in case. See Figure 5-98.



Figure 5-98. Installing Rear Countershaft

13. While advancing countershaft, install oil slinger retaining spring on shaft. With flared lip of slinger toward the rear, install slinger on countershaft splines. Compress retaining spring with slinger and install slinger front snap ring in groove, provided to retain slinger. See Figure 5-99. Where power take-off gear is incorporated, position gear on countershaft splines, then install gear front snap ring in groove provided in shaft.



Figure 5-99 . Installing Oil Slinger Retaining Front Snap Ring

14. Observe timing "O" marks on front and rear countershaft splines. See Figure 5-100. Align timing "O" marks on rear countershaft with timing "O" marks on front countershaft and continue advancing shaft until the countershaft rear bearing positioning snap ring seats against case.



Figure 5-100. Aligning Timing "O" Mark on Rear Countershaft with Front Countershaft

15. Install O-rings in countershaft rear bearing covers. See Figure 5-101. Install covers with capscrews and washers, then tighten capscrews to recommended torque.



Figure 5-101. Installing O-Rings in Rear Bearing Cover

16. Install third speed gear thrust washer in third speed gear.

17. Install fourth speed gear in case (clutch teeth forward) with thrust washer and engage with countershaft gears. See Figure 5-102. Engage reverse speed sliding gear with the reverse idler gears.



Figure 5-102. Installing Fourth Speed Gear

18. Start mainshaft in case through gear bearing opening. See Figure 5-103. Advance shaft through reverse speed gear, second and third speed sliding clutch and fourth speed gear until rear bearing positioning snap ring seats against case. Install speedometer drive gear on shaft. Apply sealer compound and install rear bearing cover gasket and cover. Install cover capscrews and tighten to recommended torque. Oil lip of cover oil seal, and install clamp plate and screw.



Figure 5-103. Installing Mainshaft

19. Place transmission in two gears which will lock up assembly. Tighten clamp plate screw to recommended torque.

20. Install fourth speed gear selective thrust washer on mainshaft. See Figure 5-104.



Figure 5-104. Installing Fourth Speed Gear Selective Thrust Washer

21. Install fourth speed gear selective thrust washer retaining snap ring. See Figure 5-105.



Figure 5-105. Installing Thrust Washer Retaining Snap Ring

22. With two feeler gages, check between third speed washer and fourth speed gear for recommended end-play. See Figure 5-106. Refer to "Screw Torques and Adjustment Chart" for selective thrust washers to obtain recommended end-play.

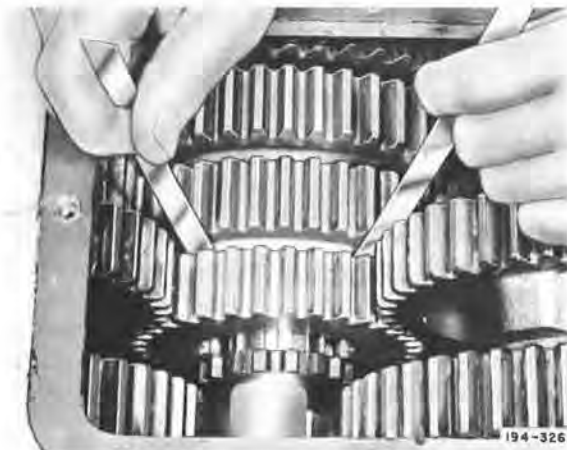


Figure 5-106. Checking Mainshaft Gear End-Play

23. Install fourth and fifth speed sliding clutch on splines of pinion, and engage with fourth speed gear. See Figure 5-107.



Figure 5-107. Installing Fourth/Fifth Speed Sliding Clutch

24. Position and drive pinion assembly into place being careful not to damage spigot bearing.

25. Install tool J23796 in main driving pinion bearing cover and carefully through cover oil seal. This tool will eliminate the possibility of cutting oil seal when installing cover over the splined end of main driving pinion. See Figure 5-108. Apply sealer compound and install gasket and cover assembly. Remove tool from cover assembly. Install cover cap-screws and tighten to recommended torque.



Figure 5-108. Installing Main Driving Pinion Bearing Cover Assembly

26. Install reverse speed fork on reverse speed sliding gear and install first speed fork on first speed sliding clutch. See Figures 5-109 and 5-110.



Figure 5-109. Installing Reverse Speed Shifter Fork



Figure 5-110. Installing First Speed Shifter Fork

27. Install first and reverse speed shifter rail through front of case and first and reverse speed shifter. See Figure 5-111. Advance rail through intermediate bore of case, first speed fork, front snap ring, reverse speed fork and rear snap ring until rail reaches neutral position. Install fork and shifter setscrews and tighten to recommended torque.



Figure 5-111. Installing First and Reverse Shifter

NOTE

Assemble snap rings with rounded edge of rings against shifter fork. After assembling the snap rings, rotate 30 degrees to assure rings are properly seated.

28. Start second and third speed shifter rail through hole provided in rear of case. Engage second and third speed fork with second and third speed sliding clutch. See Figure 5-112. Advance rail through hub of fork and intermediate bore of case.

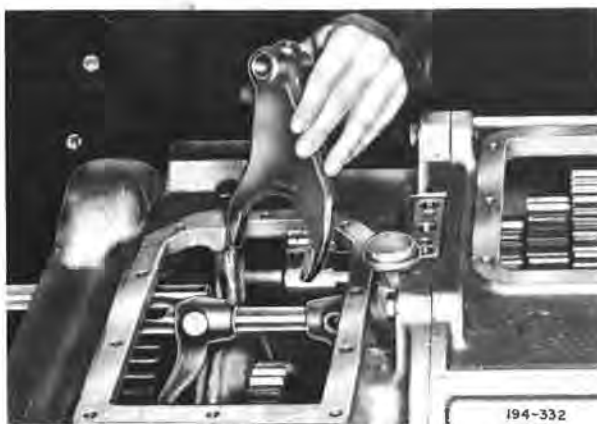


Figure 5-112. Installing Second and Third Speed Shifter Fork

29. Install second and third speed shifter on rail, see Figure 5-113, and continue advancing rail into front support until it reaches neutral position. Install fork and shifter setscrew and tighten to recommended torque.



Figure 5-113. Installing Second and Third Speed Shifter

30. Start fourth and fifth speed shifter rail in hole provided in front of case. Engage fourth and fifth speed fork with fourth and fifth speed sliding clutch. See Figure 5-114.

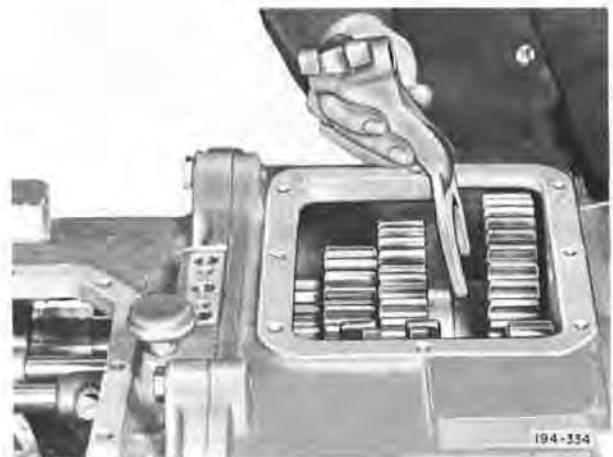


Figure 5-114. Installing Fourth and Fifth Speed Shifter Fork

Advance rail through hub of fork and intermediate bore until rail reaches neutral position. Install fork setscrew and tighten to recommended torque. At this point make sure that the two shift rail oil seals and one expansion plug are installed at the front of the case and the two shift rail expansion plugs are in place at the rear of the case.

31. Install shift rail poppet balls and springs in holes provided at top of case. See Figures 5-115 and 5-116.



Figure 5-115. Installing Shift Rail Poppet Ball



Figure 5-116. Installing Shift Rail Poppet Ball Spring

32. Install poppet ball cover with capscrews and tighten capscrews to recommended torque. See Figure 5-117.



Figure 5-117. Tightening Shift Rail Poppet Ball Cover Capscrews

33. Apply sealer compound to transmission case top cover gaskets and install on case, then install covers with capscrews and tighten to recommended torque. Apply sealer compound to surface of power-take-off covers. Install covers with capscrews and tighten.

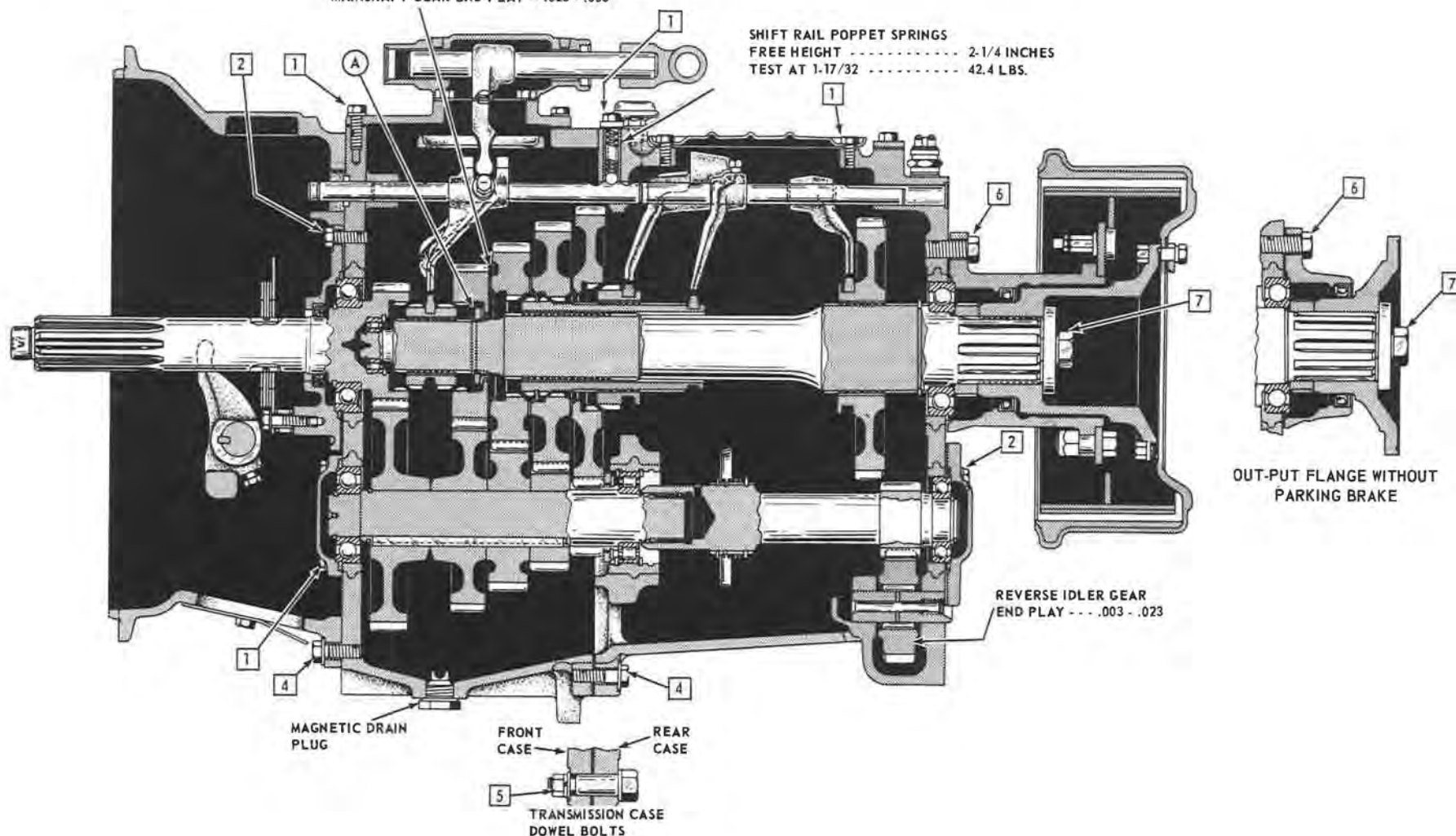
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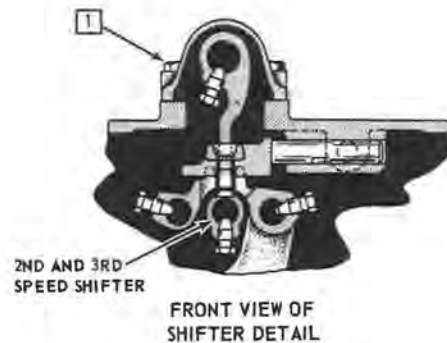
TRL-1076 and TRL-1078 5-SPEED TRIPLE COUNTERSHAFT TRANSMISSION

SCREW TORQUES & ADJUSTMENT CHART

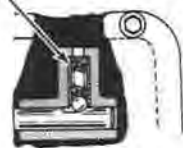
WITH TWO FEELER GAGES AT EACH SIDE, CHECK BETWEEN
3RD SPEED WASHER AND 4TH SPEED GEAR TO OBTAIN
MAINSHAFT GEAR END-PLAY - .025 - .035

SHIFT RAIL POPPET SPRINGS
FREE HEIGHT 2-1/4 INCHES
TEST AT 1-17/32 42.4 LBS.

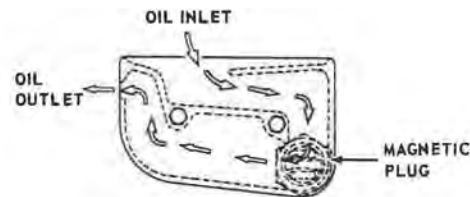




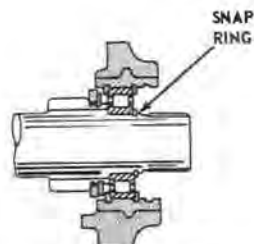
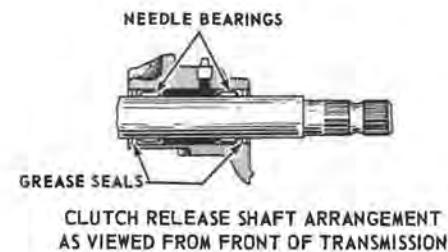
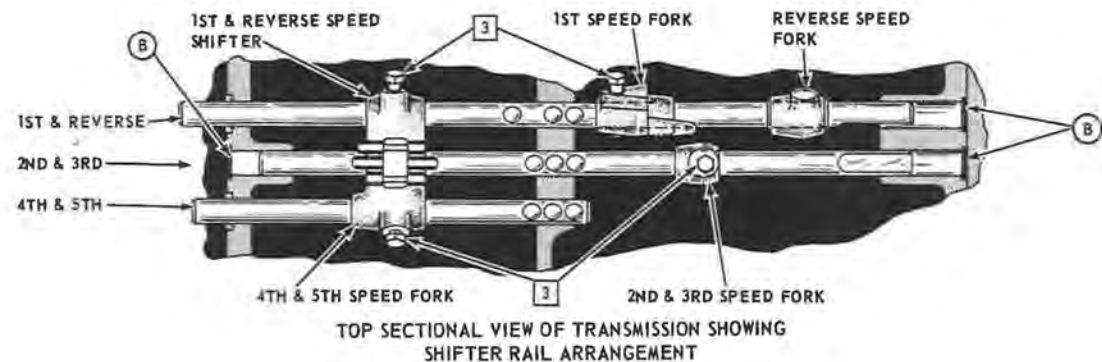
FORK INTERLOCK BALL SPRING
 FREE HEIGHT ----- 1-1/4 INCHES
 TEST AT 1-1/8 INCHES ----- 38 TO 46 LBS.



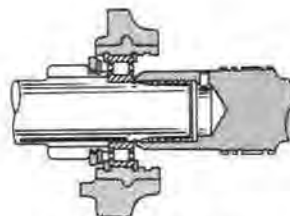
DETAIL OF SHIFTER FORK
 INTERLOCK SPRING-LOADED
 BALL AND DETENT ARRANGEMENT



VIEW SHOWING MAGNETIC OIL
 FILTER ON INSIDE WALL OF
 TRANSMISSION CASE



VIEW SHOWING LEFT
 HAND COUNTERSHAFT
 TRL1076



VIEW SHOWING LEFT
 HAND COUNTERSHAFT
 TRL1078

SCREW TORQUES IN LBS. FT.		
SCREW LOCATION		TORQUE (LUBRICATED)
1	-	18 TO 28
2	-	30 TO 40
3	-	35 TO 45
4	-	65 TO 75
5	-	55 TO 75
6	-	105 TO 115
7	-	480 TO 520

B IMPORTANT - BE SURE EXPANSION PLUGS ARE IN PLACE BEFORE INSTALLING UNIT IN CHASSIS (2 REAR - 1 FRONT)

THRUST WASHER	AVAILABLE THICKNESS
A 4TH SPEED GEAR SELECT FOR TIGHTEST FIT IN GROOVE TO OBTAIN 0.025 TO 0.035 MAIN-SHAFT GEAR END-PLAY.	0.318 - 0.321
	0.304 - 0.306
	0.289 - 0.291
	0.274 - 0.276
	0.259 - 0.261
	0.244 - 0.246
	0.229 - 0.231
	0.214 - 0.216
	0.199 - 0.201
	0.184 - 0.186

ALL FORKS IN SLIDING CLUTCHES			
	MIN. NEW	MAX. NEW	MAX. * WEAR
SIDE CLEARANCE	0.005	0.020	0.050

* NOTE: IF UNIT HAS EXPERIENCED DISENGAGEMENT SIDE CLEARANCE MUST NOT EXCEED 0.030 MAX.

NOTES

MACK 6 SPEED MAXITORQUE TRANSMISSION
TRDXL107 & 1071 Direct (Early Production)
TRDXL1070 Overdrive (Early Production)

DESCRIPTION

The TRDXL107 series is a triple countershaft transmission designed primarily for use in mixer and dumper operations. The new transmissions have a main box gearset of one reverse and five forward speeds, plus an integrated compound gearset which provides a Lo-range for first and reverse in the TRDXL107, 1071 and a Hi-range for fifth in the TRDXL1070. See Figures 5-118 and 5-119. Due to a positive interlock, the only time Lo-range in the TRDXL107, 1071 can be used is with main box in the select position of first or reverse gear. Likewise, Hi-range in the TRDXL1070 can be used only with main box in the select position of fifth gear.

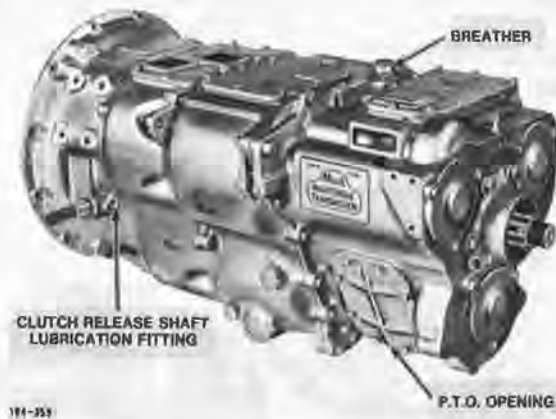


Figure 5-118. Left Rear View of Transmission

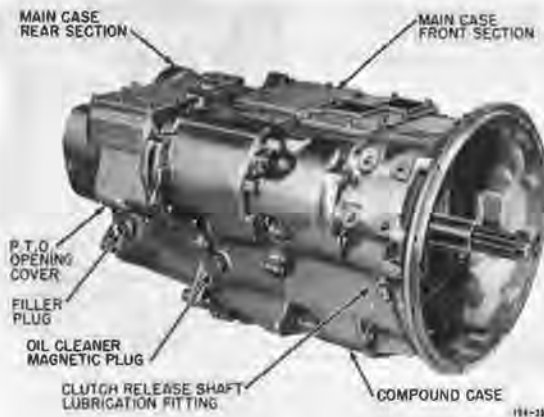


Figure 5-119. Right Front View of Transmission

Unlike conventional transmissions, three countershafts are equally spaced around the main shafts. This design provides extremely high capacity in a short overall length. By distributing the load equally among three shafts, normal deflection is reduced to a minimum. Another unique design is that all gears are centered among three countershafts, eliminating the need for gear bushings.

All gears of the gearset are of the spur type design and with the exception of reverse speed sliding gear, are in constant mesh with the countershaft gears. Other than reverse, driving engagement for the six forward speeds is effected by means of sliding clutches. Reverse is obtained by engaging reverse sliding spur gear with the three individually mounted idler gears. Two gear shifter hand control levers, one for each gearset are located at the forward end on top of the compound case cover. The shifter levers engage shifters carried by the extended shift rails positioned in the top of the case. Conventional forks spanning the sliding clutches and reverse gear move these parts in response to the movement of the gear shifter hand control levers.

The compound main driving pinion and main driving pinion is supported by a single row ball bearing. Straight roller bearings mounted in the gear end of the main driving pinion and compound main driving pinion carry the front ends of the main driving pinion and mainshaft in spigot arrangement. The main case countershafts are carried by a ball bearing and roller bearing combination. Ball bearings which are the snap ring type provide shaft location, while the roller bearing is located adjacent to the more heavily loaded low range gears. The compound countershafts are supported by ball bearings at the front and rear of the compound case. In constant mesh with the main case countershafts, each of the three reverse idler gears revolves on a roller bearing mounted on a shaft.

LUBRICATION

All rotating and sliding parts of the transmission are bathed in oil from gear throw-off when in operation.

However, the sliding clutches and mainshaft gears require more positive provision for lubrication, and for this reason, pressure lubrication of the clutches and gears is provided by a simple eccentric shuttle type pump built in the compound main driving pinion.

As the pinion rotates, the pump vane reciprocates in its eccentric housing, thus forcing lubricant under pressure through rifle-drilled holes in the mainshaft to the sliding clutches and mainshaft gears. To supply the pump, oil from gear throw-off is collected by a trough located above the compound main driving pinion and is then gravity fed to the pump.

Removal of all ferrous metallic particles within the transmission is accomplished by a magnetic oil filter on the side of the case. The filter consists of an integral open trough and baffle arrangement with a removable sheet metal cover. At the bottom of the trough, a tapped hole in the case accommodates a large hex plug with a built-in magnet.

Oil from gear throw-off is collected by the filter and is made to pass the magnetic plugs which pull all ferrous metallic particles out of the passing oil and hold them. After passing the magnet, clean and chip-free oil then rises to the outlet near the top of the filter and drops down into the transmission case. Magnetic drain plugs are also provided at the bottom of the main case and compound case.

To add oil, remove plug on the right side of the case. The level should not be above the filler-plug hole. Check oil level at interval specified.

At every check or change, always remove, clean and reinstall magnetic plug on right side of case.

To change oil, at interval specified, remove fill plug and magnetic drain plugs. Drain oil from case while at operating temperature. If oil has thickened, flush case with flushing oil and drain thoroughly. Clean and reinstall magnetic drain plug in case. Fill with specified gear oil to level of filler plug hole. Reinstall filler plug.

NOTE

Earlier production transmissions used two magnetic filter plugs, one on either side of the main compound.

CLUTCH BRAKE

In any unsynchronized transmission, the rapidity with which an upshift can be made is limited by the time it takes for the free-spinning clutch disc and countershaft assemblies to slow down to the slower rotating speed of

the transmission mainshaft. In order to reduce this time element to a minimum, a clutch brake, which is standard equipment, is employed.

The brake is assembled on the transmission lower countershaft, and since the countershaft is always connected to the clutch disc through the constant mesh driving pinion, action of the brake will overcome the tendency of the discs to continue to rotate at high speed when the clutch is disengaged.

ADJUSTMENTS

See Figure 5-120

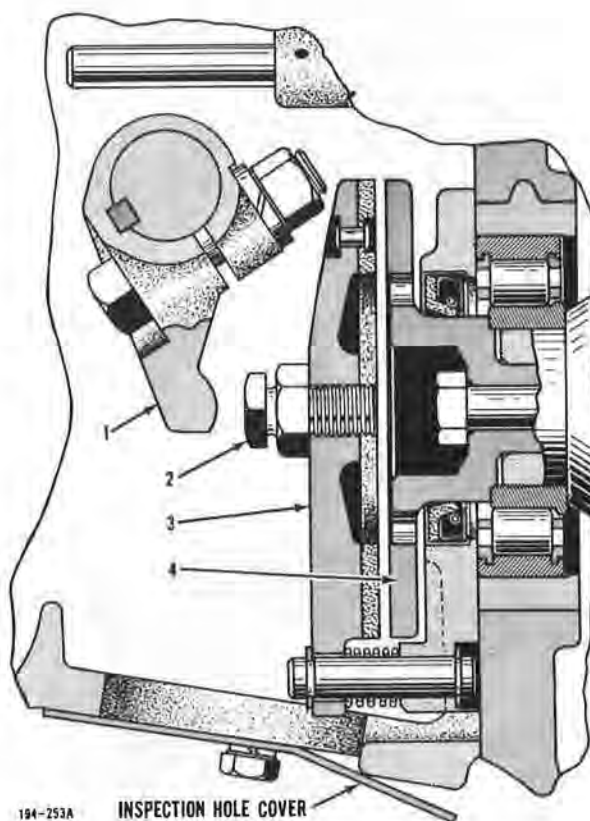


Figure 5-120. Sectional View of Clutch Brake

To adjust the clutch brake, remove inspection hole cover on bottom of bell housing. Loosen set screw locknut. Depress clutch pedal to within 1/2 to 1 inch of the end of its travel. Adjust set screw (2) so that brake pressure plate and lining assembly (3) firmly contacts flange (4). Lock set screw with locknut and install inspection hole cover.

NOTE

It must be remembered, that each time a clutch adjustment is made to provide the 1/8 to 3/16 in. release bearing clearance, the set screw (2) which pushes the clutch brake pressure plate and lining assembly (3) must also be adjusted to suit location of clutch throw-out lever (1).

When the initial wear on clutch driven disc assembly has been used up and the spacers on CL50 series clutch are to be removed, first move set screw (2) into allow sufficient clearance with lever (1); then remove adjusting spacers. When clutch cover is tightened down, readjust release bearing and clutch brake.

SPECIFICATIONS

Gearset

Make	-----	Mack
Model	-----	TRDXL107
Type	-----	Three Countershafts
Control	---	Selective, Two Lever, Manual
Speeds, Forward	-----	Six
Reverse (TRDXL107, 1071)	-----	Two
(TRDXL1070)	-----	One
Bell Housing, Type	-----	Separable
Lubrication	-----	Gear Throw-off and Pump
		Feed Through Rifle Drilled
		Passages in Mainshaft to
		Sliding Clutches and
		Mainshaft Gears.
Pump, Type	---	Built-in Reciprocating Vane
Case, Material	-----	Aluminum
P. T. O. Openings		
Left Side	-----	Standard SAE8 Hole
Right Side	-----	Standard SAE6 Hole
Oil Capacity, Pts.	-----	28

DISASSEMBLY

Main Components

NOTE

Unless a complete overhaul is necessary, remove only those parts required to gain access to the faulty parts. Do not disturb parts having heavy press fits unless replacement is necessary. In that case, use proper press setups and pullers so that usable parts are not damaged.

1. After draining lubricant and removing transmission from vehicle, clean externally and mount unit in overhaul stand.

2. Remove compound case top opening cover, then remove shifter rail poppet spring. Remove main case top opening covers. Cautiously, remove shifter rail poppet ball cover (cover is spring-loaded), pins and springs. See Figure 5-121. Poppet balls may then be removed with a magnet.

NOTE

Pins were used in early production units only.

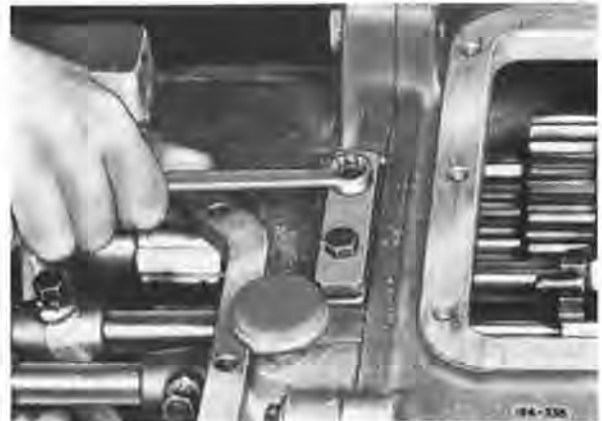


Figure 5-121. Removing Main Case Shifter Rail Poppet Ball Cover

3. Remove set screws from shifter rail shifters, then remove shifters. See Figure 5-122.



Figure 5-122. Removing Shift Rail Shifter Set Screws

4. Remove compound case to main case cap-screw. With the aid of a hoist, separate main case from compound case. See Figure 5-123.

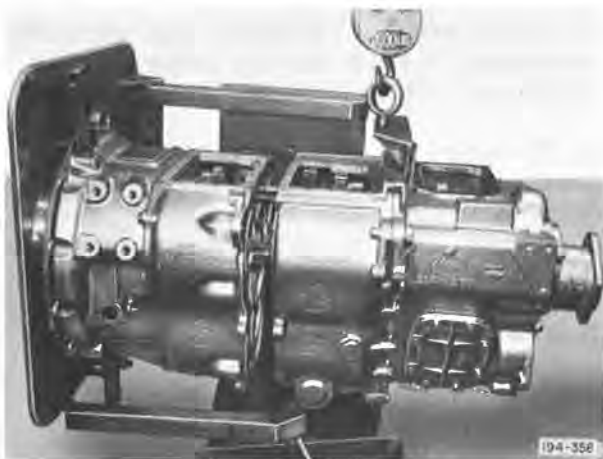


Figure 5-123. Separating Main Case from Compound Case

Main Case

1. Place main case in an overhaul stand. Remove set screws from shifter forks. Remove reverse speed shifter fork front snap ring. Withdraw shift rails from case and at the same time, remove shifter forks. Slide reverse shifter fork snap ring forward, then slide fork forward to be able to slide rear snap ring rearward. While moving rail forward, alternately move front and rear snap rings rearward until rail is out of case.

2. Place transmission in two gears which will lock up assembly to facilitate the removal of the drive flange nut. Remove drive flange nut. Install standard puller and remove drive flange from mainshaft splines. Remove mainshaft rear bearing cover, then slide speedometer gear off of mainshaft.

3. Remove main driving pinion bearing cover capscrews and cover. Tap on gear end of main driving pinion with a nylon mallet if necessary and remove assembly from case.

4. Remove fourth/fifth speed sliding clutch from mainshaft, then pry key out of mainshaft spline using a small tool. See Figure 5-124.

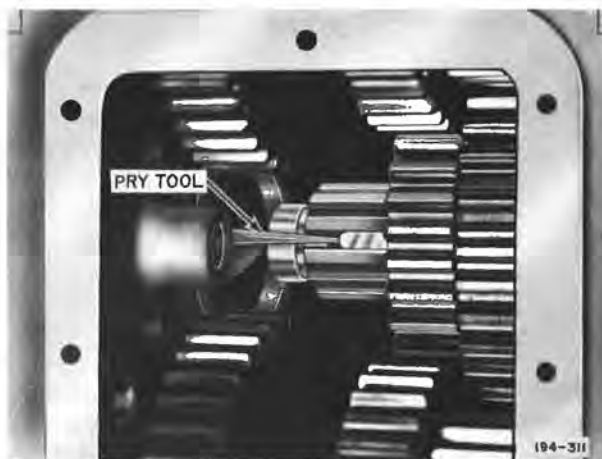


Figure 5-124. Removing Fourth Speed Gear Thrust Washer Key

5. Using a small tool, rotate fourth speed gear thrust washer one spline tooth and slide washer off of mainshaft. See Figures 5-125 and 5-126.



Figure 5-125. Disengaging Fourth Speed Gear Thrust Washer for Removal

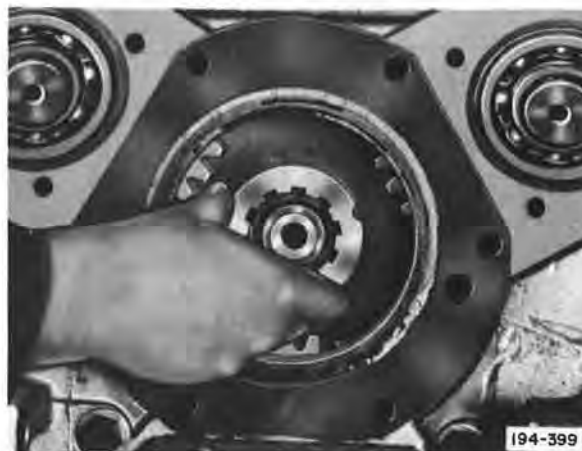


Figure 5-126. Removing Fourth Speed Gear Thrust Washer

6. Carefully withdraw mainshaft from case through rear bearing opening. See Figure 5-127.



Figure 5-127. Removing Mainshaft

7. Remove fourth speed gear and thrust washer through transmission case top cover opening. See Figure 5-128.



Figure 5-128. Removing Fourth Speed Gear

8. Remove countershaft rear bearing cover capscrews and covers. Remove power-take-off cover capscrews and covers. Through power-take-off cover openings, remove the lower and right-hand rear countershaft power-take-off gear, or oil slinger when incorporated instead of power-take-off gear, front snap rings. See Figure 5-129.



Figure 5-129. Removing Rear Countershaft P. T. O. Gear Front Snap Ring

9. Remove the three rear countershafts from case through rear bearing cover openings. While withdrawing the lower and right-hand countershafts, at the same time, slide the power-take-off gear with its front snap ring off of shaft. See Figure 5-130. Where oil slinger is incorporated, instead of power-take-off gear, slide oil slinger and oil slinger retaining spring with its front snap ring off of shaft.

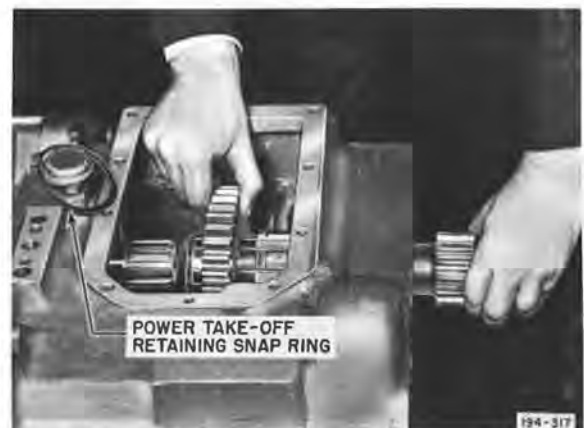


Figure 5-130. Removing Rear Countershafts

10. Place main case in a vertical position. Remove all case-to-case dowel bolts and capscrews. With a nylon headed mallet, tap rear case and separate it from the front case. Remove rear case and place on bench.

11. With transmission front case still in a vertical position, remove mainshaft sliding clutches and gears with thrust washers from case. See Figure 5-131.



Figure 5-131. Removing First Speed Sliding Clutch

12. Place transmission in a horizontal position. Remove snap rings from outer race of countershaft front bearings.

13. Position transmission vertically, then remove the three front countershaft assemblies from case. See Figure 5-132.



Figure 5-132. Removing Front Countershafts

Compound Case

1. Remove clutch release bearing assembly with return spring, clutch release shaft and yoke.

2. Remove clutch brake pressure plate snap rings as shown in Figure 5-133, then remove pressure plate and springs. See Figure 5-134.

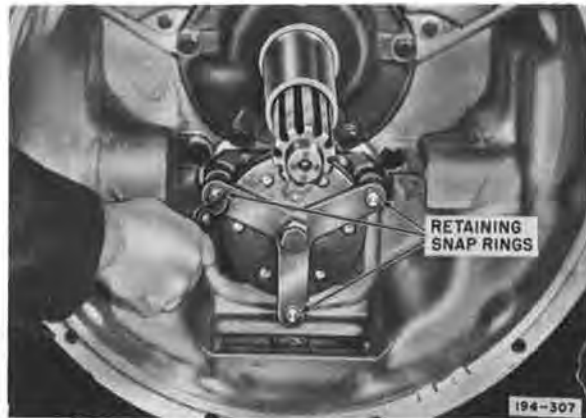


Figure 5-133. Removing Clutch Brake Pressure Plate Retaining Snap Rings

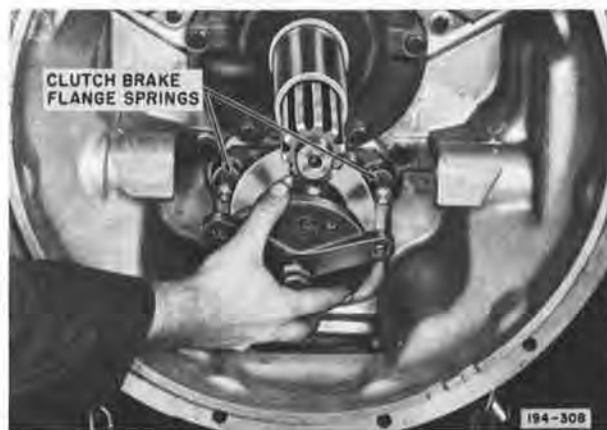


Figure 5-134. Removing Clutch Brake Pressure Plate

3. Remove clutch brake flange screw (left-hand thread). Using tool J-23067, remove clutch brake flange. See Figure 5-135.

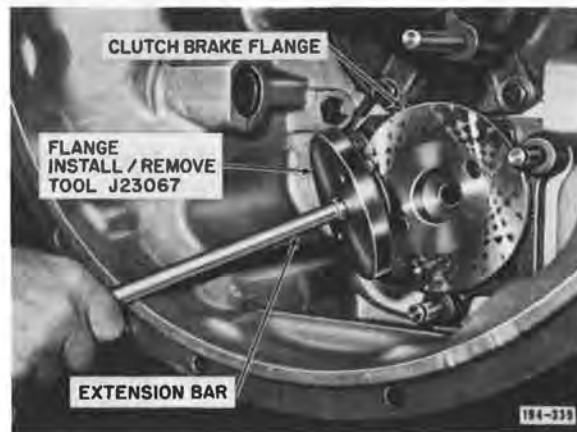


Figure 5-135. Removing Clutch Brake Flange

4. Remove compound shifter fork set screw. Withdraw shift rail from case and at the same time remove shifter fork. See Figure 5-136.

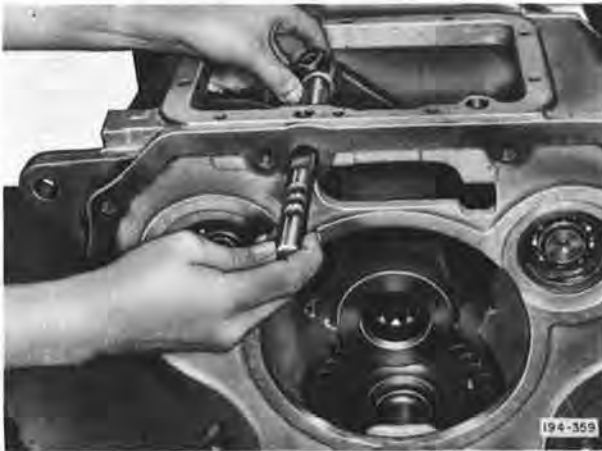


Figure 5-136. Removing Compound Shift Rail and Shifter Fork

5. Remove compound countershaft gear retaining thrust washer capscrews. See Figure 5-137.

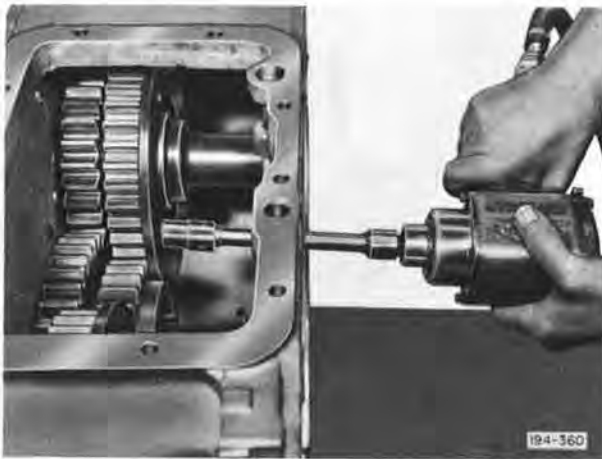


Figure 5-137. Removing Compound Countershaft Gear Retaining Thrust Washer Capscrews

6. Remove main driving pinion sliding clutch and Hi-range (Lo-range for TRDXL107 and TRDXL1071) gear from compound case assembly. See Figure 5-138.



Figure 5-138. Removing Main Driving Pinion Sliding Clutch and Hi-Range Gear from Compound Case

7. Remove bell housing-to-compound case capscrews. See Figure 5-139. Separate compound case from bell housing and using bell housing as a base to work on, place compound case on bell housing with compound main driving pinion facing upward.

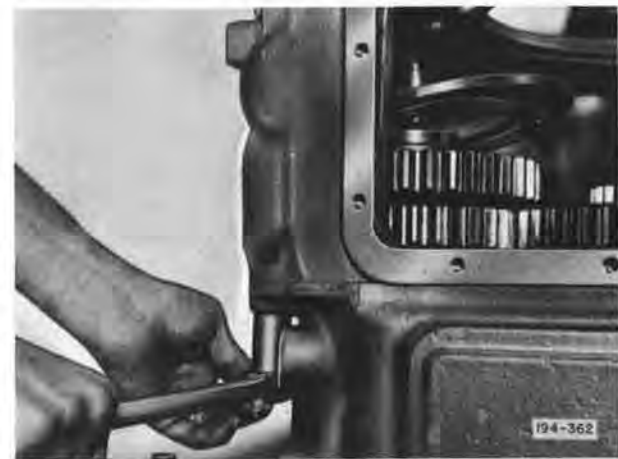


Figure 5-139. Removing Bell Housing-to-Compound Case Capscrews

8. Remove lower compound countershaft bearing cover assembly with O-ring. Remove compound main driving pinion cover assembly, then remove oil pump vane from pinion. See Figure 5-140.



Figure 5-140. Removing Oil Pump Vane from Pinion

9. Remove compound main driving pinion bearing positioning snap ring. See Figure 5-141. Remove compound countershaft front bearing cover capscrews and covers.



Figure 5-141. Removing Compound Main Driving Pinion Bearing Positioning Snap Ring

NOTE

In the TRDXL1070, procedure for removing the compound main driving pinion and compound countershafts from the compound case will be different than disassembly procedure for the TRDXL107 and 1071. Therefore, follow steps 10 through 12 for TRDXL107, 1071 and steps 13 through 18 for the TRDXL1070.

10. (TRDXL107 and 1071) With a soft headed mallet, tap on spigot end of compound main driving pinion thus driving pinion and bearing assembly through case opening. Remove assembly from inside of case.

11. (TRDXL107 and 1071) Using a soft iron drift and hammer, tap on rear of compound countershafts driving shafts forward. (This will facilitate the removal of compound countershaft front bearings). Remove compound countershaft rear bearing retaining snap rings from case.

12. (TRDXL107 and 1071) Turn compound case over, install bearing puller on compound countershaft front bearings and remove bearings. Then with a soft headed mallet, tap on front of compound countershafts driving shafts rearward. (This will facilitate removal of compound countershaft rear bearings and remove bearings. Then remove compound countershafts from case.

13. (TRDXL1070) Using a length of suitable tubing as a tool, drive compound main driving pinion as far forward as possible. See Figure 5-142. (This step is necessary for the removal of the compound countershaft front bearings).



Figure 5-142. Driving Compound Main Driving Pinion Forward

14. (TRDXL1070) Using a soft iron drift and hammer, drive each compound countershaft forward until gear bottoms against case. See Figure 5-143. Remove compound countershaft rear ball bearing retaining snap ring from case. See Figure 5-144.



Figure 5-143. Driving Compound Countershaft Forward



Figure 5-145. Removing Compound Countershaft Front Bearings

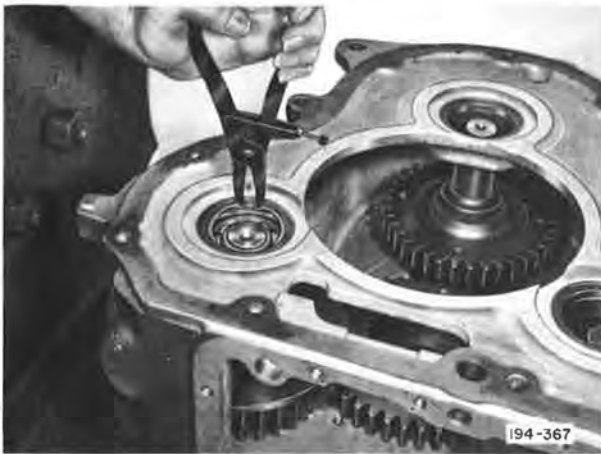


Figure 5-144. Removing Compound Countershaft Rear Bearing Retaining Snap Ring



Figure 5-146. Driving Compound Countershafts Rearward

16. (TRDXL1070) Install puller on compound countershaft rear bearings and remove. See Figure 5-147.



Figure 5-147. Removing Compound Countershaft Rear Bearing

15. (TRDXL1070) Turn compound case over, install puller on compound countershaft front bearings and remove. See Figure 5-145. With a soft headed mallet, tap on front of compound countershafts, driving shafts rearward and partially through rear bearing opening. See Figure 5-146.

17. (TRDXL1070) Tap on spigot end of compound main driving pinion with a soft headed mallet thus driving pinion and bearing assembly rearward through case opening. Tilt the three countershaft assemblies to one side, then remove compound main driving pinion from inside of case. See Figure 5-148.



Figure 5-148. Removing Compound Main Driving Pinion

18. (TRDXL1070) Remove the three compound countershaft assemblies from case. See Figure 5-149.



Figure 5-149. Removing Compound Countershaft Assembly

Sub-Assemblies

Main Driving Pinion and Compound Main Driving Pinion

Remove bearing retaining spirolox snap ring. See Figure 5-150.

NOTE

Early production units incorporated a left-hand threaded nut to retain bearing. Unstake bearing nut and with a wrench, remove the left-hand threaded nut.

(Main Driving Pinion Only) Remove spigot bearing retaining snap ring and bearing inner race.



Figure 5-150. Removing Pinion Bearing Retaining Spirolox Snap Ring

Remove pinion ball bearing by pressing or tapping off. Turn pinion over and remove retaining snap ring and spigot bearing. Remove oil tube only if replacement is necessary.

Mainshaft

Remove mainshaft rear ball bearing positioning snap ring then press shaft out of rear ball bearing. Remove ball bearing spacer from shaft. Place mainshaft in vise having soft metal jaws and remove spigot bearing retaining snap ring and bearing inner race.

Main Case - Rear Case

With a suitable puller, withdraw the three idler gear shafts from case. Remove idler gears, bearings, thrust washers, and reverse speed gear from case. Remove countershaft roller bearing retaining snap rings and bearings from case.

Main Case - Rear Countershafts

Remove countershaft rear bearing retaining snap ring and positioning snap ring, then press countershafts out of rear ball bearing.

Main Case - Front Countershafts

Remove countershafts front bearing retaining snap ring. Remove countershafts front bearing and gear retaining snap ring. Turn countershafts over and remove roller bearing inner race from shafts.

For shops having a small capacity hydraulic press, press off one countershaft gear at a time. For shops having a large capacity hydraulic press, place countershaft assembly in press, slide length of heavy tubing over integral gear to engage the second speed gear and remove all gears in one operation.

Compound Countershafts

Remove countershaft gear retaining snap rings. Place countershaft in hydraulic press and press gears off of shaft.

Main Driving Pinion Bearing Cover

Using oil pump sleeve remover J-23387-01, remove oil pump sleeve and seal assembly as follows: Insert remover in cover. Place spreader jaws behind oil seal, then tighten setscrew to expand jaws and grip rear of oil seal. Place assembly in arbor press and press seal and pump sleeve out of housing. See Figures 5-151 and 5-152.



Figure 5-151. Installing Sleeve Remover Tool with Griper Jaws Contracted

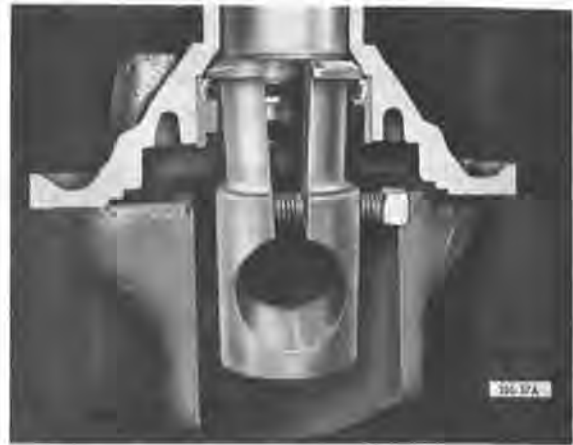


Figure 5-152. Cutaway Detail of Installed Remover and Cover in Press Set-Up

INSPECTION

Clean case, covers and all other parts of transmission thoroughly, using a suitable cleaning solvent to remove all grease and foreign matter. Dry parts with moisture-free compressed air.

Bearings - Soak bearings in a suitable cleaning solvent to loosen all hardened grease and foreign matter. Strike bearings flat against block of wood several times and again immerse in cleaning solvent turning races slowly. Repeat these operations until bearings are clean and then blow them dry with filtered moisture-free compressed air.

CAUTION

Do not spin bearings with compressed air as damage to the bearing may result.

Bearings - Check bearings for flaking, cracks and fractures, cavities and indentations, measurable wear, brinelling, fretting, corrosion, seizing, galling, scoring, nicking and cage failures. If any of these defects are apparent in any amount, replace bearings.

Gears - Replace gear if teeth show any sign of abrasive wear, scratching, ridging, scoring, surface fatigue, pitting, spalling, corrosive wear, digging in and cracking. Gears may also be checked by Magnaflux or similar system for cracks which would not otherwise be visible.

Shifter Fork, Sliding Clutch and Shift Rail -

Replace forks and/or clutches if side clearance in groove is in excess of specified limits, shown on "Screw Torques and Adjustment Chart". Replace shift rails if cracked in either the poppet or stake screw holes. In the case of wear whereby the clearance between the shift rail and the mating housing bore exceeds .010 inch maximum, check to determine which member is worn before replacing same. Shaft wear may be checked by comparing shaft diameter at an "unwearing" point as against the wear point.

Vane Oil Pump Parts - Renew pump parts only if they are scored or chipped or if vane is loose in its mating bore in excess of .006 inch.

Oil Seals - When a complete overhaul is required, replace all oil seals. Lower compound countershaft bearing cover and shift rail oil seals. For complete details, see GENERAL DATA, Section I. When replacing compound main driving pinion cover oil seal, refer to Disassembly of sub-assemblies and Reassembly of sub-assemblies.

Replace cases found to be cracked. Check all other parts for wear and damage. Replace all parts as required. Replace all gaskets, O-rings, staked nuts and any part that shows mutilation. Replace poppet springs that have lost their tension. Clean up any threads that show mutilation.

Measuring Oil Pump Pressure - Pressure of the pump is low and therefore difficult to measure. A functional check should be made on the pump prior to installing the transmission cover. This can be accomplished by pouring oil into the pump pick-up trough while revolving the main driving pinion clockwise. If the pump is functioning, oil will appear at various outlets along the mainshaft. This practice will also insure initial prime to the pump.

REASSEMBLY

NOTE

Refer to "Screw Torques and Adjustment Chart" for fits and

Sub-Assemblies

NOTE

All working parts, especially the bearings, are to be coated with SAE 30 oil while the transmission is being assembled. This will insure immediate lubrication when first starting and will prevent seizing of these parts. As moving parts are assembled, check frequently to see that they move freely.

Main Driving Pinion and Compound Main Driving Pinion

Assemble spigot bearing in gear end of pinion and retain with snap ring. Install oil tube if removed at disassembly. Turn pinion over and install ball bearing with outer race snap ring toward pilot end of pinion. Install bearing retaining spirolox snap ring. See Figure 5-153.



Figure 5-153. Installing Pinion Bearing Retaining Spirolox Snap Ring

NOTE

Early production units incorporated a left-hand threaded nut to retain bearing. To install nut, clamp gear end of compound main driving pinion securely in large bench vise with soft jaws. Install bearing nut and tighten (left-hand thread) to recommended torque

Then positive stake lip of nut to pinion in slot provided.

(Main Driving Pinion Only) Place main driving pinion in vise having soft metal jaws. Install spigot bearing inner race and retain with snap ring.

Mainshaft

Install bearing inner race on mainshaft spigot and retain with snap ring. Position mainshaft in arbor press with spigot end down. Slide ball bearing spacer on shaft then press bearing on shaft. Install positioning snap ring in outer race of ball bearing.

Main Case - Rear Case

Install roller bearing snap ring in inner retaining groove of case countershaft bores. Install and seat roller bearings against inner snap rings, then install outer snap ring in groove provided to retain bearings. Through top cover hole of case, install reverse speed gear (shifter groove of gear forward).

Position reverse idler gear shafts so that flats on end of shaft are pointing towards centerline of countershaft bore. Start shafts into case. Assemble roller bearing in idler gear. Position assembled gear in case (rounded teeth of idlers forward) with thrust washers at each end, and with a nylon hammer tap shaft into case through thrust washers and gear. For final seating of idler gear shafts, see Figure 5-154.

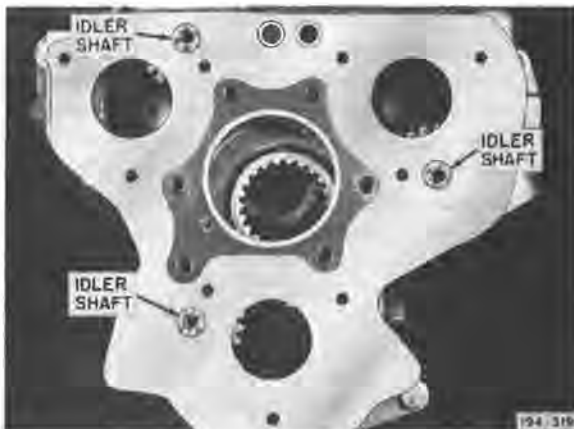


Figure 5-154. Final Seating of Idler Gears

NOTE

Apply sealer around idler gear shafts before final seating.

Main Case - Rear Countershafts

Install lower and right-hand countershaft power-take-off gear, or oil slinger inner snap ring in groove provided. Press rear ball bearing on end of countershafts and retain with snap ring. Install positioning snap ring in outer race of bearings.

Main Case - Front Countershafts

See Figure 5-155.

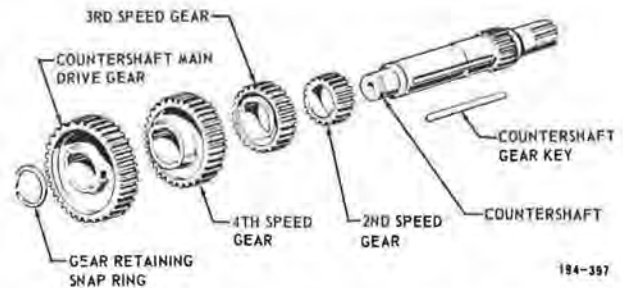


Figure 5-155. Main Case Front Countershaft Assembly

Press roller bearing inner race on rear end of countershafts. Insert gear key in countershafts and press gears on one at a time. These gears have an interference fit and can be pressed on cold, but for best results, the gears should be heated. With a heat lamp or hot oil, heat gears 270 to 300° F. for a period of not more than 1/2 hour. Oil shaft for each gear. Install gear snap ring, then press ball bearings on end of shafts. Install ball bearing retaining snap rings.

Compound Countershafts

See Figures 5-156 and 5-157.

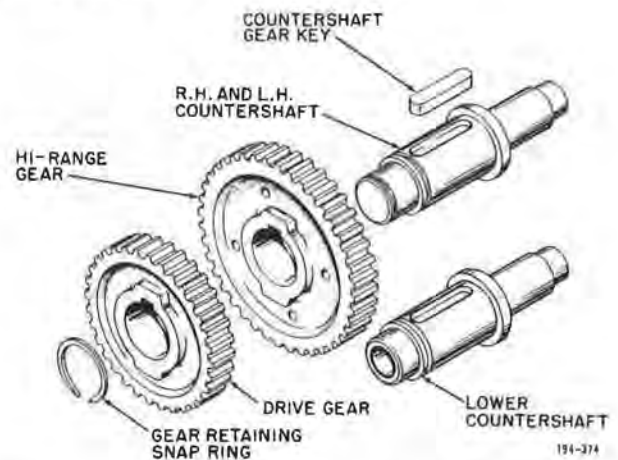


Figure 5-156. Compound Countershaft Assembly (TRDXL10170)

Insert gear key in countershafts and press gears on one at a time. Use same procedure of installing gears as described for main case front countershafts. Install gear snap ring.

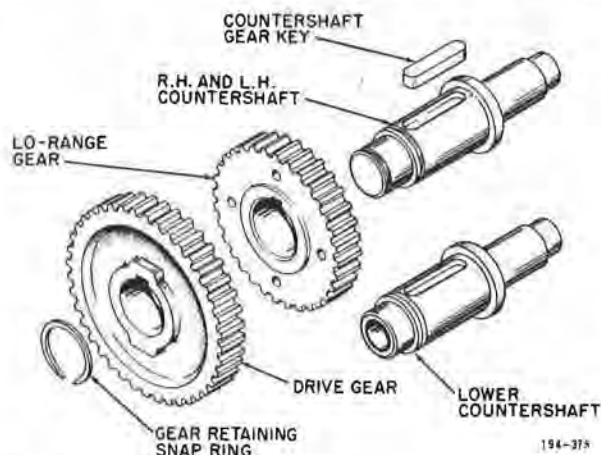


Figure 5-157. Compound Countershaft Assembly (TRDXL 107 and 1071)

Compound Main Driving Pinion Bearing Cover

Apply gasket sealer to the press fit outside diameter of a new oil seal. Care must be exercised to avoid getting any sealer on the sealing lip. Place oil pump sleeve on press table with oil seal counterbore facing up. With lip of oil seal down, press oil seal in counterbore of sleeve until metal flange of seal is flush with sleeve. Spread a 1/8 inch diameter bead of cement, 243SX26, in the corner of the cover bore. Register pump sleeve oil inlet slot with pump oil supply slot in cover. Press sleeve assembly into cover and tight against cover shoulder. See Figure 5-158. Then wipe excess sealant from area.

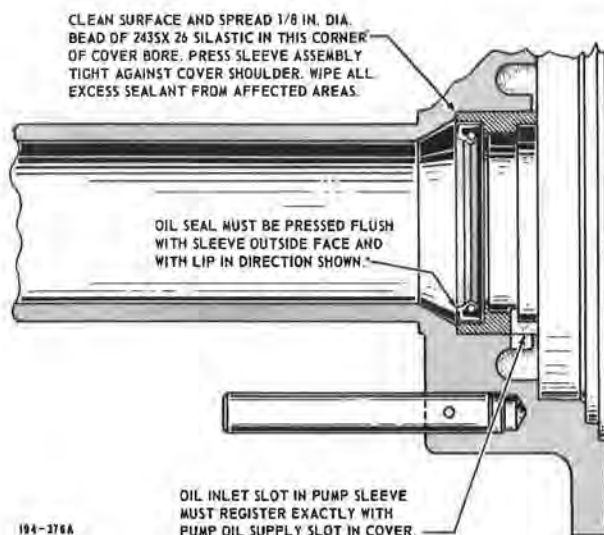


Figure 5-158. Sectional View of Compound Main Driving Pinion Bearing Cover Assembly

Compound Case

NOTE

Procedure of installing compound main driving pinion and compound countershafts will be different between the TRDXL107, 1071 and the TRDXL1070. Therefore, follow steps 1 through 5 for the TRDXL107, 1071 and steps 6 through 15 for the TRDXL1070.

1. (TRDXL107, 1071) Install lower compound countershaft assembly in compound case. Position thick thrust washer loosely on each of the two upper compound countershaft Lo-range gears, (split shims to be added later) and install in compound case.

2. (TRDXL107, 1071) Place a suitable steel support block under forward end of each compound countershaft. Use a tubular driver and hammer to install rear bearing on rear end of compound countershaft.

3. (TRDXL107, 1071) Remove steel support blocks. Using a soft iron drift drive countershaft forward, then install countershaft ball bearing retaining snap rings in grooves provided in case.

4. (TRDXL107, 1071) Turn compound case assembly over and install ball bearing on front end of all three compound countershafts. Continue driving each bearing until countershaft assembly bottoms against rear bearing snap ring. Install snap ring in groove provided in each compound countershaft front ball bearing. Install compound countershaft front ball bearing retaining snap ring in groove provided on front end of each compound countershaft.

5. (TRDXL107, 1071) Turn compound case assembly over. Install compound main driving pinion aligning timing "O" marks of the compound main driving pinion with timing "O" marks on compound countershaft gears.

6. (TRDXL1070) Install lower compound countershaft assembly in compound case. See Figure 5-159.



Figure 5-159. Installing Lower Compound Countershaft Assembly

7. (TRDXL1070) Position thick thrust washers loosely on each of the two upper compound countershaft Hi-range gears, (split shims to be added later). Install upper compound countershaft assemblies in compound case and tilt assemblies to one side. See Figure 5-160. (Tilting countershafts to one side will facilitate installation of compound main driving pinion).

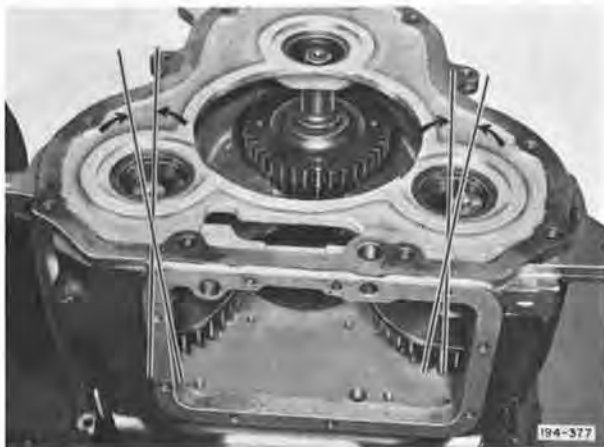


Figure 5-160. Compound Countershafts Tilted to One Side

8. (TRDXL1070) Install compound main driving pinion in compound case. See Figure 5-161.

9. (TRDXL1070) Position compound main driving pinion bearing squarely in case mounting bore. Place a suitable length of tubing in

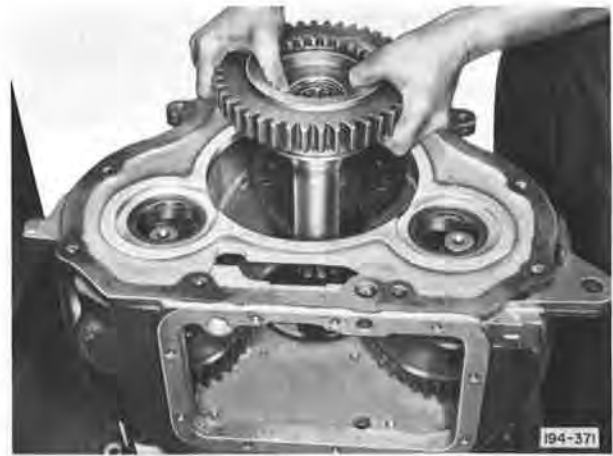


Figure 5-161. Installing Compound Main Driving Pinion

end of pinion so that spigot bearing will not be damaged and drive compound main driving pinion as far forward as possible. See Figures 5-162 and 5-163.

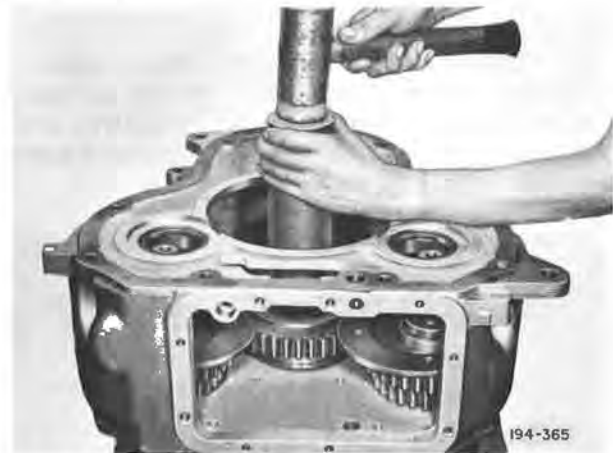


Figure 5-162. Driving Compound Main Driving Pinion Forward

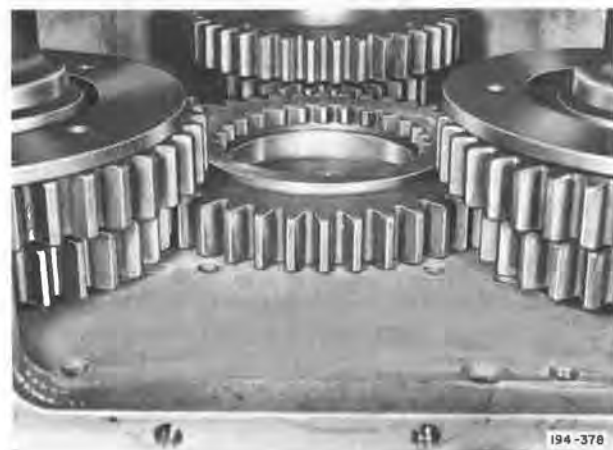


Figure 5-163. Compound Main Driving Pinion in Extreme Forward Position

10. (TRDXL1070) Place steel support block under forward end of each compound counter-shaft. Use a tubular driver and install rear bearing on rear end of compound counter-shaft. See Figure 5-164.

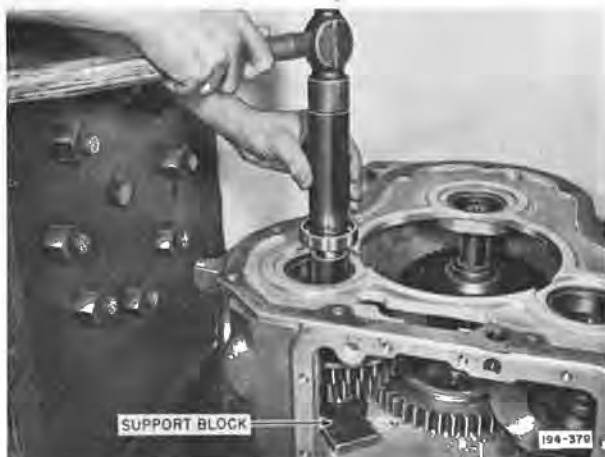


Figure 5-164. Installing Compound Counter-shaft Rear Ball Bearings

11. (TRDXL1070) Remove steel support blocks. Match timing "O" marks on main driving pinion with timing "O" marks on each of the compound countershaft gears and mesh gears. See Figure 5-165.



Figure 5-165. Aligning Compound Main Driving Pinion Timing "O" Marks with Compound Countershaft Timing "O" Marks

12. (TRDXL1070) After gears have been timed correctly, use a suitable soft iron drift and hammer to drive each compound counter-shaft assembly forward until gear bottoms against case. See Figure 5-166.



Figure 5-166. Driving Compound Counter-shaft Forward

13. (TRDXL1070) Install compound counter-shaft rear ball bearing retaining snap ring in groove provided in compound case. See Figure 5-167.



Figure 5-167. Installing Compound Counter-Shaft Rear Bearing Retaining Snap Ring

14. (TRDXL1070) Turn compound case assembly over and install ball bearing on front end of all three compound countershafts. See Figure 5-168. Continued driving each bearing until countershaft assembly bottoms against rear bearing snap ring.



Figure 5-168. Install Compound Counter-shaft Front Ball Bearing

15. (TRDXL1070) Install front ball bearing retaining snap ring in groove provided on front end of each compound countershaft. See Figure 5-169. Install snap ring in groove provided in each compound countershaft front ball bearing. See Figure 5-170.

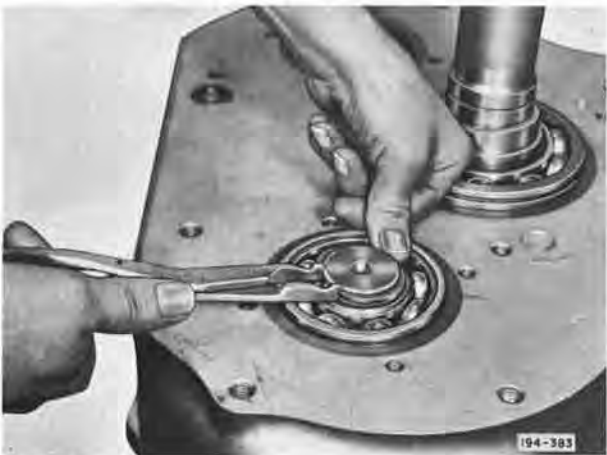


Figure 5-169. Installing Compound Counter-shaft Front Bearing Retaining Snap Ring



Figure 5-170. Installing Compound Counter-shafts Front Ball Bearing Positioning Snap Ring

16. Install O-Ring in each of the two upper bearing covers. See Figure 5-171. Install cover assemblies with capscrews on front of compound case and tighten capscrews to recommended torque.



Figure 5-171. Installing Compound Counter-shaft Upper Front Bearing Cover O-Ring

17. Install snap ring in groove provided in compound main driving pinion ball bearing. See Figure 5-172.



Figure 5-172. Installing Compound Main Driving Pinion Ball Bearing Positioning Snap Ring

18. Install oil pump vane in compound main driving pinion, see Figure 5-173. Vane should be flush with right-hand side of the pinion shaft and protruding slightly from the left side (as observed from the front of the transmission). This will insure alignment of vane with eccentric bore in cover during assembly.



Figure 5-173. Installing Oil Pump Vane

19. Apply a thin coating of gasket sealer to the compound main driving pinion bearing cover mounting flange. Place new gasket on wet sealer and align all bolt and oil holes. See Figure 5-174.

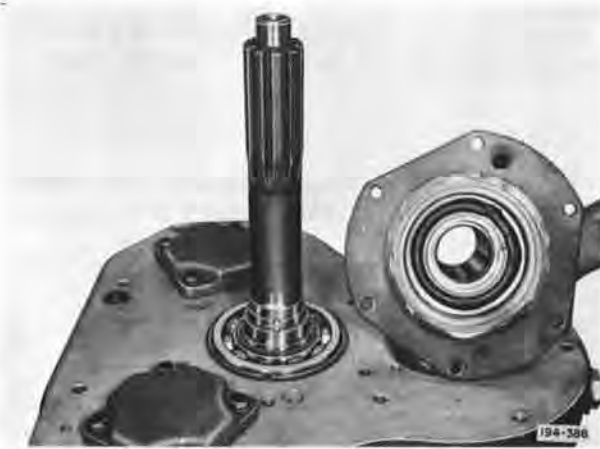


Figure 5-174. Gasket Installed on Compound Main Driving Pinion Bearing Cover

20. Wipe the pump oil seal lip and the lip seat on the pinion shaft with transmission gear oil. (Dry running of sealing member on seat at initial start-up is detrimental and must be avoided). Carefully lower compound main driving pinion cover assembly down over the compound main driving pinion making sure that the lip of the oil seal and oil pump vane are properly positioned. Install cover capscrews and tighten to recommended torque. See Figure 5-175.



Figure 5-175. Torquing Compound Main Driving Pinion Cover Capscrews

21. Install O-ring in the lower compound countershaft from bearing cover. See Figure 5-176. Install cover assembly with capscrews on front of compound case and tighten capscrews to recommended torque.



Figure 5-176. Installing Compound Countershaft Lower Front Bearing Cover O-Ring

22. Turn compound case assembly over and attach case to bell housing. Install capscrews and tighten to recommended torque. See Figure 5-177.

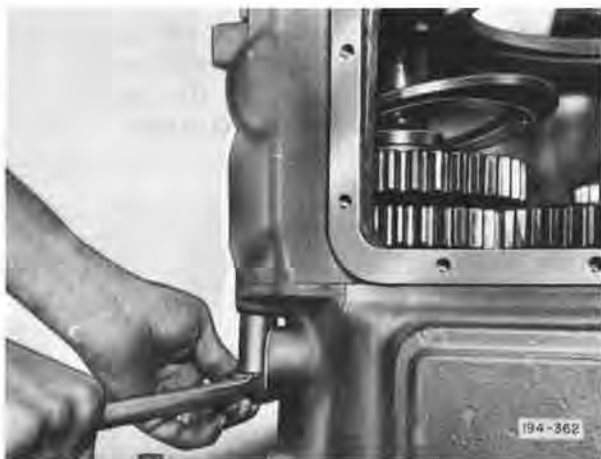


Figure 5-177. Tightening Compound Case to Bell Housing Capscrews

23. Apply a light coat of heavy grease to gear side of compound countershaft Hi-range gear thrust washer, Lo-range gear thrust washer for TRDXL107, 1071. Then place thrust washer on front face of gear hub. See Figure 5-178. The grease will hold these parts together until they are completely assembled.



Figure 5-178. Installing Gear Thrust Washer On Hi-Range Gear

24. Assemble the main driving pinion sliding clutch into the main driving pinion Hi-range gear, Lo-range for TRDXL107, 1071. See Figure 5-179.

NOTE

Because of the two rows of staggered clutching teeth, sliding clutch must be installed in gear prior to installing assembly in case.

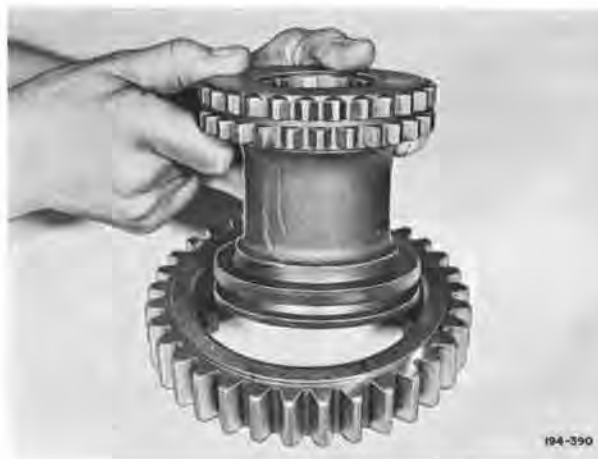


Figure 5-179. Installing Main Driving Pinion Sliding Clutch in Hi-range Gear

25. Turn sliding clutch and gear assembly over and carefully engage main driving pinion Hi-range gear teeth (Lo-range for TRDXL107, 1071) with teeth of the three compound countershaft Hi-range gears (Lo-range gears for TRDXL107, 1071) in the case. See Figure 5-180.



Figure 5-180. Installing Main Driving Pinion Sliding Clutch and Gear Assembly

26. Install existing split adjusting shims between two upper compound countershaft Hi-range gears (Lo-range for TRDXL107, 1070) and their thick thrust washers. See Figure 5-181.

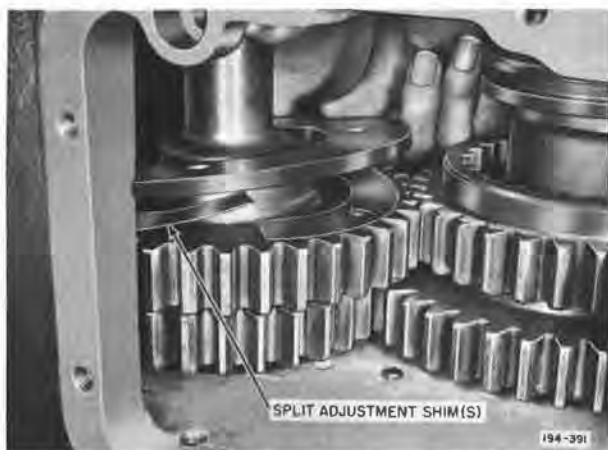


Figure 5-181. Installing Split Adjusting Shims

27. Install upper compound countershaft thick thrust washer capscrews and run down finger-tight. So that gears cannot turn, place a soft iron wedge between gear teeth and tighten thrust washer capscrews to recommended torque. See Figure 5-182.



Figure 5-182. Tightening Upper Compound Countershaft Thrust Washer Capscrews

28. With two identical feeler gages inserted between compound main driving pinion and main driving pinion Hi-range gear thrust washer (Lo-range gear for TRDXL107, 1071) check for recommended end-play clearance. See Figure 5-183.

NOTE

The adjustment shims are split so that they may easily be installed without removing the compound countershafts. If clearance is

less than recommended, add split shims as required. Remove shims as required if clearance is greater than recommended.



Figure 5-183. Checking Main Driving Pinion Hi-range Gear End-play

29. Install and engage compound shifter fork with groove provided in main driving pinion sliding clutch. See Figure 5-184.



Figure 5-184. Installing Compound Shifter Fork

30. Hold compound shifter fork in working position and install compound shift rail in case and fork. See Figure 5-185. Install shifter fork set screw and tighten to recommended torque.



Figure 5-185. Installing Compound Shift Rail

31. Using tool J-23067, install clutch brake flange as shown in Figure 5-186, then install flange screw (left-hand thread).

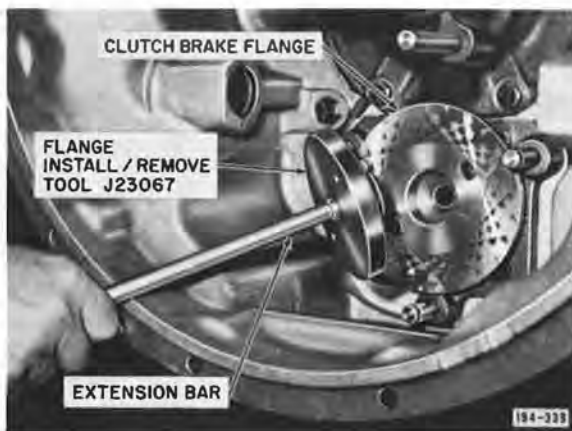


Figure 5-186. Installing Clutch Brake Flange

32. Install clutch brake flange springs on cover pins, then install clutch brake pressure plate. See Figure 5-187.



Figure 5-187. Installing Clutch Brake Pressure Plate

33. Retain clutch brake pressure plate by installing three snap rings as shown in Figure 5-188.

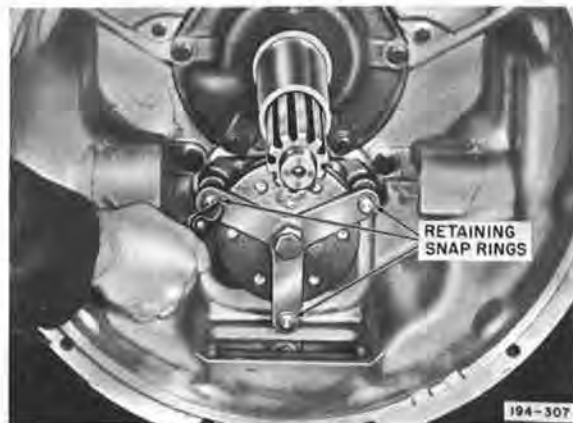


Figure 5-188. Installing Clutch Brake Pressure Plate Retaining Snap Rings

Main Case

1. Position main case front case vertically and install the three front countershaft assemblies in case. See Figure 5-189.



Figure 5-189. Installing Front Countershaft Assembly

2. Position main case front case horizontally. Install front countershaft ball bearing positioning snap rings in outer race of bearings, then tap countershaft assemblies rearward until positioning snap ring seats against case.

3. Place transmission front case in a vertical position. Install mainshaft third speed gear so that the three alignment "O" marks on face of gear mate with the alignment "O" marks on the countershaft third speed gears. See Figure 5-190.



Figure 5-190. Installing Mainshaft Third Speed Gear

4. Install second/third speed sliding clutch and engage with third speed gear clutch teeth. See Figure 5-191.



Figure 5-191. Installing Second/Third Speed Sliding Clutch

5. Install second speed gear (clutch teeth to the rear) with thrust washer over second/third speed sliding clutch and engage with countershaft second speed gears. See Figure 5-192.



Figure 5-192. Installing Second Speed Gear

6. Install first speed gear (clutch teeth to rear) with thrust washer and engage with countershaft first speed gears. See Figure 5-193.



Figure 5-193. Installing First Speed Gear

7. Position first speed sliding clutch on second/third speed sliding clutch. See Figure 5-194.



Figure 5-194. Installing First Speed Sliding Clutch

8. Paint end of front case with a good gasket sealer compound and install case-to-case gasket. Paint rim of gasket with sealer. Apply a light coat of grease to side of retainer thrust washer. Place thrust washer on face of rear case retainer and lower rear case assembly over assembled countershafts. Tap case into position so that bearings are seated properly. Install case-to-case cap screws and dowel bolts and tighten to recommended torque.

NOTE

The following step will include the installation of all three rear countershafts. The only exception will be that the upper left-hand countershaft does not require a power-take-off gear, in early production units, or an oil slinger.

9. Position transmission horizontally. Start rear countershaft through rear bearing opening in case. While advancing countershaft, position power-take-off gear and gear retaining front snap ring on shaft. See Figure 5-195. Where oil slinger is incorporated, instead of power-take-off gear, advance countershaft and install slinger retaining spring on shaft. With flared lip of slinger toward the rear, install slinger and slinger retaining front snap ring.

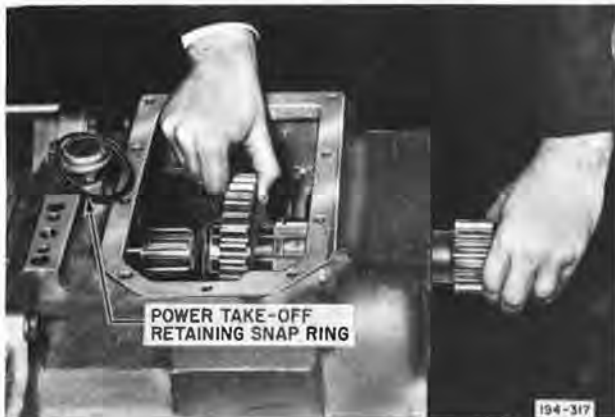


Figure 5-195. Installing P. T. O. Gear on Rear Countershaft

10. Observe timing "O" marks on front and rear countershaft splines. See Figure 5-196. Align timing "O" marks on rear countershaft with timing "O" marks on front countershaft and continue advancing shaft until the countershaft rear bearing positioning snap ring seats against case.



Figure 5-196. Aligning Timing "O" Mark on Rear Countershaft with Front Countershaft

11. Position power-take-off gear on countershaft splines, then install gear front snap ring in groove provided to retain gear. See Figure 5-197.



Figure 5-197. Installing P. T. O. Gear Front Snap Ring

Where oil slinger is incorporated, compress slinger retaining spring with slinger and install slinger front snap ring in groove provided to retain slinger. See Figure 5-198.



Figure 5-198. Countershaft Rear Shaft Oil Slinger Assembly

12. Install O-rings in countershaft rear bearing covers. Install covers with cap-screws and washers, then tighten capscrews to recommended torque.

13. Engage reverse speed sliding gear with the reverse idler gears. Install fourth speed gear in case (clutch teeth forward) with thrust washer and engage with countershaft gears. See Figure 5-199.



Figure 5-199. Installing Fourth Speed Gear

14. Start mainshaft in case through rear bearing opening. See Figure 5-200. Advance shaft through reverse speed gear, second and third speed sliding clutch and fourth speed gear until rear bearing positioning snap ring seats against case. Install speedometer drive gear on shaft. Apply sealer compound and install rear bearing cover gasket and cover. Install cover cap screws and tighten to recommended torque. Oil lip of cover oil seal, and install drive flange and nut.



Figure 5-200. Installing Mainshaft

15. Place transmission in two gears which will lock up assembly. Tighten flange nut to recommended torque.

16. Install fourth speed gear thrust washer on mainshaft. Install fourth speed gear splined thrust washer on mainshaft. See Figure 5-201.



Figure 5-201. Installing Fourth Speed Gear Thrust Washer

17. Using a small tool, move thrust washer one tooth so that the inner teeth align with mainshaft splines. See Figure 5-202.

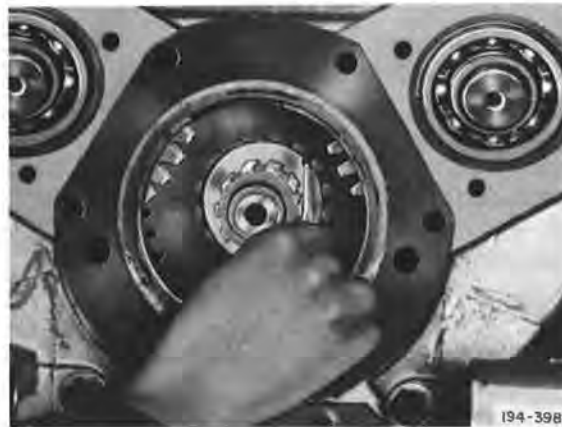


Figure 5-202. Aligning Fourth Speed Gear Thrust Washer Internal Teeth with Mainshaft External Teeth

18. With two feeler gages, check between third and fourth speed gear for recommended end-play. See Figure 5-203. Refer to "Screw Torques and Adjustment Chart" for selective thrust washers to obtain recommended end-play.



Figure 5-203. Checking Mainshaft Gear End-play

19. Install washer key in deepened spline root and slide fourth and fifth speed sliding clutch on splines, over inlaid key, and engage with fourth speed gear.

20. Position and drive pinion assembly into place being careful not to damage spigot bearing. Install main driving pinion cover with capscrews. Then tighten capscrews to recommended torque.

21. Install reverse speed fork on reverse speed sliding gear and install first speed fork on first speed sliding clutch. See Figures 5-204 and 5-205.



Figure 5-204. Installing Reverse Speed Shifter Fork



Figure 5-205. Installing First Speed Shifter Fork

22. Install first and reverse speed shifter rail through front of case and first and reverse speed shifter. See Figure 5-206. Advance rail through intermediate bore of case, first speed fork, front snap ring, reverse speed fork and rear snap ring until rail reaches neutral position. Install fork and shifter set screws and tighten to recommended torque.



Figure 5-206. Installing First and Reverse Shifter

NOTE

Assemble snap rings with rounded edge of rings against shifter fork. After assembling snap rings, rotate 30 degrees to assure rings are properly seated.

23. Start second and third speed shifter rail through hole provided in rear of case. Engage second and third speed fork with second and third speed sliding clutch, see Figure 5-207. Advance rail through hub of fork and intermediate bore of case.



Figure 5-207. Installing Second and Third Speed Shifter Fork

24. Install second and third speed shifter on rail, see Figure 5-208, and continue advancing rail into front support until it reaches neutral position. Install fork and shifter set screw and tighten to recommended torque.



Figure 5-208. Installing Second and Third Speed Shifter

25. Start fourth and fifth speed shifter rail in hole provided in front of case. Engage fourth and fifth speed fork with fourth and fifth speed sliding clutch. See Figure 5-209. Advance rail through hub of fork and intermediate bore until rail reaches neutral position. Install fork set screw and tighten to recommended torque. At this point, make sure the two shift rail welsh plugs are in place at the rear of the case.



Figure 5-209. Installing Fourth and Fifth Speed Shifter Fork

Main Components

1. With bell housing and compound case assembled and mounted in overhaul stand, install new gasket to compound case. With the aid of a hoist, pick up transmission main case. Align main case with compound case, and carefully engage units together. See Figure 5-210.



Figure 5-210. Engaging Main Case to Compound Case

2. Install main case to compound case cap-screws and washers, then tighten to recommended torque. See Figure 5-211.



Figure 5-211. Tightening Main Case to Compound Case Capscrews

3. Install shifters on shift rail. Install shifter set screw and tighten to recommended torque. See Figure 5-212.



Figure 5-212. Installing Shifters on Shift Rails

4. Install shift rail poppet balls, with springs in holes provided at top of main case. See Figure 5-213 and 5-214. In early production units where poppet ball pins were incorporated, install pins as shown in Figure 5-215.



Figure 5-213. Installing Shift Rail Poppet Ball



Figure 5-214. Installing Shift Rail Poppet Ball Spring



Figure 5-215. Installing Shift Rail Poppet Ball Pins (Early Production Units Only)

5. Install poppet ball cover with capscrews and tighten capscrews to recommended torque. See Figure 5-216.

6. Install main case top covers. Install compound rail poppet ball and spring, then install compound case top cover.

7. Install clutch release shaft with needle bearings and grease seals, yoke, bearing return spring, and any other external part that was removed for disassembly. Recheck all fasteners for correct torque. Then remove transmission from stand.

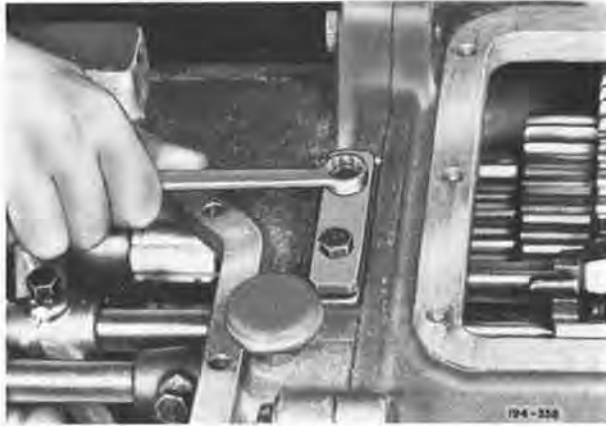
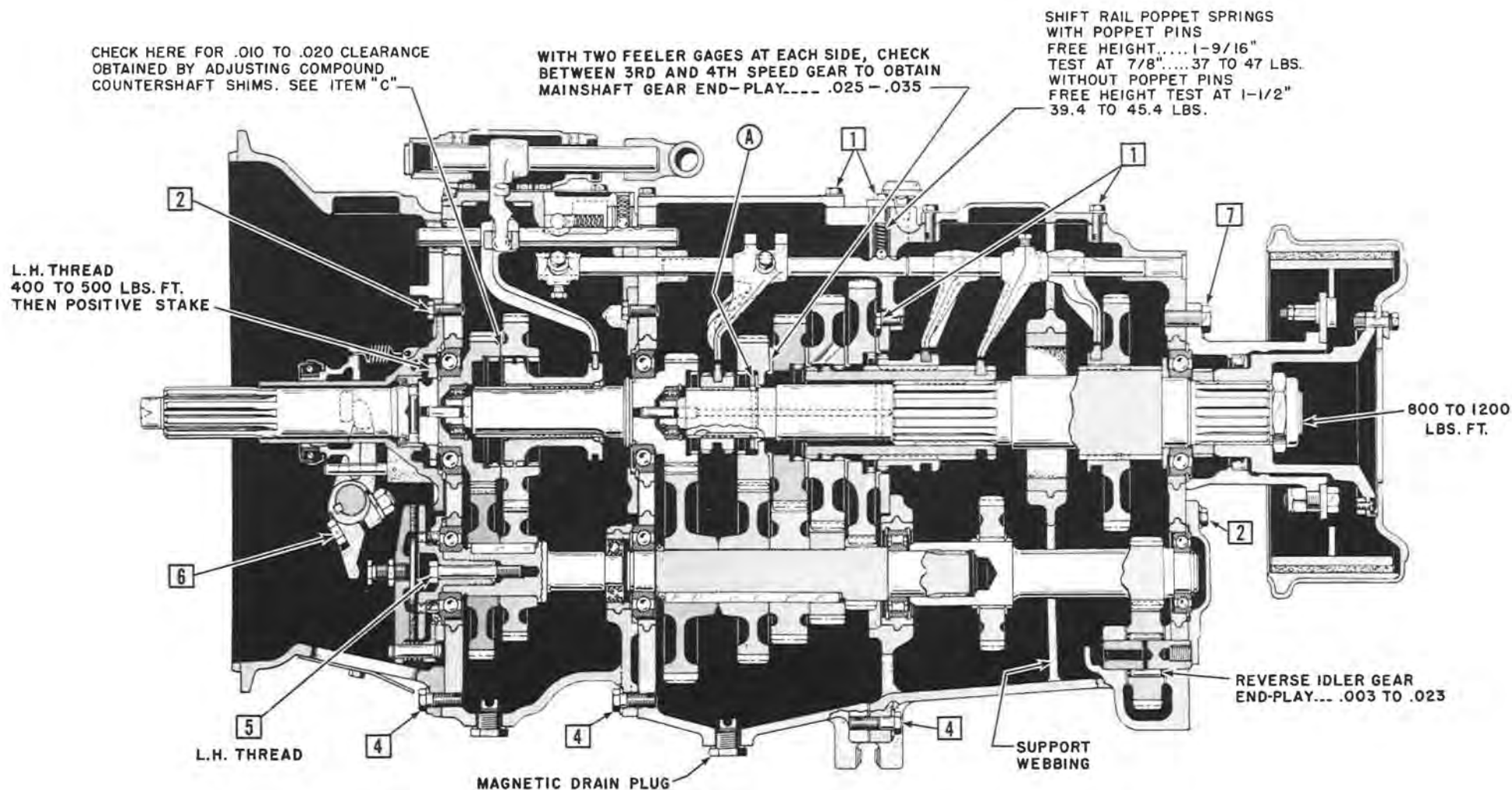


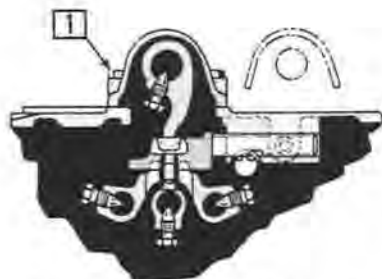
Figure 5-216. Tightening Main Case Shift Rail Poppet Ball Cover Capscrews

NOTES

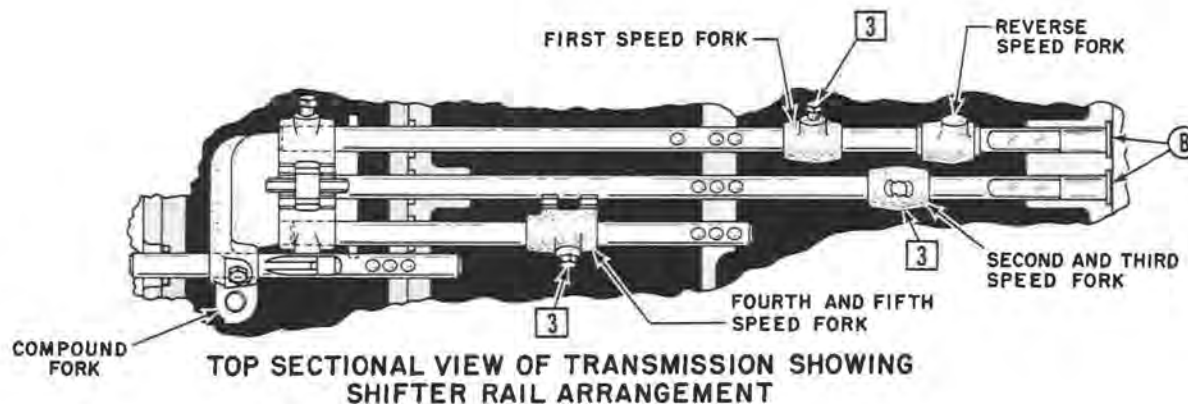
TRDXL 107 | SERIES TRIPLE COUNTERSHAFT TRANSMISSION

SCREW TORQUES AND ADJUSTMENT CHART

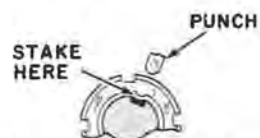




FRONT VIEW OF SHIFTER DETAIL

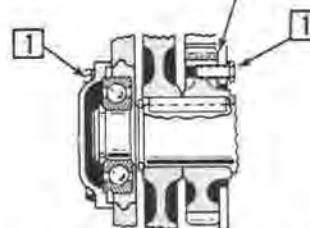


TOP SECTIONAL VIEW OF TRANSMISSION SHOWING SHIFTER RAIL ARRANGEMENT

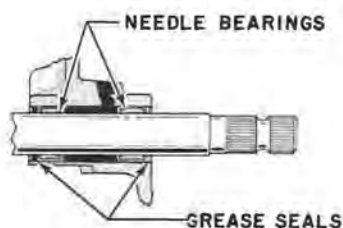


POSITIVE STAKING METHOD
USE ROUND-NOSED PUNCH TO STAKE METAL LIP OF NUT INTO MILLED SLOT IN SHAFT

Ⓒ ADJUST SHIMS TO OBTAIN .010 TO .020 CLEARANCE



SECTIONAL VIEW SHOWING RIGHT HAND AND LEFT HAND COMPOUND COUNTERSHAFT



CLUTCH RELEASE SHAFT ARRANGEMENT AS VIEWED FROM FRONT OF TRANSMISSION



TRANSMISSION CASE DOWEL BOLTS

ALL FORKS IN SLIDING CLUTCHES			
	MIN. NEW	MAX. NEW	MAX. WEAR
SIDE-CLEARANCE..	.005	.020	.050

* NOTE - IF UNIT HAS EXPERIENCED DISENGAGEMENT SIDE CLEARANCE MUST NOT EXCEED .030 MAX.

THRUST WASHER	AVAILABLE THICKNESSES
Ⓐ 4TH. SPEED GEAR SELECT FOR TIGHTEST FIT IN GROOVE TO OBTAIN .025 - .035 MAINSHAFT GEAR END-PLAY	.267 - .269 .257 - .259 .247 - .249 .237 - .239 .227 - .229 .217 - .219 .207 - .209 .197 - .199

Ⓑ IMPORTANT - BE SURE WELCH PLUGS ARE IN PLACE BEFORE INSTALLING UNIT IN CHASSIS

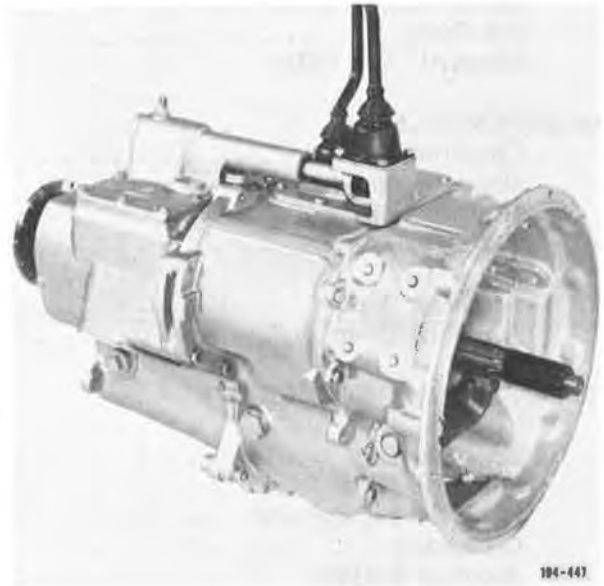
SCREW TORQUES IN LBS. FT.	
SCREWS	LUBRICATED
1	18 TO 28
2	30 TO 40
3	35 TO 45
4	65 TO 75
5	55 TO 75
6	105 TO 115
7	155 TO 185

NOTES

MACK SIX SPEED DIRECT MAXITORQUE TRANSMISSIONS
TRXL107, TRXL1071, TRXL107A, TRXL1071A



TRXL107, TRXL1071



TRXL107, TRXL1071



TRXL107A, TRXL1071A



TRXL107A, TRXL1071A

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NOTE

The illustrations contained in this publication are typical, and not necessarily exact. When working on these transmissions, the mechanic may find small differences between his unit and the illustrations.

NOTES

MACK SIX SPEED MAXITORQUE TRANSMISSIONS
TRXL107, TRXL1071, TRXL107A, TRXL1071A

DESCRIPTION

These transmissions are triple countershaft, non-synchronized units providing six forward speeds and five reverse speeds. They consist of a main box gear set of five speeds, plus an integral rear compound gear set. The rear compound provides a direct-range position for each of the five speeds in the main box, and a lo-range (or lo lo-range) position for first speed gear. Lo-range (or lo lo-range) is impractical to use in second, third, fourth, and fifth speed gears because these ratios are almost identical to the ratios in direct-range. The rear compound also provides a reverse position for each of the five speeds in the main box, thus giving five reverse speeds.

The TRXL107 and TRXL1071 have manually shifted rear compounds, while the TRXL107A and TRXL1071A have air shifted rear compounds.

The TRXL107 and TRXL107A have a lo-range for first speed gear, while the TRXL1071 and TRXL1071A have a lo lo-range (creeper gear).

The TRXL107 and TRXL1071 are provided with two manually shifted control levers, one for the main box and one for the rear compound. The TRXL107A and TRXL1071A are provided with only one manually shifted control lever, for the main box. The rear compound is shifted by an air control valve (selectair valve) mounted on the gear shift lever. The valve has a finger-operated flipper to direct air pressure to the shift cylinders for shifting the rear compound into direct, lo-range, reverse, and neutral for P.T.O. operation.

The three countershafts are equally spaced around the mainshafts. This design distributes the load equally among the countershafts, thus keeping normal deflection and gear tooth loading to a minimum. See Figure 5-217.

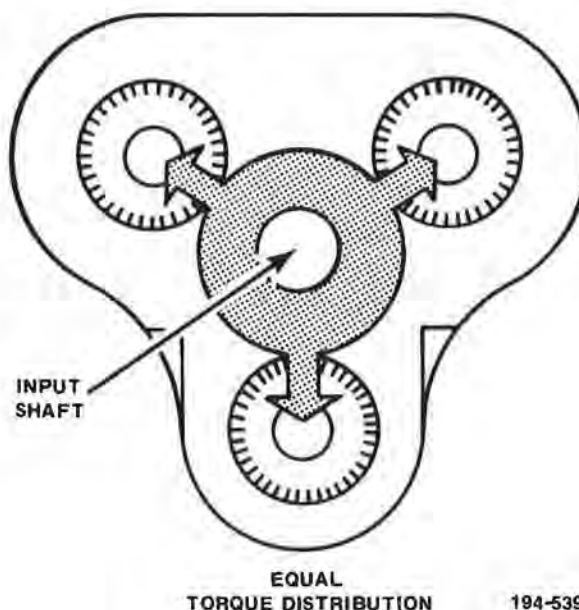


Figure 5-217. Torque Distribution

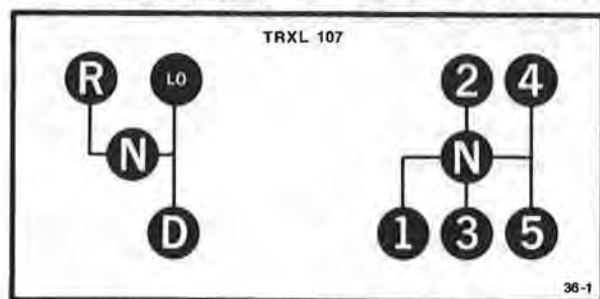
The mainshaft gears are either splined to the mainshaft, or self-centering among the three countershafts, thus eliminating the need for gear bushings.

All mainshaft gears are of the spur type design and, with the exception of the reverse speed sliding gear, are in constant mesh with the countershaft gears.

Other than reverse gear, shifting for the six forward speeds is done by sliding clutches. Reverse is obtained by engaging the reverse sliding spur gear with the three reverse idler gears.

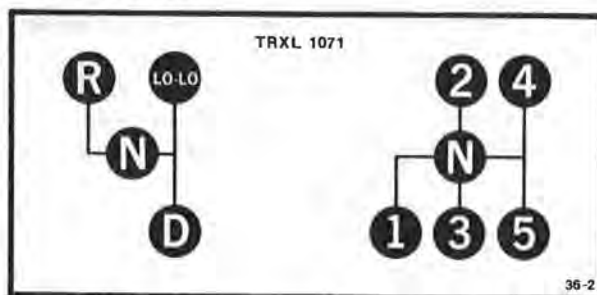
SPECIFICATIONS

Gearset, Make	Mack
Type	Three Countershaft
Control, TRXL107 and TRXL1071	Selective, Two Lever Manual
Control, TRXL107A and TRXL1071A	Selective, One Lever with Air Shift Rear Compound
Speeds, Forward	Six
Reverse	Five
Bell Housing, Type	Separable, Aluminum
Lubrication	Gear throw-off, and pump feed through rifle-drilled passages in mainshaft to sliding clutches and mainshaft gears.
Pump, Type	Built-In Reciprocating Vane
Case, Material	Aluminum, with Steel Inserts at Bearing Bores
P. T. O. Openings:	
Left Side	Standard S. A. E. 8 hole
Right Side	Standard S. A. E. 6 hole
Oil Capacity	22 pints



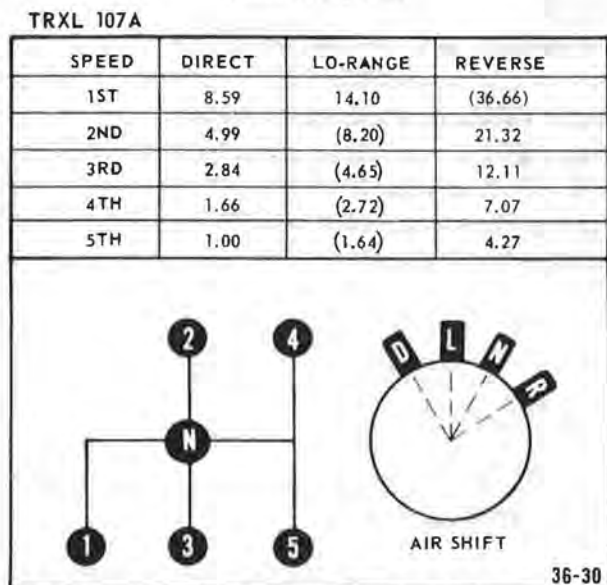
SPEED	DIRECT	LO RATIO	REV.
First	8.59	14.10	36.66
Second	4.99	—	21.32
Third	2.84	—	12.11
Fourth	1.66	—	7.07
Fifth	1.00	—	4.27

Figure 5-218. TRXL107 Gear Ratios and Shift Diagram



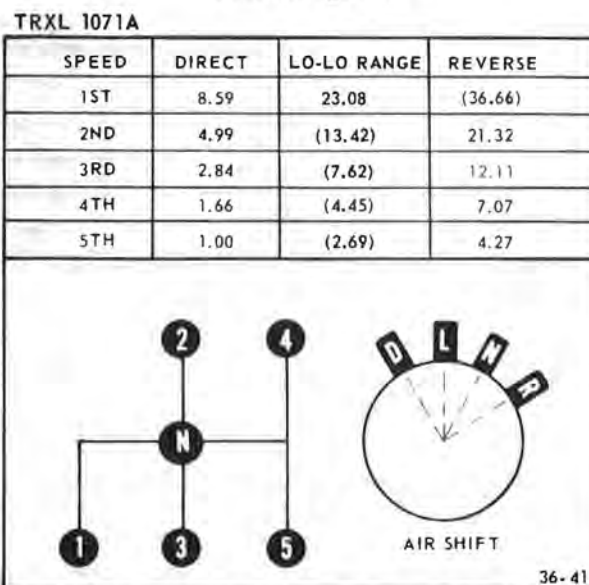
SPEED	DIRECT	LO-LO RATIO	REV.
First	8.59	23.08	36.66
Second	4.99	—	21.32
Third	2.84	—	12.11
Fourth	1.66	—	7.07
Fifth	1.00	—	4.27

Figure 5-219. TRXL1071 Gear Ratios and Shift Diagram



() RATIOS IN PARENTHESIS ARE NOT FUNCTIONAL TO OPERATIONS.

Figure 5-220. TRXL107A Gear Ratios and Shift Diagram



() RATIOS IN PARENTHESIS ARE NOT FUNCTIONAL TO OPERATIONS.

Figure 5-221. TRXL1071A Gear Ratios and Shift Diagram

LUBRICATION

Splash Lubrication

All rotating and sliding parts of the transmission are bathed in oil from gear throw-off when in operation. See Figure 5-222.



SPLASH LUBRICATION

194-536

Figure 5-222. Gear Lubrication

Oil Pump

The sliding clutches and mainshaft gears are also provided with pressurized lubrication. A simple eccentric shuttle type pump is built into the main drive pinion. As the pinion rotates, the pump vane reciprocates in its eccentric housing, thus forcing lubricant under pressure through rifle-drilled holes in the mainshaft to the sliding clutches and mainshaft gears. See Figure 5-223.

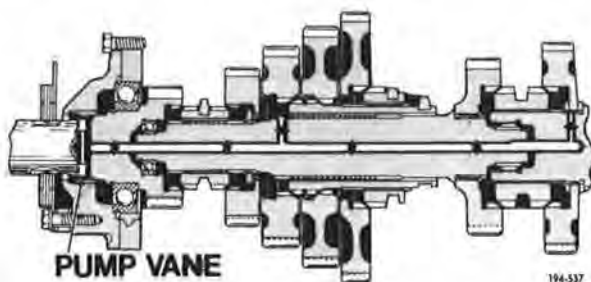


Figure 5-223. Pressure Lubrication

To supply the pump, oil from gear throw-off is collected by a trough located above the main drive pinion, and is then gravity fed to the pump.

Magnetic Oil Filter

A magnetic oil filter plug, located on the right-hand side of the main case, removes ferrous metallic particles. The filter consists of an integral open trough and baffle arrangement, with a removable sheet metal cover. At the bottom of the baffle, a tapped hole in the case accommodates a large hex head plug with a built-in magnet. See Figure 5-224.



Figure 5-224. Magnetic Oil Filter

The oil from gear throw-off is collected by the filter, and is channeled past the magnetic plug, which pulls ferrous metal particles out of the passing oil and holds them. After passing the magnet, clean and particle-free oil then rises to the outlet near the top of the filter, and drops down into the transmission case. A magnetic drain plug is also provided at the bottom of the case.

Early production TRXL107 and TRXL1071 transmissions were equipped with an additional magnetic oil filter, located on the left-hand side of the main case. This plug was eliminated, starting with transmission serial number 9W8502 (produced October, 1974) for the TRXL107, and serial number 9W8670 (produced October, 1974) for the TRXL1071.

MAINTENANCE

Checking Oil

To check the oil in the transmission, remove the fill plug on the right-hand side of the case. The oil should be level with the bottom of the filler plug hole. The oil should be checked when it is hot, as when coming in from a run, and with the vehicle in a level position.

Check the oil at the intervals specified in the Maintenance and Lubrication Manual. Add oil, if needed, until oil begins to run out of the filler hole. Use oil of the proper specification as outlined in the Maintenance and Lubrication Manual.

CAUTION

Be sure to add oil to the transmission through the filler plug hole, NOT the magnetic plug hole. See Figure 5-225. Severe damage could occur due to low oil level if the transmission is filled through the wrong hole.



1. Air Shift Cover Assembly
2. Breather
3. Magnetic Oil Filter Plug
4. Filler Plug

Figure 5-225. Typical Air Shift Transmission

Changing Oil

To change oil, remove the magnetic drain plug and drain the oil from the case while hot. If necessary, also flush the case with flushing oil and drain thoroughly. Clean and replace the magnetic drain plug. Remove the fill plug, and fill the transmission with the proper specification of oil (as outlined in the Maintenance and Lubrication Manual) to the level of the bottom of the filler plug hole. See the preceding CAUTION note. Reinstall the filler plug. Change oil at the intervals specified in the Maintenance and Lubrication Manual, or more often if conditions warrant it.

Magnetic Oil Filter

The magnetic oil filter plug should be removed and cleaned every time the oil is changed. Also clean the trough inside, and then reinstall the magnetic plug.

Breather

The breather, located on the top of the transmission, should be cleaned with a suitable solvent and checked for unobstructed air flow every time the oil is changed.

Air Filter (TRXL107A and TRXL1071A only)

The transmission air filter should be replaced at every Mack C Inspection.

Selectair Valve (TRXL107A and TRXL1071A only)

The Selectair valve, located on the transmission gear shift lever, should be disassembled for cleaning, inspection, and lubrication at every Mack C Inspection. Refer to the Selectair valve sections under DISASSEMBLY, INSPECTION AND CLEANING, and REASSEMBLY for the proper procedures and lubricants.

Air Shift Cover (TRXL107A and TRXL1071A only)

The air shift cover should be disassembled for cleaning, inspection, and lubrication at every Mack C Inspection. Refer to the Air Shift Cover sections under DISASSEMBLY and REASSEMBLY for the proper procedures and lubricants.

TROUBLE SHOOTING CHART

The following Trouble Shooting Chart is provided as an aid to assist in diagnosing and repairing the more common transmission complaints. It is not intended to include every possible cause - only those that most frequently occur.

Care should be exercised by the mechanic, when dealing with complaints of transmission problems, to be sure to eliminate all other possible sources of trouble before removing the transmission. Noise problems in particular are often assumed to be the fault of the transmission, while actually the noise comes from the axle, propeller shafts, universal joints, engine or clutch.

TROUBLE SHOOTING CHART

Symptom	Probable Cause	Remedy
Noisy	<ul style="list-style-type: none"> a. Low oil level b. Wrong oil used c. P.T.O. installed too tight or too loose d. Loose bell housing to flywheel housing capscrews e. Torsional vibrations from engine and/or rear axle f. Excessive mainshaft gear endplay g. Gears worn, chipped, rough, cracked h. Bearings worn, cracked, corroded, galled, etc. 	<ul style="list-style-type: none"> a. Fill to correct level b. Drain and refill with correct oil c. Reinstall P.T.O. correctly d. Tighten capscrews e. Install dampened disc clutch and/or driveline vibration damper f. Adjust using correct selective thrust washers g. Replace gears h. Replace bearings
Hard Shifting	<ul style="list-style-type: none"> a. Improperly adjusted clutch, clutch linkage, clutch brake, or shift linkage b. Low oil level c. Wrong oil used d. Incorrect driving practices e. Remote shift linkage not lubricated f. Shift lever binding or interference g. Poppet balls binding in their holes h. Loose setscrews in shifters or shift forks i. Worn shift rail bores j. Worn spigot bearing k. Clutch brake ears broken l. Clutch discs worn into main drive pinion 	<ul style="list-style-type: none"> a. Adjust properly b. Fill to correct level c. Drain and refill with correct oil d. Educate driver e. Clean and lubricate f. Relieve binding or interference g. Clean holes and balls h. Tighten to correct torque i. Install bushings j. Replace bearing k. Replace clutch brake l. Replace clutch discs and main drive pinion
Slow Air Shift	<ul style="list-style-type: none"> a. Low system air pressure b. Restricted or clogged air filter c. Restricted air lines (bent, squeezed, twisted, etc.) d. Air lines too small e. Defective pressure protection, pressure reducing, or quick release valve f. Clogged shift cylinder breather g. Defective o-rings in air shift cylinders h. Scored air shift cylinders or pistons 	<ul style="list-style-type: none"> a. Wait for pressure to build back up to normal b. Replace air filter c. Reroute and/or replace air lines d. Replace with correct size air lines e. Replace valve f. Clean or replace breather g. Replace o-rings h. Repair or replace cylinders or pistons

TROUBLE SHOOTING CHART (continued)

Symptom	Probable Cause	Remedy
Gear Disengagement (jumping out of gear)	<ul style="list-style-type: none"> a. Improperly adjusted remote control linkage b. Shift lever interference c. Excessive length and/or weight of gear shift lever and/or knob d. Worn or loose mounting insulators e. Loose, broken, or missing capscrews between main case, clutch housing, and flywheel housing f. Weak or broken shifter rail poppet springs g. Bent or worn shifter forks h. Broken snap rings i. Shift rail bent or poppet notches worn j. Excessive mainshaft gear endplay k. Worn taper or chipped teeth on sliding clutch teeth l. Worn spigot bearing m. Engine flywheel housing misalignment 	<ul style="list-style-type: none"> a. Adjust properly b. Remove interference c. Replace with standard lever and/or knob d. Replace insulators e. Tighten or replace capscrews f. Replace springs g. Replace forks h. Replace snap rings i. Replace shift rail j. Adjust using correct selective thrust washers k. Replace sliding clutch l. Replace bearing m. Realign properly
Oil Leaks	<ul style="list-style-type: none"> a. Drain plug, fill plug, or magnetic plug loose b. Oil level too high c. Improper lubricant used d. Loose or missing capscrews e. Clogged breather f. Shift rail expansion plugs loose or missing g. Gaskets or o-rings broken, shifted, or squeezed out of position h. Worn oil seals i. O-rings in air shift cover leaking air pressure into transmission 	<ul style="list-style-type: none"> a. Tighten plugs b. Fill to correct level c. Drain and refill with correct oil d. Tighten or replace e. Clean or replace f. Replace expansion plugs g. Replace gaskets and o-rings h. Replace seals i. Replace o-rings
Bearing Failure	<ul style="list-style-type: none"> a. Dirt in system b. Wrong grade of oil, or contaminated oil c. Excessive vibrations d. Binding or seized propeller shaft slip yoke e. Improper bearing clamping f. Improper bearing installation 	<ul style="list-style-type: none"> a. Clean and replace as necessary b. Drain and refill with correct oil c. Eliminate vibrations d. Clean and replace as needed e. Reclamp using correct procedures f. Replace using correct procedures

DISASSEMBLY

Main Components Disassembly

NOTE

Unless a complete overhaul is necessary, remove only those parts required to gain access to the faulty parts. Do not disturb parts having heavy press fits (interference fits) unless replacement is necessary. In that case, use proper press setups and pullers, so that usable parts are not damaged.

1. (TRXL107A and TRXL1071A only)
Remove air lines from Air Shift Cover Assembly. For easier reassembly, tag each air line with the same number stamped near the fitting on the Air Shift Cover.

2. Drain lubricant, and remove transmission from vehicle. Clean it externally and mount unit in overhaul stand.

3. Remove clutch release yoke tapered setscrews. See Figure 5-226.

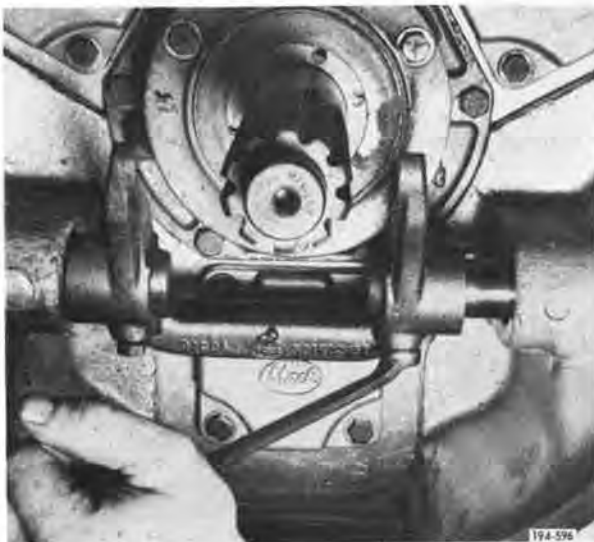


Figure 5-226. Removing Setscrews

4. Drive splined clutch release shaft inward, and remove Woodruff key. See Figure 5-227.

5. Drive splined clutch release shaft outward, and remove.



Figure 5-227. Removing Woodruff Key

6. Slide clutch release stub shaft inward, and remove it with clutch release yoke. See Figure 5-228.

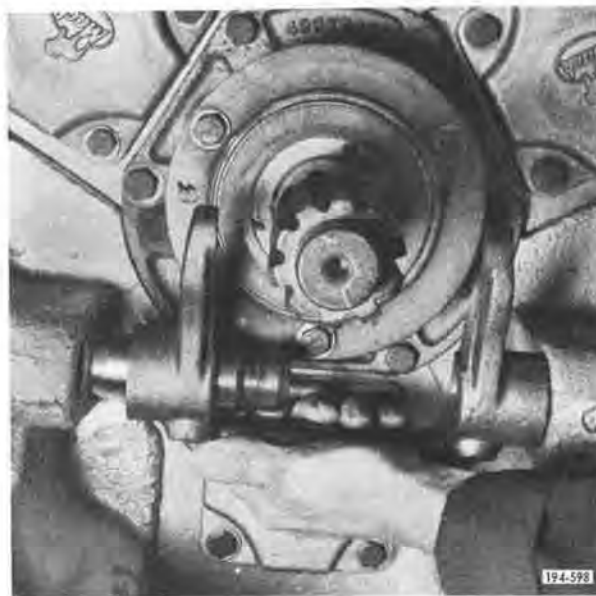


Figure 5-228. Removing Yoke and Stub Shaft

7. Remove clutch brake from input shaft. See Figure 5-229.

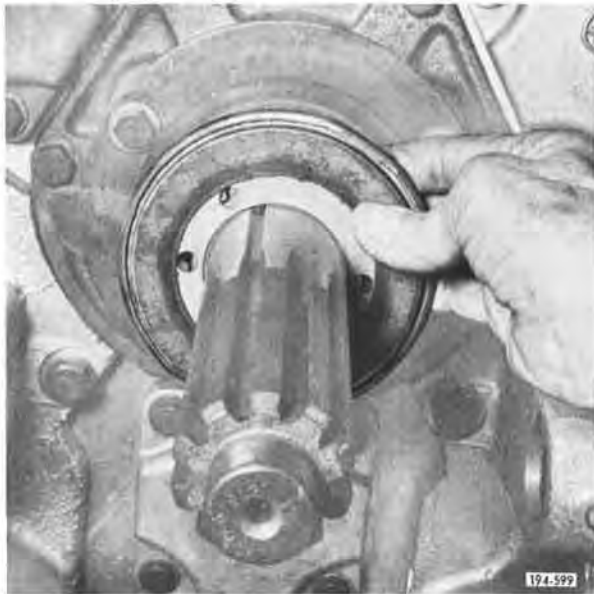


Figure 5-229. Removing Clutch Brake

8. Remove front case top cover capscrews. See Figure 5-230.



Figure 5-230. Removing Capscrew

9. Remove front case top cover. See Figure 5-231.

10. (TRXL107A and TRXL1071A only)
Remove air shift cover capscrews. See Figure 5-232.

11. (TRXL107 and TRXL1071 only)
Remove rear case top cover capscrews, and top cover.

12. (TRXL107A and TRXL1071A only)
Remove air shift cover assembly. See Figure 5-233.

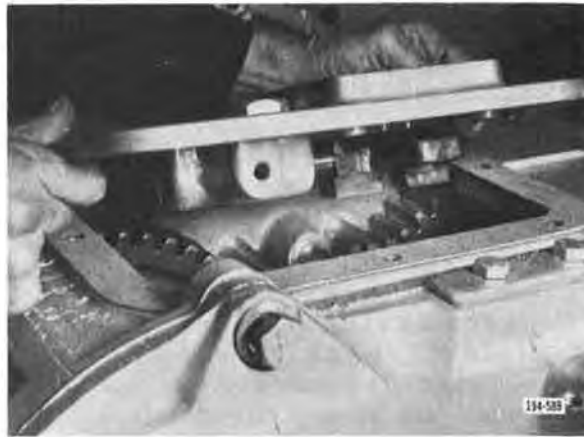


Figure 5-231. Removing Top Cover



Figure 5-232. Removing Capscrew



Figure 5-233. Removing Cover

13. Remove shifter rail poppet ball cover capscrews and cover. See Figure 5-234.



Figure 5-234. Removing Capscrews

WARNING

Cover is spring-loaded. Remove cover evenly and carefully to prevent damage or injury.

14. Remove poppet spring and poppet ball. See Figure 5-235.



Figure 5-235. Removing Poppet Spring and Ball

15. Remove set-screws from first speed shift fork and second/third speed shift fork. See Figure 5-236.

16. Remove set-screw from fourth/fifth speed shift fork. See Figure 5-237.



Figure 5-236. Removing Setscrew

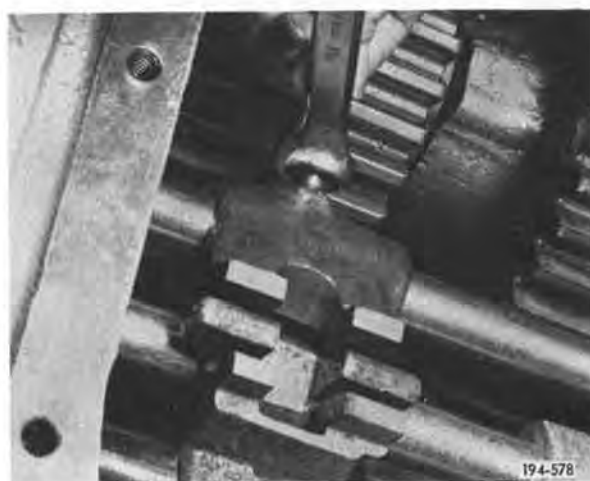


Figure 5-237. Removing Setscrew

17. Slide fourth/fifth speed shift rail forward, and at the same time remove fourth/fifth speed shift fork. See Figures 5-238 and 5-239.

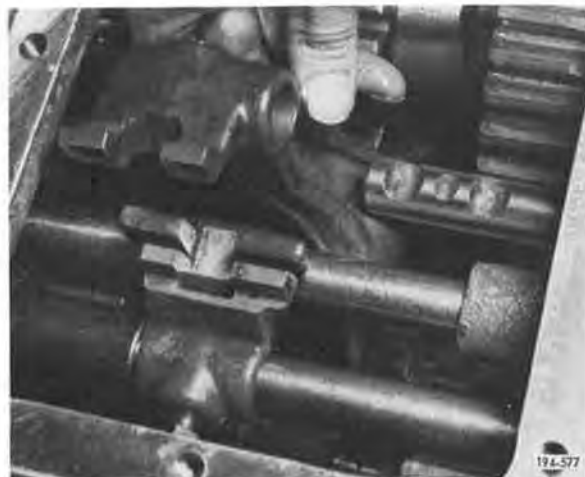


Figure 5-238. Sliding Shift Rail Forward

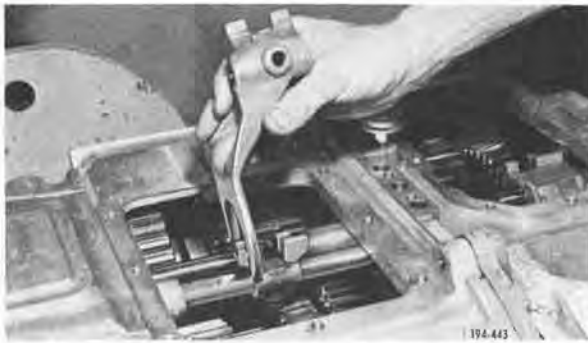


Figure 5-239. Removing Shift Fork

18. Remove first speed shifter setscrew, slide first speed shift rail forward, and remove first speed shifter and reverse lockout spacer. See Figure 5-240.



Figure 5-240. Removing Shifter and Spacer

19. Remove first speed shift fork. See Figure 5-241.

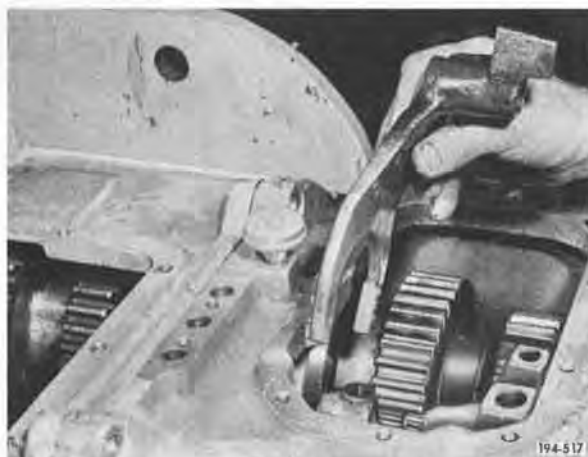


Figure 5-241. Removing Shift Fork

20. Using a soft drift, drive second/third speed shifter and shift rail forward, which will drive out expansion plug at front of shaft. See Figure 5-242.



Figure 5-242. Driving Shift Rail Forward

21. Remove second/third speed shifter setscrew. See Figure 5-243.

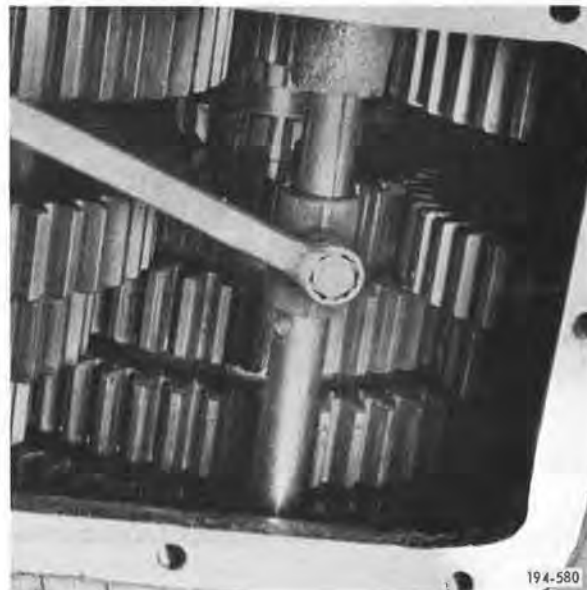


Figure 5-243. Removing Setscrew

22. Slide second/third speed shift rail forward, and remove shifter. See Figure 5-244.



Figure 5-244. Removing Shifter

23. Remove second/third speed shift fork. See Figure 5-245.

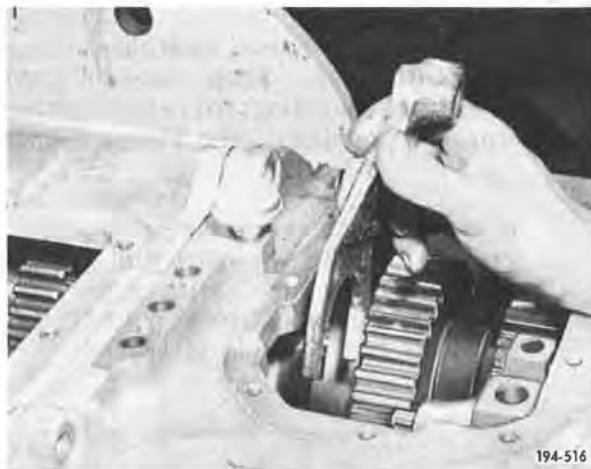


Figure 5-245. Removing Shift Fork

24. Place two sliding clutches into engaged position, which will lock up mainshaft, to make it easier to remove drive flange (or yoke) assembly.

25. Remove drive flange (or yoke) clamp plate cap screw and clamp plate. See Figure 5-246.

26. Install puller J-29031 or equivalent, and remove drive flange (or yoke) from rear mainshaft splines. See Figure 5-247.

27. Remove front case to rear case cap screws. See Figure 5-248.

28. Place transmission in a vertical position.



Figure 5-246. Removing Capscrew

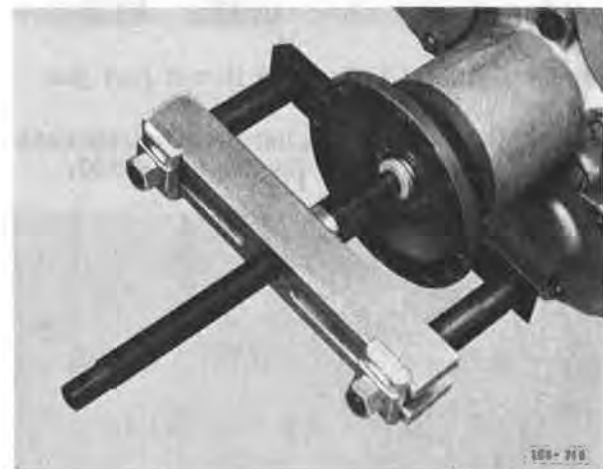


Figure 5-247. Removing Drive Flange



Figure 5-248. Removing Capscrews

29. Loosen front case to rear case dowel bolt nuts. See Figure 5-249.



Figure 5-249. Loosening Dowel Bolt Nut

30. With nut still engaging dowel bolt threads, drive dowel bolt out. See Figure 5-250.

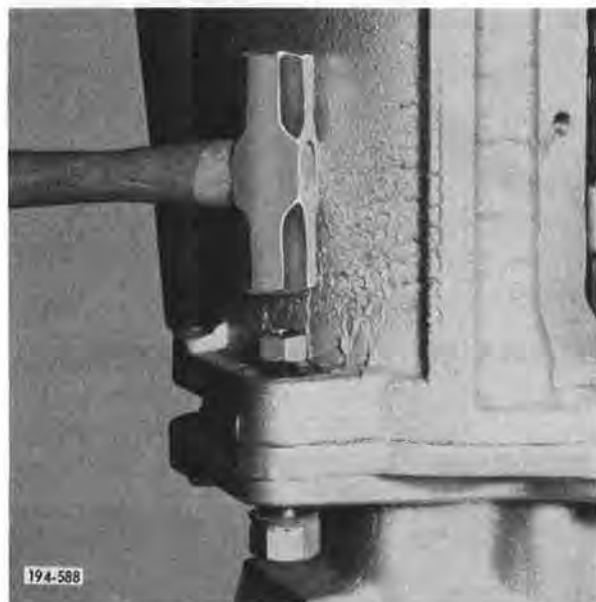


Figure 5-250. Removing Dowel Bolt

31. Secure Direct/Lo-range shift fork in position, using a piece of wire. This will prevent it from sliding forward. See Figure 5-251.

WARNING

Direct/Lo-range sliding clutch and shift fork could fall out of case and cause injury, if they are not secured.



Figure 5-251. Wire Holding Shift Fork

32. Remove rear case from front case, using a hoist and lifting eye. Keep cases in good alignment while separating, to prevent binding of countershaft bearings. See Figure 5-252.

NOTE

If cases do not separate easily, gently pry them apart with a prybar, using non-mating surfaces located at various points around the outside of transmission.

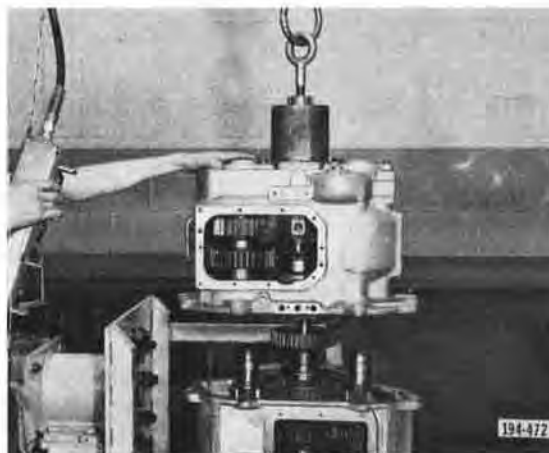


Figure 5-252. Removing Rear Case

Front Case Disassembly

1. With front case in a vertical position, remove front mainshaft oil tube, only if necessary to replace it. Run a tap into the tube, and then insert a capscrew into the threads cut by the tap. The oil tube can then be removed by pulling and twisting the cap-screw. See Figure 5-253.



Figure 5-253. Front Mainshaft Oil Tube

2. Remove mainshaft Lo-range main drive gear retaining snap ring, using snap ring pliers J-6435 or equivalent. See Figure 5-254.



Figure 5-254. Removing Snap Ring

3. Remove Lo-range main drive gear. See Figure 5-255.

4. Remove front countershaft selective thrust washer snap rings, using snap ring pliers J-6435 or equivalent. See Figure 5-256.



Figure 5-255. Removing Gear



Figure 5-256. Removing Snap Rings

5. Remove front countershaft selective thrust washers. See Figure 5-257.



Figure 5-257. Removing Thrust Washers

NOTE

Establish a way of keeping each selective thrust washer with its respective countershaft assembly for reassembly.

6. Remove first speed gear sliding clutch. See Figure 5-258.

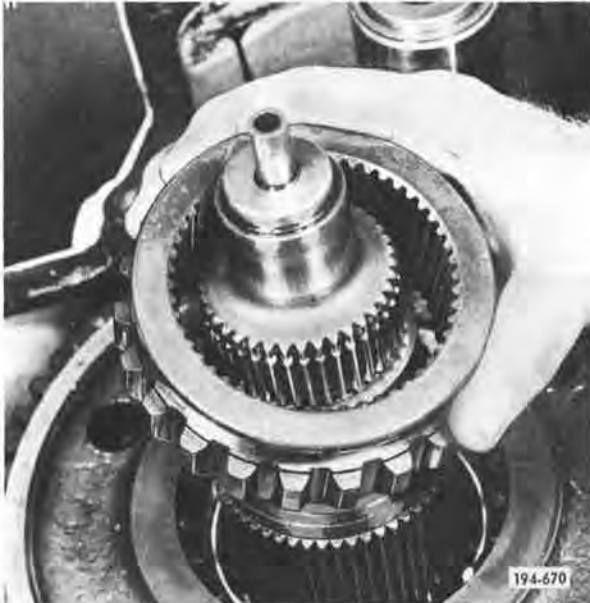


Figure 5-258. Removing Sliding Clutch

7. Remove first speed gear and its thrust washer. See Figure 5-259.



1. First Speed Gear
2. First Speed Gear Thrust Washer

Figure 5-259. Removing Gear

8. Remove second speed gear and its thrust washer. See Figure 5-260.



1. Second Speed Gear
2. Second Speed Gear Thrust Washer

Figure 5-260. Removing Gear

9. Remove front mainshaft assembly. See Figure 5-261.



Figure 5-261. Removing Front Mainshaft Assembly

10. Place front case in a horizontal position, and remove countershaft front cover cap-screws. See Figure 5-262.



Figure 5-262. Removing Capscrews

11. Remove countershaft front covers. See Figure 5-263.

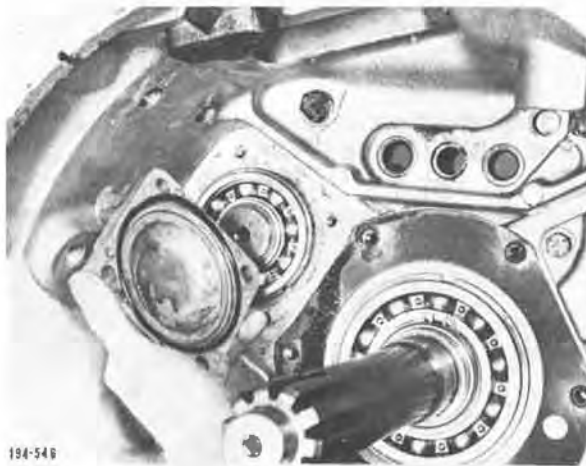


Figure 5-263. Removing Covers

12. Remove main drive pinion bearing cover capscrews. See Figure 5-264.

13. Remove main drive pinion bearing cover. See Figure 5-265.

14. Remove oil pump vane from main drive pinion. See Figure 5-266.

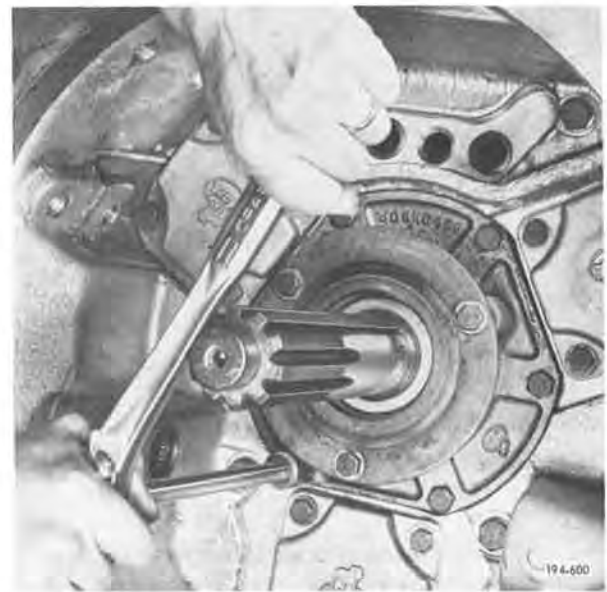


Figure 5-264. Removing Capscrews

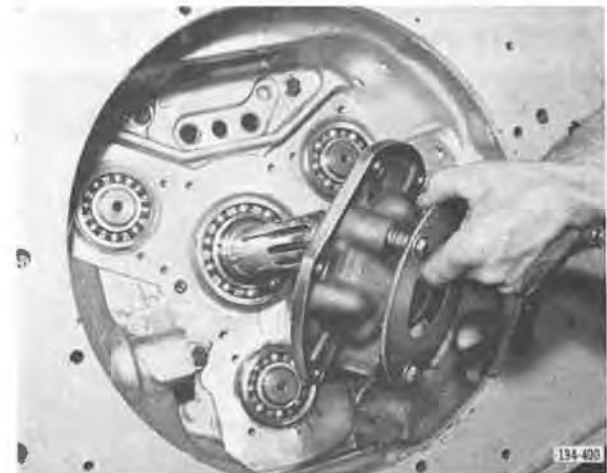


Figure 5-265. Removing Bearing Cover

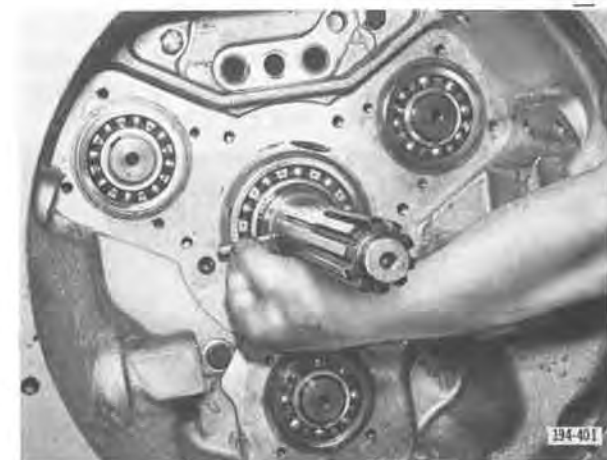


Figure 5-266. Removing Oil Pump Vane

15. Remove main drive pinion assembly from front case. See Figure 5-267.



Figure 5-267. Removing Main Drive Pinion

NOTE

Tap on end of pinion, if necessary, with nylon mallet, to loosen the pinion.

16. Remove countershaft front bearing positioning snap rings, using snap ring pliers J-25445 or equivalent. See Figure 5-268.



Figure 5-268. Removing Snap Ring

17. Place transmission front case in a vertical position, and remove three front countershaft assemblies. See Figure 5-269.



Figure 5-269. Removing Countershaft Assemblies

Rear Case Disassembly

1. Remove rear countershaft rear bearing cover capscrews. See Figure 5-270.



Figure 5-270. Removing Capscrews

2. Remove rear countershaft rear bearing cover. See Figure 5-271.



Figure 5-271. Removing Bearing Cover

3. Remove rear mainshaft rear bearing cover capscrews. See Figure 5-272.

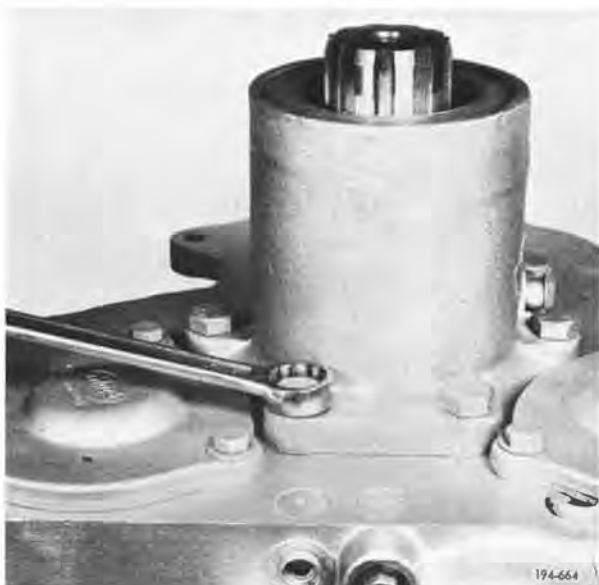


Figure 5-272. Removing Capscrew

4. Remove rear mainshaft rear bearing cover. See Figure 5-273.

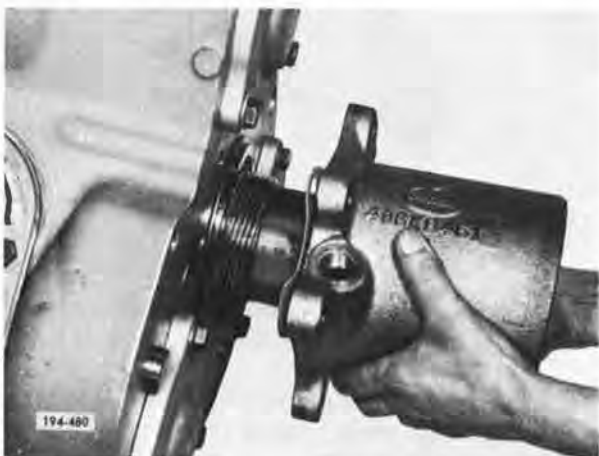


Figure 5-273. Removing Cover

5. Note location of any hollow rear counter-shafts for rear mounted P.T.O. , so that unit can be reassembled with shafts in same positions. If factory installed, the letter "O" will be stamped on the case next to each such shaft, as shown in Figure 5-274. If field installed, the same mark should be stamped into the case by the mechanic. Note in Figure 5-274 the pencil pointing to the "O" and the P.T.O. quill shaft being removed from the hollow shaft.

6. Remove wire previously installed for safety, and remove the Direct/Lo-range sliding clutch and its shift fork as an assembly. See Figure 5-275.



Figure 5-274. Rear Countershaft for P. T. O.



Figure 5-275. Removing Clutch and Shift Fork

7. Remove Lo-range (or Lo-Lo-range) gear snap ring through the rear case front opening using snap ring pliers J-6435 or equivalent. See Figure 5-276.

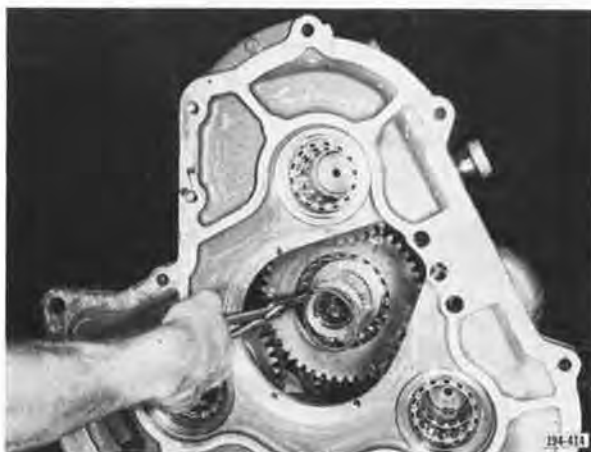


Figure 5-276. Removing Snap Ring

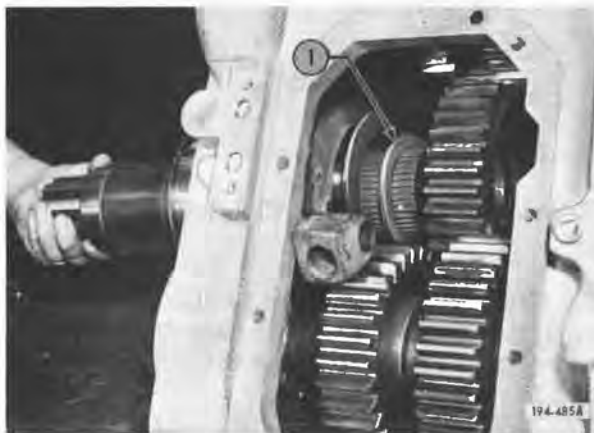
8. Remove Lo-range (or Lo-Lo-range) gear front thrust washer. See Figure 5-277.



Figure 5-277. Removing Thrust Washer

9. Slide reverse sliding gear rearward to engage it with the three reverse idler gears.

10. Partially withdraw rear mainshaft from the case by sliding it rearward, and at the same time remove the Lo-range (or Lo-Lo-range) gear rear thrust washer from the mainshaft. See Figure 5-278.



1. Lo-range Gear Rear Thrust Washer

Figure 5-278. Removing Mainshaft and Washer

11. Remove rear mainshaft the rest of the way. See Figure 5-279.

WARNING

Support the mainshaft to prevent injury which could result from dropping it.



Figure 5-279. Removing Rear Mainshaft

12. (TRXL107 and TRXL107A only)
Remove Lo-range gear through front opening of rear case. See Figure 5-280.



Figure 5-280. Removing Gear

13. Remove rear countershaft rear bearing retaining snap ring, using snap ring pliers J-25445 or equivalent. See Figure 5-281.



Figure 5-281. Removing Snap Ring

14. Drive rear countershaft rearward, using a suitable driver, to provide access to rear bearing positioning snap ring. See Figure 5-282.

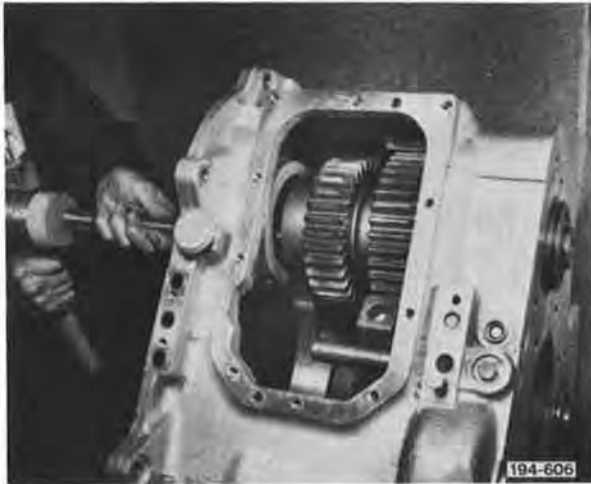


Figure 5-282. Driving Countershaft Rearward

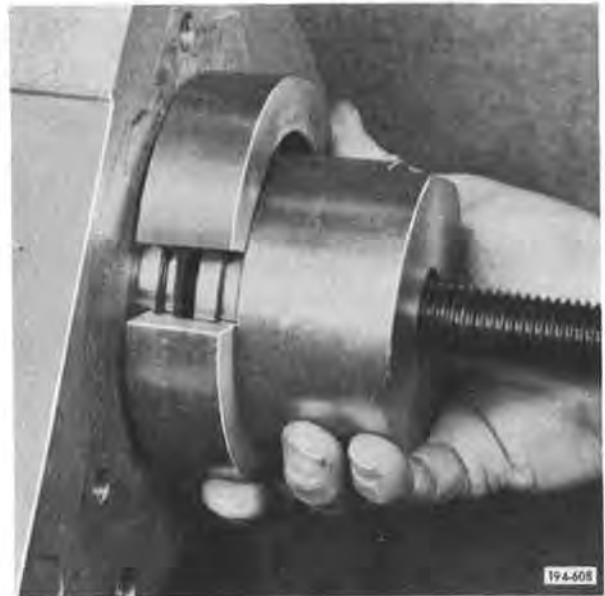


Figure 5-284. Installing Puller and Second Clamping Half

15. Position the first clamping half of tool S593C to engage the snap ring, as shown in Figure 5-283. Note pencil pointing to snap ring and corresponding groove in tool.



Figure 5-283. Installing First Clamping Half

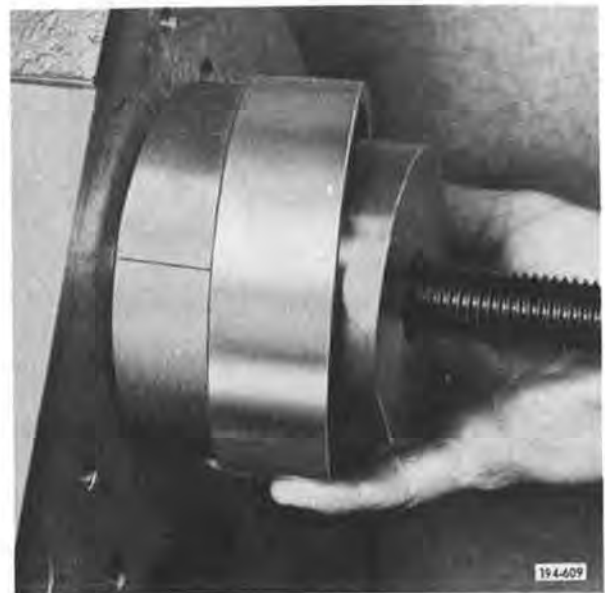


Figure 5-285. Installing Sleeve

16. Install puller section of tool S593C and second clamping half. See Figure 5-284.

17. Slide the sleeve over the assembly to secure the two clamping halves together. See Figure 5-285.

18. Tighten threaded shaft of the puller until bearing is removed from rear countershaft. See Figures 5-286 and 5-287.

19. (TRXL1071 and TRXL1071A only)
After upper right rear countershaft is moved rearward 1 to 2 inches, remove Lo-Lo-range gear through rear case top opening.

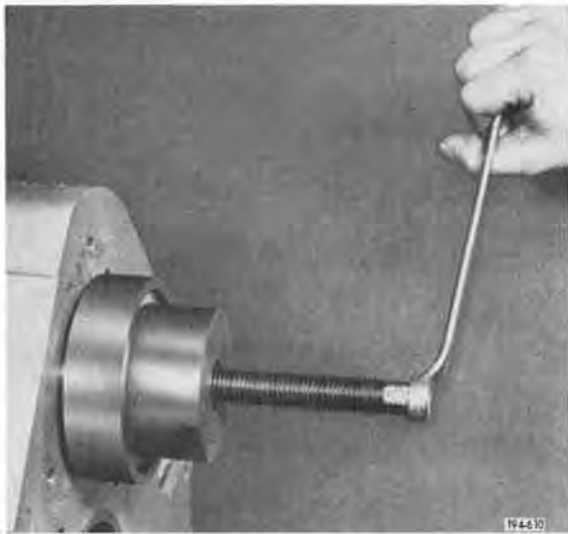


Figure 5-286. Tightening Puller



Figure 5-287. Bearing Removed

20. Remove three rear countershaft assemblies from case. See Figure 5-288.

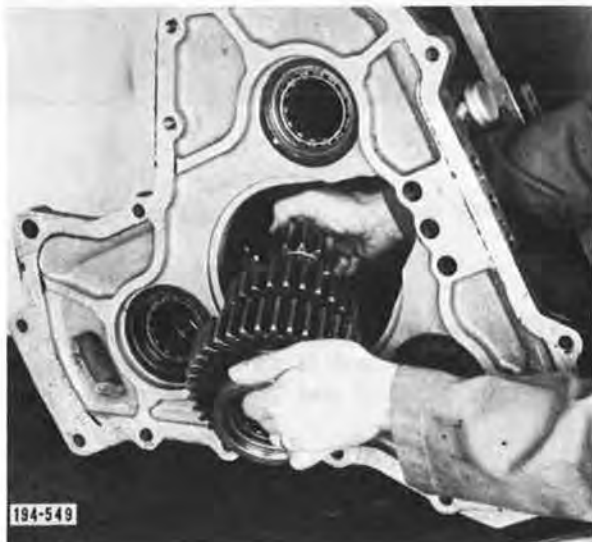


Figure 5-288. Removing Countershaft

21. Remove reverse gear and its shift fork. See Figure 5-289.



Figure 5-289. Removing Reverse Gear and Shift Fork

22. Remove front countershaft rear bearing retaining snap rings (using snap ring pliers J-4646 or equivalent) and bearings from front of rear case. See Figure 5-290.



Figure 5-290. Removing Snap Rings and Bearings

23. Punch holes in the reverse idler shaft expansion plugs, and remove plugs. See Figure 5-291.



Figure 5-291. Removing Expansion Plug

24. Install tool J28668 into the internal threads of reverse idler shaft. See Figure 5-292.



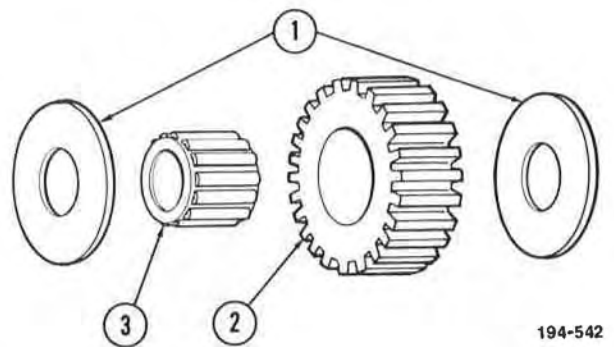
Figure 5-292. Installing Tool

25. Tighten threaded shaft of tool, and withdraw reverse idler shaft. See Figure 5-293.

26. Remove reverse idler gear, bearing, and thrust washers. See Figures 5-294 and 5-295.



Figure 5-293. Withdrawing Shaft



1. Thrust Washers
2. Idler Gear
3. Roller Bearing

Figure 5-294. Exploded View of Reverse Idler Gear Assembly



Figure 5-295. Removing Gear

Main Drive Pinion Disassembly

1. Remove bearing retaining spirolax snap ring. See Figure 5-296.



Figure 5-296. Removing Snap Ring

2. Press main drive pinion bearing off of the shaft. See Figure 5-297.



Figure 5-297. Pressing Bearing Off Shaft

Main Drive Pinion Bearing Cover Disassembly

(TRXL107 prior to Serial Number 7B9969 produced January, 1972, and TRXL1071 prior to Serial Number 7B0540 produced January, 1972)

1. To remove oil pump eccentric sleeve and seal assembly, use tool J-23387-01. Insert tool into cover, place spreader jaws behind oil seal, then tighten setscrew to expand jaws and grip rear of oil seal. See Figure 5-298.

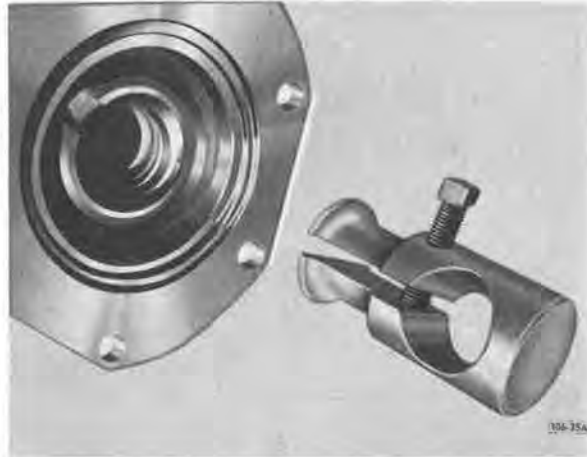


Figure 5-298. Installing Tool

2. Place assembly in a press, and press seal and pump sleeve out of housing. See Figure 5-299.

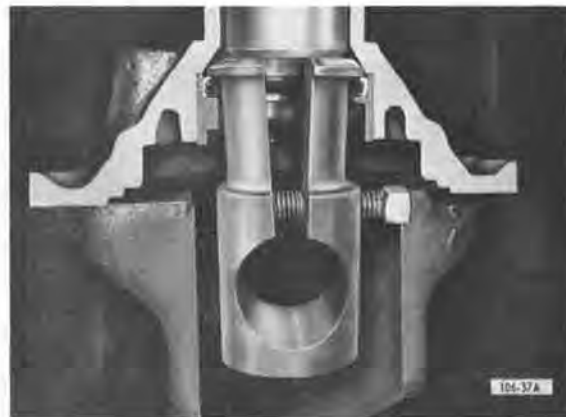


Figure 5-299. Pressing Sleeve and Seal Out of Cover

Main Drive Pinion Bearing Cover Disassembly

(TRXL107 Serial Number 7B9969, produced January, 1972, and up. TRXL1071 Serial Number 7B0540 produced January, 1972 and up, and all TRXL107A and TRXL1071A)

1. Oil seal is not installed in oil pump sleeve. Therefore, oil seal can be removed without removing oil pump sleeve. Use tool J-23387-01, placing jaws behind oil seal, then tighten setscrew to expand jaws, place assembly in a press, and press out seal.

Front Mainshaft Disassembly

1. (TRXL107 and TRXL1071 only)
Prior to TRXL107 Serial Number 9X1061 (produced November, 1974) and TRXL1071 Serial Number 9X1329 (produced November, 1974), a snap ring was used to retain the front mainshaft front spigot bearing, and must be removed before proceeding.

NOTE

Transmissions built after above serial numbers, and all TRXL107A and TRXL1071A transmissions, do not have a spigot bearing retaining snap ring.

2. Remove front mainshaft front spigot bearing using tool CG-250. See Figure 5-300.



Figure 5-300. Removing Bearing

3. Remove fourth/fifth speed sliding clutch. See Figure 5-301.



Figure 5-301. Removing Clutch

4. Remove fourth speed gear retaining snap ring, using snap ring pliers J-29045 or equivalent. See Figure 5-302.

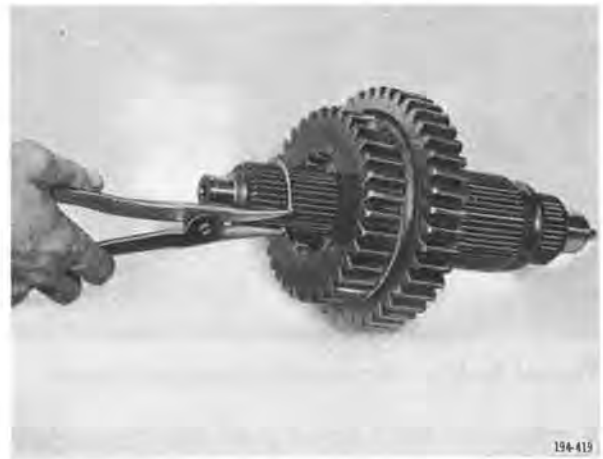


Figure 5-302. Removing Snap Ring

5. Remove fourth speed gear splined thrust washer and flanged thrust washer. See Figure 5-303.



Figure 5-303. Removing Thrust Washers

6. Remove fourth speed gear and third speed gear flanged thrust washer. See Figure 5-304.

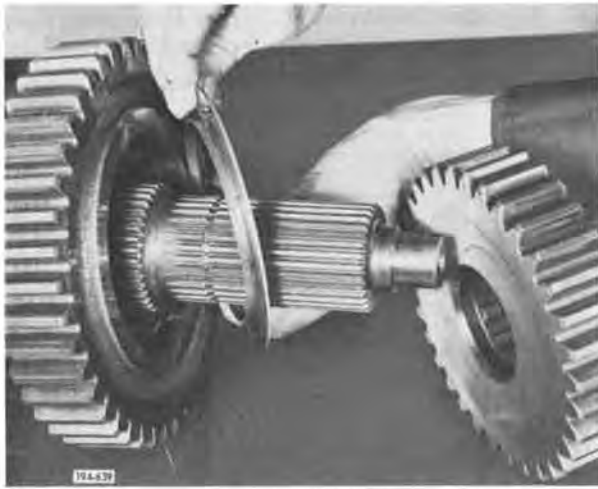


Figure 5-304. Removing Gear and Washer

7. Remove third speed gear. See Figure 5-305.



Figure 5-305. Removing Gear

8. Remove second/third speed sliding clutch. Note pencil pointing to oil hole. See Figure 5-306.



Figure 5-306. Removing Clutch

Rear Mainshaft Disassembly

1. Remove rear mainshaft front bearing retaining spirolax snap ring. See Figure 5-307.



Figure 5-307. Removing Snap Ring

2. Remove rear mainshaft front bearing, using tool S-501. See Figure 5-308.



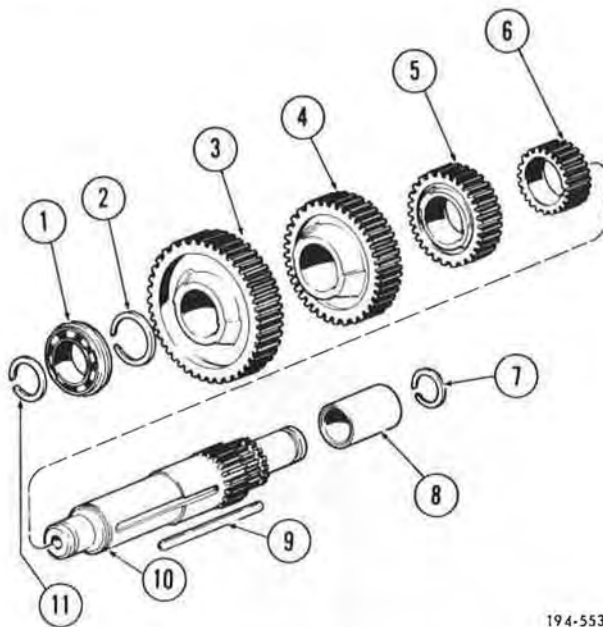
Figure 5-308. Removing Bearing

3. Place rear mainshaft assembly in a press, and press off rear bearing, speedometer gear, rear spacer, and rear bearing cover bearing inner race all at once. See Figure 5-309.



Figure 5-309. Pressing Off Bearing, Gear, Spacer and Inner Race

Front Countershaft Disassembly



- | | |
|-----------------------------|---------------------------------|
| 1. Bearing | 7. Retaining Snap Ring |
| 2. Gear Retaining Snap Ring | 8. Bearing Inner Race |
| 3. Fifth Speed Gear | 9. Key |
| 4. Fourth Speed Gear | 10. Front Countershaft |
| 5. Third Speed Gear | 11. Bearing Retaining Snap Ring |
| 6. Second Speed Gear | |

Figure 5-310. Exploded View of Front Countershaft

1. Remove front countershaft front bearing retaining snap ring, using snap ring pliers J-25445, or equivalent. See Figure 5-311.



Figure 5-311. Removing Snap Ring

2. Remove front countershaft front bearing using tool S593C. See Figure 5-312.

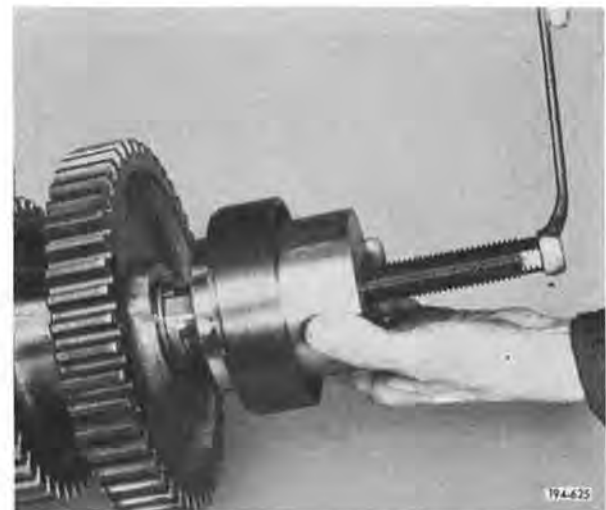


Figure 5-312. Removing Bearing

3. Remove front countershaft gear retaining snap ring, using snap ring pliers J-25445 or equivalent. See Figure 5-313.

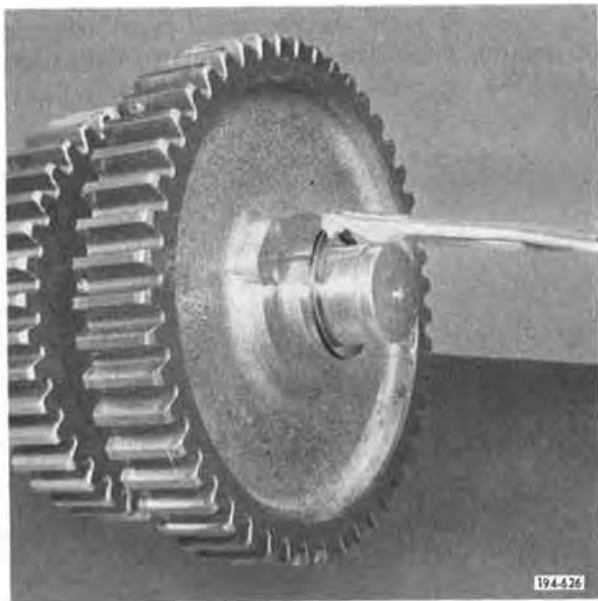


Figure 5-313. Removing Snap Ring

4. Remove bearing inner race retaining snap ring from rear of front countershaft, using snap ring pliers J-24339 or equivalent. See Figure 5-314.



Figure 5-314. Removing Snap Ring

5. Remove bearing inner race from rear of front countershaft using tool S500. See Figure 5-315.



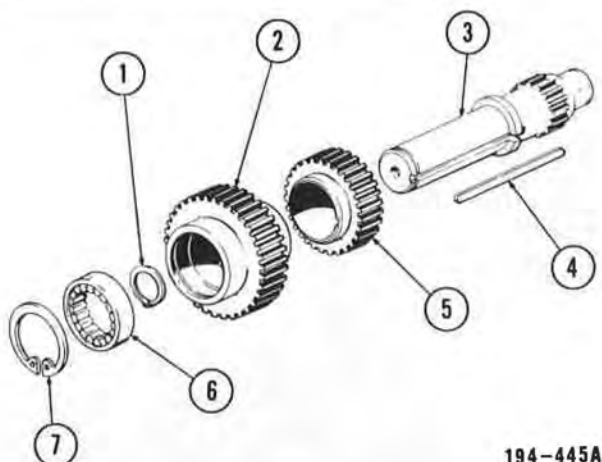
Figure 5-315. Removing Race

6. Place front countershaft assembly in a press, and press the gears off one at a time, starting with fifth speed gear. See Figure 5-316.



Figure 5-316. Pressing Gears Off

Rear Countershaft Disassembly



194-445A

- | | |
|-----------------------------|--------------------------------|
| 1. Gear Retaining Snap Ring | 5. Lo-range Gear Ring |
| 2. Direct Gear | 6. Bearing |
| 3. Rear Countershaft | 7. Bearing Retaining Snap Ring |
| 4. Key | |

Figure 5-317. Exploded View of Rear Countershaft

1. Remove rear countershaft front bearing retaining snap ring, using snap ring pliers J-4646 or equivalent. See Figure 5-318.



Figure 5-318. Removing Snap Ring

2. Remove rear countershaft front bearing using tool CG-270. See Figure 5-319.
3. Remove rear countershaft gear retaining snap ring, using snap ring pliers J-6435 or equivalent. See Figure 5-320.
4. Press the gears off of the rear countershaft. See Figure 5-321.



Figure 5-319. Removing Bearing



Figure 5-320. Removing Snap Ring



Figure 5-321. Pressing Gears Off of Rear Countershaft

Rear Mainshaft Rear Bearing Cover Disassembly

1. Remove rear bearing cover oil seal, using a hammer and punch to drive it out from the inside. See Figure 5-322.



Figure 5-322. Removing Oil Seal

2. Remove rear bearing cover bearing retaining snap ring (using snap ring pliers J-4646 or equivalent) and bearing. See Figure 5-323.

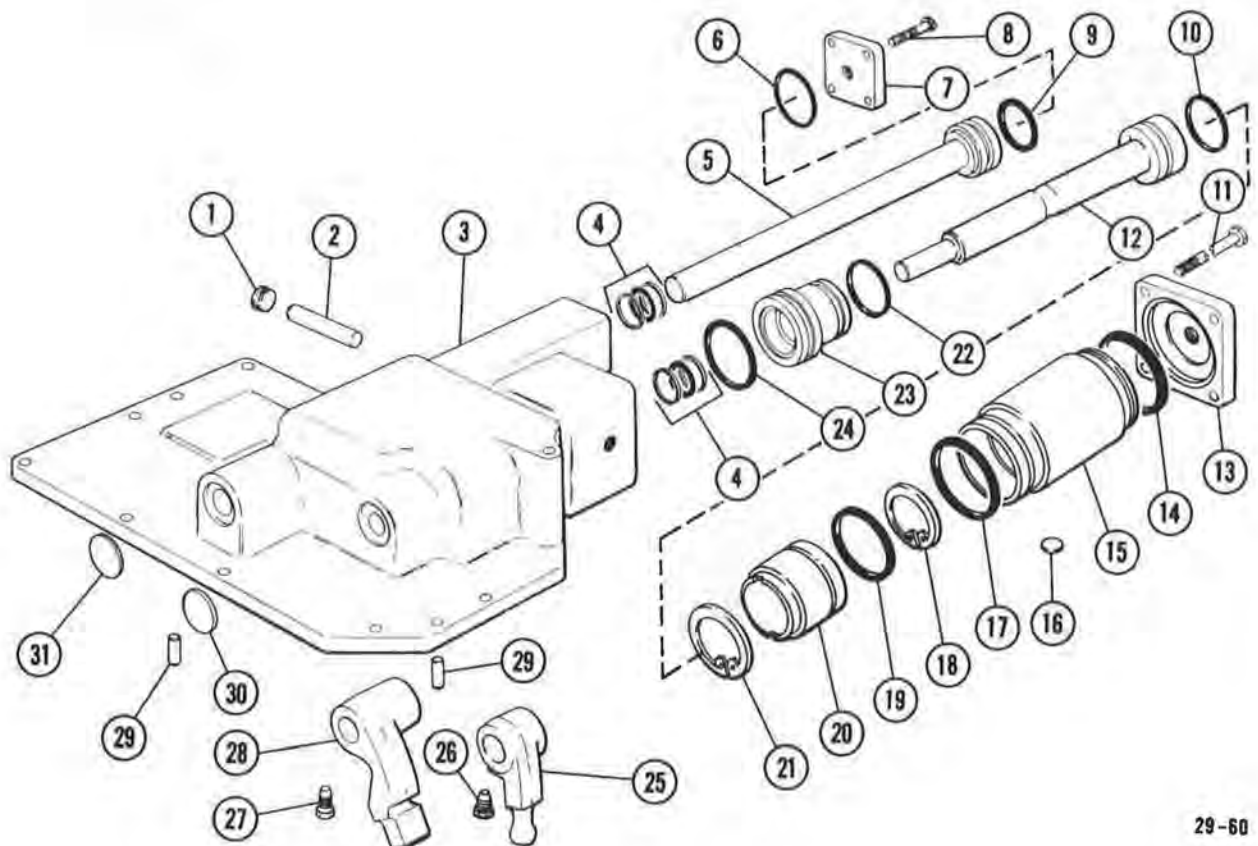


Figure 5-323. Removing Snap Ring and Bearing

Air Shift Cover Disassembly (Current Production)

(Transmission Serial Number 7O0525, produced August, 1977, and up)

(TRXL107A and TRXL1071A only)



29-60

- | | | |
|-----------------------------|---------------------------|-----------------------|
| 1. Plug | 12. Lo/Direct Shift Rail | 23. Direct Piston |
| 2. Interlock Plunger | 13. Lo/Direct Shift Cover | 24. O-ring |
| 3. Shift Cover | 14. O-ring | 25. Lo/Direct Shifter |
| 4. O-ring with Teflon Rings | 15. Shift Cylinder | 26. Setscrew |
| 5. Reverse Shift Rail | 16. Breather | 27. Setscrew |
| 6. O-ring | 17. O-ring | 28. Reverse Shifter |
| 7. Reverse Shift Cover | 18. Snap Ring | 29. Dowel Pin |
| 8. Capscrew | 19. O-ring | 30. Expansion Plug |
| 9. O-ring | 20. Lo-range Piston | 31. Expansion Plug |
| 10. O-ring | 21. Snap Ring | |
| 11. Capscrew | 22. O-ring | |

Figure 5-324. Exploded View of Air Shift Cover Assembly
(Current Production)

1. Place both shift rails in neutral position.

2. Remove reverse shifter setscrew. See Figure 5-325.

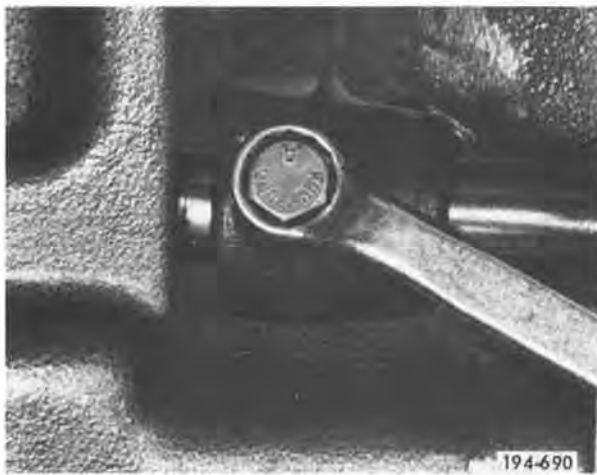


Figure 5-325. Removing Setscrew

3. Remove reverse shift cover capscrews. See Figure 5-326.



Figure 5-326. Removing Capscrews

4. Remove reverse shift cover and o-ring. See Figure 5-327.



Figure 5-327. Removing Cover and O-ring

5. Slide reverse shift rail rearward out of cover, and, as it moves, remove reverse shifter through bottom opening. See Figure 5-328,



Figure 5-328. Removing Shift Rail and Shifter

6. Remove o-ring from reverse shift rail. See Figure 5-329.



Figure 5-329. Removing O-ring

7. Remove interlock plunger plug from air shift cover. See Figure 5-330.

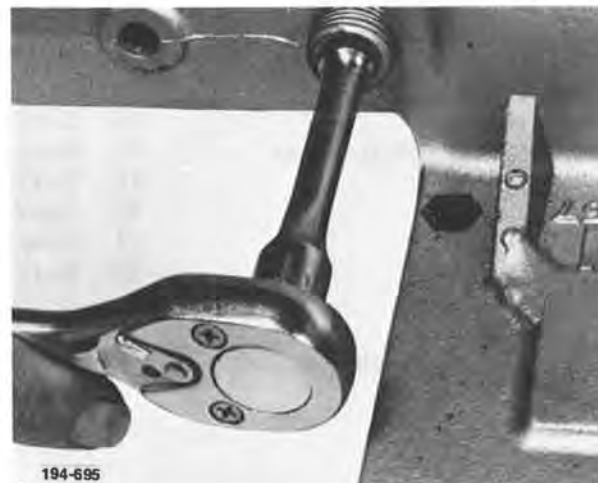


Figure 5-330. Removing Plug

8. Remove interlock plunger from air shift cover. See Figure 5-331.



Figure 5-331. Removing Plunger

9. Remove Lo/Direct shift cover capscrews. See Figure 5-332.



Figure 5-332. Removing Capscrews

10. Remove Lo/Direct shift cover. See Figure 5-333.



Figure 5-333. Removing Cover

11. Remove Lo/Direct shift cover o-ring. See Figure 5-334.



Figure 5-334. Removing O-ring

12. Remove Lo/Direct shift cylinder from air shift cover. See Figure 5-335.



Figure 5-335. Removing Shift Cylinder

13. Remove Lo-range piston from Lo/Direct shift cylinder. See Figure 5-336.



Figure 5-336. Removing Piston

14. Remove snap ring from inside Lo/Direct shift cylinder, using snap ring pliers J-24339 or equivalent. See Figure 5-337.



Figure 5-337. Removing Snap Ring

15. Remove o-ring from end of Lo/Direct shift cylinder. See Figure 5-338.



Figure 5-338. Removing O-ring

16. Remove snap ring from inside Lo-range piston, using snap ring pliers J-24339 or equivalent. See Figure 5-339.

17. Remove o-ring from Lo-range piston. See Figure 5-340.

18. Remove Lo/Direct shifter setscrew. See Figure 5-341.



Figure 5-339. Removing Snap Ring



Figure 5-340. Removing O-ring



Figure 5-341. Removing Setscrew

19. Slide Lo/Direct shift rail rearward out of cover, and, as it moves, remove Lo/Direct shifter through bottom opening. See Figure 5-342.

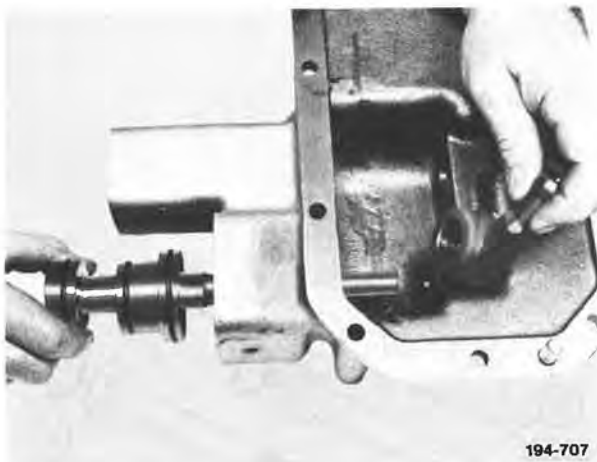


Figure 5-342. Removing Shift Rail and Shifter

20. Remove Direct piston from Lo/Direct shift rail. See Figure 5-343.



Figure 5-343. Removing Piston

21. Remove o-ring from Lo/Direct shift rail. See Figure 5-344.



Figure 5-344. Removing O-ring

22. Remove o-rings from Direct piston. See Figure 5-345.



Figure 5-345. Removing O-rings

23. Remove o-ring and two Teflon rings from both the reverse opening and the Lo/Direct opening of the shift cover. See Figure 5-346.



Figure 5-346. Removing O-ring and Teflon Rings

24. Clean air breather in Lo/Direct shift cylinder. See Figure 5-347.

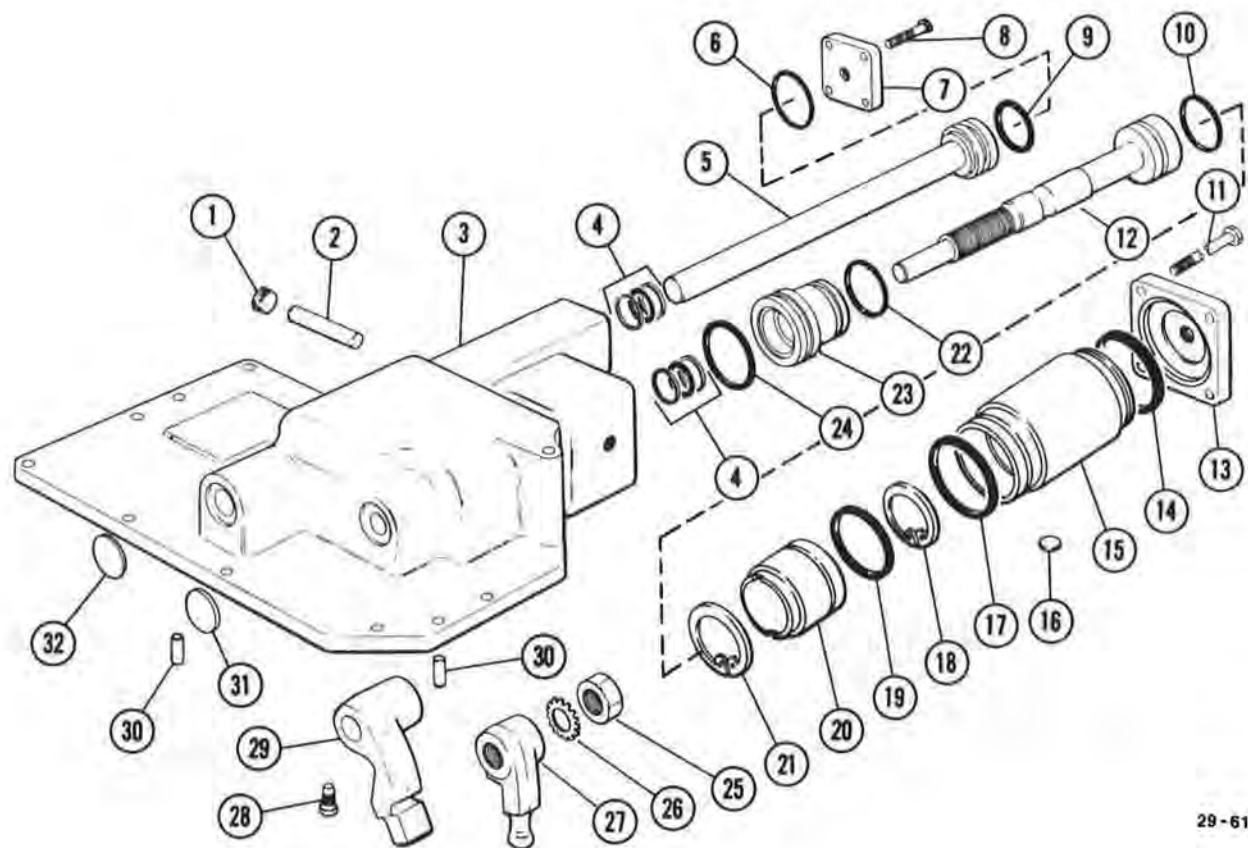


Figure 5-347. Air Breather

Air Shift Cover Disassembly (Non-Current Production)

(Prior to Transmission Serial Number 7O0525 produced August, 1977)

(TRXL107A and TRXL1071A only)



- | | | |
|-----------------------------|---------------------------|-----------------------|
| 1. Plug | 12. Lo/Direct Shift Rail | 23. Direct Piston |
| 2. Interlock Plunger | 13. Lo/Direct Shift Cover | 24. O-ring |
| 3. Shift Cover | 14. O-ring | 25. Locknut |
| 4. O-ring with Teflon Rings | 15. Shift Cylinder | 26. Lockwasher |
| 5. Reverse Shift Rail | 16. Breather | 27. Lo/Direct Shifter |
| 6. O-ring | 17. O-ring | 28. Setscrew |
| 7. Reverse Shift Cover | 18. Snap Ring | 29. Reverse Shifter |
| 8. Capscrew | 19. O-ring | 30. Dowel Pin |
| 9. O-ring | 20. Lo-range Piston | 31. Expansion Plug |
| 10. O-ring | 21. Snap Ring | 32. Expansion Plug |
| 11. Capscrew | 22. O-ring | |

Figure 5-348. Exploded View of Air Shift Cover Assembly

(Non-Current Production)

1. Place both shift rails in neutral position.

2. Remove reverse shifter setscrew. See Figure 5-349.



Figure 5-349. Removing Setscrew

3. Remove reverse shift cover capscrews. See Figure 5-350.



Figure 5-350. Removing Capscrews

4. Remove reverse shift cover and o-ring. See Figure 5-351.



Figure 5-351. Removing Cover and O-ring

5. Slide reverse shift rail rearward out of cover, and, as it moves, remove reverse shifter through bottom opening. See Figure 5-352.



Figure 5-352. Removing Shift Rail and Shifter

6. Remove o-ring from reverse shift rail. See Figure 5-353.



Figure 5-353. Removing O-ring

7. Remove interlock plunger plug from air shift cover. See Figure 5-354.



Figure 5-354. Removing Plug

8. Remove interlock plunger from air shift cover. See Figure 5-355.



Figure 5-355. Removing Plunger

9. Remove Lo/Direct shift cover capscrews. See Figure 5-356.



Figure 5-356. Removing Capscrews

10. Remove Lo/Direct shift cover. See Figure 5-357.



Figure 5-357. Removing Cover

11. Remove Lo/Direct shift cover o-ring. See Figure 5-358.



Figure 5-358. Removing O-ring

12. Remove Lo/Direct shift cylinder from air shift cover. See Figure 5-359.



Figure 5-359. Removing Shift Cylinder

13. Remove Lo-range piston from Lo/Direct shift cylinder. See Figure 5-360.



Figure 5-360. Removing Piston

14. Remove snap ring from inside Lo/Direct shift cylinder, using snap ring pliers J-24339 or equivalent. See Figure 5-361.



Figure 5-361. Removing Snap Ring

15. Remove o-ring from end of Lo/Direct shift cylinder. See Figure 5-362.



Figure 5-362. Removing O-ring

16. Remove snap ring from inside Lo-range piston, using snap ring pliers J-24339 or equivalent. See Figure 5-363.

17. Remove O-ring from Lo-range piston. See Figure 5-364.

18. Loosen Lo/Direct shifter locknut. See Figure 5-365.



Figure 5-363. Removing Snap Ring



Figure 5-364. Removing O-ring

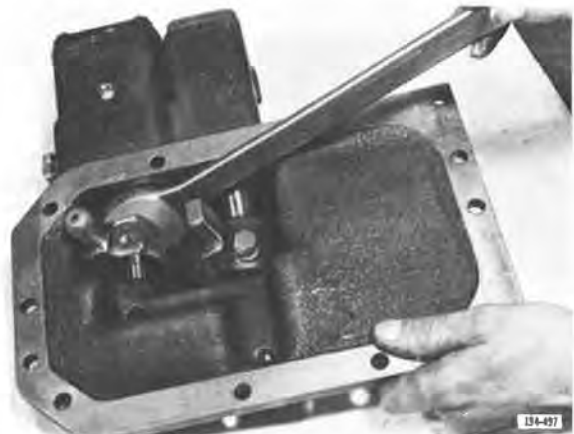


Figure 5-365. Loosening Locknut

19. Turn Lo/Direct shift rail to unscrew locknut and Lo/Direct shifter, slide shift rail rearward out of cover, and at the same time, remove locknut, lockwasher, and shifter.

20. Remove Direct piston from Lo/Direct shift rail.

21. Remove o-ring from Lo/Direct shift rail. See Figure 5-366.



Figure 5-366. Removing O-ring

22. Remove o-rings from Direct piston. See Figure 5-367.



Figure 5-367. Removing O-rings

23. Remove o-ring and two Teflon rings from both the reverse opening and the Lo/Direct opening of the shift cover. See Figure 5-368.



Figure 5-368. Removing O-ring and Teflon Rings

24. Clean air breather in Lo/Direct shift cylinder. See Figure 5-369.

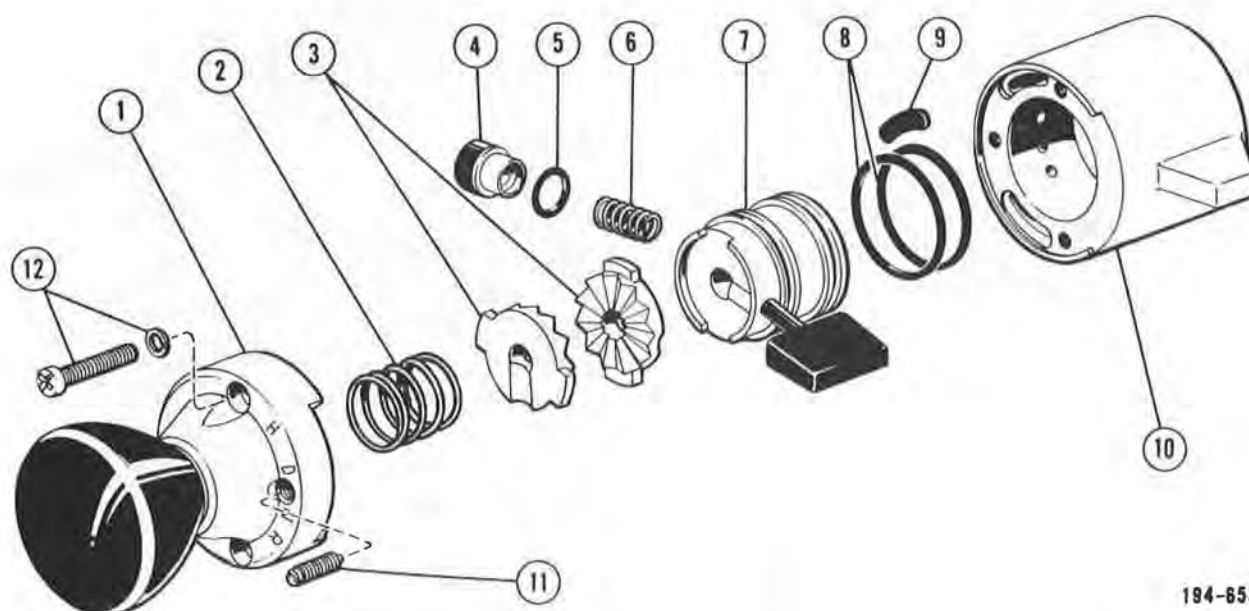


Figure 5-369. Air Breather

25. Punch a hole in the Lo/Direct shift rail expansion plug, and remove it.

Selectair Valve Disassembly

(TRXL107A and TRXL1071A only)



- | | |
|-------------------------|--------------------|
| 1. Cover | 7. Rotor |
| 2. Detent Spring | 8. O-rings |
| 3. Detent Wafers | 9. Gasket |
| 4. Exhaust Valve | 10. Valve Body |
| 5. Exhaust Valve O-ring | 11. Detent Plunger |
| 6. Exhaust Valve Spring | 12. Screw |

Figure 5-370. Exploded View of Selectair Valve

1. Disconnect air lines from valve. For ease of reassembly, tag each line with the number that is stamped on the bottom of the valve.

2. Remove valve from shift lever.

3. Loosen and remove the three Phillips head screws that hold the cover. See Figure 5-371.

CAUTION

The cover provides compression for the detent spring. Screws should be loosened evenly to prevent jamming or cocking.



Figure 5-371. Removing Screws

4. Remove cover from valve body. See Figure 5-372.



Figure 5-372. Removing Cover

5. Remove detent wafer from cover. See Figure 5-373.



Figure 5-373. Removing Detent Wafer

6. Remove spring from cover. See Figure 5-374.



Figure 5-374. Removing Spring

7. Remove detent wafer from top of rotor. See Figure 5-375.



Figure 5-375. Removing Detent Wafer

8. Remove rotor from valve body. See Figure 5-376.

NOTE

Exhaust valve is spring loaded, and could pop out and become lost.



Figure 5-376. Removing Rotor

9. Remove exhaust valve from rotor. See Figure 5-377.



Figure 5-377.. Removing Valve

10. Remove exhaust valve spring. See Figure 5-378.



Figure 5-378. Removing Spring

11. Remove exhaust valve o-ring. See Figure 5-379.



Figure 5-379. Removing O-ring

12. Remove both o-rings from rotor. See Figure 5-380.



Figure 5-380. Removing O-rings

13. Remove both rubber gaskets from valve body. See Figure 5-381.



Figure 5-381. Removing Gaskets

14. Remove detent plunger from cover. See Figures 5-382 and 5-383.



Figure 5-382. Loosening Plunger



Figure 5-383. Removing Plunger

INSPECTION AND CLEANING

Clean case, covers, and all other parts of the transmission thoroughly, using a suitable cleaning solvent, to remove all grease, oil, and foreign matter. Dry parts with moisture-free compressed air.

Bearings

Soak bearings in a suitable cleaning solvent to loosen all hardened grease and foreign matter. Strike bearings flat against block of wood several times and again immerse in cleaning solvent, turning races slowly. Repeat these operations until bearings are clean, and then blow them dry with filtered, moisture-free compressed air.

CAUTION

Do not spin bearings with compressed air, as damage to the bearings may result.

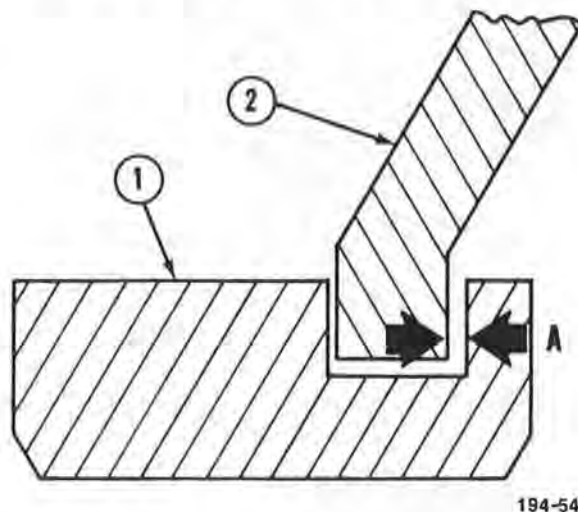
Inspect bearings for flaking, cracks, fractures, cavities, indentations, measurable wear, brinelling, fretting, corrosion, nicking, and cage failures. If any of these are apparent in any amount, they should be replaced.

Gears

Replace gears if teeth show any sign of abrasive wear, scratching (except for normal manufacturing tool marks), ridging, scoring, surface fatigue, pitting, spalling, corrosive wear, digging in, and cracking. Gears should also be inspected by Magnaflux or similar system for cracks which would not otherwise be visible.

Shifter Forks, Sliding Clutches, and Shift Rails

Replace forks and/or clutches if side clearance in groove is in excess of specified limits, as shown in the Torque and Tolerance Table, Item 15. See Figure 5-384.



- 1. Clutch A. Wear Tolerance Reference
- 2. Fork

Figure 5-384. Fork and Clutch Detail

Replace shift rails if cracked in either the poppet or stake screw holes. In the case of wear, if the clearance between the shift rail and the mating housing bore exceeds 0.010 inch maximum, check to determine which member is worn before replacing. Shaft wear may be checked by comparing shaft diameter at an "unwearing" point as against the wear point. Refer to Torque and Tolerance Table, Item 18. See Figure 5-385.

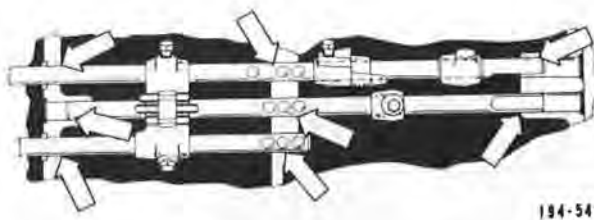


Figure 5-385. Shift Rail Wear Points

Vane Oil Pump

Replace oil pump parts if they are scored or chipped, or if vane is loose in its mating bore in excess of 0.006 inch. Refer to Torque and Tolerance Table, Item 19.

Oil Seals

When an overhaul is required, replace all oil seals. Care must be taken to be sure that the sealing surface of the seal is not damaged, turned back, or cut. A nick on the shaft surface will cut the seal. Remove sharp edges that could damage the seal (chamfer edges if possible). Press seals into housing with smooth, uniform pressure to prevent cocking the seal. Be careful when installing a shaft through a new seal. The shaft should be lubricated before inserting through a seal. Splines, keyways, or holes in shafts can damage seals unless care is taken. The sealing surface of seals should be manually lubricated to provide lubrication during "start-up" period before normal lubrication occurs.

Measuring Oil Pump Pressure

Pressure of the oil pump is low, and therefore difficult to measure. A functional check of the pump should be made prior to installing the transmission cover. This can be accomplished by pouring oil into the pump pickup trough while revolving the main drive pinion clockwise. If the pump is functioning, oil will appear at various outlets along the mainshaft. This practice will also assure initial prime to the pump and oil passages.

Selectair Valve

Clean all metal parts in a suitable solvent. Wash rubber and plastic parts with soap and water. Rinse all parts thoroughly, and blow dry with low pressure compressed air. Inspect for any signs of wear. In the case of rubber parts, if any one is worn, it is recommended that all be replaced. Inspect for any nicks, scratches, or rough edges or surfaces, that could damage O-rings. Also check for any cracks in any of the metal or plastic parts.

General Inspection

Replace cases found to be cracked. Check all other parts for wear and damage. Replace all parts as required. Replace all gaskets, O-rings, staked nuts, or any part that shows mutilation. Test and replace poppet springs that have lost their tension. Refer to Torque and Tolerance Table, Item 16. Clean up any threads that show mutilation. Repair stripped threads by using Heli-Coil or equivalent repair parts.

Repairing Worn Bearing Bores

Worn bearing bores are caused by the bearing outer races turning in their respective inserts and the bearing retaining rings wearing the inserts. When worn bearing bores are encountered, follow the instructions contained in Figure 5-386.

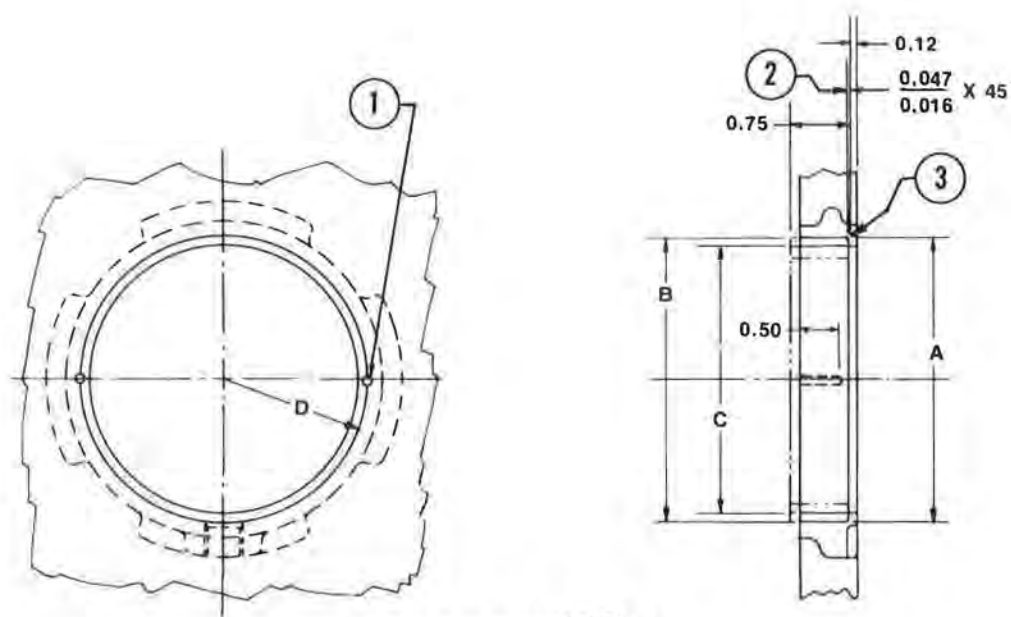
To prevent bearings turning and causing insert wear, position respective cover in place and inspect for correct cover to case clearance. See Figures 5-387 through 5-390. Replace cover if necessary.

If the clearance between the main driving pinion cover and case is 0.015 inch or more, use cover gasket 628KB310-P2 which is 0.031 inch thick.

If the clearance between the main driving pinion cover and case is less than 0.015 inch, use cover gasket 628KB310-P1 which is 0.016 inch thick.

If the clearance between the mainshaft rear cover and case is 0.015 inch or more, use cover gasket 628KB312A-P1 which is 0.031 inch thick.

If the clearance between the mainshaft rear cover and case is less than 0.015 inch, use cover gasket 628KB312A-P2 which is 0.016 inch thick.



1. DRILL & REAM $\frac{0.1245}{0.1240}$ DIA.
FOR TWO PINS, 31AX 289
2. ON SLEEVE
3. $\frac{0.016}{0.000}$ R. IN CASE

INSTRUCTIONS

1. APPLY LOCTITE TO SLEEVE AND PRESS INTO CASE.
2. FACE SLEEVE FLUSH WITH CASE.
3. DRILL AND REAM FOR 2 STRAIGHT PINS.
4. INSTALL 2 STRAIGHT PINS.
5. BORE TO 'C' DIMENSION.

NOTE:

SLEEVES TO BE MADE FROM
LOW CARBON STEEL TUBING
S.A.E. J403 NO. 1010 OR EQUAL
(E.G. 1018, 1020, 1112, 1118)

CAUTION

SLEEVES MUST BE BORED
CONCENTRIC WITHIN 0.002 IN.
OF EACH OTHER.

PART NO.	BORE LOCATION	A CASE BORE	B SLEEVE O.D.	C BEARING BORE	D PIN HOLE R.
281KB 562A AUXILIARY CASE	COUNTERSHAFT	3.794/3.793	3.7950/3.7945	3.544/3.543	1.897
	MAINSHAFT	5.172/5.171	5.1730/5.1725	4.922/4.921	2.586
284KB 5159B REAR CASE	COUNTERSHAFT	3.400/3.399	3.4010/3.4005	3.150/3.149	1.700
	MAINSHAFT	5.172/5.171	5.1730/5.1725	4.922/4.921	2.586
284KB 5163 FRONT CASE	COUNTERSHAFT	3.794/3.793	3.7950/3.7945	3.544/3.543	1.897
	MAINSHAFT	5.172/5.171	5.1730/5.1725	4.922/4.921	2.586

194-713

Figure 5-386. Bearing Bore Repair

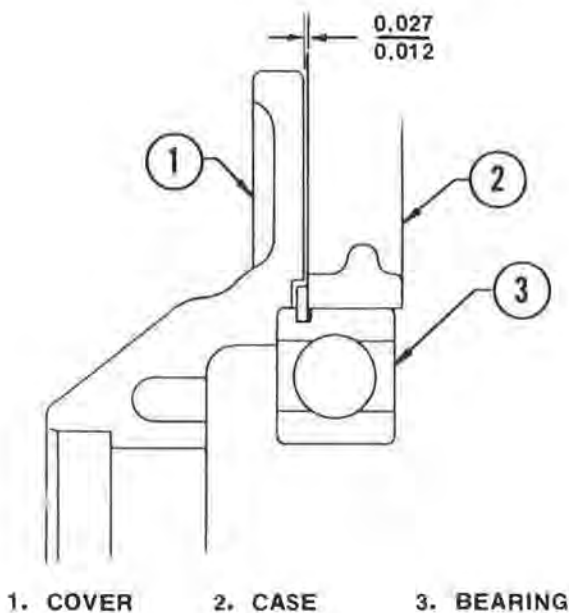


Figure 5-387. Main Drive Pinion Cover Clearance

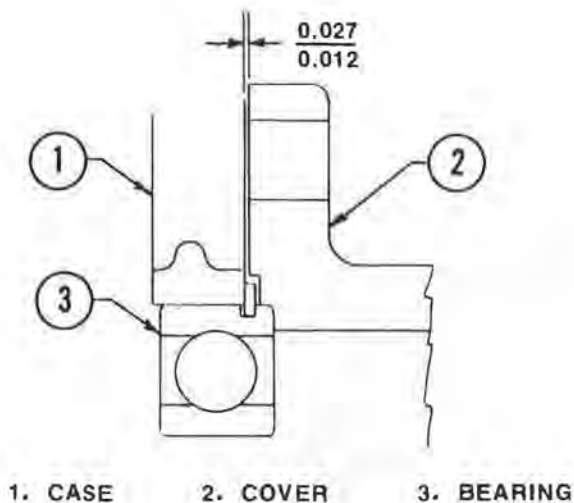
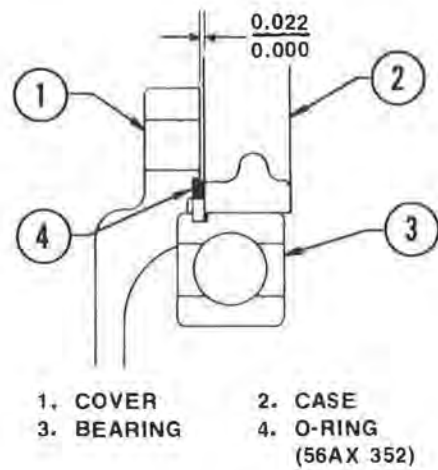


Figure 5-388. Mainshaft Rear Cover Clearance

GENERAL INSTRUCTIONS FOR REASSEMBLY

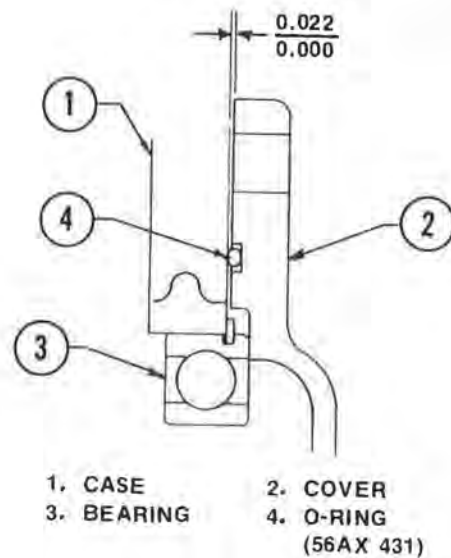
Refer to Torque and Tolerance Table for fits and limits.

All working metal parts, especially the bearings, should be coated with SAE30 oil while the transmission is being reassembled. This



194-716

Figure 5-389. Countershaft Front Cover Clearance



194-717

Figure 5-390. Countershaft Rear Cover Clearance

will insure immediate lubrication when first starting, and will prevent seizing of these parts.

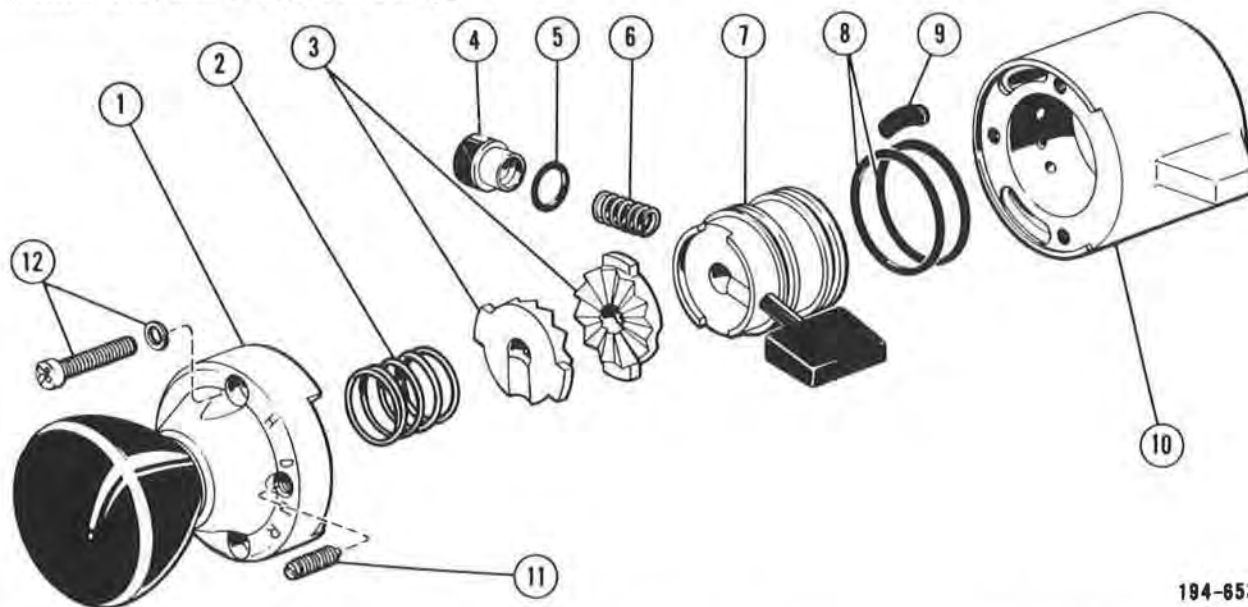
When installing bearings, use proper bearing drivers. Do not apply force to an unloaded race, because bearing damage can result (even though not visible or evident at the time) which will cause premature bearing failure. Apply pressure evenly to prevent cocking the bearing.

As moving parts are assembled, check frequently to see that they move freely.

REASSEMBLY

Selectair Valve Reassembly

(TRXL107A and TRXL1071A only)



194-653

- | | | |
|------------------|-------------------------|--------------------|
| 1. Cover | 5. Exhaust Valve O-Ring | 9. Gasket |
| 2. Detent Spring | 6. Exhaust Valve Spring | 10. Valve Body |
| 3. Detent Wafers | 7. Rotor | 11. Detent Plunger |
| 4. Exhaust Valve | 8. O-Rings | 12. Screw |

Figure 5-391. Exploded View of Selectair Valve

Lubrication: On plastic detents, use Sun Oil C-8-91-T, Sunaplex 781, Texaco Marfax "O" grease, or equivalent. On all rubber to metal surfaces, use Dow Corning #55 Pneumatic grease (MIL-G-4343B) or equivalent. On all metal to metal surfaces, use Fiske Lubriplate 107, or equivalent.

1. Insert detent plunger into cover and screw plunger in until its tip just protrudes through bottom of cover. See Figures 5-392 and 5-393.



Figure 5-392. Installing Plunger



194-686

Figure 5-393. Tightening Plunger

2. Install both rubber gaskets onto their slots in valve body. See Figure 5-394.

3. Install both o-rings onto rotor. See Figure 5-395.



Figure 5-394. Installing Gaskets



Figure 5-397. Installing Spring



Figure 5-395. Installing O-rings

4. Install exhaust valve o-ring. See Figure 5-396.



Figure 5-396. Installing O-ring

5. Install exhaust valve spring. See Figure 5-397.



Figure 5-398. Installing Valve

7. Hold exhaust valve in place against its spring, and install rotor into valve body. See Figure 5-399.



Figure 5-399. Installing Rotor

8. Install one detent wafer onto top of rotor. See Figure 5-400.

CAUTION

Depression in back of detent wafer must align with raised portion in top of rotor, and wafer tangs must align with slots in top of rotor, to prevent detent wafer from cracking.



Figure 5-400. Installing Lower Detent Wafer

9. Place the other detent wafer on top of the one just installed, aligning depression in the top detent wafer with the two tangs of the bottom wafer. See Figure 5-401.



Figure 5-401. Installing Top Detent Wafer

10. Align handle of rotor directly over reference extension of valve body.

11. Install spring into cover. See Figure 5-402.



Figure 5-402. Installing Spring

12. Bring two halves together, aligning rotor handle with slot provided for it in cover. See Figure 5-403.



Figure 5-403. Installing Cover

13. Press two halves together manually, compressing detent spring, and rotate each half slightly until tangs of top detent wafer seat themselves in slots provided in cover assembly.

14. Continue holding two halves together to maintain alignment, and install the cover screws. See Figure 5-404.



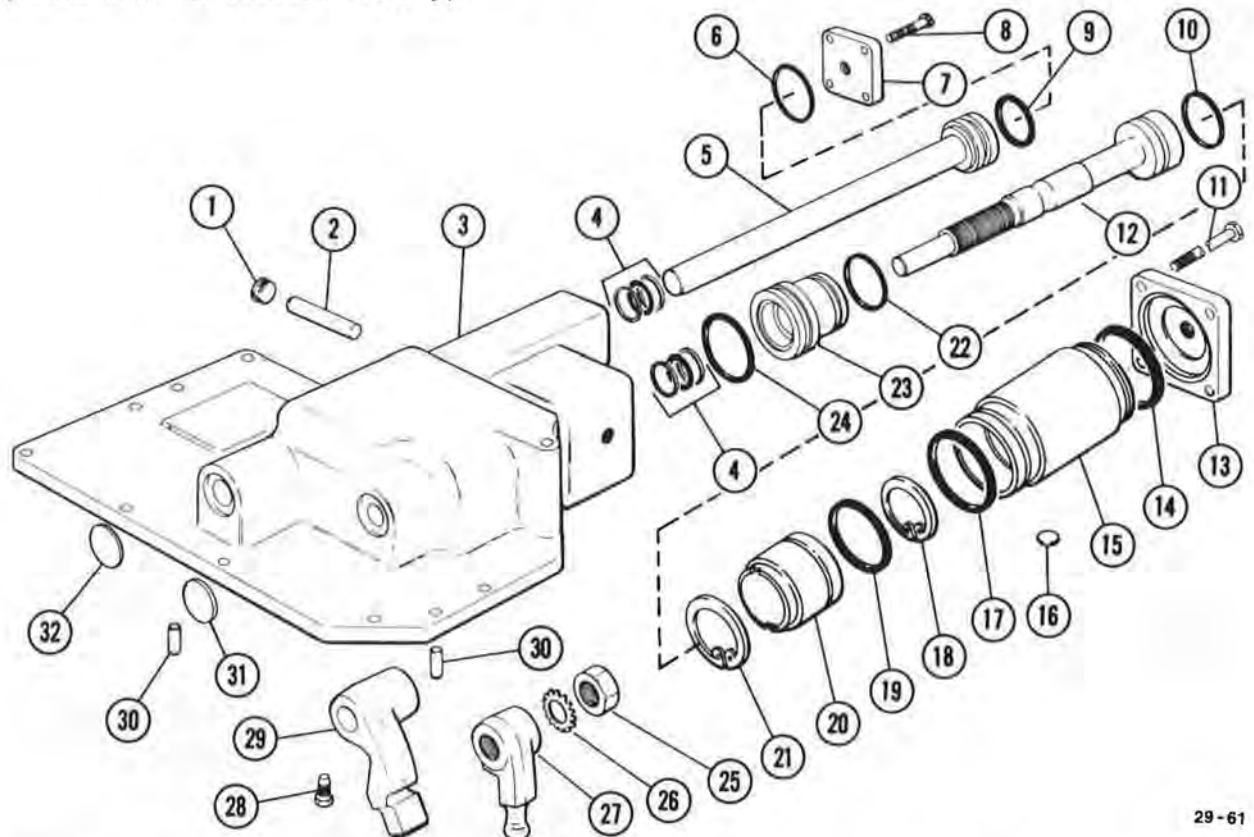
15. Adjust detent plunger so that it provides added resistance to movement of the lever between Direct and Neutral positions.

16. Connect air lines to valve, and install valve on shift lever.

Figure 5-404. Installing Screws

Air Shift Cover Reassembly (Non-Current Production)

(Prior to Transmission Serial #700525 produced August, 1977)
(TRXL107A and TRXL1071A only)



29-61

- | | | |
|-----------------------------|---------------------------|-----------------------|
| 1. Plug | 12. Lo/Direct Shift Rail | 23. Direct Piston |
| 2. Interlock Plunger | 13. Lo/Direct Shift Cover | 24. O-ring |
| 3. Shift Cover | 14. O-ring | 25. Locknut |
| 4. O-ring with Teflon Rings | 15. Shift Cylinder | 26. Lockwasher |
| 5. Reverse Shift Rail | 16. Breather | 27. Lo/Direct Shifter |
| 6. O-ring | 17. O-ring | 28. Setscrew |
| 7. Reverse Shift Cover | 18. Snap Ring | 29. Reverse Shifter |
| 8. Capscrew | 19. O-ring | 30. Dowel Pin |
| 9. O-ring | 20. Lo-Range Piston | 31. Expansion Plug |
| 10. O-ring | 21. Snap Ring | 32. Expansion Plug |
| 11. Capscrew | 22. O-ring | |

Figure 5-405. Exploded View of Air Shift Cover Assembly (Non-Current Production)

NOTE

Lubricate o-rings with a multi-purpose grease meeting Mack specification MG-C before installation.

1. Install o-ring and two Teflon rings in both the reverse opening and the Lo/Direct opening of shift cover. See Figure 5-406.



Figure 5-406. Installing O-ring and Teflon Rings

2. Install o-rings onto Direct piston. See Figure 5-407.



Figure 5-407. Installing O-rings

3. Install o-ring onto Lo/Direct shift rail. See Figure 5-408.

4. Install Direct piston onto Lo/Direct shift rail, small end first.

5. Insert Lo/Direct shift rail into shift cover, and at the same time, install locknut, lockwasher, and Lo/Direct shifter.



Figure 5-408. Installing O-ring

6. Turn Lo/Direct shift rail to screw it into and through the locknut, lockwasher, and shifter. Leave locknut loose for adjustment later.

7. Install o-ring onto Lo-range piston. See Figure 5-409.



Figure 5-409. Installing O-ring

8. Install snap ring into inside of Lo-range piston, using snap ring pliers J-24339 or equivalent. See Figure 5-410.



Figure 5-410. Installing Snap Ring

9. Install o-ring onto end of Lo/Direct shift cylinder that is nearest the air breather. See Figure 5-411.



Figure 5-411. Installing O-ring

10. Install snap ring into inside of Lo/Direct shift cylinder, using snap ring pliers J-24339 or equivalent. See Figure 5-412.



Figure 5-412. Installing Snap Ring

11. Install Lo-range piston into Lo/Direct shift cylinder. See Figure 5-413.



Figure 5-413. Installing Piston

12. Install Lo/Direct shift cylinder onto shift cover, by sliding it over the end of the Lo/Direct shift rail. See Figure 5-414.

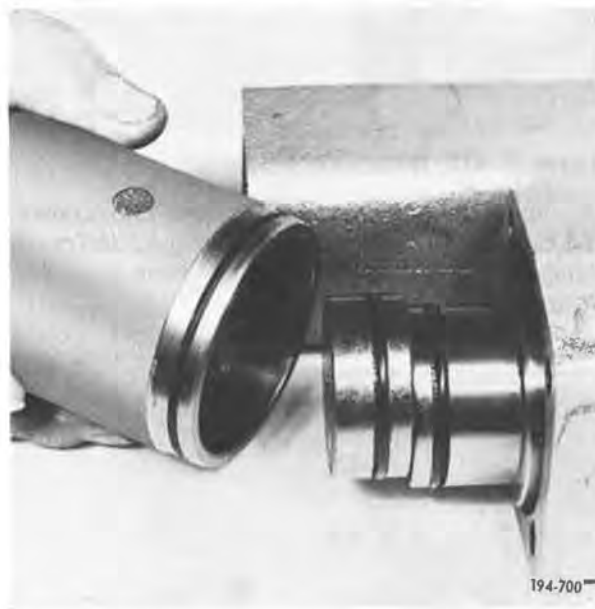


Figure 5-414. Installing Shift Cylinder

13. Install o-ring onto end of Lo/Direct shift cylinder. See Figure 5-415.



Figure 5-415. Installing O-ring

14. Install Lo/Direct shift cover onto Lo/Direct shift cylinder. See Figure 5-416.



Figure 5-416. Installing Cover

15. Install Lo/Direct shift cover capscrews, and tighten to recommended torque. Refer to Torque and Tolerance Table, Item 2. See Figure 5-417.



Figure 5-417. Installing Capscrews

16. Place Lo/Direct shift rail in neutral position, and install interlock plunger. See Figure 5-418.



Figure 5-418. Installing Plunger

17. Install interlock plunger plug into shift cover. See Figure 5-419.



Figure 5-419. Installing Plug

18. Install o-ring onto reverse shift rail.
See Figure 5-420.



Figure 5-420. Installing O-ring

19. Slide reverse shift rail into shift cover and, at the same time, install reverse shifter. See Figure 5-421.



Figure 5-421. Installing Shift Rail and Shifter

20. Install reverse shift cover o-ring and reverse shift cover. See Figure 5-422.



Figure 5-422. Installing Cover and O-ring

21. Install reverse shift cover capscrews, and tighten to recommended torque. Refer to Torque and Tolerance Table, Item 14. See Figure 5-423.



Figure 5-423. Installing Capscrews

22. Install reverse shifter setscrew, and tighten to recommended torque. Refer to Torque and Tolerance Table, Item 8. See Figure 5-424.



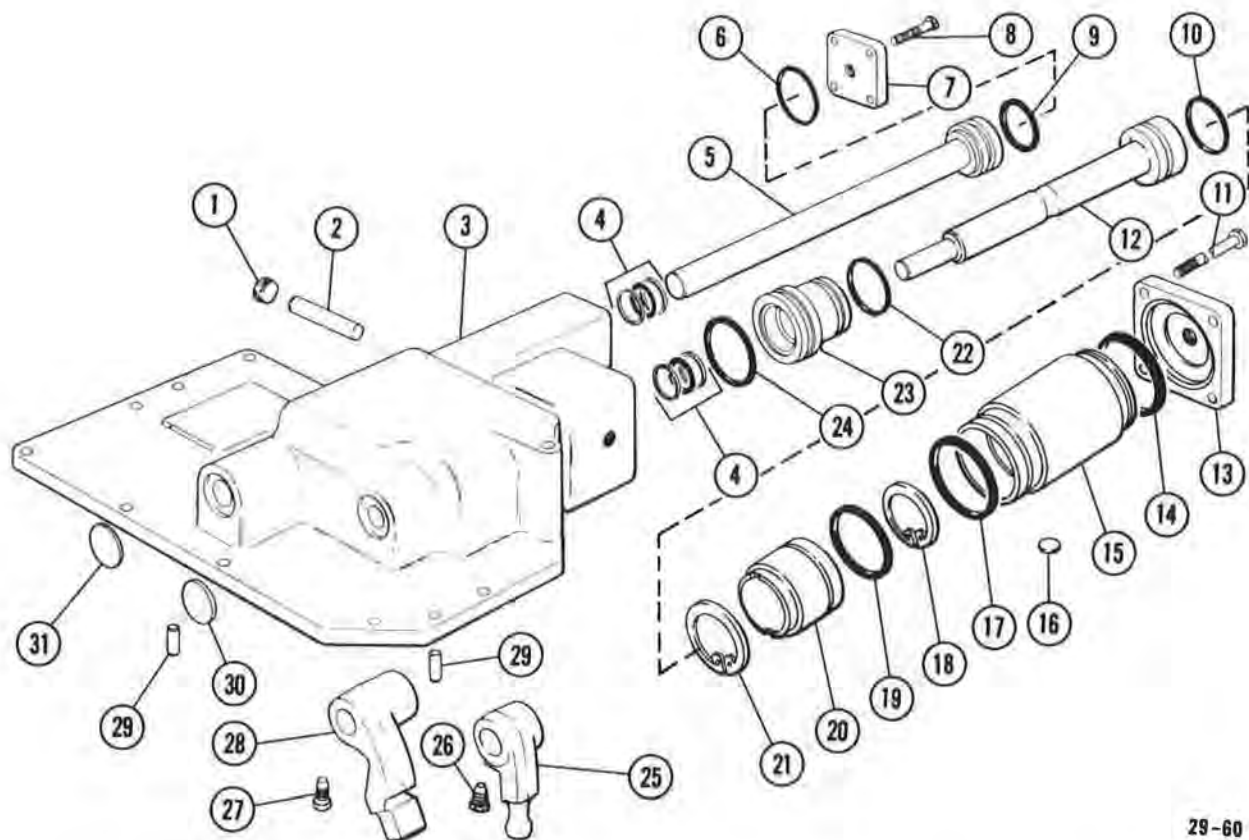
Figure 5-424. Installing Setscrew

NOTE

Do not install expansion plug (Item 32 in Figure 5-405) at this time, so that Lo/Direct shifter may be adjusted later.

Air Shift Cover Reassembly (Current Production)

(Transmission Serial # 700525, produced August, 1977, and up)
(TRXL107A and TRXL1071A only)



29-60

- | | | |
|-----------------------------|---------------------------|-----------------------|
| 1. Plug | 12. Lo/Direct Shift Rail | 23. Direct Piston |
| 2. Interlock Plunger | 13. Lo/Direct Shift Cover | 24. O-Ring |
| 3. Shift Cover | 14. O-Ring | 25. Lo/Direct Shifter |
| 4. O-Ring with Teflon Rings | 15. Shift Cylinder | 26. Setscrew |
| 5. Reverse Shift Rail | 16. Breather | 27. Setscrew |
| 6. O-Ring | 17. O-Ring | 28. Reverse Shifter |
| 7. Reverse Shift Cover | 18. Snap Ring | 29. Dowel Pin |
| 8. Capscrew | 19. O-Ring | 30. Expansion Plug |
| 9. O-Ring | 20. Lo-Range Piston | 31. Expansion Plug |
| 10. O-Ring | 21. Snap Ring | |
| 11. Capscrew | 22. O-Ring | |

Figure 5-425. Exploded View of Air Shift Cover Assembly
(Current Production)

NOTE

Lubricate o-rings with a multi-purpose grease meeting Mack specification MG-C before installation.

1. Install o-ring and two Teflon rings in both the reverse opening and the Lo/Direct opening of shift cover. See Figure 5-426.



Figure 5-426. Installing O-ring and Teflon Rings

2. Install o-rings onto Direct piston. See Figure 5-427.



Figure 5-427. Installing O-rings

3. Install o-ring onto Lo/Direct shift rail. See Figure 5-428.



Figure 5-428. Installing O-ring

4. Install Direct piston onto Lo/Direct shift rail. See Figure 5-429.



Figure 5-429. Installing Piston

5. Insert Lo/Direct shift rail into shift cover, and at the same time, install Lo/Direct shifter onto shift rail. See Figure 5-430.

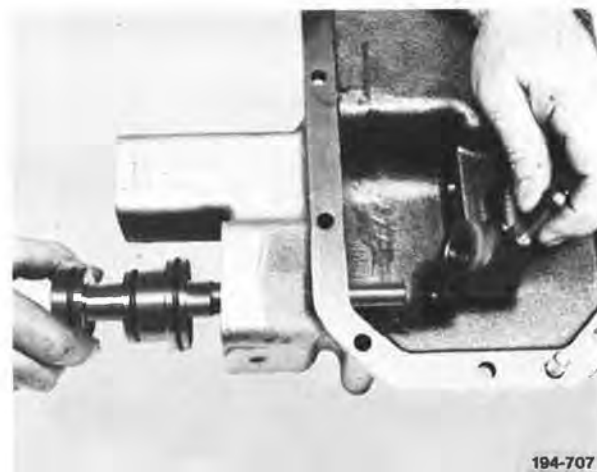


Figure 5-430. Installing Shift Rail and Shifter

6. Install Lo/Direct shifter setscrew, and tighten to recommended torque. Refer to Torque and Tolerance Table, Item 8. See Figure 5-431.



Figure 5-431. Installing Setscrew

7. Install o-ring onto Lo-range piston. See Figure 5-432.



Figure 5-432. Installing O-ring

8. Install snap ring onto inside of Lo-range piston, using snap ring pliers J-24339 or equivalent. See Figure 5-433.



Figure 5-433. Installing Snap Ring

9. Install o-ring onto end of Lo/Direct shift cylinder that is nearest the air breather. See Figure 5-434.



Figure 5-434. Installing O-ring

10. Install snap ring into inside of Lo/Direct shift cylinder, using snap ring pliers J-24339 or equivalent. See Figure 5-435.



Figure 5-435. Installing Snap Ring

11. Install Lo-range piston into Lo/Direct shift cylinder. See Figure 5-436.



Figure 5-436. Installing Piston

12. Install Lo/Direct shift cylinder onto shift cover, by sliding it over the end of the Lo/Direct shift rail. See Figure 5-437.



Figure 5-437. Installing Shift Cylinder

13. Install o-ring onto end of Lo/Direct shift cylinder. See Figure 5-438.



Figure 5-438. Installing O-ring

14. Install Lo/Direct shift cover onto Lo/Direct shift cylinder. See Figure 5-439.



Figure 5-439. Installing Cover

15. Install Lo/Direct shift cover capscrews, and tighten to recommended torque. Refer to Torque and Tolerance Table, Item 2. See Figure 5-440.



Figure 5-440. Installing Capscrews

16. Place Lo/Direct shift rail in neutral position, and install interlock plunger. See Figure 5-441.



Figure 5-441. Installing Plunger

17. Install interlock plunger plug into shift cover. See Figure 5-442.

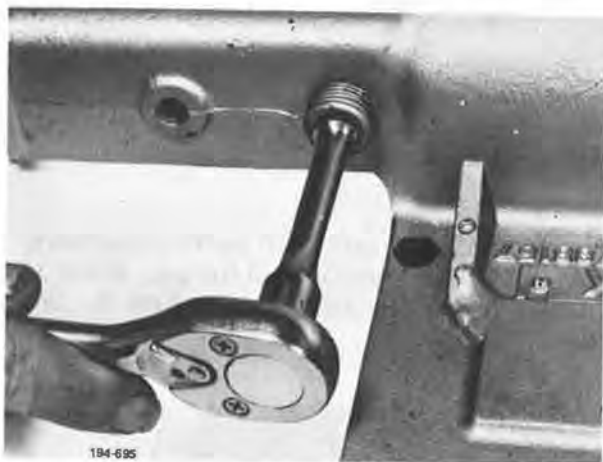


Figure 5-442. Installing Plug

18. Install o-ring onto reverse shift rail. See Figure 5-443.



Figure 5-443. Installing O-ring

19. Slide reverse shift rail into shift cover and, at the same time, install reverse shifter. See Figure 5-444.



Figure 5-444. Installing Shift Rail and Shifter

20. Install reverse shift cover o-ring and reverse shift cover. See Figure 5-445.



Figure 5-445. Installing Cover and O-ring

21. Install reverse shift cover capscrews, and tighten to recommended torque. Refer to Torque and Tolerance Table, Item 14. See Figure 5-446.



Figure 5-446. Installing Capscrews

22. Install reverse shifter setscrew, and tighten to recommended torque. Refer to Torque and Tolerance Table, Item 8. See Figure 5-447.

2. Apply a bead of sealer to shoulder where seal will seat. Use Silastic RTV732 (Mack 243SX32) or equivalent. See Figure 5-449.

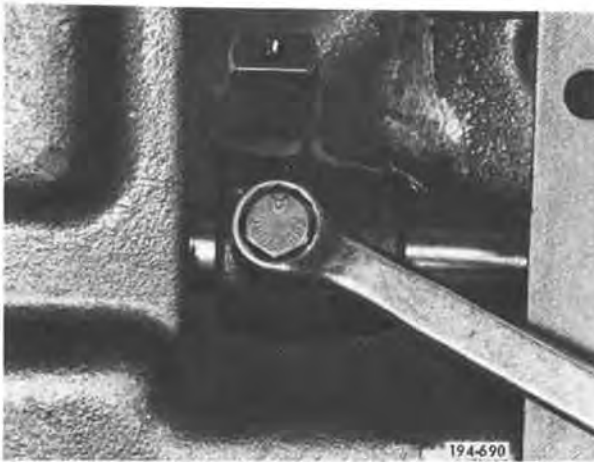


Figure 5-447. Installing Setscrew



Figure 5-449. Applying Sealer

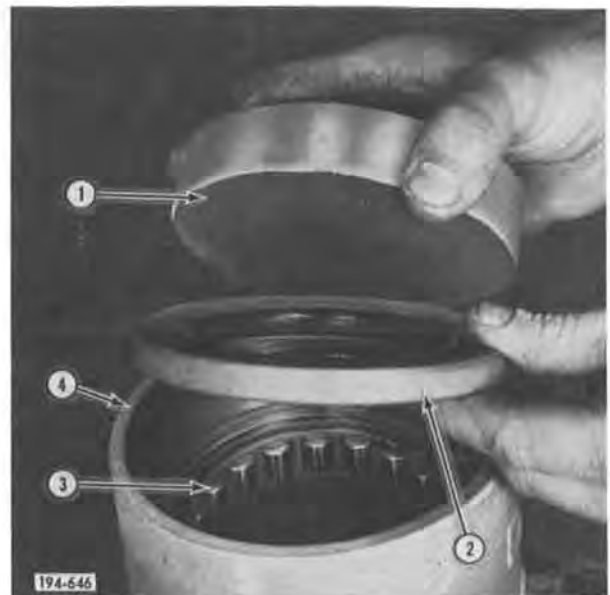
Rear Mainshaft Rear Bearing Cover Reassembly

1. Install bearing and snap ring into rear mainshaft rear bearing cover. See Figure 5-448.



Figure 5-448. Installing Bearing and Snap Ring

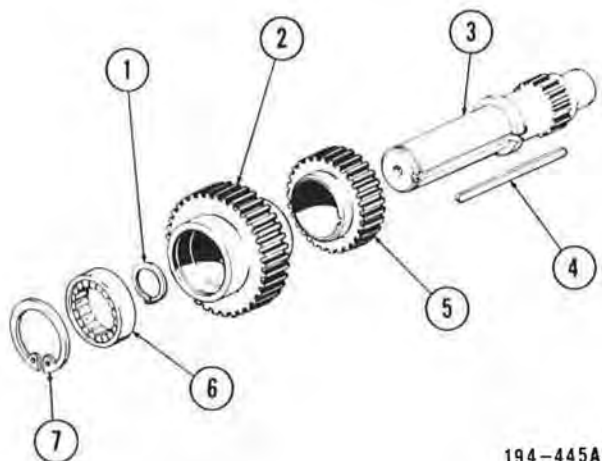
3. Press oil seal into rear bearing cover, using a suitable driver and press, until seal seats on shoulder. See Figure 5-450.



- | | |
|-------------|-----------------------|
| 1. Driver | 3. Bearing |
| 2. Oil Seal | 4. Rear Bearing Cover |

Figure 5-450. Installing Seal

Rear Countershaft Reassembly



- | | |
|-----------------------------|--------------------------------|
| 1. Gear Retaining Snap Ring | 5. Lo-Range Gear |
| 2. Direct Gear | 6. Bearing |
| 3. Rear Countershaft | 7. Bearing Retaining Snap Ring |
| 4. Key | |

Figure 5-451. Exploded View of Rear Countershaft

NOTE

Gears (2 and 5) have an interference fit with rear countershaft (3) and, for best results, should be heated before being pressed on. Using heat lamp or hot oil, heat gears to 270 to 300° F. (132 to 149° C.) for a period of not more than 30 minutes.

1. Insert gear key into countershaft keyway.
2. Apply a light coat of oil to the countershaft.
3. Align the Lo-range gear with the large hub facing away from reverse gear, and press gear onto shaft until it seats against shoulder on shaft.

NOTE

Align keyway of gear carefully with key. Guard against shaving key or raising burr on key. Before final seating of gear, inspect for and remove any burrs between gear and its mating surface.

4. Apply another coat of oil to the countershaft.

5. Align Direct gear with large hub facing away from Lo-range gear, and press onto shaft until it seats against Lo-range gear. Refer to previous NOTE. See Figure 5-452.

NOTE

Notice pencils pointing to areas where there must not be any burrs.



Figure 5-452. Pressing Gears onto Countershaft

6. Install gear retaining snap ring, using snap ring pliers J-6435 or equivalent. See Figure 5-453.



Figure 5-453. Installing Snap Ring

7. Install rear countershaft front bearing.
See Figure 5-454.



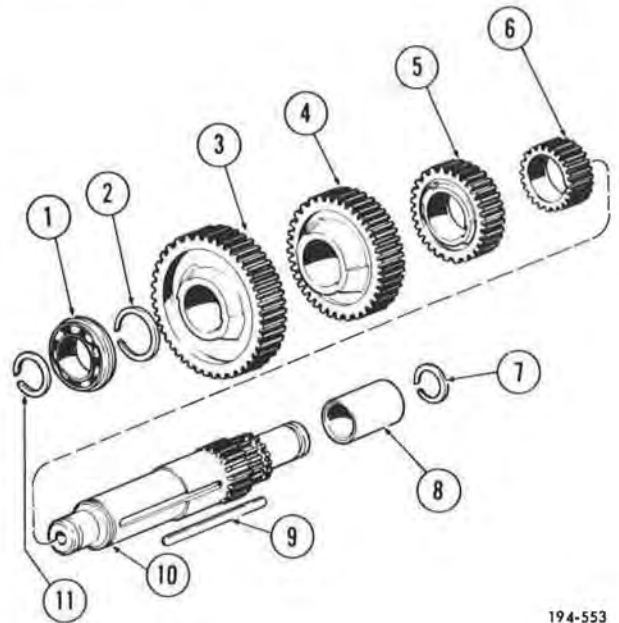
Figure 5-454. Installing Bearing

8. Install front bearing retaining snap ring using snap ring pliers J-4646 or equivalent.
See Figure 5-455.



Figure 5-455. Installing Snap Ring

Front Countershaft Reassembly



194-553

1. Bearing
2. Gear Retaining Snap Ring
3. Fifth Speed Gear
4. Fourth Speed Gear
5. Third Speed Gear
6. Second Speed Gear
7. Retaining Snap Ring
8. Bearing Inner Race
9. Key
10. Front Countershaft
11. Bearing Retaining Snap Ring

Figure 5-456. Exploded View of Front Countershaft

NOTE

Gears have an interference fit with front countershaft and, for best results, should be heated before being pressed on. Using heat lamp or hot oil, heat gears to 270 to 300° F. (132 to 149° C.) for a period of not more than 30 minutes.

1. Insert gear key into countershaft keyway.

2. Apply a light coat of oil to the countershaft.

3. Align keyway of second speed gear with key, and press gear onto shaft.

NOTE

Align keyway of gears carefully with key. Guard against shaving key or raising burr on key. Before final seating of each gear, inspect for and remove any burrs between gear and its mating surface.

4. Repeat procedure with remaining gears. Fourth speed gear hub to be toward front (away from third speed gear). Main drive gear (fifth speed gear) hub to be toward rear (next to fourth speed gear hub). See Figure 5-457.

NOTE

Notice pencil pointing to area where there must not be any burrs.

5. Install gear retaining snap ring, using snap ring pliers J-25445 or equivalent. See Figure 5-458.



Figure 5-457. Pressing Gears onto Countershaft

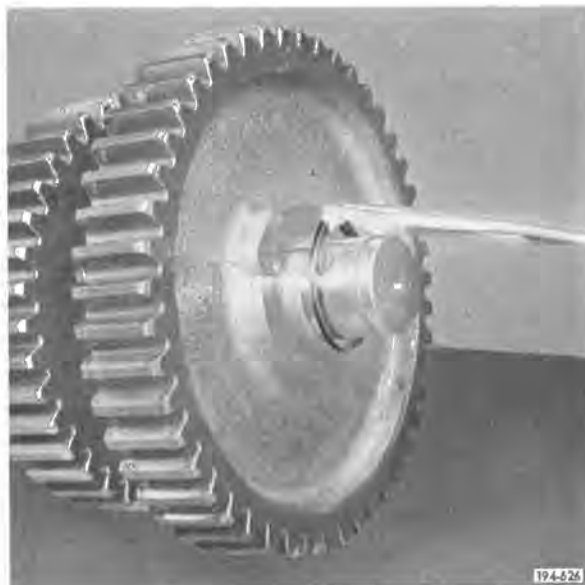


Figure 5-458. Installing Snap Ring

6. Install front countershaft front bearing, being careful to apply force to the inner race only. A soft mallet or suitable driving sleeve may be used. See Figure 5-459.

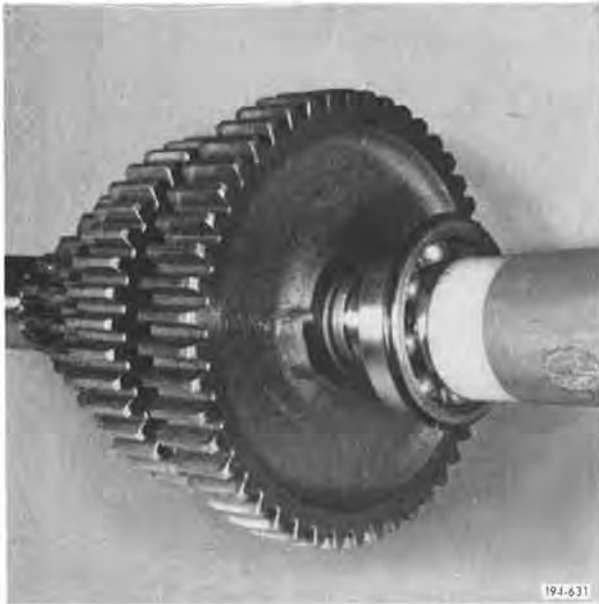


Figure 5-459. Installing Bearing

7. Install front bearing retaining snap ring, using snap ring pliers J-25445 or equivalent. See Figure 5-460.



Figure 5-460. Installing Snap Ring

8. Install bearing inner race on rear of front countershaft, driving it on carefully using a soft mallet or a suitable driving sleeve.

9. Install inner race retaining snap ring, using snap ring pliers J-24339 or equivalent. See Figure 5-461.



Figure 5-461. Installing Snap Ring

Rear Mainshaft Reassembly

1. Press rear mainshaft rear bearing onto shaft. See Figure 5-462.



Figure 5-462. Pressing Bearing onto Mainshaft

2. Slide speedometer gear and spacer onto rear mainshaft. See Figure 5-463.



Figure 5-463 Installing Gear and Spacer

3. Press rear bearing cover bearing inner race onto rear mainshaft. See Figure 5-464.



Figure 5-464. Pressing Race onto Mainshaft

4. Install rear mainshaft front bearing, using suitable driver and soft mallet. See Figure 5-465.



Figure 5-465. Installing Bearing

5. Install rear mainshaft front bearing retaining snap ring. See Figure 5-466.



Figure 5-466. Installing Snap Ring

Front Mainshaft Reassembly

Since mainshaft third speed gear will be needed for timing the front countershafts, do not assemble the front mainshaft at this time.

Main Drive Pinion Bearing Cover Reassembly

1. Apply a bead of sealer to shoulder where the seal will seat. Use Silastic RTV732 (Mack 243SX32) or equivalent. See Figure 5-467.

Main Drive Pinion Reassembly



Figure 5-467. Applying Sealer

2. Place seal in position and select an appropriate driver. See **Figure 5-468**.



Figure 5-468. Placing Seal in Position

3. Place assembly in a press, and press seal into cover, until it seats on shoulder. See **Figure 5-469**.



Figure 5-469. Pressing Seal into Cover

1. Press main drive pinion bearing onto main drive pinion shaft. Be sure outer race snap ring is positioned toward pilot end of pinion (away from pinion gear teeth). See **Figure 5-470**.



Figure 5-470. Installing Bearing

2. Install bearing retaining spirollox snap ring. See **Figure 5-471**.



Figure 5-471. Installing Snap Ring

Rear Case Reassembly

1. Insert expansion plug into reverse idler shaft. See Figure 5-472.



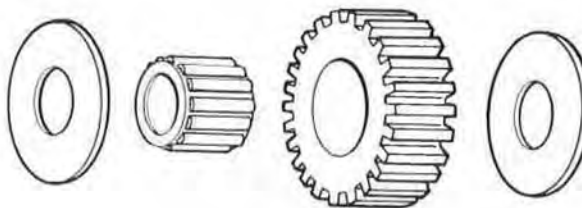
Figure 5-472. Inserting Expansion Plug

2. Install expansion plug by driving it downward with a driver. Driver to be cylindrical in shape, with a diameter the same as the expansion plug, and a flat (not rounded) end.
3. Insert reverse idler shaft partially into rear case, taking care to align flats on end of shaft with centerline of countershaft bore. See Figure 5-473.



Figure 5-473. Alignment of Idler Shaft

4. Install reverse idler gear, bearing, and thrust washers into rear case. See Figures 5-474 and 5-475.



194-542

Figure 5-474. Exploded View of Reverse Idler Gear Assembly



Figure 5-475. Installing Reverse Idler Gear Assembly

NOTE

Install with rounded edge of teeth of reverse idler gear forward.

5. Drive reverse idler shaft part way into rear case with a soft mallet, being sure that reverse idler gear, bearing, and thrust washers are in proper alignment for shaft to go through them. See Figure 5-476.



Figure 5-476. Installing Shaft

6. Apply appropriate sealer around the outer edge of shaft where it meets the case. See Figure 5-477.



Figure 5-477. Applying Sealer

7. Drive reverse idler shaft the rest of the way into case, until relief is flush with case.

8. Measure reverse idler gear end play with a feeler gauge. See Figure 5-478. Refer to Torque and Tolerance Table, Item 20. If end play is not within tolerance, replace washers. If still not correct, replace reverse idler gear. If still not within tolerance, case must be replaced.



Figure 5-478. Measuring End Play

9. Apply appropriate sealer to end of reverse idler shaft, including around expansion plug. See Figure 5-479.



Figure 5-479. Applying Sealer

10. Install front countershaft rear bearings and retaining snap rings, using snap ring pliers J-4646 or equivalent. See Figure 5-480.



Figure 5-480. Installing Bearing and Snap Rings

11. Install reverse gear and its shift fork. See Figure 5-481.



Figure 5-481. Installing Reverse Gear and Shift Fork

12. Locate timing O-marks on the rear countershaft Lo-range gears, and, with yellow paint, mark direct gear tooth top land that is directly in line with each such O-mark. Then install there rear countershaft assemblies into case. See Figure 5-482.



- 1. Timing Mark
- 2. Yellow Paint Marking

Figure 5-482. Installing Rear Countershaft

13. Place a block of metal at front end of rear countershaft, to provide a solid base, and install rear countershaft rear bearing using a suitable driving sleeve. Apply force to the inner race only. See Figure 5-483.

NOTE

Notice pencil pointing to block of metal temporarily installed.

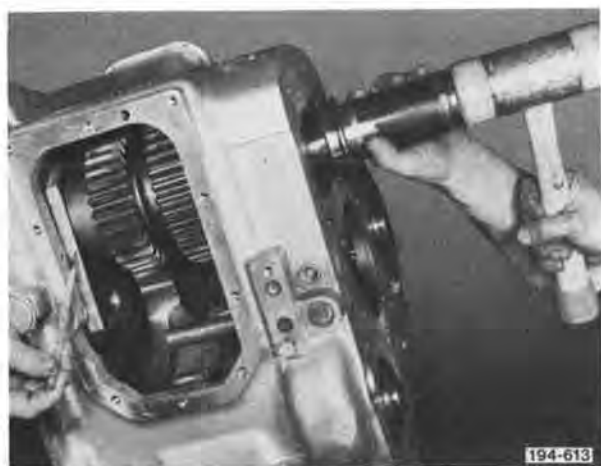


Figure 5-483. Installing Bearing

14. (TRXL1071 and TRXL1071A only) Install Lo-Lo range gear through rear case top opening.

15. Place rear countershafts in position, and install rear bearing retaining snap ring, using snap ring pliers J-25445 or equivalent. See Figure 5-484.



Figure 5-484. Installing Snap Ring

16. (TRXL107 and TRXL107A only) Install Lo-range gear, and temporarily position it between countershaft direct gear and Lo-range gear. See Figure 5-485.



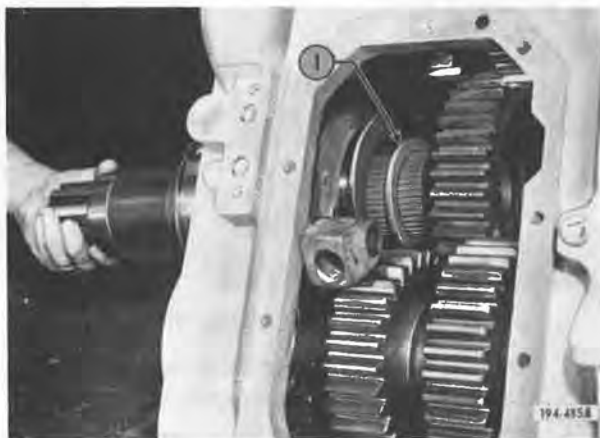
Figure 5-485. Installing Gear

17. Start rear mainshaft into rear case through rear bearing opening. See Figure 5-486.



Figure 5-486. Inserting Rear Mainshaft

18. Advance shaft carefully through reverse gear, and then install mainshaft Lo-range (or Lo-Lo range) gear rear thrust washer onto shaft. See Figure 5-487.



1. Lo-Range Gear Rear Thrust Washer

Figure 5-487. Installing Mainshaft and Washer

19. Continue advancing shaft through Lo-range (or Lo-Lo range) gear until rear bearing positioning snap ring seats against case.

20. Install O-ring in countershaft rear bearing cover. See Figure 5-488.

21. Install rear countershaft rear bearing cover. See Figure 5-489.

22. Install rear countershaft rear bearing cover capscrews, and tighten to recommended torque. See Figure 5-490. Refer to Torque and Tolerance Table, Item 7.



Figure 5-488. Installing O-Ring



Figure 5-489. Installing Cover



Figure 5-490. Tightening Capscrew

23. Apply sealer compound and install mainshaft rear bearing cover gasket and cover assembly. See Figure 5-491.

24. Install rear bearing cover capscrews, and tighten to recommended torque. Refer to Torque and Tolerance Table, Item 12. See Figure 5-492.



Figure 5-491. Installing Cover and Gasket

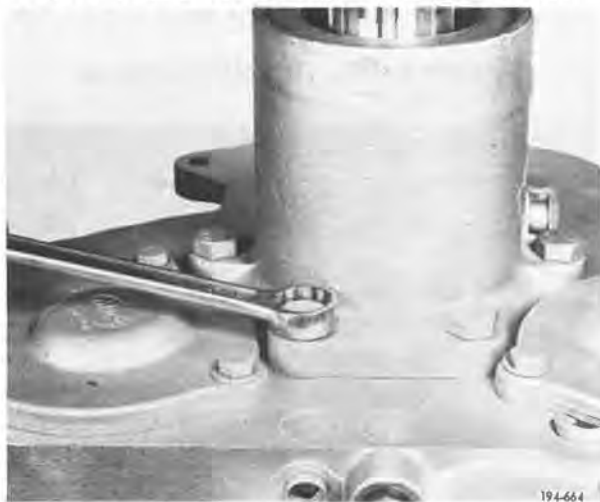


Figure 5-492. Installing Capscrews

25. Disengage reverse gear from its idler gears.

26. Locate three O-marks on face of mainshaft Lo-range (or Lo-Lo range) gear, and locate painted timing marks on countershaft direct gears.

27. Place O-marks and painted timing marks in alignment, and engage mainshaft Lo-range (or Lo-Lo range) gear. See Figure 5-493.



- 1. Mainshaft Lo-range Gear Timing Marks
- 2. Countershaft Direct Gear Timing Marks

Figure 5-493. Timing Mark Alignment

28. Through rear case front opening, install Lo-range (or Lo-Lo range) gear front thrust washer. See Figure 5-494.



Figure 5-494. Installing Thrust Washer

29. Install Lo-range (or Lo-Lo range) gear retaining snap ring, using snap ring pliers J-6435 or equivalent. See Figure 5-495.

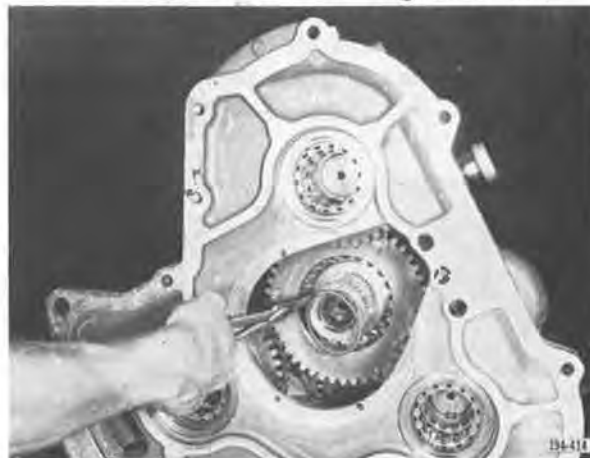


Figure 5-495. Installing Snap Ring

30. Install Direct/Lo-range sliding clutch and its shift fork as an assembly. See Figure 5-496.



Figure 5-496. Installing Sliding Clutch and Shift Fork

31. Install a wire to hold the Direct/Lo-range shift fork from sliding forward. See Figure 5-497.



Figure 5-497. Wire Holding Shift Fork

WARNING

Direct/Lo-range sliding clutch and shift fork could fall out of case and cause injury, if they are not secured.

Front Case Reassembly

1. Position transmission front case in a vertical position, and install three front countershafts. See Figure 5-498.



Figure 5-498. Installing Countershafts

2. Position front case horizontally. Install front countershaft bearing positioning snap rings in outer race of bearings, using snap ring pliers J-25445 or equivalent, then tap countershafts rearward until positioning snap ring seats against case. See Figure 5-499.

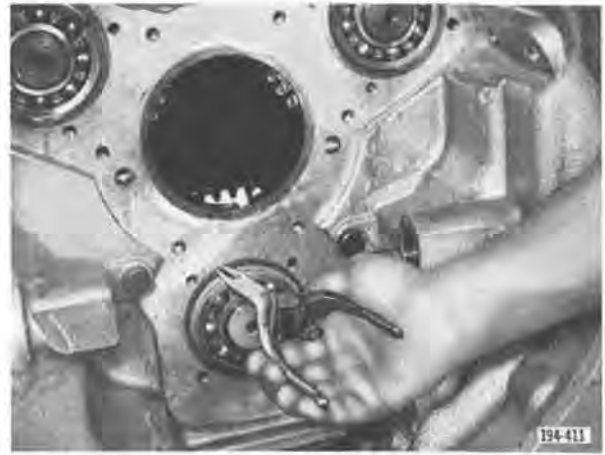


Figure 5-499. Installing Snap Ring

3. Temporarily install front mainshaft third speed gear, so that the three alignment O-marks on face of gear mate with alignment O-marks on countershaft third speed gears. See Figure 5-500.



1. Front Mainshaft Third Speed Gear Timing Marks
2. Front Countershaft Third Speed Gear Timing Marks

Figure 5-500. Third Speed Gear Temporarily Installed

4. Install main drive pinion assembly into place. See Figure 5-501.

NOTE

After main drive pinion is installed, the countershafts are timed and held in alignment by the main drive pinion. Therefore, the third speed gear can now be removed from the case and set aside until reassembling the front mainshaft.



Figure 5-501. Installing Main Drive Pinion

5. Place oil pump vane into its bore in main drive pinion. See Figure 5-502.



Figure 5-502. Installing Pump Vane

NOTE

Vane should be flush with the right-hand side of the pinion shaft, and protruding slightly from the left-hand side (as observed from the front of transmission). This will assure alignment of the vane with the eccentric bore in the cover when the cover is installed.

6. Install main drive pinion bearing cover gasket. See Figure 5-503.

NOTE

Notice pencil pointing to oil hole in gasket, which must align with oil hole in front case.

CAUTION

Improper gasket placement will block oil supply to oil pump, causing wear and internal damage.

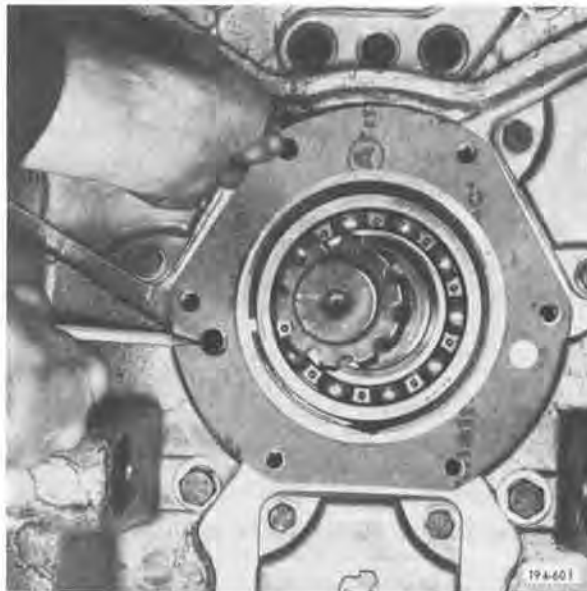


Figure 5-503. Installing Gasket

7. For pull-type clutch application only: Install main drive pinion bearing cover, using Tool J23796 to protect sealing lip of oil seal. See Figure 5-504.



1. Tool J23796 For Use With Pull-Type Clutches Only

Figure 5-504. Installing Cover

8. For push-type clutch application only: Install main drive pinion bearing cover, using care not to damage sealing lip of oil seal. No special tool is required. See Figure 5-505.



Figure 5-505. Installing Cover

9. Install main drive pinion cover capscrews, and tighten to recommended torque. See Figure 5-506. Refer to Torque and Tolerance Table, Item 6.

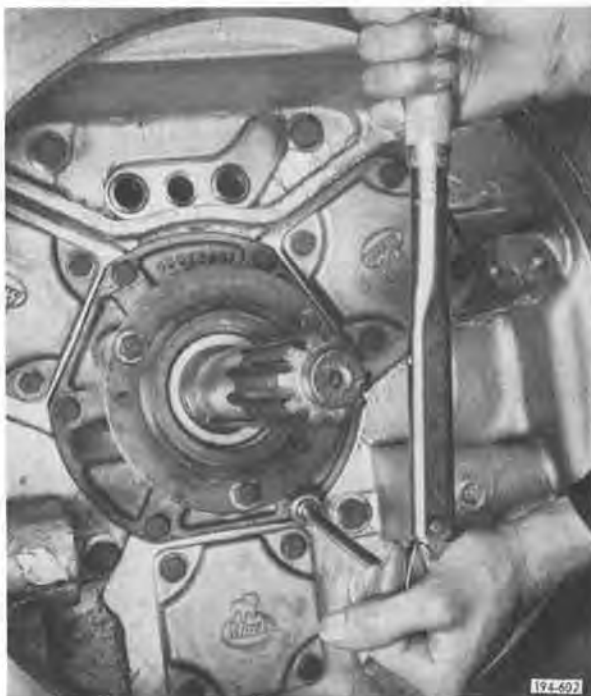


Figure 5-506. Torquing Capscrews

10. Install O-ring in each of three front countershaft front bearing covers. See Figure 5-507.



Figure 5-507. Installing O-Ring

11. Install front countershaft front bearing covers. See Figure 5-508.

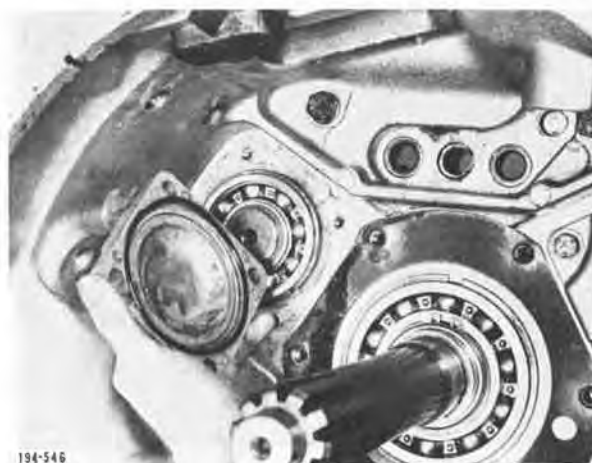


Figure 5-508. Installing Cover

12. Install capscrews into cover, and tighten to correct torque. See Figure 5-509. Refer to Torque and Tolerance Table, Item 5.



Figure 5-509. Torquing Capscrews

13. Install second/third speed sliding clutch onto front mainshaft. See Figure 5-510.

NOTE

Notice pencil pointing to oil hole, which must be clean and open for oil to pass through.



Figure 5-510. Installing Sliding Clutch

14. Install third speed gear onto front mainshaft. See Figure 5-511.



Figure 5-511. Installing Gear

15. Install third speed gear flanged thrust washer, and fourth speed gear. See Figure 5-512.

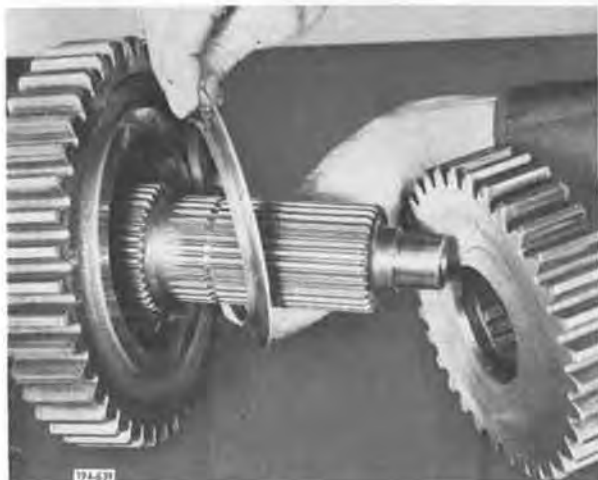


Figure 5-512. Installing Thrust Washer and Gear

16. Install fourth speed gear flanged thrust washer, and fourth speed gear splined thrust washer. See Figure 5-513.



Figure 5-513. Installing Thrust Washers

17. Install fourth speed gear retaining snap ring, using snap ring pliers J-29045 or equivalent. See Figure 5-514.

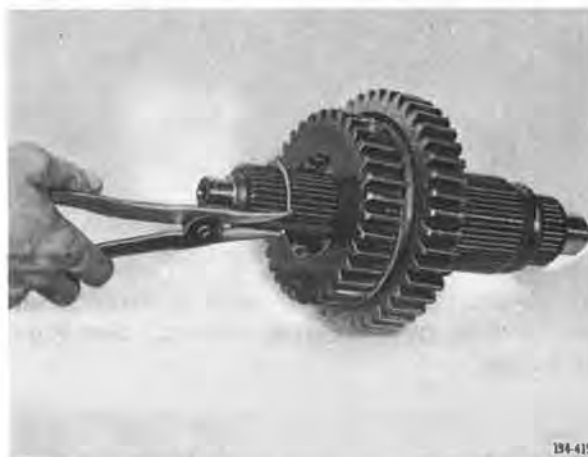


Figure 5-514. Installing Snap Ring

18. Install fourth/fifth speed sliding clutch. See Figure 5-515.

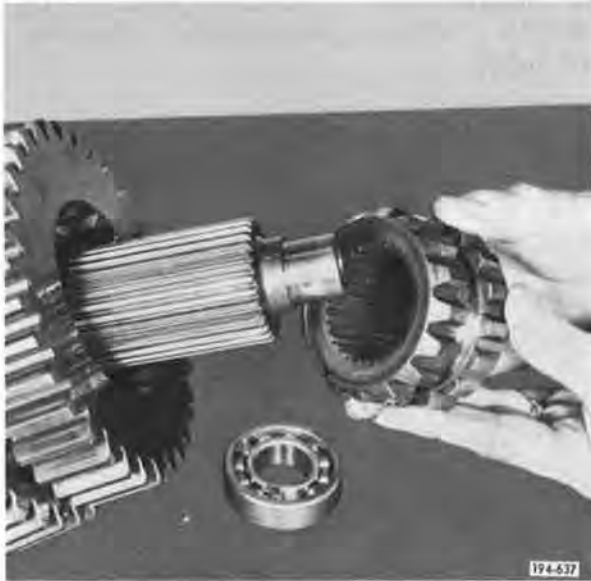


Figure 5-515. Installing Clutch

19. Install spigot bearing onto front of front mainshaft, using a soft mallet or a suitable driving sleeve. Apply force to the inner race only. See Figure 5-516.

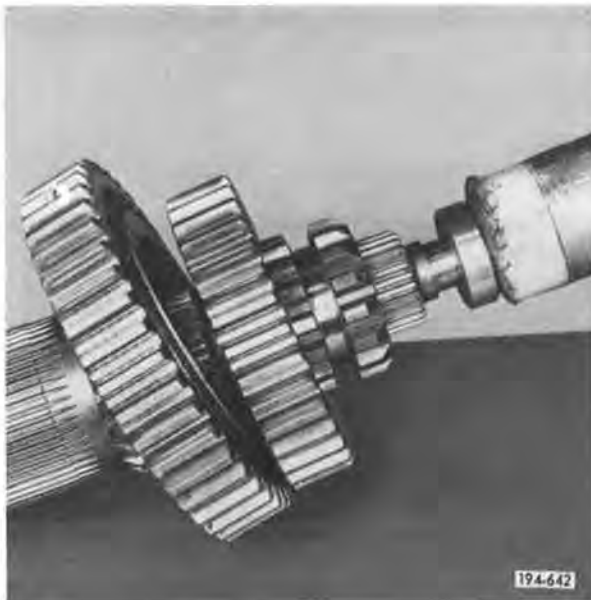


Figure 5-516. Installing Bearing

20. (TRXL107 and TRXL1071 only)
Prior to TRXL107 Serial #9X1061 (produced November, 1974) and TRXL1071 Serial #9X1329 (produced November, 1974), install spigot bearing retaining snap ring.

NOTE

Transmissions built after above serial numbers, and all TRXL107A and TRXL1071A transmissions, do not have a spigot bearing retaining snap ring.

21. Install front mainshaft into front case. Advance mainshaft all the way forward to completely seat spigot bearing into main drive pinion. See Figure 5-517.

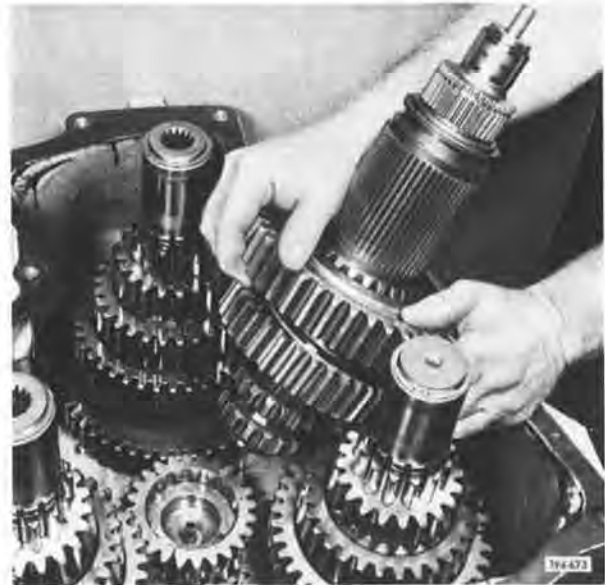


Figure 5-517. Installing Mainshaft

22. Apply a light coat of grease to front face of second speed gear, and then place second speed gear thrust washer onto front face of gear. Grease will hold washer in position during installation. See Figure 5-518.

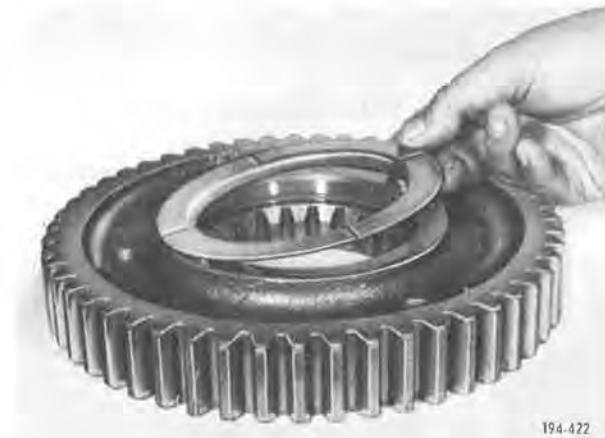


Figure 5-518. Installing Thrust Washer

23. Install second speed gear (beveled side of clutch teeth toward front of transmission), and engage with countershaft second speed gears. See Figure 5-519.

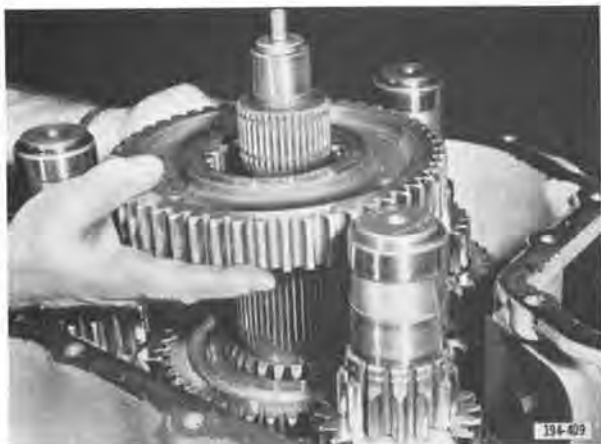


Figure 5-519. Installing Gear

24. Secure first speed gear thrust washer to front face of first speed gear with a light coat of grease, and then install first speed gear (beveled side of clutch teeth toward rear of transmission) with its thrust washer and engage with countershaft first speed gear. See Figure 5-520.



Figure 5-520. Installing Gear

25. Install first speed gear sliding clutch. See Figure 5-521.



Figure 5-521. Installing Clutch

26. Install front countershaft selective thrust washers on three countershafts. See Figure 5-522.



Figure 5-522. Installing Washers

27. Install front countershaft selective thrust washer retaining snap rings, using snap ring pliers J-6435 or equivalent. See Figure 5-523.



Figure 5-523. Installing Snap Rings

28. Check countershaft end-play clearance (each countershaft) by inserting a feeler gauge between mainshaft first speed gear and countershaft selective thrust washer. Hold each thrust washer squarely against its snap ring when inserting feeler gauge. Refer to Torque and Tolerance Table, Item 17 for correct end-play and for selective thrust washer thicknesses used to obtain correct end-play. If too much end play is measured,

use thicker washer; if too little end-play is measured, use thinner washer. See Figure 5-524.



Figure 5-524. Measuring End-Play

29. If front mainshaft rear oil tube was removed previously, install it now using a suitable driver. See Figure 5-525.



Figure 5-525. Installing Oil Tube

30. Install mainshaft Lo-range main drive gear. See Figure 5-526.

31. Install Lo-range main drive gear retaining snap ring, using snap ring pliers J-6435 or equivalent. See Figure 5-527.



Figure 5-526. Installing Gear



Figure 5-527. Installing Snap Ring

Main Components Reassembly

1. Install a new front case to rear case gasket. See Figure 5-528.



Figure 5-528. Installing Gasket

2. Install front case to rear case, with the aid of a hoist. See Figure 5-529.

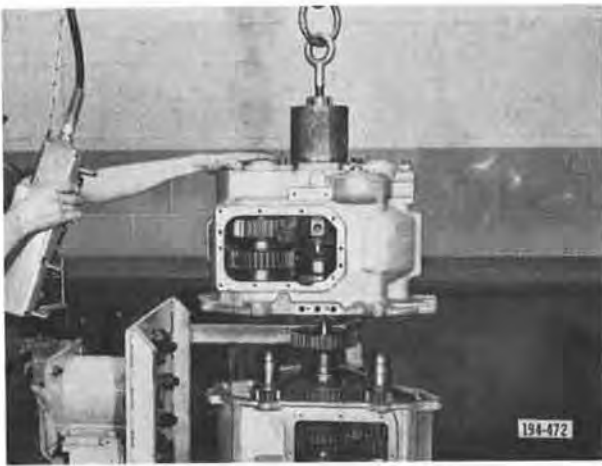


Figure 5-529. Installing Rear Case

WARNING

Keep hands clear of mating surfaces when installing front case to rear case, to avoid serious personal injury.

3. Install front case to rear case capscrews and dowel bolts and nuts. Tighten to recommended torque. See Figures 5-530 and 5-531. Refer to Torque and Tolerance Table, Items 9 and 10.



Figure 5-530. Installing Dowel Bolt



Figure 5-531. Installing Capscrew

4. Remove wire previously installed to hold Direct/Lo-range shift fork. See Figure 5-532.



Figure 5-532. Wire Holding Shift Fork.

5. Install drive flange (or yoke) on rear mainshaft splines. See Figure 5-533.



Figure 5-533. Installing Drive Flange

6. Lubricate threads of drive flange (or yoke) clamp plate screw, and install clamp plate and screw. See Figure 5-534.



Figure 5-534. Lubricating Screw

7. Place two sliding clutches into engaged position, which will lock up assembly, and tighten drive flange (or yoke) clamp plate capscrew to recommended torque. See Figure 5-535. Refer to Torque and Tolerance Table, Item 13.

8. Install second/third speed shift fork onto second/third speed sliding clutch. See Figure 5-536.



Figure 5-535. Torquing Capscrew

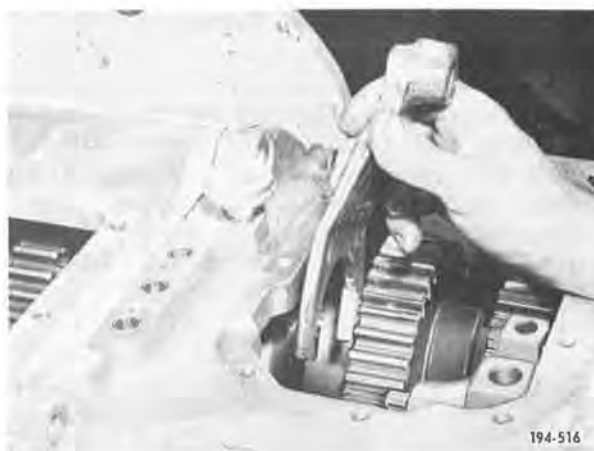


Figure 5-536. Installing Shift Fork

9. Install first speed shift fork onto first speed sliding clutch. See Figure 5-537.

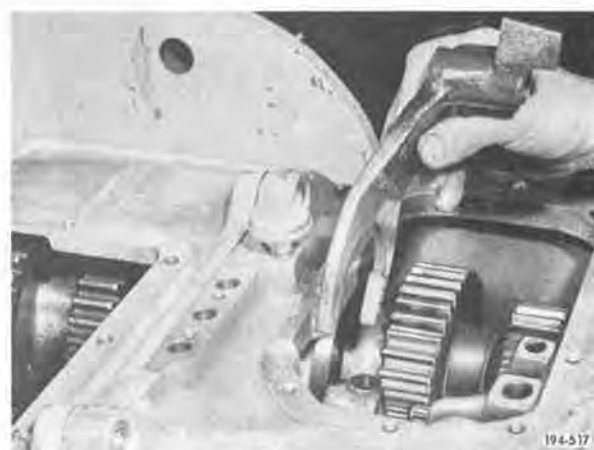


Figure 5-537. Installing Shift Fork

10. Slide second/third speed shift rail through front of case, and install second/third speed shifter onto rail. See Figure 5-538.



Figure 5-538. Installing Shifter

11. Advance rail through intermediate bore of case and second/third speed shift fork, until rail reaches neutral position. Install setscrew into second/third speed shifter, and tighten to recommended torque. See Figure 5-539. Refer to Torque and Tolerance Table, Item 8.



Figure 5-539. Installing Setscrew

12. Slide first speed shift rail through front of case, and install first speed shifter and reverse lockout spacer onto rail. See Figure 5-540.

13. Advance rail through intermediate bore of case and first speed shift fork, until rail reaches neutral position. Install first speed shifter setscrew and tighten to recommended torque. Refer to Torque and Tolerance Table, Item 8.



Figure 5-540. Installing Shifter and Spacer

14. Install setscrews into second/third speed shift fork and first speed shift fork, and tighten to recommended torque. See Figure 5-541. Refer to Torque and Tolerance Table, Item 8.



Figure 5-541. Installing Setscrew

15. Install fourth/fifth speed shift fork onto fourth/fifth speed sliding clutch. See Figure 5-542.



Figure 5-542. Installing Shift Fork

16. Slide fourth/fifth speed shift rail through front of case, into and through hub of fourth/fifth speed shift fork, into intermediate bore of case, until rail reaches neutral position. See Figure 5-543.

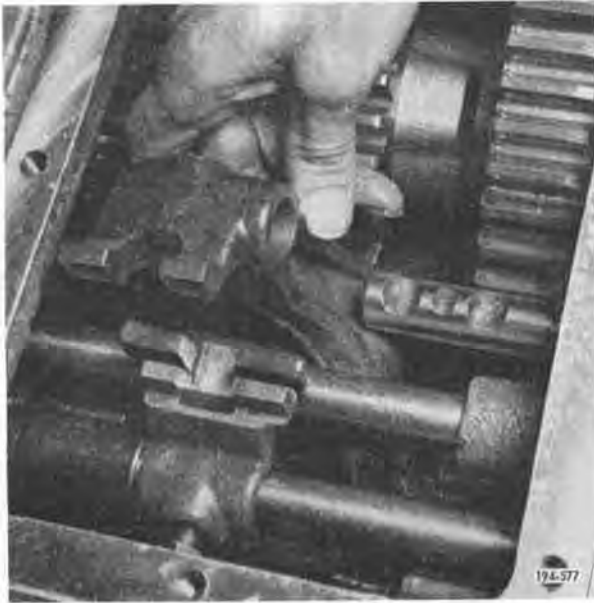


Figure 5-543. Installing Shift Rail

17. Install setscrew into fourth/fifth speed shift fork, and tighten to recommended torque. See Figure 5-544. Refer to Torque and Tolerance Table, Item 8.

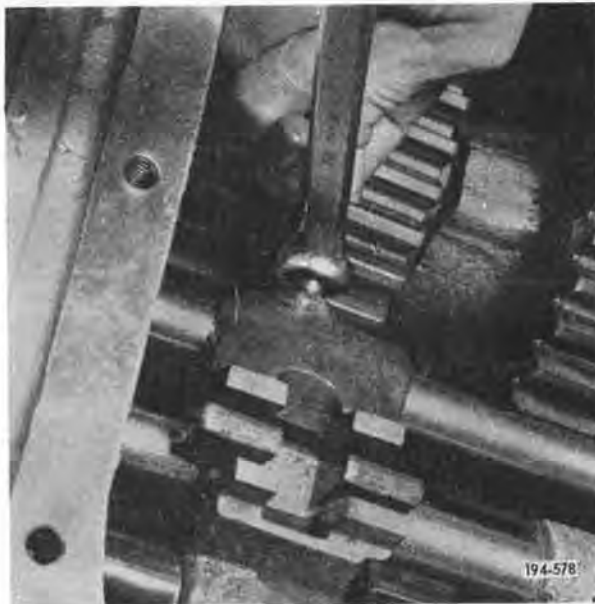


Figure 5-544. Installing Setscrew

18. Place expansion plug in position at front of second/third speed shift rail. See Figure 5-545.

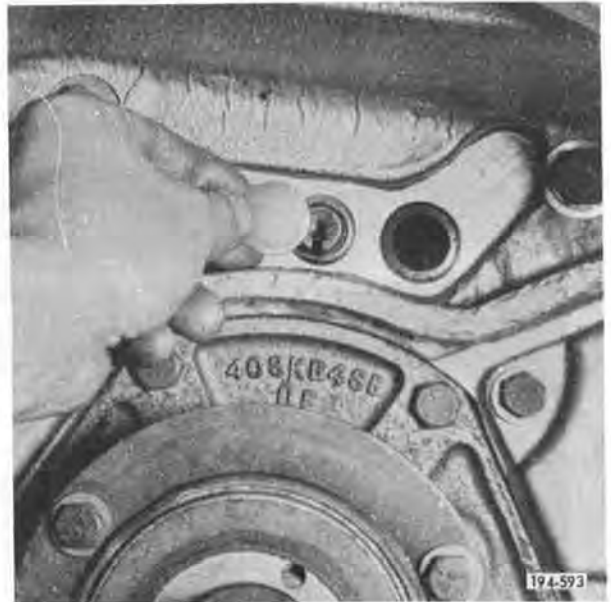


Figure 5-545. Positioning Expansion Plug

19. Install expansion plug by driving it rearward with a driver. Driver to be cylindrical in shape, with a diameter the same as the expansion plug, and a flat (not rounded) end.

20. Install clutch brake onto input shaft. See Figure 5-546.



Figure 5-546. Installing Clutch Brake

21. Insert clutch release stub shaft into clutch release yoke, place in position in bell housing, and tap stub shaft into housing.

22. Install setscrew and tighten to recommended torque. See Figure 5-547. Refer to Torque and Tolerance Table, Item 1.

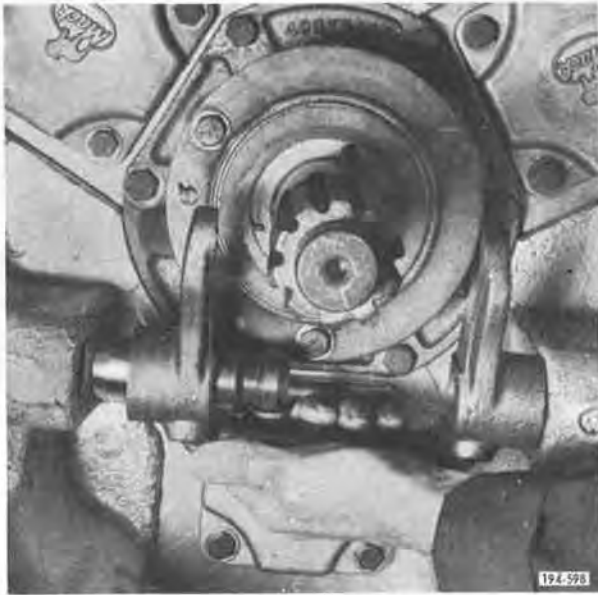


Figure 5-547. Installing Yoke and Stub Shaft

23. Tap splined clutch release shaft into housing from outside of housing. Insert Woodruff key. See Figure 5-548.



Figure 5-548. Installing Key

24. Tap splined clutch release shaft to seat Woodruff key in keyway of clutch release yoke.

25. Install setscrew and tighten to recommended torque. See Figure 5-549. Refer to Torque and Tolerance Table, Item 1.

26. Install poppet balls and poppet springs. See Figure 5-550.



Figure 5-549. Installing Setscrew



Figure 5-550. Installing Ball and Spring

27. Install poppet ball cover with capscrews, and tighten to recommended torque. See Figure 5-551. Refer to Torque and Tolerance Table, Item 4.

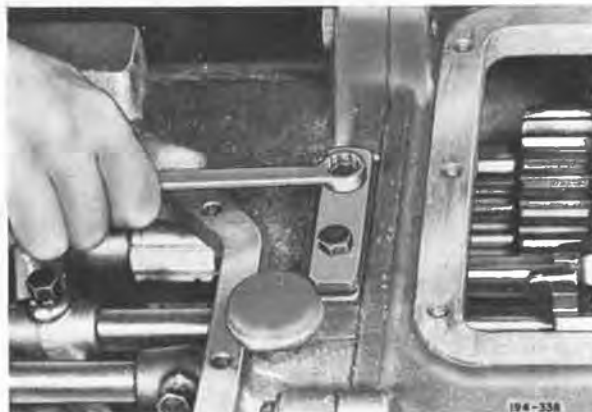


Figure 5-551. Installing Cover

28. Install front case top cover gasket. See Figure 5-552.



Figure 5-552. Installing Gasket

29. Install front case top cover. See Figure 5-553.



Figure 5-553. Installing Cover

30. Install front case top cover capscrews, and tighten to recommended torque. See Figure 5-554. Refer to Torque and Tolerance Table, Item 3.



Figure 5-554. Installing Capscrew

AIR SHIFT COVER (NON-CURRENT PRODUCTION)

ADJUSTMENT AND INSTALLATION

1. Temporarily install air shift cover assembly on rear case. See Figure 5-555.



Figure 5-555. Installing Cover

2. Connect air lines to Lo-range and Direct fittings of shift cover, and apply equal air to both sides.

3. Insert screw driver into slot provided in forward end of Lo/Direct shift rail. See Figure 5-556.



1. Air Lines

Figure 5-556. Adjusting Rail

4. Turn shift rail clockwise with screwdriver and at the same time rotate output flange (or yoke) until gear clash is heard.

5. Now turn shift rail counter-clockwise, counting number of turns until gear clash is obtained.

6. Turn shift rail clockwise again half the number of turns counted from gear clash to gear clash. Shift rail will now be in neutral position.

7. Disconnect air lines and remove shift cover.

8. Lock Lo/Direct shifter in neutral position by tightening the locknut. See Figure 5-557.

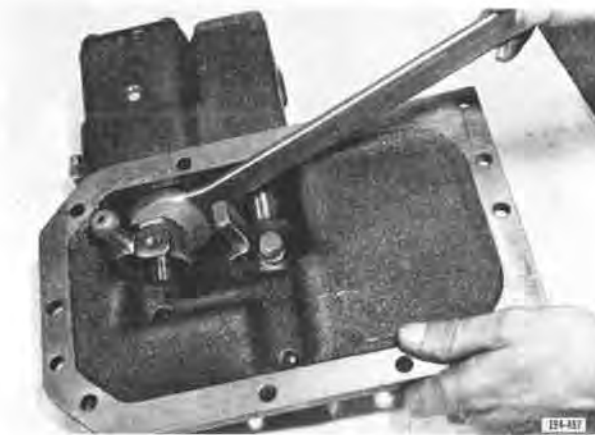


Figure 5-557. Tightening Nut

9. Install expansion plug into shift cover at front end of Lo/Direct shift rail. This plug was previously omitted. (Item 31 in Figure 5-405.

10. Install air shift cover gasket. See Figure 5-558.



Figure 5-558. Installing Gasket

11. Install air shift cover, being careful to be sure shift levers engage shift forks. See Figure 5-559.



Figure 5-559. Installing Cover

12. Install air shift cover capscrews, and tighten to recommended torque. See Figure 5-560. Refer to Torque and Tolerance Table, Item 3.



Figure 5-560. Installing Capscrews

**AIR SHIFT COVER
(CURRENT PRODUCTION)**

INSTALLATION

1. Install air shift cover gasket. See Figure 5-561.



Figure 5-561. Installing Gasket

2. Install air shift cover, being careful to be sure shift levers engage shift forks. See Figure 5-562.

3. Install air shift cover capscrews, and tighten to recommended torque. See Figure 5-563. Refer to Torque and Tolerance Table, Item 3.



Figure 5-562. Installing Cover

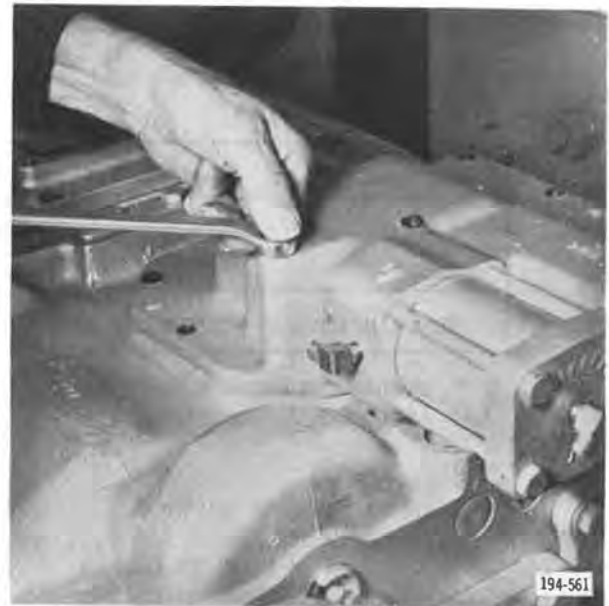


Figure 5-563. Installing Capscrews

TORQUE AND TOLERANCE TABLE

Screw Torques

<u>Item</u>	<u>Location</u>	<u>Lb. Ft.</u>
1	Clutch release yoke setscrew	13 to 21
2	Lo/Direct shift cylinder cover capscrews	24 to 30
3	Transmission case top cover capscrews	24 to 30
4	Poppet ball cover capscrews	24 to 30
5	Countershaft front cover capscrews	24 to 30
6	Main drive pinion bearing cover capscrews	36 to 44
7	Countershaft rear cover capscrews	36 to 44
8	Shifter and shift fork setscrews	41 to 49
9	Front case to rear case capscrews	56 to 70
10	Front case to rear case dowel bolts	66 to 80
11	Bell housing to main case capscrews	76 to 86
12	Mainshaft rear cover capscrews	96 to 120
13	Mainshaft drive flange (or yoke) clamp plate capscrew	474 to 574
		<u>Lb. In.</u>
14	Reverse shift cylinder cover capscrews	81 to 101

Tolerances

15	All Forks in Sliding Clutches		
		Minimum New	Maximum New
	Side Clearance	0.005	0.020
			Maximum Wear
			0.050*

* If unit has experienced disengagement, side clearance must not exceed 0.030 maximum.

16	Shift rail poppet springs
	Free Height. 2.25 inches
	Test at 1-17/32 inches 42.4 pounds

17	<u>Thrust Washer</u>	<u>Available Thickness</u>
	First Speed Gear: Select correct thickness to obtain 0.025 to 0.035 inch mainshaft gear end play.	0.143 inch 0.158 inch 0.173 inch 0.188 inch
	* NOTE	0.203 inch 0.218 inch
	The 0.025 to 0.035 inch mainshaft gear end play cannot vary more than 0.005 inch among the three countershaft measurements.	0.233 inch 0.248 inch 0.263 inch

18	Shift rail to mating housing bore	0.010 inch maximum
19	Oil pump vane to mating bore	0.006 inch maximum
20	Reverse idler gear end play	0.003 inch minimum to 0.023 inch maximum

TOOLS

S500	Front Countershaft Rear Bearing Inner Race Removal Tool
S501	Rear Mainshaft Front Bearing Removal Tool
S593C	Rear Countershaft Rear Bearing, and Front Countershaft Front Bearing Removal Tool

Above tools available from:

Shel's Supply and Equipment Company
496-504 Orange Avenue
West Haven, Connecticut 06516
Phone (203) 934-8544

J23387-01	Main Drive Pinion Bearing Cover Oil Seal and Eccentric Removal Tool
J-23796	Main Drive Pinion Bearing Cover Installation Tool
J-28668	Reverse Idler Shaft Removal Tool
J-29031	Drive Flange Removal Tool
J-4646	Snap Ring Pliers
J-6435	Snap Ring Pliers
J-24339	Snap Ring Pliers
J-25445	Snap Ring Pliers
J-29045	Snap Ring Pliers

Above tools available from:

Kent Moore Corporation
1501 South Jackson Street
Jackson, Michigan 49203
Phone (517) 784-8561

CG-250	Front Mainshaft Front Spigot Bearing Removal Tool
CG-270	Rear Countershaft Front Bearing Removal Tool

Above tools available from:

Snap-On Tools Corp.
Kenosha, Wisconsin 53140
Phone (414) 654-8681

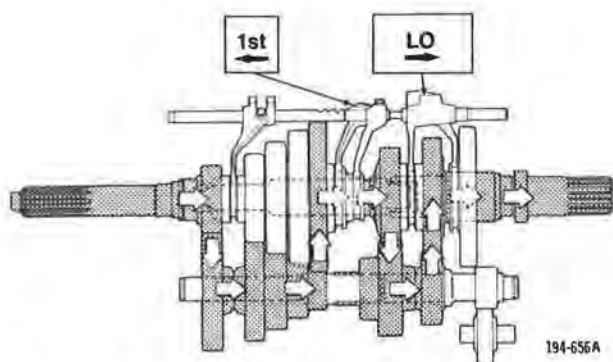


Figure 5-564. First Speed Lo

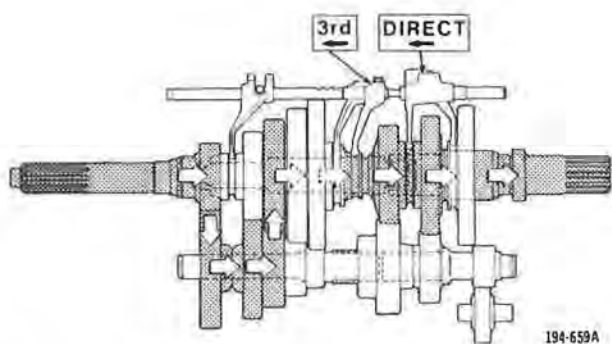


Figure 5-567. Third Speed Direct

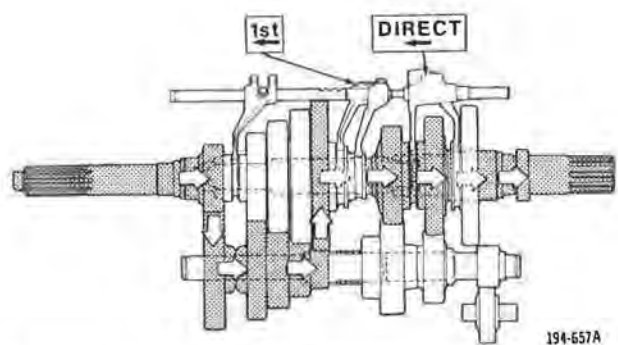


Figure 5-565. First Speed Direct

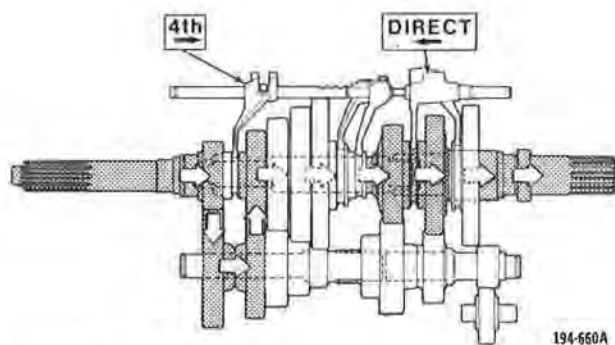


Figure 5-568. Fourth Speed Direct

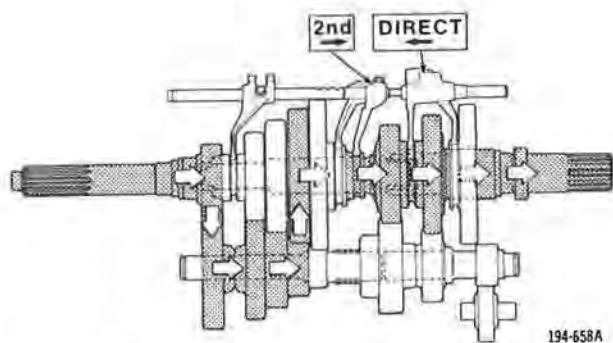


Figure 5-566. Second Speed Direct

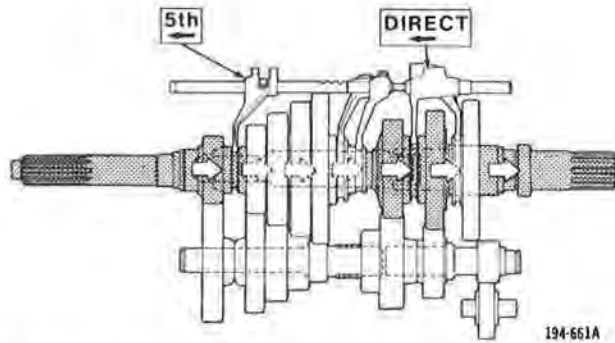


Figure 5-569. Fifth Speed Direct

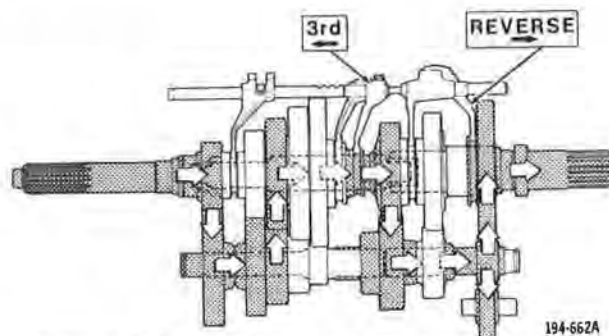
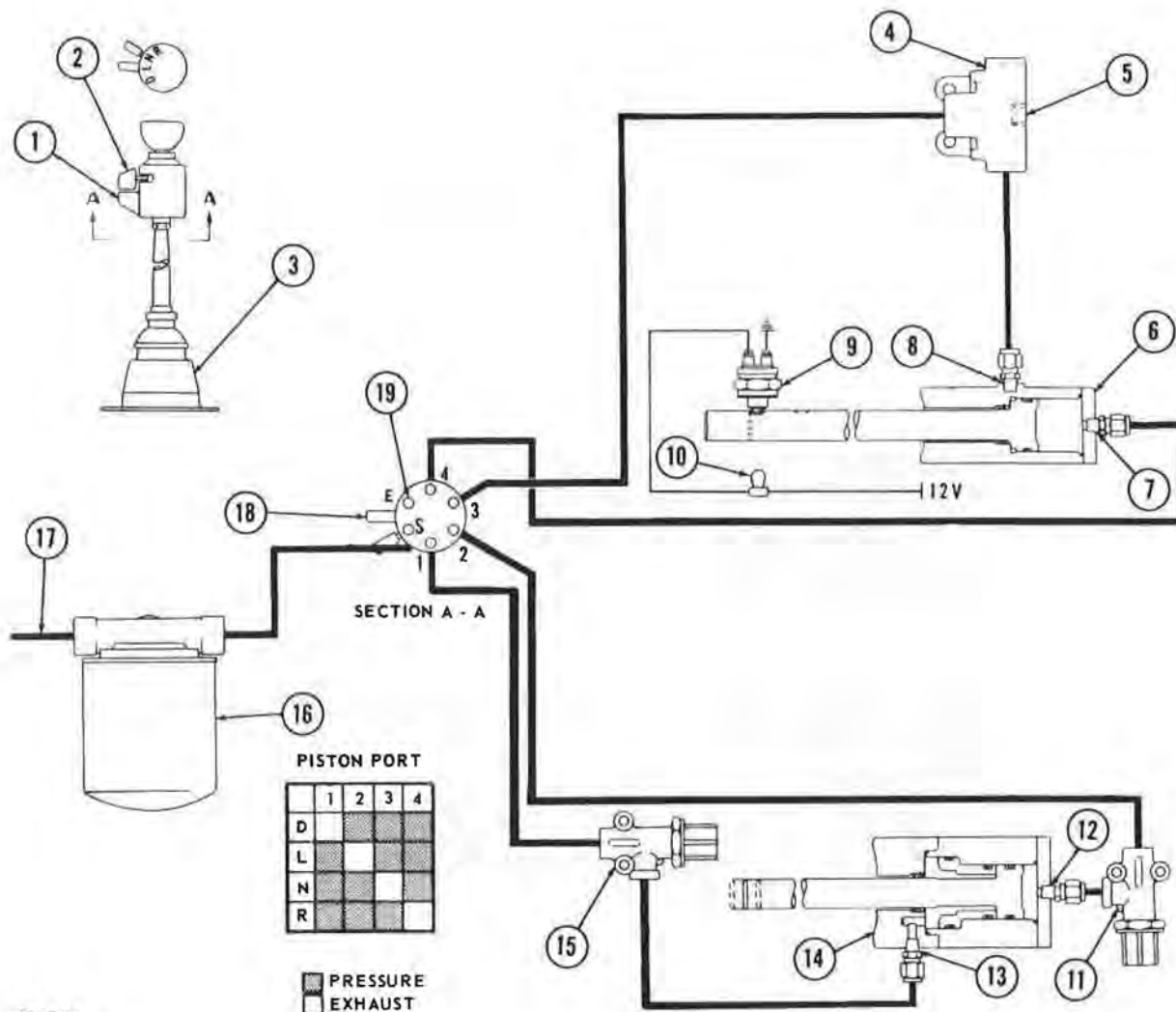


Figure 5-570. Reverse (using Third)

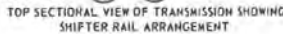


29-57A

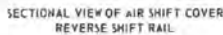
AIR CONTROL SYSTEM SCHEMATIC

- | | |
|---|---|
| 1. Air Control Reference Locator | 11. Pressure Reducing Valve (60 psi delivery) |
| 2. Air Control Select Lever | 12. Number 2 Port |
| 3. Gear Select Lever | 13. Number 1 Port |
| 4. Quick Release Valve | 14. Lo/Direct Shift Cylinder |
| 5. Exhaust | 15. Pressure Reducing Valve (60 psi delivery) |
| 6. Reverse Shift Cylinder | 16. Air Filter |
| 7. Number 4 Port | 17. Air Supply |
| 8. Number 3 Port | 18. Selectair Valve |
| 9. Back-Up Switch (normally open) | 19. Exhaust |
| 10. Amber Indicator Light (on in reverse) | |

SCREW TORQUES & ADJUSTMENT CHART



**CALLOUTS REFER TO
TORQUE AND TOLERANCE
TABLE ITEM NUMBERS**



MACK TEN SPEED DIRECT MAXITORQUE TRANSMISSION TRDL107 (Early Production)

DESCRIPTION

The TRDL-107 is a triple countershaft non-synchronized transmission providing ten forward speeds and five reverse speeds. This transmission has a main box gear set of five forward speeds plus an integrated air shifted compound gear set which provides an underdrive splitter ratio for each main box ratio available. See Figure 5-571.

Because of its location behind the main box forward gears, reverse is also air controlled, thus providing five ratios.

Only one manually-shifted control lever is provided, which controls only the main box gearset. The compound gearset is shifted by an air control valve mounted on the gear shift lever. The valve has a finger-operated flipper to direct the air to cylinders for shifting the rear section into direct, split and reverse. See Specifications for gear ratios and shift pattern.



- | | |
|--------------|-----------------|
| 1. Air Shift | 3. Magnetic Oil |
| Cover | Filter Plug |
| 2. Breather | 4. Filler Plug |

Figure 5-571, Right Front View of
Transmission

Unlike conventional transmissions, three countershafts are equally spaced around the mainshafts. This design provides extremely high capacity in a short overall length. By distributing the load equally among three shafts, normal deflection is reduced to a minimum.

Another unique design is that the mainshaft gears are either splined to the mainshaft or self centered among the three countershafts, thus eliminating the need for gear bushings.

All gears of the gear set are of the spur type design and with the exception of reverse speed sliding gear, are in constant mesh with the countershafts.

LUBRICATION

All rotating and sliding parts of the transmission are bathed in oil from gear throw-off when in operation. However, the sliding clutches and mainshaft gears require more positive provision for lubrication, and for this reason, pressure lubrication of the clutches and gears is provided by a simple eccentric shuttle type pump built in the main driving pinion. As the pinion rotates, the pump vane reciprocates in its eccentric housing, thus forcing lubricant under pressure through rifle-drilled holes in the mainshaft to the sliding clutches and mainshaft gears. To supply the pump, oil from the gear throw-off is collected by a trough located above the main driving pinion and is then gravity fed to the pump.

Removal of all ferrous metallic particles within the transmission is accomplished by a magnetic oil filter on the side of the case. The filter consists of an integral open trough and baffle arrangement with a removable sheet metal cover. At the bottom of the baffle, a tapped hole in the case accommodates a large hex plug with a powerful built-in magnet.

The oil from gear throw-off is collected by the filter and is made to pass the magnetic plugs which pull all ferrous metal particles out of the passing oil and holds them. After passing the magnet, clean and chip-free oil then rises to the outlet near the top of the filter and drops down into the transmission case. A magnetic drain plug is also provided at the bottom of the case.

When the oil is hot, as when coming in from a run, the oil level of the transmission should be checked with the vehicle on level ground. To add oil, remove plug on the right side of the case and fill. The level should not be above the filler-plug hole. Check level at interval specified.

At every check or change, always remove, clean and reinstall magnetic plug on side of case.

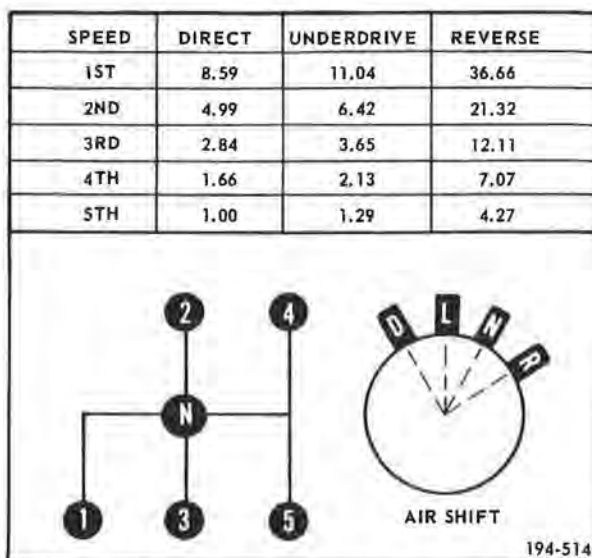
To change oil, remove magnetic drain plug and drain oil from case while hot. If necessary, also flush case with flushing oil and drain thoroughly. Clean and replace magnetic drain plug. Remove fill plug and fill with specified gear oil to level of filler plug hole. Reinstall filler plug. Follow schedule instructions closely and if operation requires it, make checks and changes more often.

NOTE

Earlier production transmissions used two magnetic filter plugs, one on either side of the main compound.

SPECIFICATIONS

Gearset, Make Mack
Model TRDL-107
Type Three Countershafts
Control Selective, One Lever,
Main Box (Manual)
Compound (Air-Actuated)
Speeds, Forward Ten
Reverse Five
Bell Housing, Type Separable
Lubrication Gear throw-off and pump
feed through rifle drilled
passages in mainshaft to
sliding clutches and main-
shaft gears
Pump, Type . . Built-in reciprocating vane
Case, Material Aluminum
P.T.O. Openings
Left Side Std. SAE 8 hole
Right Side Std. SAE 6 hole
Oil Capacity, Pts. 22
Air Filter . . . Change air filter every 50,000
miles or one year, whichever
comes first
Selectair Valve . . . Every 50,000 miles or
one year, whichever
comes first, disassem-
ble the valve for clean-
ing, inspection and lub-
rication. See Disassem-
bly of Sub-Assemblies
for disassembly proce-
dure.



Gear Ratios and Shift Sequence

DISASSEMBLY

Main Components

NOTE

Unless a complete overhaul is necessary, remove only those parts required to gain access to the faulty parts. Do not disturb parts having heavy press fits unless replacement is necessary. In that case, use proper press setups and pullers so that usable parts are not damaged.

1. Remove air lines from air shift cover assembly. However, to assemble air lines more easily at reassembly, tag each line with the same number stamped near the fitting of the air shift cover.
2. After draining lubricant and removing transmission from vehicle, clean externally and mount unit in overhaul stand.
3. Remove hand brake parts, clutch release shaft and yoke.
4. Remove transmission front case top opening cover. Remove air shift cover assembly. See Figure 5-572.



Figure 5-572. Removing Air Shift Cover Assembly

5. Cautiously remove shifter rail poppet ball cover (cover is spring loaded), springs and balls. See Figure 5-573.

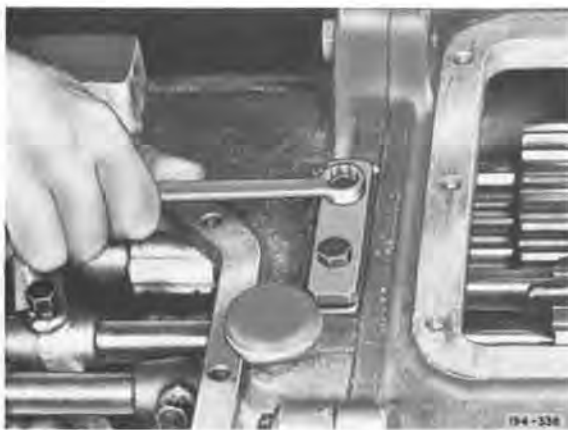


Figure 5-573. Remove Shifter Rail Poppet Ball Cover

6. Remove shifter and shifter fork set-screws. Withdraw shift rails from front case and at the same time remove shifter forks and shifters. See Figure 5-574.

7. Place transmission in two gears which will lock up assembly to facilitate the removal of the drive flange clamp plate screw. Remove clamp plate screw and clamp plate. Install standard puller and remove drive flange from rear mainshaft splines.

8. Remove transmission front case to rear case capscrews and dowel bolts, and with the aid of a hoist, remove rear case from front case. See Figure 5-575. Place rear case on a clean bench for disassembly.

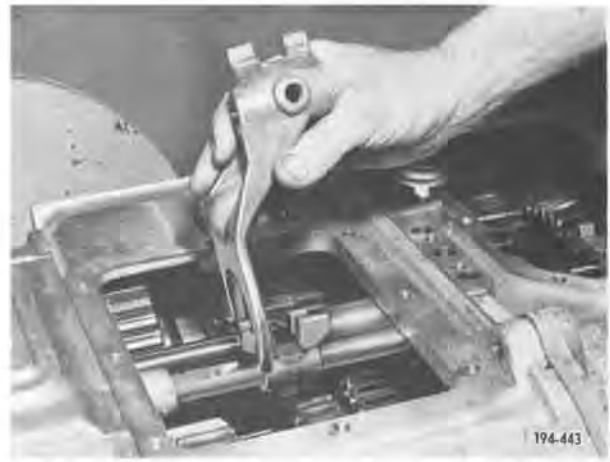


Figure 5-574. Removing Fourth and Fifth Speed Shifter Fork

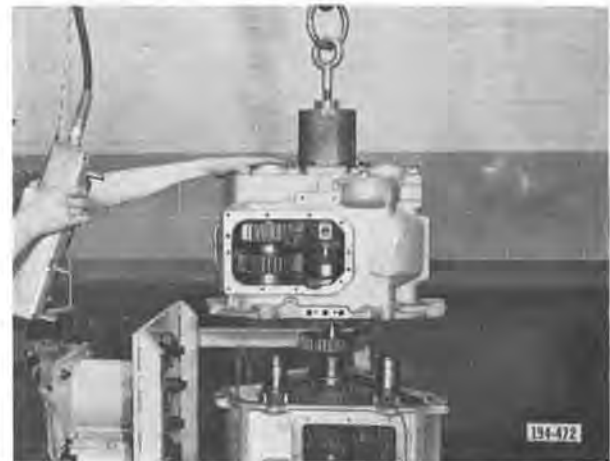


Figure 5-575. Removing Rear Case from Front Case

CAUTION

Front and rear case must be held in good alignment during removal to eliminate binding of these countershaft bearings. Do not force cases apart.

REAR CASE

1. With rear case on a bench, remove mainshaft rear bearing cover capscrews and cover. See Figure 5-576. Remove countershaft rear bearing cover capscrews and cover.

2. Slide Direct and Lo-range sliding clutch off shift rail and mainshaft. See Figure 5-577. Remove Direct and Lo-range shifter rail cap-screw and remove shift rail. See Figure 5-578.

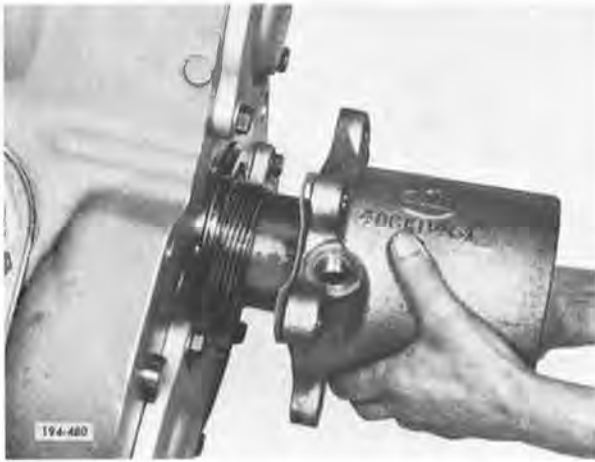


Figure 5-576. Removing Mainshaft Rear Bearing Cover



Figure 5-577. Removing Direct and Lo-Range Sliding Clutch



Figure 5-578. Removing Shifter Rail Capscrew

3. Through rear case front opening, remove Lo-range gear retaining snap ring. Then remove Lo-range gear front thrust washer. See Figures 5-579 and 5-580.



Figure 5-579. Removing Lo-Range Gear Retaining Snap Ring

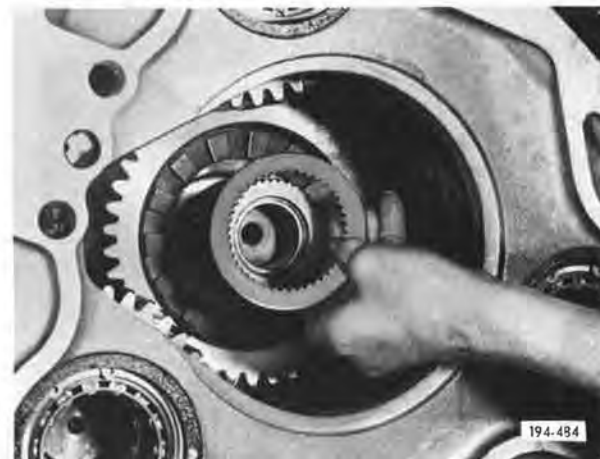


Figure 5-580. Removing LO-Range Gear Front Thrust Washer

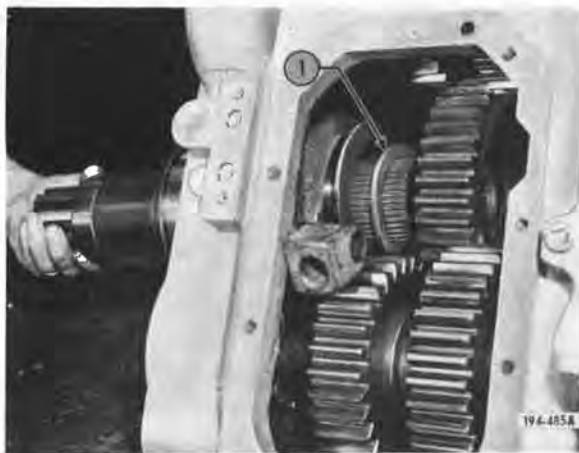
4. Carefully withdraw rear mainshaft from case through rear bearing opening and at the same time slide Lo-range gear rear thrust Washer off of mainshaft. See Figure 5-581.

5. Remove Lo-range gear from rear case. See Figure 5-582.

NOTE

Reverse gear must be engaged before removing Lo-range gear.

6. Remove reverse gear shifter fork. See Figure 5-583.



1. Lo-Range Gear Thrust Washer

Figure 5-581. Removing Rear Mainshaft



Figure 5-582. Removing Lo-Range Gear

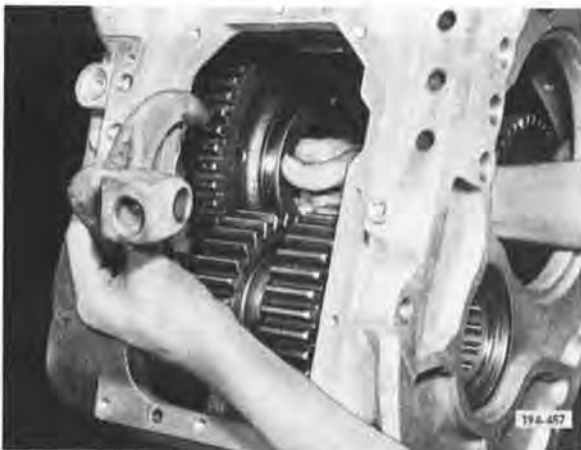


Figure 5-583. Removing Reverse Gear Shifter Fork

7. Slide the three rear countershafts rearward and partially through rear bearing opening. Remove bearing retaining snap ring. Install puller on countershaft rear bearings and remove. See Figure 5-584. Then remove the three rear countershaft assemblies from case.



Figure 5-584. Removing Countershaft Rear Bearing

8. Remove reverse gear.

9. With a suitable puller, withdraw the three idler gear shafts from case. Remove idler gears, bearings and thrust washers from case.

10. Remove front countershaft rear roller bearing retaining snap ring and roller bearing from case.

FRONT CASE

1. With front case in a vertical position, remove mainshaft Lo-range main drive gear retaining snap ring. See Figure 5-585.



Figure 5-585. Removing Lo-Range Main Drive Gear Retaining Snap Ring

2. Remove Lo-range main drive gear. See Figure 5-586.



Figure 5-586. Removing Lo-Range Main Drive Gear

3. Remove front countershaft selective thrust washer snap rings from the three countershafts, then remove the three countershaft selective thrust washers. See Figures 5-587 and 5-588.

NOTE

Establish a way to keep selective thrust washer with its respective countershaft assembly for reassembly.



Figure 5-587. Removing Countershaft Selective Thrust Washer Snap Ring



Figure 5-588. Removing Selective Thrust Washer

4. Remove first speed gear sliding clutch, first speed gear, first speed gear thrust washer, second speed gear and second speed gear thrust washer. See Figures 5-589, 5-590, and 5-591.



Figure 5-589. Removing First Speed Gear Sliding Clutch



Figure 5-590. Removing First Speed Gear

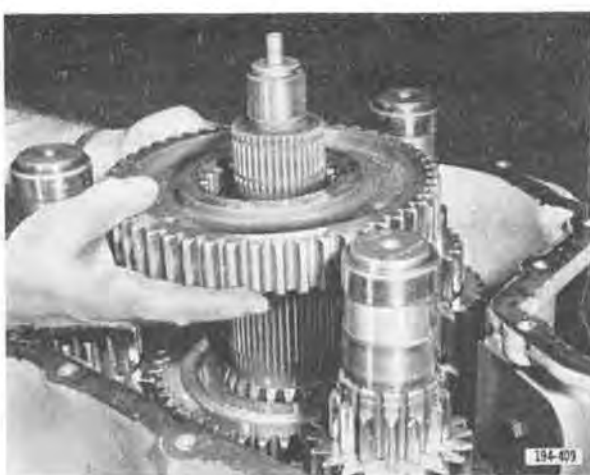


Figure 5-591. Removing Second Speed Gear

5. Remove front mainshaft assembly. See Figure 5-592.



Figure 5-592. Removing Front Mainshaft Assembly

6. Place transmission front case in a horizontal position and remove countershaft front bearing covers. Remove main drive pinion bearing cover assembly. See Figure 5-593.



Figure 5-593. Removing Main Drive Pinion Bearing Cover Assembly

7. Remove oil pump vane from main driving pinion. Tap on gear end of main driving pinion with a nylon mallet, if necessary, and remove assembly from case. See Figures 5-594 and 5-595.



Figure 5-594. Removing Oil Pump Vane

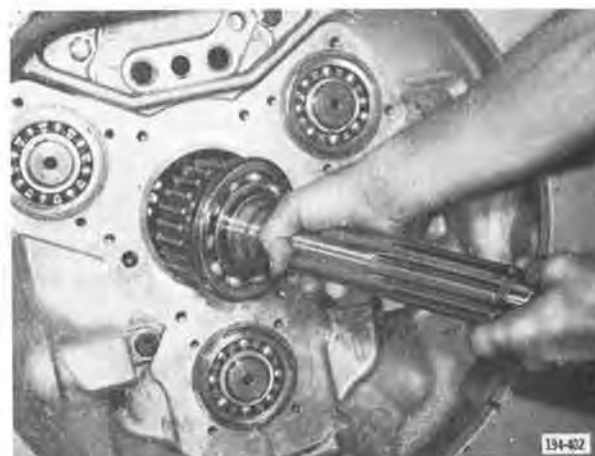


Figure 5-595. Removing Main Driving Pinion Assembly

8. Remove countershaft front ball bearing positioning snap ring. See Figure 5-596.



Figure 5-596. Removing Countershaft Front Bearing Positioning Snap Ring

9. Place transmission front case vertically and remove the three countershaft assemblies from case. See Figure 5-597.



Figure 5-597. Removing Front Countershaft Assemblies

SUB-ASSEMBLIES

Main Driving Pinion

Remove bearing retaining spirollox snap ring. See Figure 5-598. Then remove pinion ball bearing by pressing or tapping off.



Figure 5-598. Removing Pinion Bearing Retaining Spirollox Snap Ring

Main Driving Pinion Bearing Cover

Early Production:

Using oil pump sleeve remover J-23387-01, remove oil pump sleeve and seal assembly as follows: Insert remover in cover. Place spreader jaws behind oil seal, then tighten

setscrew to expand jaws and grip rear of oil seal. Place assembly in arbor press and press seal and pump sleeve out of housing. See Figures 5-599 and 5-600.

Current Production:

In current production transmission, oil seal is not installed in oil pump sleeve, therefore when replacing oil seal, do not remove sleeve unless a new sleeve is required.

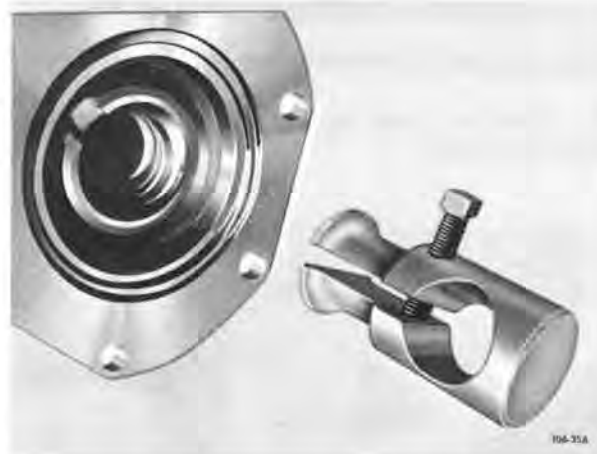


Figure 5-599. Installing Sleeve Remover Tool With Griper Jaws Contracted

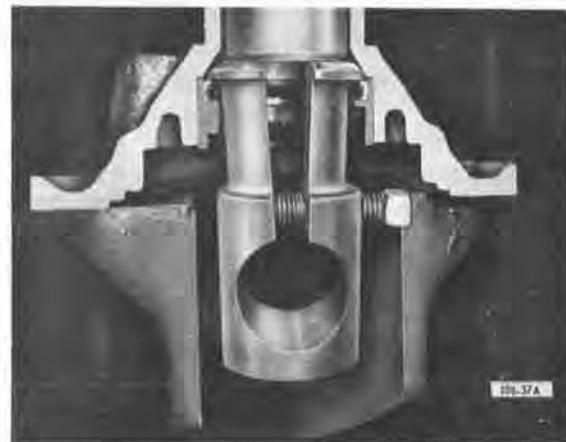


Figure 5-600. Cutaway Detail of Installed Remover and Cover in Press Set-Up

Front Mainshaft

Remove front mainshaft front spigot ball bearing retaining snap ring, and ball bearing. Remove fourth and fifth speed gear sliding clutch. Remove fourth speed gear snap ring (see Figure 5-601) and continue disassembling mainshaft as follows: fourth speed gear splined thrust washer, fourth

speed gear with thrust washer, third speed gear with thrust washer and second/third speed sliding clutch. Then remove mainshaft rear bearing inner race spirollox snap ring and bearing inner race.



Figure 5-601. Removing Fourth Speed Gear Retaining Snap Ring

Rear Mainshaft

Remove mainshaft front roller bearing retaining spirollox snap ring. See Figure 5-602. Then remove roller bearing. Turn mainshaft over and remove rear bearing cover bearing inner race, spacer, speedometer gear and rear ball bearing from mainshaft. Remove reverse sliding gear stop snap ring.



Figure 5-602. Removing Roller Bearing Retaining Snap Ring

Direct and Lo-Range Sliding Clutch Assembly

To disassemble direct and Lo-range sliding clutch assembly, remove the six capscrews and nuts.

Front Countershafts

Remove countershaft front bearing retaining snap ring and bearing. Remove countershaft gear retaining snap ring. Turn countershafts over and remove rear countershaft bearing inner race retaining spirollox snap ring and inner race, spacer and front countershaft rear bearing inner race from shaft.

For shops having a small capacity hydraulic press, press off one countershaft gear at a time. For shops having a large capacity hydraulic press, place countershaft assembly in press, slide length of heavy tubing over integral gear to engage the second speed gear and remove all gears in one operation.

Rear Countershafts

Remove countershaft front bearing retaining snap ring and bearing. Remove countershaft gear retaining snap ring. Place countershaft in hydraulic press and press gears off of shaft.

Rear Mainshaft Rear Bearing Cover

Remove oil seal from bearing cover. Remove roller bearing retainer snap ring and bearing.

Air Shift Cover Assembly

Disassemble air shift cover assembly, the opposite of reassembly procedure, as outlined under Reassembly of Sub-Assemblies.

Selectair Valve - See Figure 5-603.

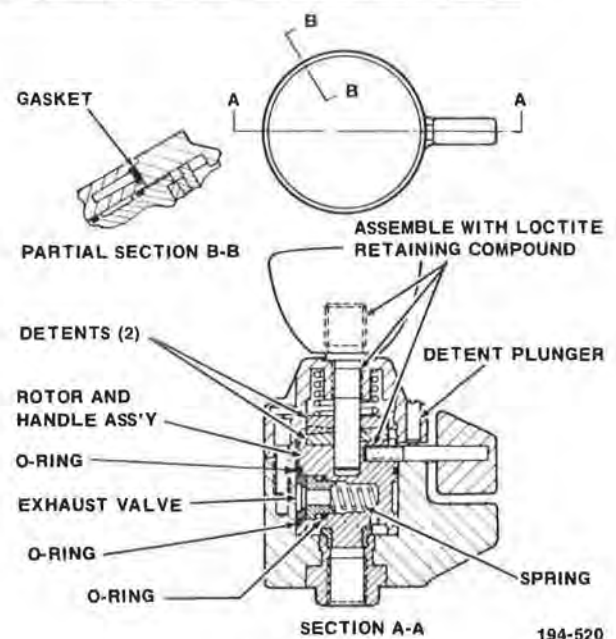


Figure 5-603. Selectair Valve Assembly

Remove shift lever knob. Remove the cover by removing three Phillips head screws.

NOTE

The cover provides compression for the detent spring; therefore these screws should be loosened evenly to prevent jamming or cocking due to this spring.

Remove the spring and both plastic detent wafers, clean and set aside. Remove the rotor assembly, being careful after exposing the top O-ring that the bonded rubber exhaust valve does not pop out and become lost. Carefully remove the spring behind the valve before completely removing the rotor from the body.

Clean all metal parts in a non-flammable solvent. Wash rubber and plastic parts with soap and water. Rinse all parts thoroughly and blow dry with a low pressure air jet. Replace those parts which are damaged or worn. In the case of rubber parts, where one is worn, it is recommended that all be replaced.

All rubber parts and the bores that they work in must be lubricated sufficiently with Dow Corning Number 55 Pneumatic grease or equivalent. Also lubricate the detent assembly with Sun M891T grease or equivalent.

Reassemble the Selectair valve the opposite procedure of disassembly. Care should be taken during reassembly not to cut or nick any of the rubber seals.

INSPECTION

Clean case, covers and all other parts of transmission thoroughly, using a suitable cleaning solvent to remove all grease and foreign matter. Dry parts with moisture-free compressed air.

Bearings

Soak bearings in a suitable cleaning solvent to loosen all hardened grease and foreign matter. Strike bearings flat against block of wood several times and again immerse in cleaning solvent turning races slowly. Repeat these operations until bearings are clean and then blow them dry with filtered moisture free compressed air.

CAUTION

Do not spin bearings with compressed air as damage to the bearing may result.

Bearings

Check bearings for flaking, cracks and fractures, cavities and indentations, measurable wear, brinelling, fretting, corrosion, seizing, galling, scoring, nicking and cage failures. If any of these are apparent in any amount, they should be replaced.

Gears

Replace gear if teeth show any sign of abrasive wear, scratching, ridging, scoring, surface fatigue, pitting, spalling, corrosive wear, digging in and cracking. Gears may also be checked by Magnaflux or similar system for cracks which would not otherwise be visible.

Shifter Fork, Sliding Clutch and Shift Rail

Replace forks and/or clutches if side clearance in groove is in excess of specified limits, shown on "Screw Torques and Adjustment Chart." Replace shift rails if cracked in either the poppet or stake screw holes. In the case of wear, whereby the clearance between the shift rail and the mating housing bore exceeds .010 inch maximum, check to determine which member is worn before replacing same. Shaft wear may be checked by comparing shaft diameter at an "unwearing" point as against the wear point.

Vane Oil Pump Parts

Renew pump parts only if they are scored or chipped or if vane is loose in its mating bore in excess of .006 inch.

Oil Seals

When a complete overhaul is required, replace all oil seals.

When replacing main driving pinion cover oil seal, refer to Disassembly of Sub-Assemblies and Reassembly of Sub-Assemblies.

Selectair Valve

See Disassembly of Sub-Assemblies

Replace cases found to be cracked. Check all other parts for wear and damage. Replace all parts as required. Replace all gaskets, O-rings, staked nuts and any part that shows mutilation. Replace poppet springs that have lost their tension. Clean up any threads that show mutilation.

Measuring Oil Pump Pressure

Pressure of the pump is low and therefore difficult to measure. A functional check should be made on the pump prior to installing the transmission cover. This can be accomplished by pouring oil into the pump pick-up trough while revolving the main driving pinion clockwise. If the pump is functioning, oil will appear at various outlets along the mainshaft. This practice will also insure initial prime to the pump.

REASSEMBLY

NOTE

Refer to "Screw Torques and Adjustment Chart" for fits and limits.

SUB-ASSEMBLIES

NOTE

All working parts, especially the bearings, should be coated with SAE30 oil while the transmission is being assembled. This will insure immediate lubrication when first starting and will prevent seizing of these parts. As moving parts are assembled, check frequently to see that they move freely.

Main Driving Pinion

Install oil tube if removed at disassembly. Turn pinion over and install ball bearing with outer race snap ring toward pilot end of pinion. Install bearing retaining spirolox snap ring. See Figure 5-604.



Figure 5-604. Installing Pinion Bearing Retaining Spirolox Snap Ring

Main Driving Pinion Bearing Cover

Early Production:

Apply gasket sealer to the press fit outside diameter of a new oil seal. Care must be exercised to avoid getting any sealer on the sealing lip. Place oil pump sleeve on press table with oil seal counterbore facing up. With lip of oil seal down, press oil seal in counterbore of sleeve until metal flange of seal is flush with sleeve. Spread a 1/8 inch diameter bead of cement, 243SX26, in the corner of the cover bore. Register pump sleeve oil inlet slot with pump oil supply slot in cover. Press sleeve assembly into cover and tight against cover shoulder. See Figure 5-605.

CLEAN SURFACE AND SPREAD 1/8 IN. DIA. BEAD OF 243SX 26 SILASTIC IN THIS CORNER OF COVER BORE. PRESS SLEEVE ASSEMBLY TIGHT AGAINST COVER SHOULDER. WIPE ALL EXCESS SEALANT FROM AFFECTED AREAS.

OIL SEAL MUST BE PRESSED FLUSH WITH SLEEVE OUTSIDE FACE AND WITH LIP IN DIRECTION SHOWN.

OIL INLET SLOT IN PUMP SLEEVE MUST REGISTER EXACTLY WITH PUMP OIL SUPPLY SLOT IN COVER.

194-515

Figure 5-605. Sectional View of Main Drive Pinion Bearing Cover Assembly (Early Production)

Current Production:

If sleeve was removed at disassembly, apply Loctite grade "B" to clean sleeve outside diameter and cover bore. Register pump sleeve oil inlet slot with pump oil supply slot in cover. Press sleeve into cover until sleeve is flush with face of cover bore. See Figure 36. Then wipe all excess sealant from area. Press oil seal in cover counterbore as shown in Figure 5-606.

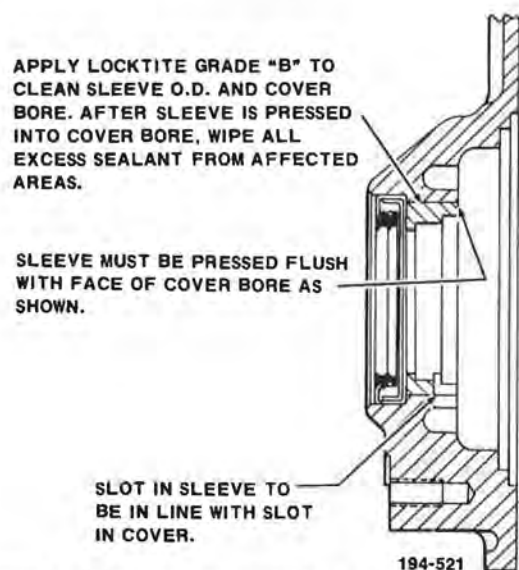


Figure 5-606. Sectional View of Main Drive Pinion Bearing Cover Assembly (Current Production)

Front Mainshaft

NOTE

Since mainshaft third speed gear will be needed for timing the countershafts, do not assemble front mainshaft at this time.

Rear Mainshaft

Press mainshaft rear ball bearing on shaft then install positioning snap ring in outer race of ball bearing. Install speedometer gear, spacer and rear bearing cover bearing inner race on shaft. Install reverse stop snap ring if removed at disassembly.

Install mainshaft front roller bearing. See Figure 5-607. Then install spirolox snap ring to retain bearing. See Figure 5-608.



Figure 5-607. Installing Front Roller Bearing



Figure 5-608. Installing Front Roller Bearing Snap Ring

Direct and Lo-Range Sliding Clutch Assembly

Observe the alignment "O" marks stamped above the capscrew hole on each sliding clutch half. See Figure 5-609. These capscrew holes must be in alignment when assembling clutch halves to the clutch fork.

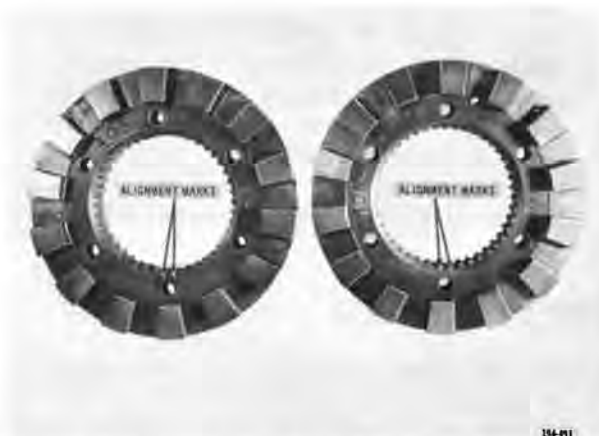


Figure 5-609. Direct and Lo-Range Alignment "O" Marks

Place needle bearing cages on clutch half and assemble clutch halves to clutch fork being sure capscrew holes with "O" marks are in alignment. See Figure 5-610. Install capscrews and nuts, and tighten finger tight only.



Figure 5-610. Exploded View of Direct and Lo-Range Sliding Clutch Assembly

Align internal clutch teeth as follows:

Place rear mainshaft in a soft jawed vise. Install sliding clutch assembly on mainshaft and lightly tap each clutch half (in the same direction) to align the internal clutch teeth. See Figure 5-611. Torque the capscrews to 100 lbs. inch.



Figure 5-611. Aligning Sliding Clutch Internal Teeth

Front Countershafts

See Figure 5-612.

Insert gear key in countershafts and press gears on one at a time. These gears have an interference fit and can be pressed on cold, but for best results, the gears should be heated. With a heat lamp, or hot oil, heat gears to 270 to 300 degrees F. for a period of not more than 1/2 hour. Oil shaft for each gear. Install gear snap ring. Press ball bearings on end of shafts then install ball bearing retaining snap rings.

Turn countershafts over and install front countershaft rear bearing inner race, spacer, rear countershaft inner race and retaining snap ring.

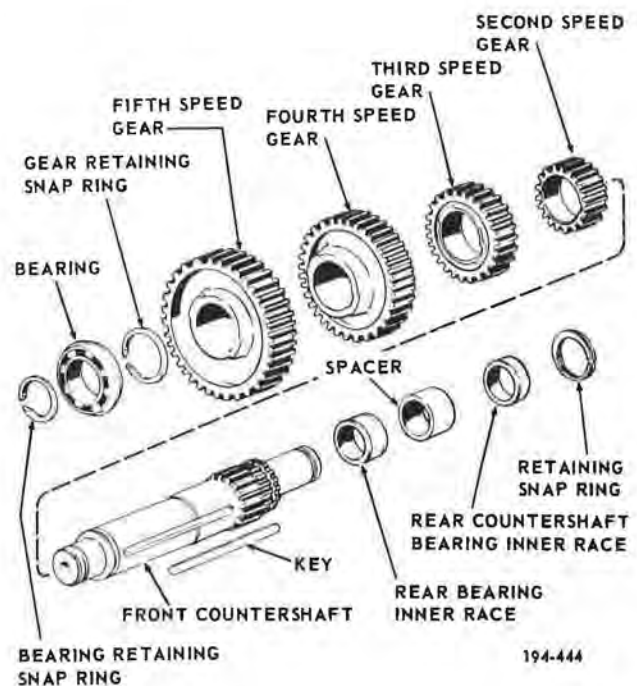


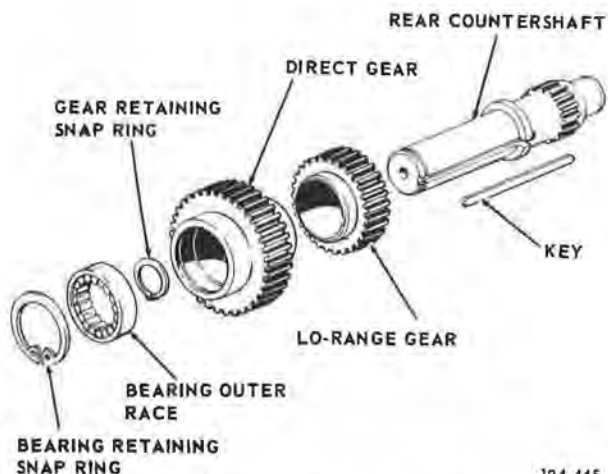
Figure 5-612. Front Countershaft Assembly

Rear Countershafts

See Figure 5-613.

Insert gear key in countershafts and press gears on one at a time. These gears have an interference fit and can be pressed on cold, but for best results, the gears should be heated. With a heat lamp or hot oil, heat gears to 270 to 300 degrees F. for a period of not more than 1/2 hour. Oil shaft for each gear. Install gear retaining snap ring.

Install front bearing in countershaft gear and retain with snap ring.



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Figure 5-613. Rear Countershaft Assembly

Rear Mainshaft Rear Bearing Cover

Install roller bearing in cover and retain with snap ring. Install oil seal.

Air Shift Cover Assembly- See Figure 5-614.

NOTE

Lubricate O-rings with an O-ring lubricant before installation.

Install teflon rings with O-rings (4) in grooves provided in air shift cover assembly (3). Install O-ring (10) in groove provided in Direct and Lo-range shift rail (11). Install O-rings (18) and (20) in grooves provided in Direct shift control piston (19), then install piston on Direct and Lo-range shift rail (11). Advance

Direct and Lo-range rail (11) with piston (19) through rear opening of shift cover (3), and at the same time through bottom opening of shift cover install nut (21), lockwasher (22) and Direct and Lo-range shift control lever (23) on rail. Install O-ring (17) in groove provided in Direct and Lo-range shift cylinder (15).

Install cylinder (15) and cylinder cover (13) with O-ring (14) on end of shift cover (3); then install capscrews (12) and tighten to recommended torque.

Install shift rail plunger interlock (2) in air shift cover (3) side opening.

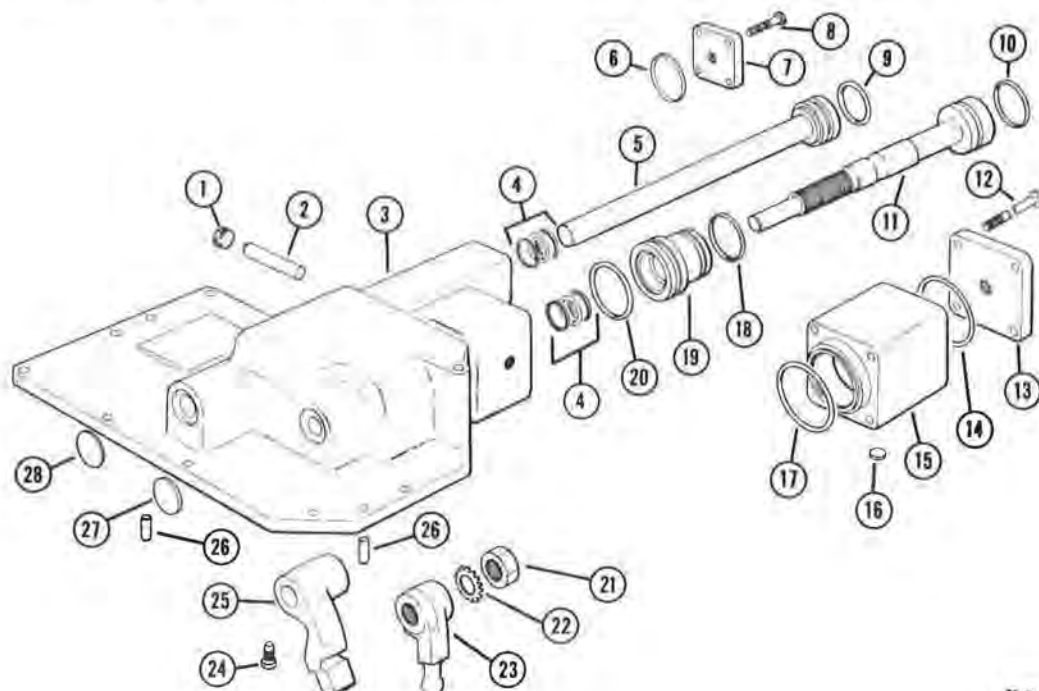
Install O-ring (9) in groove provided in reverse shift rail (5). Advance reverse shift rail (5) through rear opening of shift cover (3) and at the same time, through bottom opening of shift cover install reverse shift control lever (25) on rail.

Install reverse shift cylinder cover (7) with O-ring (6) on end of shift cover (3). Install capscrews (8) and tighten to recommended torque. Install reverse shift control lever tapered screw (24) and tighten to recommended torque.

Install plug (1) in side opening of air shift cover (3).

Install breather (16) in Direct and Lo-range shift cylinder (15) and dowel pins (26) in shift cover (3).

Install expansion plug (28) in shift cover (3).



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Figure 5-614. Exploded View of Air Shift Cover Assembly

NOTE

So that the Direct and Lo-range shift lever can be adjusted do not install expansion plug (27) at this time.

Selectair Valve

See Disassembly of Sub-Assemblies

REAR CASE

1. With transmission rear case on a clean bench, position reverse idler gear shafts so that flats on end of shaft are pointing towards center line of countershaft bore. Start shafts into case. Assemble roller bearing in idler gear. Position the assembled gear in case (rounded teeth of idlers forward) with thrust washers at each end. Advance shaft into case through thrust washers and gear. For final seating of idler gear shafts, see Figure 5-615.

NOTE

Apply sealer around idler gear shafts before final seating.

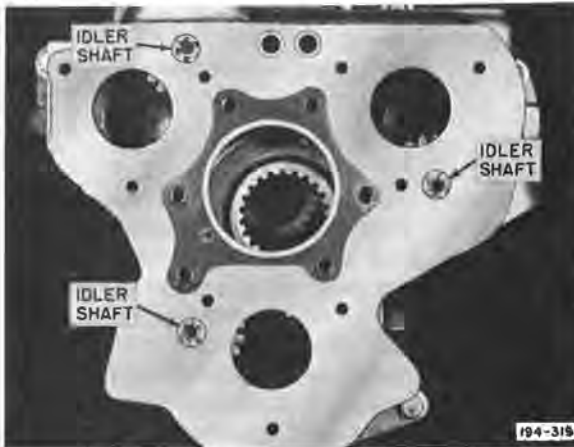


Figure 5-615. Final Seating of Idler Gears

2. Install front countershaft rear roller bearing rear retaining snap ring in groove of case countershaft bores. Install roller bearing against rear snap ring, then install front snap ring in groove provided in case to retain bearings.

3. Install reverse gear in case and engage with the three idler gears.

4. To time the rear countershafts more easily, use the following procedure:

Observe the timing O-marks on the Lo-range countershaft gears. With yellow paint mark the "direct" gear tooth directly opposite Lo-range gear O-marks; then install the three countershaft assemblies in case. See Figure 5-616.

5. Install ball bearing on rear end of all three countershafts. Install positioning snap ring in groove of bearings then install bearing retaining snap rings.



1. Timing Mark
2. Yellow Paint Marking

Figure 5-616. Installing Rear Countershaft Assemblies

6. Engage reverse gear shifter fork in groove provided in reverse speed gear. See Figure 5-617.

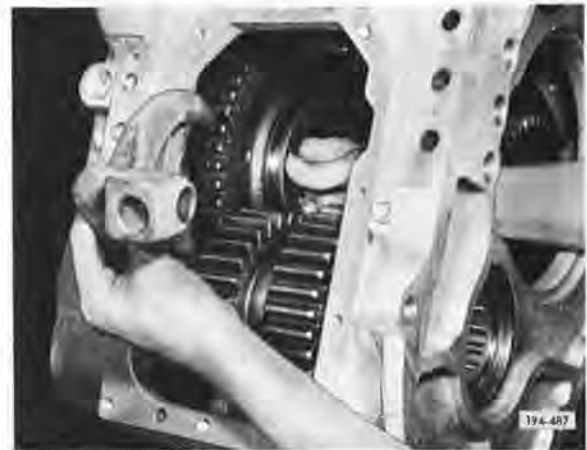


Figure 5-617. Installing Reverse Gear Shifter Fork

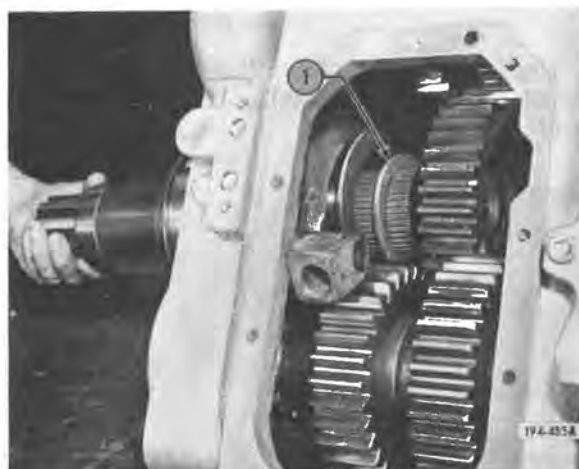
7. Through front opening of rear case install mainshaft Lo-range gear. See Figure 5-618. Temporarily place gear between countershaft direct gear and Lo-range gear.

8. Start rear mainshaft in case through rear bearing opening. Advance shaft through reverse speed gear. Install mainshaft Lo-range gear rear thrust washer on shaft. See Figure 5-619. Continue advancing shaft through Lo-range gear until rear bearing positioning snap ring seats against case.

9. Install O-ring in each of the three countershaft rear bearing covers. See Figure 5-620. Install cover assemblies with capscrews on rear of rear case and tighten capscrews to recommended torque.



Figure 5-618. Installing Lo-Range Gear



1. Lo-Range Gear Rear Thrust Washer

Figure 5-619. Lo-Range Gear Rear Thrust Washer Installed



Figure 5-620. Installing Rear Countershaft Rear Bearing Cover O-ring

10. Apply sealer compound and install mainshaft rear bearing cover gasket and cover assembly. See Figure 5-621. Install cover capscrews and tighten to recommended torque.

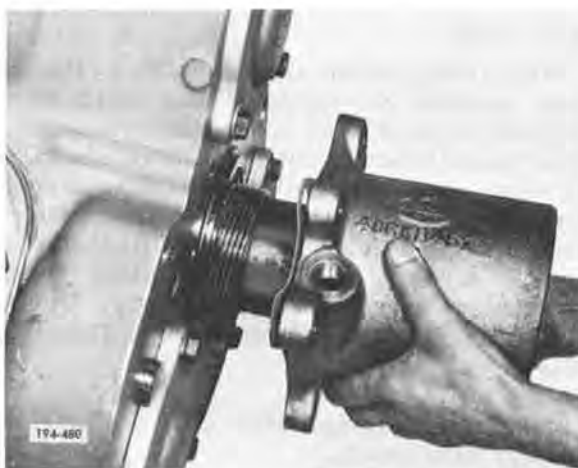


Figure 5-621. Installing Mainshaft Rear Bearing Cover Assembly

11. Disengage reverse gear from the three idler gears. Align the three alignment O-marks on face of mainshaft Lo-range gear with the countershaft Direct gears which were previously marked with yellow paint. See Figure 5-622. When marks are in alignment, engage rear mainshaft Lo-range gear. Be sure O-marks on Lo-range gear align with O-marks on countershaft Lo-range gears before continuing to assemble rear case.

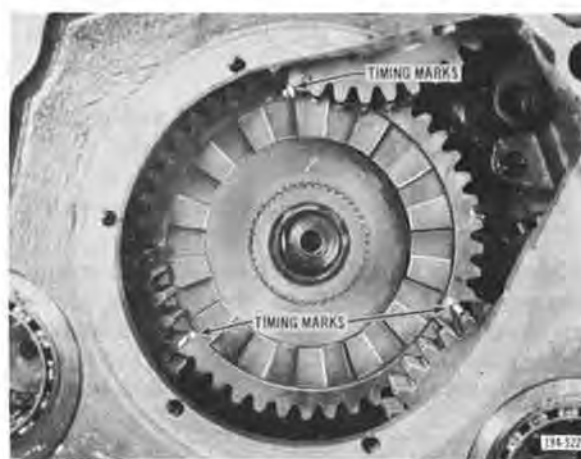


Figure 5-622. Aligning O-Marks on Lo-Range Gear with Countershaft Gears

12. Through rear case front opening install Lo-range gear front thrust washer and retain with Lo-range gear retaining snap ring. See Figures 5-623 and 5-624.

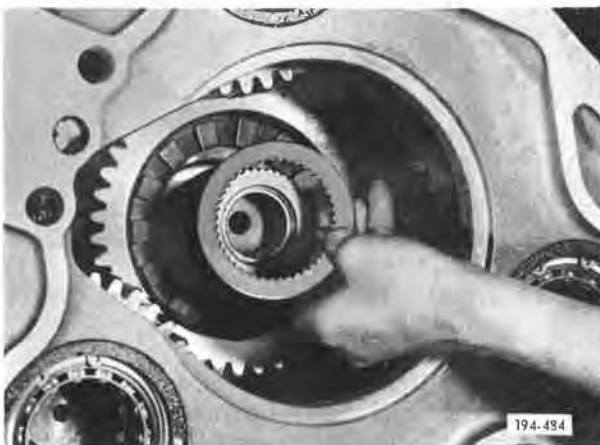


Figure 5-623. Installing Lo-Range Gear Front Thrust Washer



Figure 5-624. Installing Lo-Range Gear Retaining Snap Ring

13. Install Direct and Lo-range shifter rail. Install shifter rail retaining capscrew. See Figure 5-625.

14. Install previously assembled Direct and Lo-range sliding clutch on mainshaft and shifter rail. See Figure 5-626.



Figure 5-625. Installing Shifter Rail Capscrew



Figure 5-626. Installing Direct and Lo-Range Sliding Clutch

FRONT CASE

1. With transmission front case in a vertical position install the three front countershafts. See Figure 5-627.



Figure 5-627. Installing Front Countershaft Assemblies

2. Position front case horizontally. Install front countershaft ball bearing positioning snap rings in outer race of bearings, then tap countershaft assemblies rearward until positioning snap ring seats against case. See Figure 5-628.



Figure 5-628. Installing Countershaft Front Bearing Positioning Snap Ring

3. Temporarily install front mainshaft third speed gear so that the three alignment O-marks on face of gear mate with the alignment O-marks on the countershaft third speed gears. See Figure 5-629.



Figure 5-629. Front Mainshaft Third Speed Gear Temporarily Installed

4. Install main driving pinion assembly into place. See Figure 5-630.

NOTE

After main driving pinion is installed, the countershafts are now timed. Therefore, remove third speed gear from case and set aside until reassembling the front mainshaft.



Figure 5-630. Installing Main Drive Pinion Assembly

5. Install oil pump vane in pinion. See Figure 5-631. Vane should be flush with the right hand side of the pinion shaft and protruding slightly from the left side (as observed from the front of the transmission). This will insure alignment of vane with eccentric bore in cover during assembly.

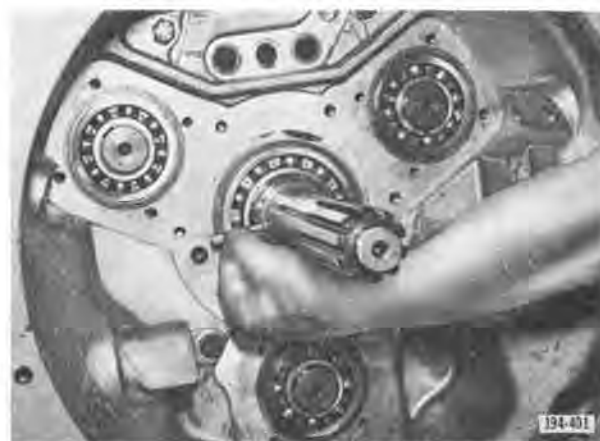


Figure 5-631. Installing Oil Pump Vane

6. Install tool J23796 in main driving pinion bearing cover and carefully through cover oil seal. This tool will eliminate the possibility of cutting oil seal when installing cover over the splined end of main driving pinion. See Figure 5-632. Apply sealer compound and install gasket and cover assembly. Remove tool from cover assembly. Install cover capscrews and tighten to recommended torque.

7. Install O-ring in each of the three countershaft front bearing covers. See Figure 5-633. Install cover assemblies with capscrews on front of front case and tighten capscrews to recommended torque.

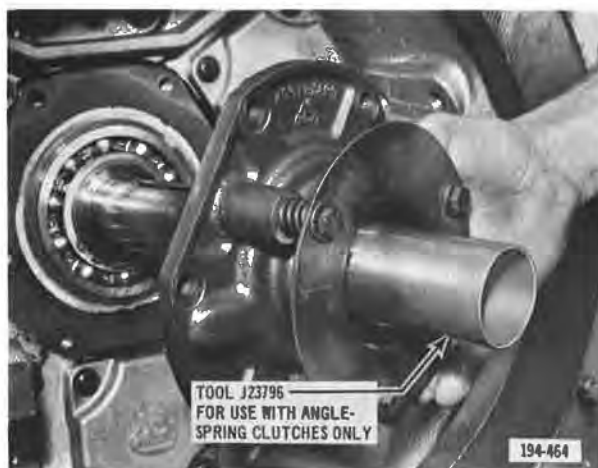


Figure 5-632. Installing Main Drive Pinion Bearing Cover Assembly



Figure 5-633. Installing Front Countershaft Front Bearing Cover O-ring

8. Apply a light coat of grease to front face of third speed gear hub, then place thrust washer on front face of gear hub. See Figure 5-634.

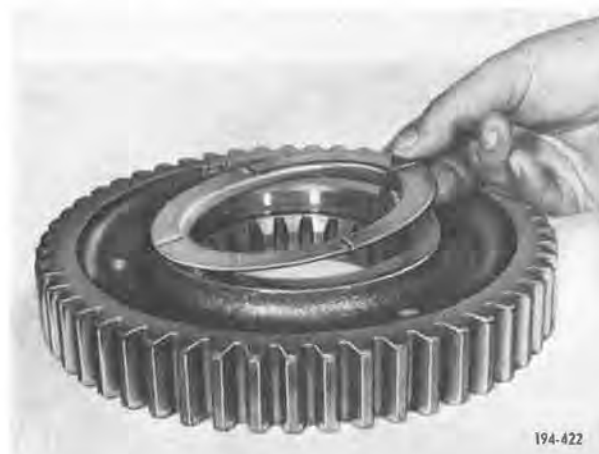


Figure 5-634. Installing Gear Thrust Washer on Third Speed Gear

9. Install second and third speed sliding clutch, third speed gear with thrust washer and fourth speed gear on front mainshaft as shown in Figure 5-635.

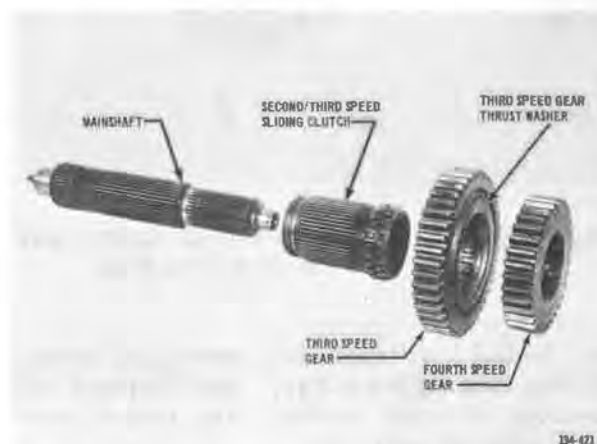


Figure 5-635. Exploded View of Front Mainshaft Assembly

10. Install fourth speed gear thrust washer and splined thrust washer. Then retain assembly with fourth speed gear retaining snap ring. See Figures 5-636 and 5-637.

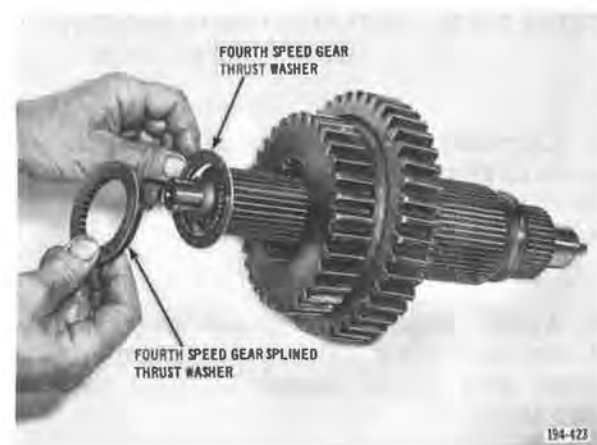


Figure 5-636. Installing Fourth Speed Gear Thrust Washer and Splined Thrust Washer

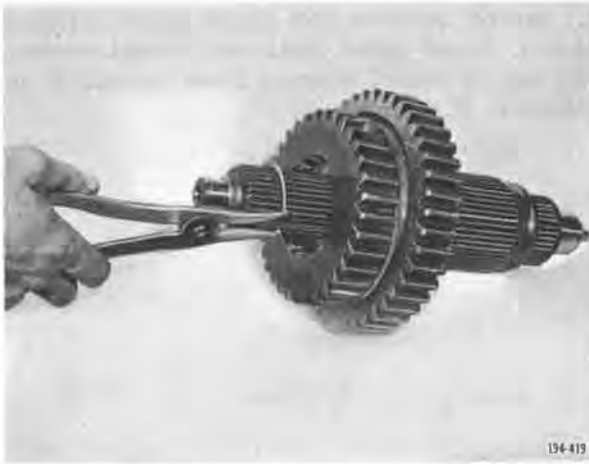


Figure 5-637. Installing Fourth Speed Gear Retaining Snap Ring

11. Install fourth and fifth speed gear sliding clutch. See Figure 5-638. Install spigot ball bearing on front of shaft, then install bearing retaining snap ring.

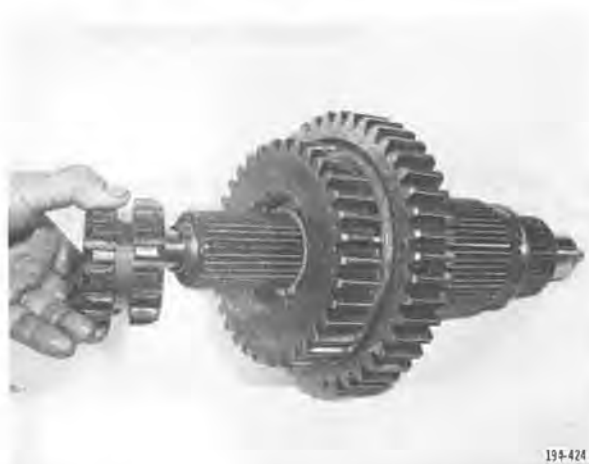


Figure 5-638. Installing Fourth and Fifth Speed Sliding Clutch

12. Carefully install mainshaft assembly as shown in Figure 5-639. Advance mainshaft all the way forward to completely seat the spigot bearing in the main drive pinion.

13. Apply a light coat of grease to front face of second speed gear hub, then place second speed gear thrust washer on front face of gear hub.

Install the second speed gear (clutch teeth to the rear) with thrust washer and engage with the countershaft second speed gear. See Figure 5-640.



Figure 5-639. Installing Front Mainshaft Assembly

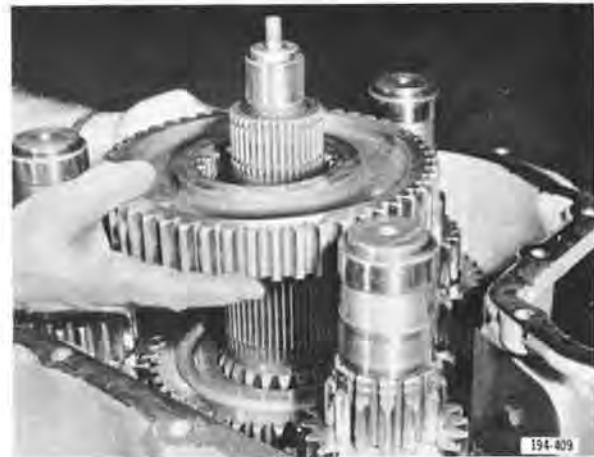


Figure 5-640. Installing Second Speed Gear

14. Apply a light coat of grease to front face of first speed gear hub, then place first speed gear thrust washer on front face of gear hub. Install first speed gear (clutch teeth to the rear) with thrust washer and engage with countershaft first speed gear. See Figure 5-641.



Figure 5-641. Installing First Speed Gear

15. Install first speed gear sliding clutch. See Figure 5-642.



Figure 5-642. Installing First Speed Gear Sliding Clutch

16. Install front countershaft selective thrust washers on the three countershafts and retain them with their snap rings. See Figures 5-643 and 5-644.



Figure 5-643. Installing Countershaft Selective Thrust Washer



Figure 5-644. Installing Thrust Washer Snap Ring

17. Check recommended end-play clearance (each countershaft) by inserting a feeler gage between first speed gear and countershaft selective thrust washer. See Figure 5-645. Hold each thrust washer squarely against its retaining snap ring when inserting feeler gage. Refer to "Screw Torques and Adjustment Chart" for selective thrust washers to obtain recommended end-play.



Figure 5-645. Checking End-Play Clearance

18. Install Lo-range main drive gear. See Figure 5-646.



Figure 5-646. Installing Lo-Range Main Drive Gear

19. Install Lo-range main drive gear retaining snap ring. See Figure 5-647.



Figure 5-647. Installing Lo-Range Main Drive Gear Retaining Snap Ring

MAIN COMPONENTS

1. Install a new front case to rear case gasket.

NOTE

Temporarily secure the Direct and Lo-range sliding clutch with a piece of wire. See Figure 5-648. This will eliminate the possibility of the sliding clutch slipping off of the mainshaft and shifter rail when installing the rear case to the front case.

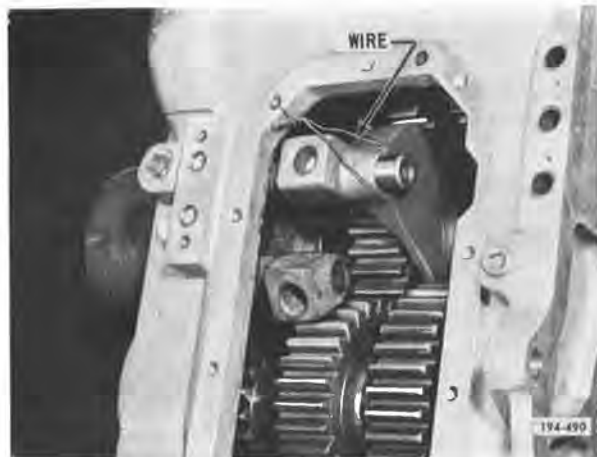


Figure 5-648. Sliding Clutch Temporarily Secured

With the aid of a hoist, carefully install rear case to front case. See Figure 5-649. Install rear case to front case capscrews and dowel bolts and tighten to recommended torque.

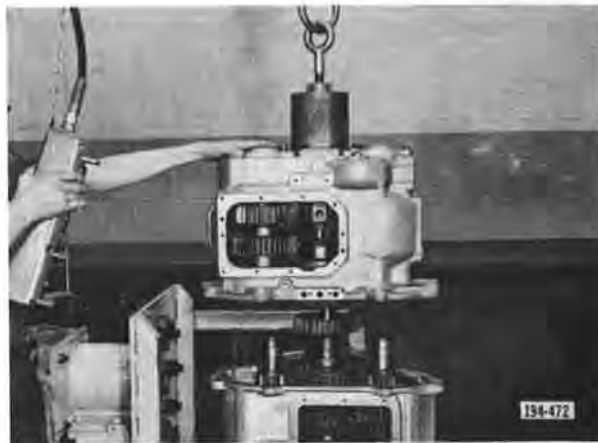


Figure 5-649. Installing Rear Case to Front Case

2. Install drive flange on rear mainshaft splines. Place transmission in two gears which will lock up assembly, then install drive flange clamp plate and screw. Tighten screw to recommended torque.
3. Install second and third speed shifter fork on second and third speed sliding clutch. See Figure 5-650.

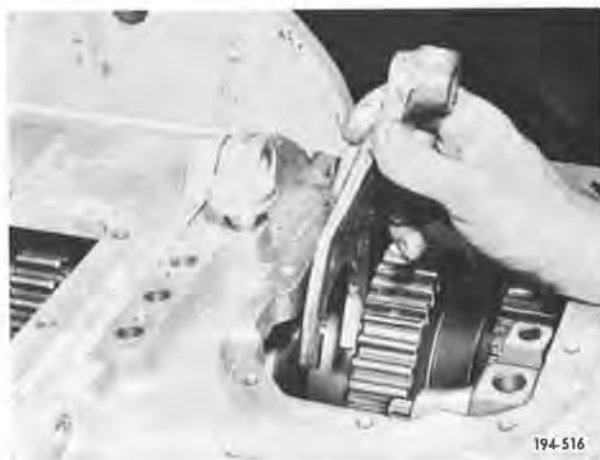


Figure 5-650. Installing Second and Third Speed Shifter Fork

4. Install first speed shifter fork on first speed sliding clutch. See Figure 5-651.
5. Install second and third speed shifter rail through front of case and install second and third speed shifter on rail. See Figure 5-652. Advance rail through intermediate bore of case through second and third speed shifter fork and into Direct and Lo-range shifter rail until rail reaches neutral position.

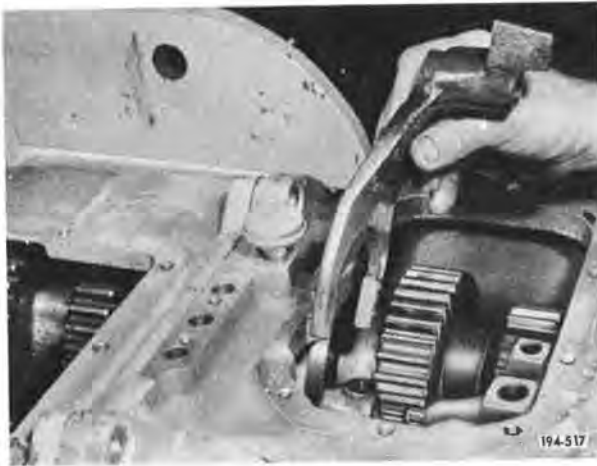


Figure 5-651. Installing First Speed Shifter Fork



Figure 5-653. Installing First Speed Shifter and Reverse Speed Lockout Spacer



Figure 5-652. Installing Second and Third Speed Shifter

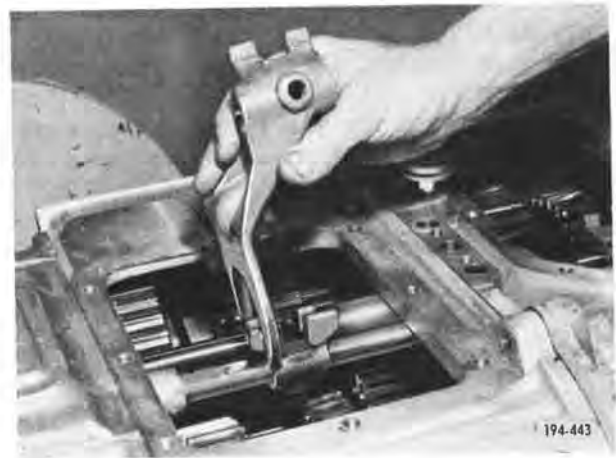


Figure 5-654. Installing Fourth and Fifth Speed Shifter Fork

6. Install first speed shifter rail through front of case and install first speed shifter and reverse speed lockout spacer on rail. See Figure 5-653. Advance rail through intermediate bore of case, through first speed shifter fork and reverse speed fork until rail reaches neutral position.

7. Install fork and shifter setscrews and tighten to recommended torque.

8. Start fourth and fifth speed shifter rail through hole provided in front of case. Engage fourth and fifth speed shifter fork with fourth and fifth speed sliding clutch. See Figure 5-654. Advance rail through hub of fork and intermediate bore of case until rail reaches neutral position. Install fork setscrew and tighten to recommended torque.

9. Install air shift cover assembly. See Figure 5-655.

NOTE

If the air shift cover assembly was disassembled, the Direct and Lo-range shifter must be adjusted to its neutral position. Continue to step 10 for adjustment procedure.



Figure 5-655. Installing Air Shift Cover Assembly

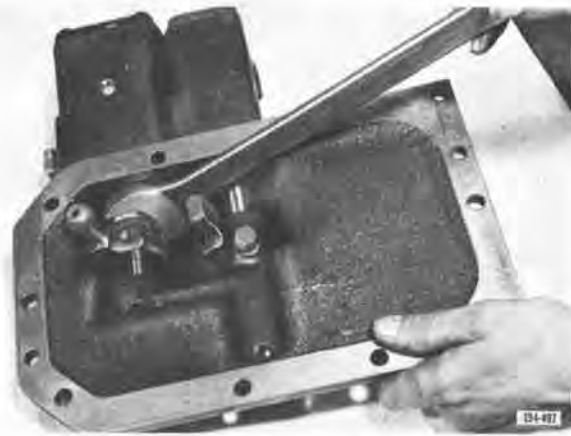


Figure 5-657. Locking Shifter in Neutral Position

10. Direct and Lo-range Shifter Adjustment:

With air shift cover assembly installed on rear case, connect air lines to the Direct and Lo-range fittings of shift cover and apply air to both sides. Insert screw driver in slot provided in the end of the Direct and Lo-range shifter rail. See Figure 5-656. Turn shift rail with the screw driver (clockwise) and at the same time rotate output flange until gear clash is obtained. Turn shift rail in opposite direction (counterclockwise) counting the number of turns until gear clash is obtained.

Again turn shifter rail (clockwise) half the amount of turns counted from gear clash to gear clash. Shifter will now be in the neutral position.

Remove air shifter cover assembly and lock shifter in neutral position with washer and nut. See Figure 5-657.



Figure 5-658. Installing Shift Rail Poppet Ball



Figure 5-656. Adjusting Direct and Lo-Range Shifter



Figure 5-659. Installing Shifter Rail Poppet Ball Spring

12. Install poppet ball cover with capscrews and tighten to recommended torque. See Figure 5-660.

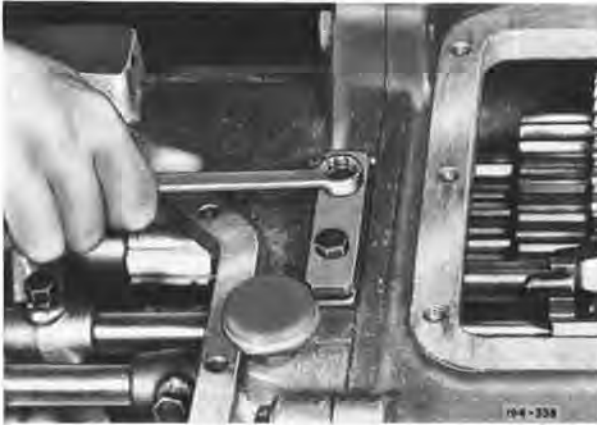


Figure 5-660. Tightening Shift Rail Poppet Ball Cover Capscrews

13. Install air shift cover assembly on case engaging Direct/Lo-shift control lever and reverse shift control lever with the Direct/Lo-range fork and reverse fork. See Figure 5-661.

NOTE

Be sure to install Direct and Lo-range piston rail expansion plug.

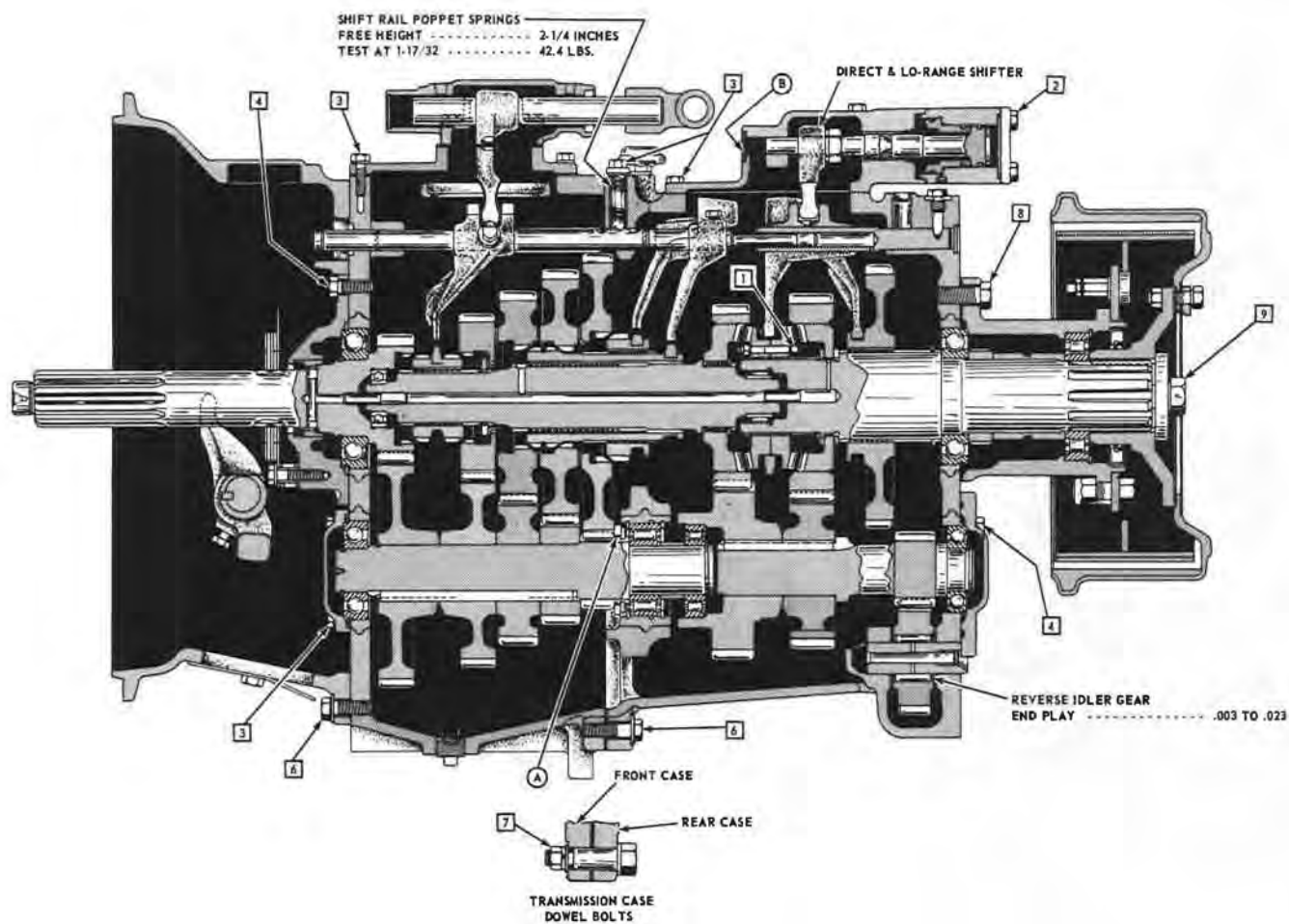


Figure 5-661. Installing Air Shift Cover Assembly

14. Install transmission front case top cover and power take-off covers with capscrews. Tighten capscrews to recommended torque.

15. Install clutch release shaft needle bearings and grease seals. Install clutch release shaft, yoke and any other external parts that were removed for disassembly. Recheck all fasteners for correct torque. Then remove transmission from stand.

TRDL-107 10-SPEED TRIPLE COUNTERSHAFT TRANSMISSION (AIR SHIFT) SCREW TORQUES & ADJUSTMENT CHART



(A) THRUST WASHER	AVAILABLE THICKNESSES
1st SPEED GEAR: SELECT FOR TIGHTEST FIT IN GROOVE TO OBTAIN 0.025 TO 0.035 IN. MAINSHAFT GEAR END-PLAY.	0.143 0.158 0.173 0.188
IMPORTANT THE 0.025 TO 0.035 IN. MAINSHAFT GEAR END-PLAY CANNOT VARY MORE THAN 0.005 IN. AMONG THE THREE SELECTIVE THRUST WASHERS.	0.203 0.218 0.233 0.248 0.263

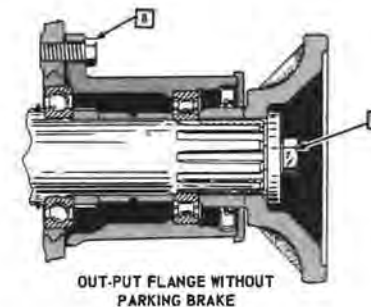
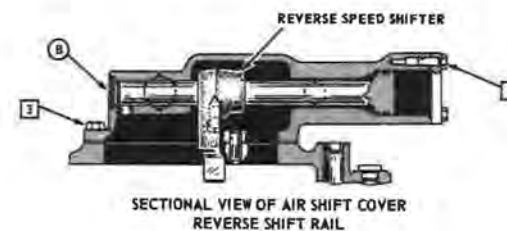
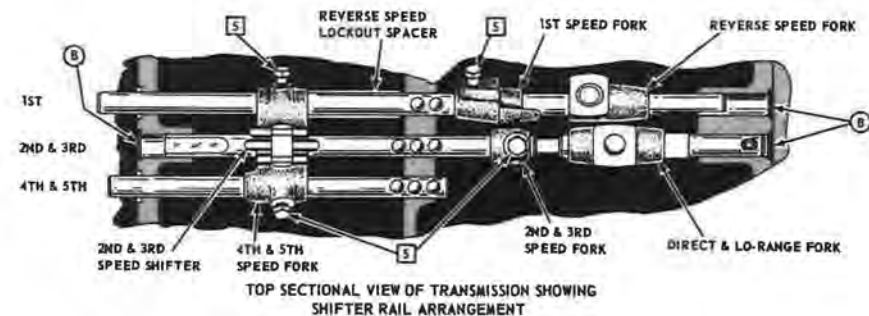
(B) IMPORTANT - BE SURE EXPANSION PLUGS ARE IN PLACE BEFORE INSTALLING UNIT IN CHASSIS MAINCASE - (2 REAR - 1 FRONT) AIRSHIFT COVER - (2 FRONT)

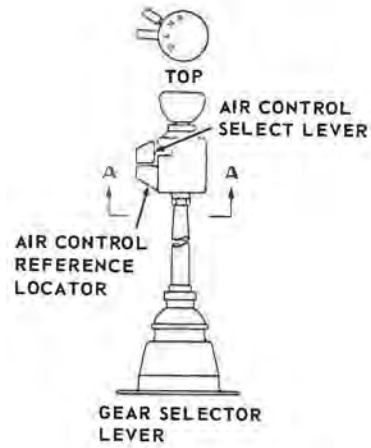
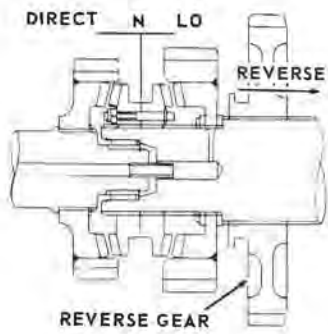
ALL FORKS IN SLIDING CLUTCHES			
	MIN. NEW	MAX. NEW	MAX. * WEAR
SIDE CLEARANCE	0.005	0.020	0.050

* NOTE: IF UNIT HAS EXPERIENCED DISENGAGEMENT SIDE CLEARANCE MUST NOT EXCEED 0.030 MAX.

SCREW TORQUES IN LBS. IN.	
SCREW LOCATION	TORQUE (LUBRICATED)
1 -	75
2 -	100
SCREW TORQUES IN LBS. FT.	
3 -	18 TO 28
4 -	30 TO 40
5 -	35 TO 45
6 -	85 TO 115
7 -	55 TO 75
8 -	105 TO 115
9 -	480 TO 520

28-50

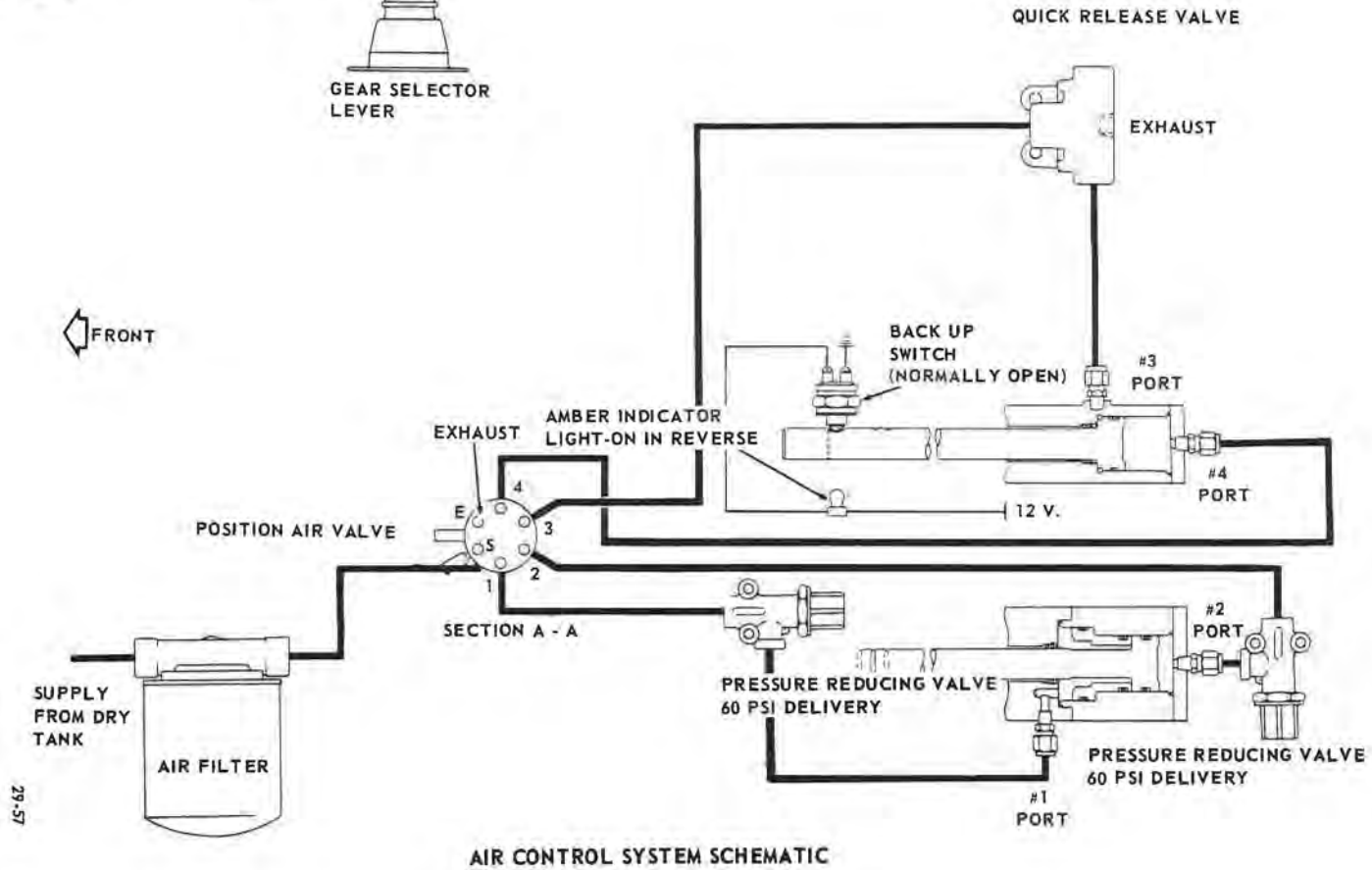




PISTON PORT

	1	2	3	4
D				
L				
N				
R				

■ PRESSURE
□ EXHAUST



**MACK SEVEN AND TEN SPEED OVERDRIVE MAXITORQUE TRANSMISSIONS
TRDL1070 and TRDLG1070**

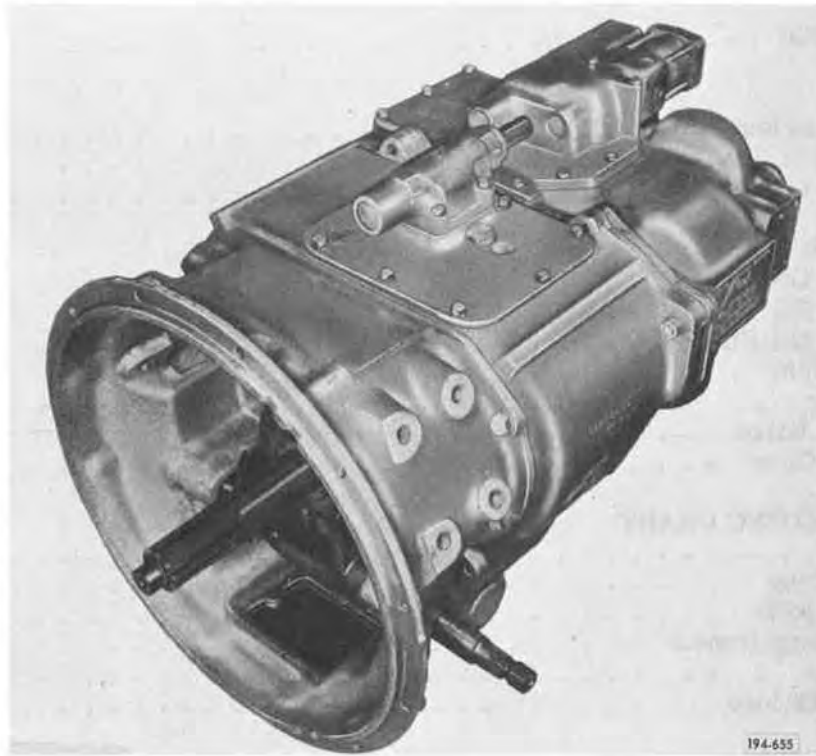


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NOTE

The illustrations contained in this publication are typical, and not necessarily exact. When working on these transmissions, the mechanic may find small differences between his unit and the illustrations.

NOTES

MACK AIR SHIFT MAXITORQUE TRANSMISSIONS
TRDL1070 and TRDLG1070

DESCRIPTION

These transmissions are triple countershaft, non-synchronized units, consisting of a main box gear set of five speeds, plus an integral, air-shifted rear compound gear set. In the TRDL1070, the rear compound provides a direct and an overgear split for each of the five main box speeds, thus giving a ten speed transmission. In the TRDLG1070, an interlock prevents the overgear splitter from engaging in first, second, and third speed gears. Since only fourth and fifth speeds are split, the TRDLG1070 is a seven speed transmission.

The rear compound also provides a reverse position for each of the five speeds in the main box, thus giving five reverse speeds.

The transmissions are provided with one manually shifted control lever, which controls the main box gear set. The rear compound is shifted by an air control valve (Selectair Valve) mounted on the gear shift lever. The valve has a finger operated flipper to direct air pressure to the shift cylinders of the air shifted rear compound. Shift positions are direct, overgear, reverse, and neutral for P.T.O. operation.

The three countershafts are equally spaced around the mainshafts. This design distributes the load equally among the countershafts, thus keeping normal deflection and gear tooth loading to a minimum. See Figure 5-662.

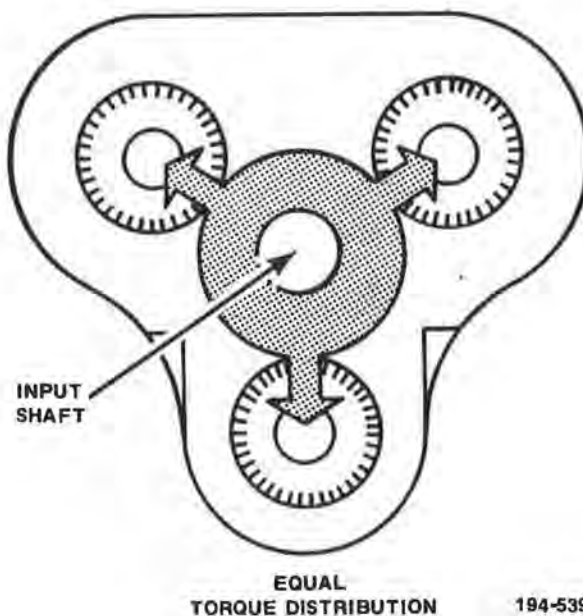


Figure 5-662. Torque Distribution

The mainshaft gears are either splined to the mainshaft, or self-centering among the three countershafts, thus eliminating the need for gear bushings.

All mainshaft gears are of the spur type design and, with the exception of the reverse speed sliding gear, are in constant mesh with the countershaft gears.

Other than reverse gear, shifting for the forward speeds is done by sliding clutches. Reverse is obtained by engaging the reverse sliding spur gear with the three reverse idler gears.

SPECIFICATIONS

Gearset, Make	Mack
Type	Three Countershaft
Control,	Selective, One Lever with Air Shift Rear Compound
Speeds, Forward	TRDL1070: Ten, TRDLG1070: Seven
Reverse	Five
Bell Housing, Type	Separable, Aluminum
Lubrication	Gear throw-off, and pump feed through rifle-drilled passages in mainshaft to sliding clutches and mainshaft gears.
Pump, Type	Built-In Reciprocating Vane
Case, Material	Aluminum, with Steel Inserts at Bearing Bores
P. T. O. Openings:	
Left Side	Standard S. A. E. 8 hole
Right Side	Standard S. A. E. 6 hole
Oil Capacity	22 pints

TRDL 1070			
SPEED	DIRECT	HI-RANGE	REVERSE
1ST	8.59	6.68	(28.52)
2ND	4.99	3.89	16.59
3RD	2.84	2.21	9.42
4TH	1.66	1.29	5.50
5TH	1.00	.78	3.32

() RATIOS IN PARENTHESIS ARE NOT FUNCTIONAL TO OPERATIONS

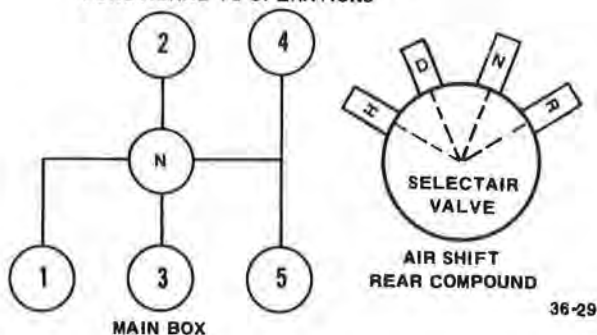


Figure 5-663. TRDL1070 Gear Ratios and Shift Diagram

TRDLG 1070			
SPEED	DIRECT	OVER GEAR	REVERSE
1ST	8.59	—	(28.52)
2ND	4.99	—	16.59
3RD	2.84	—	9.42
4TH	1.66	1.29	5.50
5TH	1.00	.78	3.32

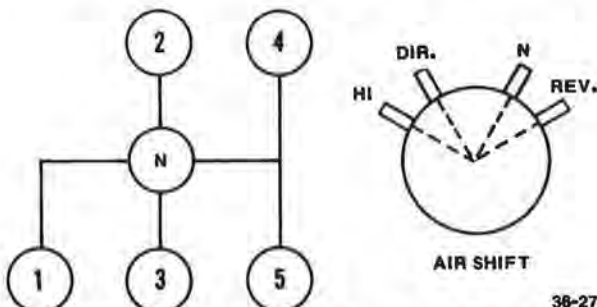


Figure 5-664. TRDLG1070 Gear Ratios and Shift Diagram

LUBRICATION

Splash Lubrication

All rotating and sliding parts of the transmission are bathed in oil from gear throw-off when in operation. See **Figure 5-665**.



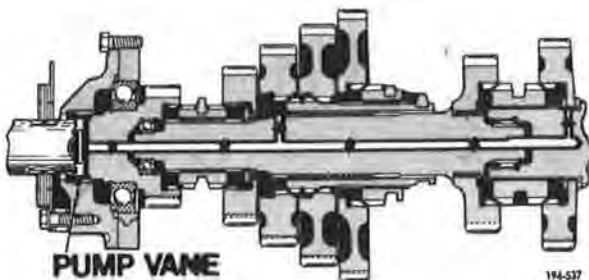
SPLASH LUBRICATION

194-536

Figure 5-665. Gear Lubrication

Oil Pump

The sliding clutches and mainshaft gears are also provided with pressurized lubrication. A simple eccentric shuttle type pump is built into the main drive pinion. As the pinion rotates, the pump vane reciprocates in its eccentric housing, thus forcing lubricant under pressure through rifle-drilled holes in the mainshaft to the sliding clutches and mainshaft gears. See **Figure 5-666**.



194-537

Figure 5-666. Pressure Lubrication

To supply the pump, oil from gear throw-off is collected by a trough located above the main drive pinion, and is then gravity fed to the pump.

Magnetic Oil Filter

A magnetic oil filter plug, located on the right-hand side of the main case, removes ferrous metallic particles. The filter consists of an integral open trough and baffle arrangement, with a removable sheet metal cover. At the bottom of the baffle, a tapped hole in the case accommodates a large hex head plug with a built-in magnet. See **Figure 5-667**.



Figure 5-667. Magnetic Oil Filter

The oil from gear throw-off is collected by the filter, and is channeled past the magnetic plug, which pulls ferrous metal particles out of the passing oil and holds them. After passing the magnet, clean and particle-free oil then rises to the outlet near the top of the filter, and drops down into the transmission case. A magnetic drain plug is also provided at the bottom of the case.

MAINTENANCE

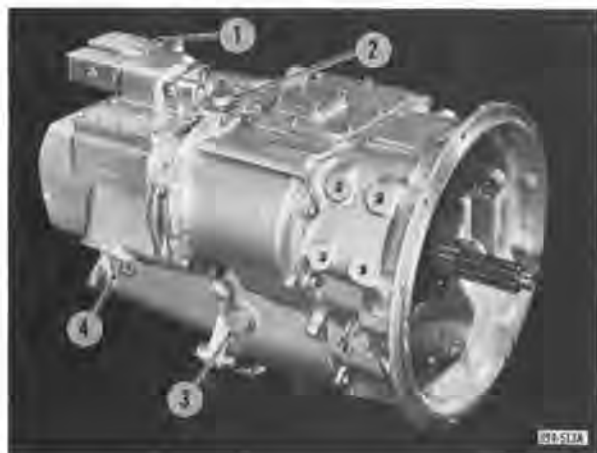
Checking Oil

To check the oil in the transmission, remove the fill plug on the right-hand side of the case. The oil should be level with the bottom of the filler plug hole. The oil should be checked when it is hot, as when coming in from a run, and with the vehicle in a level position.

Check the oil at the intervals specified in the Maintenance and Lubrication Manual. Add oil, if needed, until oil begins to run out of the filler hole. Use oil of the proper specification as outlined in the Maintenance and Lubrication Manual.

CAUTION

Be sure to add oil to the transmission through the filler plug hole, NOT the magnetic plug hole. See Figure 5-668. Severe Damage could occur due to low oil level if the transmission is filled through the wrong hole.



1. Air Shift Cover Assembly
2. Breather
3. Magnetic Oil Filter Plug
4. Filler Plug

Figure 5-668. Typical Air Shift Transmission

Changing Oil

To change oil, remove the magnetic drain plug and drain the oil from the case while hot. If necessary, also flush the case with flushing oil and drain thoroughly. Clean and replace the magnetic drain plug. Remove the fill plug, and fill the transmission with the proper specification of oil (as outlined in the Maintenance and Lubrication Manual) to the level of the bottom of the filler plug hole. See the preceding CAUTION note. Reinstall the filler plug. Change oil at the intervals specified in the Maintenance and Lubrication Manual, or more often if conditions warrant it.

Magnetic Oil Filter

The magnetic oil filter plug should be removed and cleaned every time the oil is changed. Also clean the trough inside, and then reinstall the magnetic plug.

Air Breather

The breather, located on the top of the transmission, should be cleaned with a suitable solvent and checked for unobstructed air flow every time the oil is changed.

Air Filter

The transmission air filter should be replaced at every Mack C Inspection.

Selectair Valve

The Selectair valve, located on the transmission gear shift lever, should be disassembled for cleaning, inspection, and lubrication at every Mack C Inspection. Refer to the Selectair valve sections under DISASSEMBLY, INSPECTION AND CLEANING, and REASSEMBLY for the proper procedures and lubricants.

Air Shift Cover

The air shift cover should be disassembled for cleaning, inspection, and lubrication at every Mack C Inspection. Refer to the Air Shift Cover sections under DISASSEMBLY and REASSEMBLY for the proper procedures and lubricants.

TROUBLE SHOOTING CHART

The following Trouble Shooting Chart is provided as an aid to assist in diagnosing and repairing the more common transmission complaints. It is not intended to include every possible cause - only those that most frequently occur.

Care should be exercised by the mechanic, when dealing with complaints of transmission problems, to be sure to eliminate all other possible sources of trouble before removing the transmission. Noise problems in particular are often assumed to be the fault of the transmission, while actually the noise comes from the axle, propeller shafts, universal joints, engine or clutch.

TROUBLE SHOOTING CHART

Symptom	Probable Cause	Remedy
Noisy	<ul style="list-style-type: none"> a. Low oil level b. Wrong oil used c. P. T. O. installed too tight or too loose d. Loose bell housing to flywheel housing capscrews e. Torsional vibrations from engine and/or rear axle f. Excessive mainshaft gear endplay g. Gears worn, chipped, rough, cracked h. Bearings worn, cracked, corroded, galled, etc. 	<ul style="list-style-type: none"> a. Fill to correct level b. Drain and refill with correct oil c. Reinstall P. T. O. correctly d. Tighten capscrews e. Install dampened disc clutch and/or driveline vibration damper f. Adjust using correct selective thrust washers g. Replace gears h. Replace bearings
Hard Shifting	<ul style="list-style-type: none"> a. Improperly adjusted clutch, clutch linkage, clutch brake, or shift linkage b. Low oil level c. Wrong oil used d. Incorrect driving practices e. Remote shift linkage not lubricated f. Shift lever binding or interference g. Poppet balls binding in their holes h. Loose setscrews in shifters or shift forks i. Worn shift rail bores j. Worn spigot bearing k. Clutch brake ears broken l. Clutch discs worn into main drive pinion 	<ul style="list-style-type: none"> a. Adjust properly b. Fill to correct level c. Drain and refill with correct oil d. Educate driver e. Clean and lubricate f. Relieve binding or interference g. Clean holes and balls h. Tighten to correct torque i. Install bushings j. Replace bearing k. Replace clutch brake l. Replace clutch discs and main drive pinion
Slow Air Shift	<ul style="list-style-type: none"> a. Low system air pressure b. Restricted or clogged air filter c. Restricted air lines (bent, squeezed, twisted, etc.) d. Air lines too small e. Defective pressure protection, pressure reducing, or quick release valve f. Clogged shift cylinder breather g. Defective o-rings in air shift cylinders h. Scored air shift cylinders or pistons 	<ul style="list-style-type: none"> a. Wait for pressure to build back up to normal b. Replace air filter c. Reroute and/or replace air lines d. Replace with correct size air lines e. Replace valve f. Clean or replace breather g. Replace o-rings h. Repair or replace cylinders or pistons

TROUBLE SHOOTING CHART (continued)

Symptom	Probable Cause	Remedy
Gear Disengagement (jumping out of gear)	<ul style="list-style-type: none"> a. Improperly adjusted remote control linkage b. Shift lever interference c. Excessive length and/or weight of gear shift lever and/or knob d. Worn or loose mounting insulators e. Loose, broken, or missing capscrews between main case, clutch housing, and flywheel housing f. Weak or broken shifter rail poppet springs g. Bent or worn shifter forks h. Broken snap rings i. Shift rail bent or poppet notches worn j. Excessive mainshaft gear endplay k. Worn taper or chipped teeth on sliding clutch teeth l. Worn spigot bearing m. Engine flywheel housing misalignment 	<ul style="list-style-type: none"> a. Adjust properly b. Remove interference c. Replace with standard lever and/or knob d. Replace insulators e. Tighten or replace capscrews f. Replace springs g. Replace forks h. Replace snap rings i. Replace shift rail j. Adjust using correct selective thrust washers k. Replace sliding clutch l. Replace bearing m. Realign properly
Oil Leaks	<ul style="list-style-type: none"> a. Drain plug, fill plug, or magnetic plug loose b. Oil level too high c. Improper lubricant used d. Loose or missing capscrews e. Clogged breather f. Shift rail expansion plugs loose or missing g. Gaskets or o-rings broken, shifted, or squeezed out of position h. Worn oil seals i. O-rings in air shift cover leaking air pressure into transmission 	<ul style="list-style-type: none"> a. Tighten plugs b. Fill to correct level c. Drain and refill with correct oil d. Tighten or replace e. Clean or replace f. Replace expansion plugs g. Replace gaskets and o-rings h. Replace seals i. Replace o-rings
Bearing Failure	<ul style="list-style-type: none"> a. Dirt in system b. Wrong grade of oil, or contaminated oil c. Excessive vibrations d. Binding or seized propeller shaft slip yoke e. Improper bearing clamping f. Improper bearing installation 	<ul style="list-style-type: none"> a. Clean and replace as necessary b. Drain and refill with correct oil c. Eliminate vibrations d. Clean and replace as needed e. Reclamp using correct procedures f. Replace using correct procedures

DISASSEMBLY

Main Components Disassembly

NOTE

Unless a complete overhaul is necessary, remove only those parts required to gain access to the faulty parts. Do not disturb parts having heavy press fits (interference fits) unless replacement is necessary. In that case, use proper press setups and pullers, so that usable parts are not damaged.

1. Remove air lines from Air Shift Cover Assembly. For easier reassembly, tag each air line with the same number stamped near the fitting on the Air Shift Cover.

2. Drain lubricant, and remove transmission from vehicle. Clean it externally and mount unit in overhaul stand.

3. Remove clutch release yoke tapered set-screws. See **Figure 5-669**.



Figure 5-669. Removing Setscrews

4. Drive splined clutch release shaft inward, and remove Woodruff key. See **Figure 5-670**.

5. Drive splined clutch release shaft outward, and remove.



Figure 5-670. Removing Woodruff Key

6. Slide clutch release stub shaft inward, and remove it with clutch release yoke. See **Figure 5-671**.



Figure 5-671. Removing Yoke and Stub Shaft

7. Remove clutch brake from input shaft. See **Figure 5-672**.



Figure 5-672. Removing Clutch Brake

8. Remove front case top cover capscrews. See **Figure 5-673**.



Figure 5-673. Removing Capscrew

9. Remove front case top cover. See **Figure 5-674**.

10. Remove air shift cover capscrews. See **Figure 5-675**.

11. Remove air shift cover assembly. See **Figure 5-676**.



Figure 5-674. Removing Top Cover



Figure 5-675. Removing Capscrew



Figure 5-676. Removing Cover

12. Remove shifter rail poppet ball cover capscrews and cover. See **Figure 5-677**.

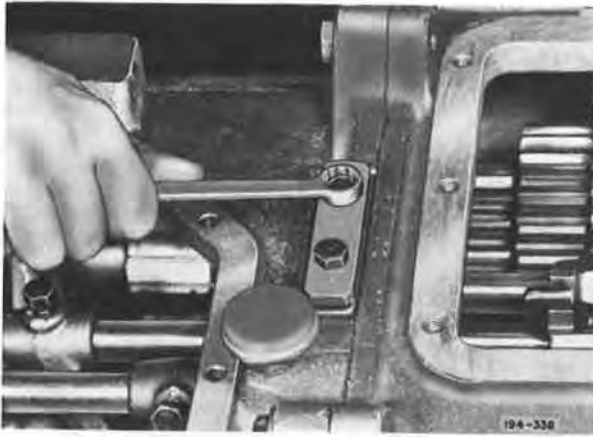


Figure 5-677. Removing Capscrews

WARNING

Cover is spring-loaded. Remove cover evenly and carefully to prevent damage or injury.

13. Remove poppet spring and poppet ball. See **Figure 5-678.**



Figure 5-678. Removing Poppet Spring and Ball

14. Remove set-screws from first speed shift fork and second/third speed shift fork. See **Figure 5-679.**

15. Remove set-screw from fourth/fifth speed shift fork. See **Figure 5-680.**



Figure 5-679. Removing Setscrew

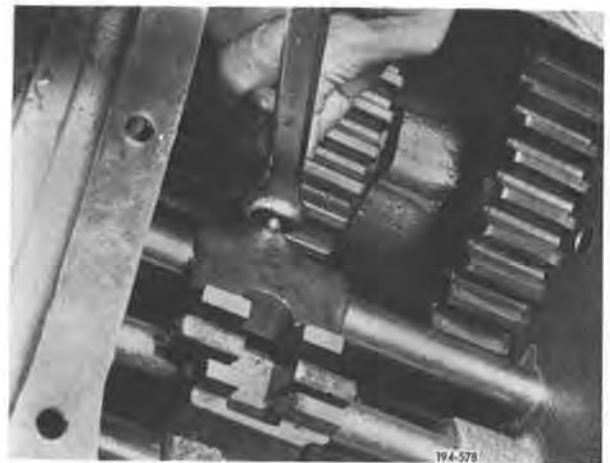


Figure 5-680. Removing Setscrew

16. Slide fourth/fifth speed shift rail forward, and at the same time remove fourth/fifth speed shift fork. See **Figures 5-681 and 5-682.**



Figure 5-681. Sliding Shift Rail Forward

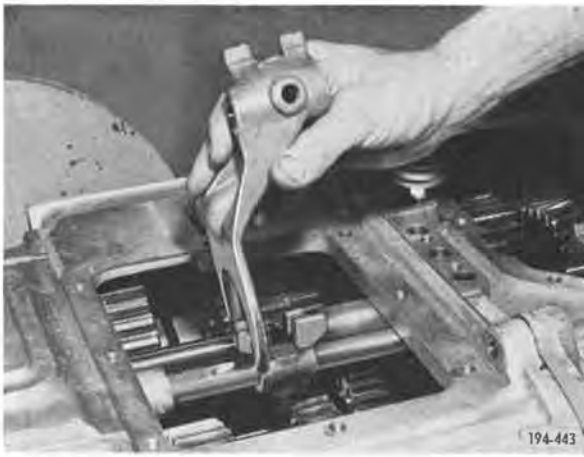


Figure 5-682. Removing Shift Fork

17. Remove first speed shifter setscrew, slide first speed shift rail forward, and remove first speed shifter and reverse lockout spacer. See Figure 5-683.



Figure 5-683. Removing Shifter and Spacer

18. Remove first speed shift fork. See Figure 5-684.

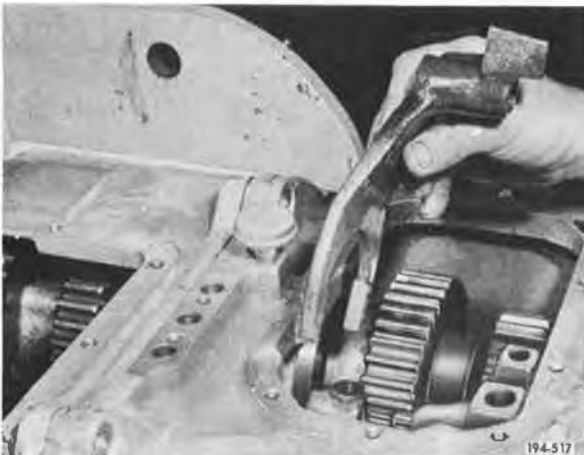


Figure 5-684. Removing Shift Fork

19. Using a soft drift, drive second/third speed shifter and shift rail forward, which will drive out expansion plug at front of shaft. See Figure 5-685.



Figure 5-685. Driving Shift Rail Forward

20. Remove second/third speed shifter setscrew. See Figure 5-686.

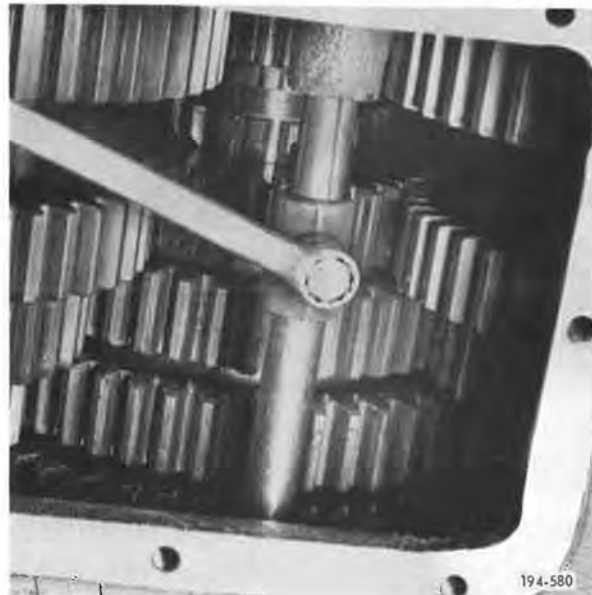


Figure 5-686. Removing Setscrew

21. Slide second/third speed shift rail forward, and remove shifter. See Figure 5-687.



Figure 5-687. Removing Shifter



Figure 5-689. Removing Capscrew

22. Remove second/third speed shift fork. See **Figure 5-688**.

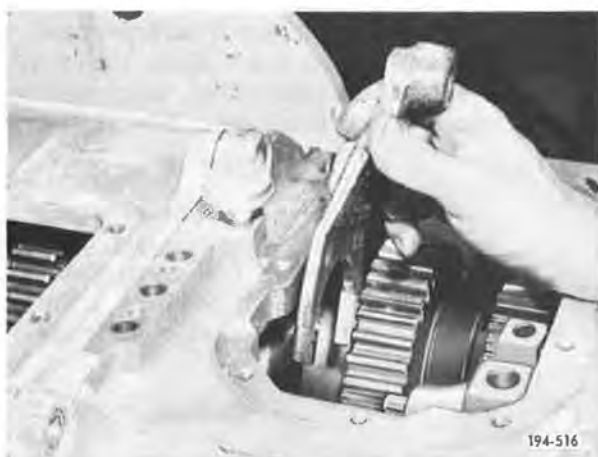


Figure 5-688. Removing Shift Fork

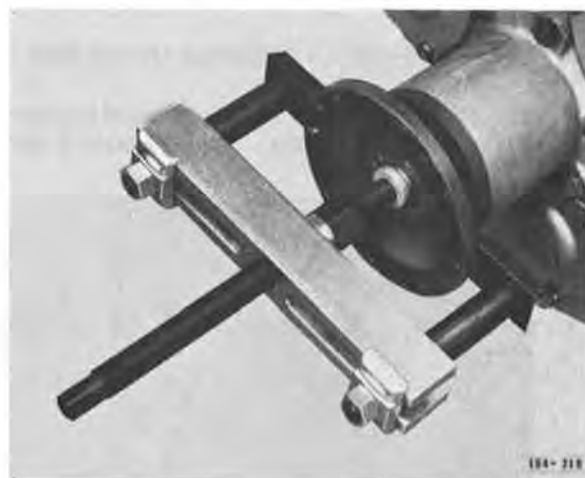


Figure 5-690. Removing Drive Flange

23. Place two sliding clutches into engaged position, which will lock up mainshaft, to make it easier to remove drive flange (or yoke) assembly.

24. Remove drive flange (or yoke) clamp plate capscrew and clamp plate. See **Figure 5-689**.

25. Install puller J-29031 or equivalent, and remove drive flange (or yoke) from rear mainshaft splines. See **Figure 5-690**.

26. Remove front case to rear case capscrews. See **Figure 5-691**.



Figure 5-691. Removing Capscrews

27. Place transmission in a vertical position.

28. Loosen front case to rear case dowel bolt nuts. See **Figure 5-692**.



Figure 5-692. Loosening Dowel Bolt Nut

29. With nut still engaging dowel bolt threads, drive dowel bolt out. See **Figure 5-693**.

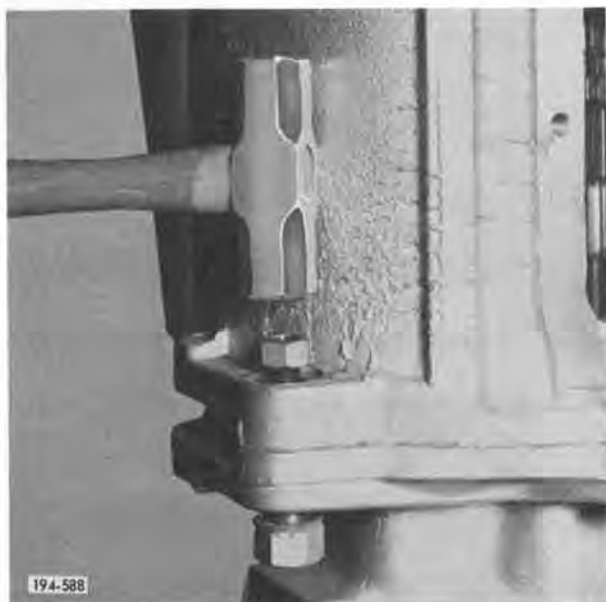


Figure 5-693. Removing Dowel Bolt

30. Secure Direct/Hi-range shift fork in position, using a piece of wire. This will prevent it from sliding forward. See **Figure 5-694**.

WARNING

Direct/Lo-range sliding clutch and shift fork could fall out of case and cause injury, if they are not secured.

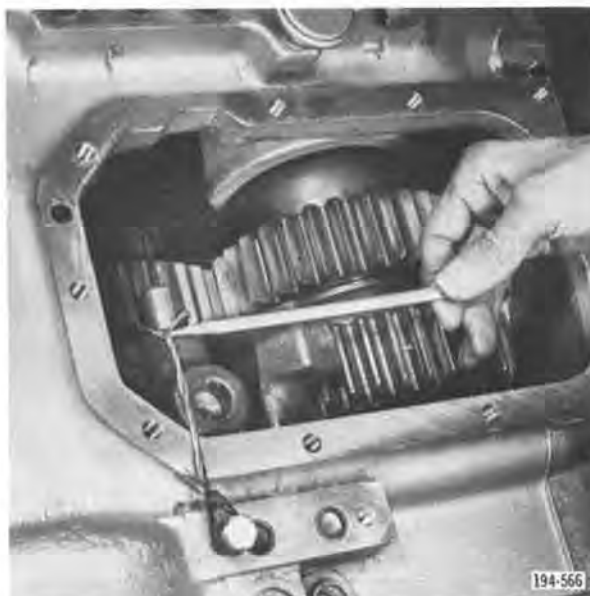


Figure 5-694. Wire Holding Shift Fork

31. Remove rear case from front case, using a hoist and lifting eye. Keep cases in good alignment while separating, to prevent binding of countershaft bearings. See **Figure 5-695**.

NOTE

If cases do not separate easily, gently pry them apart with a prybar, using non-mating surfaces located at various points around the outside of transmission.

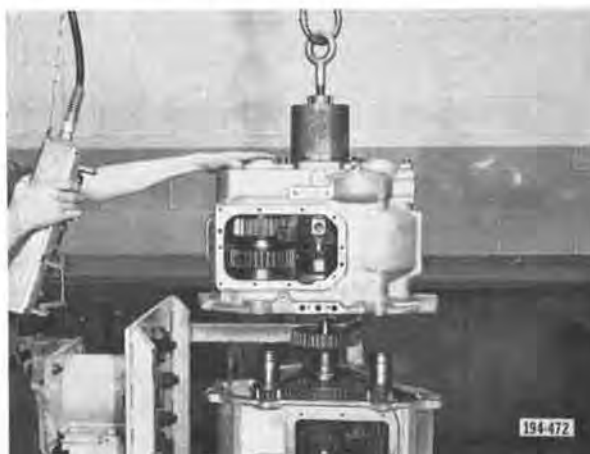


Figure 5-695. Removing Rear Case

Front Case Disassembly

1. With front case in a vertical position, remove front mainshaft oil tube, only if necessary to replace it. Run a tap into the tube, and then insert a capscrew into the threads cut by the tap. The oil tube can then be removed by pulling and twisting the capscrew. See **Figure 5-696**.



Figure 5-696. Front Mainshaft Oil Tube

2. Remove mainshaft Hi-range main drive gear retaining snap ring, using snap ring pliers J-6435 or equivalent. See Figure 5-697.



Figure 5-697. Removing Snap Ring

3. Remove Hi-range main drive gear. See Figure 5-698.

4. Remove front countershaft selective thrust washer snap rings, using snap ring pliers J-6435 or equivalent. See Figure 5-699.



Figure 5-698. Removing Gear



Figure 5-699. Removing Snap Rings

5. Remove front countershaft selective thrust washers. See Figure 5-700.



Figure 5-700. Removing Thrust Washers

NOTE

Establish a way of keeping each selective thrust washer with its respective countershaft assembly for reassembly.

6. Remove first speed gear sliding clutch. See **Figure 5-701**.



Figure 5-701. Removing Sliding Clutch

7. Remove first speed gear and its thrust washer. See **Figure 5-702**.



1. First Speed Gear
2. First Speed Gear Thrust Washer

Figure 5-702. Removing Gear

8. Remove second speed gear and its thrust washer. See **Figure 5-703**.



1. Second Speed Gear
2. Second Speed Gear Thrust Washer

Figure 5-703. Removing Gear

9. Remove front mainshaft assembly. See **Figure 5-704**.



Figure 5-704. Removing Front Mainshaft Assembly

10. Place front case in a horizontal position, and remove countershaft front cover cap-screws. See **Figure 5-705**.



Figure 5-705. Removing Capscrews

11. Remove countershaft front covers. See **Figure 5-706.**

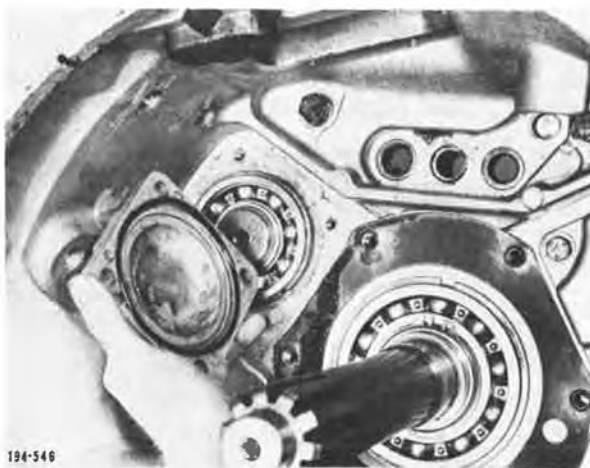


Figure 5-706. Removing Covers

12. Remove main drive pinion bearing cover cap screws. See **Figure 5-707.**

13. Remove main drive pinion bearing cover. See **Figure 5-708.**

14. Remove oil pump vane from main drive pinion. See **Figure 5-709.**

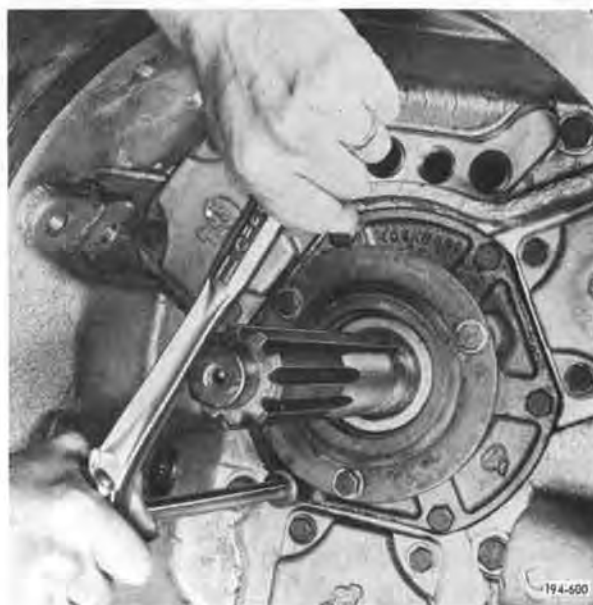


Figure 5-707. Removing Capscrews



Figure 5-708. Removing Bearing Cover



Figure 5-709. Removing Oil Pump Vane

15. Remove main drive pinion assembly from front case. See **Figure 5-710.**

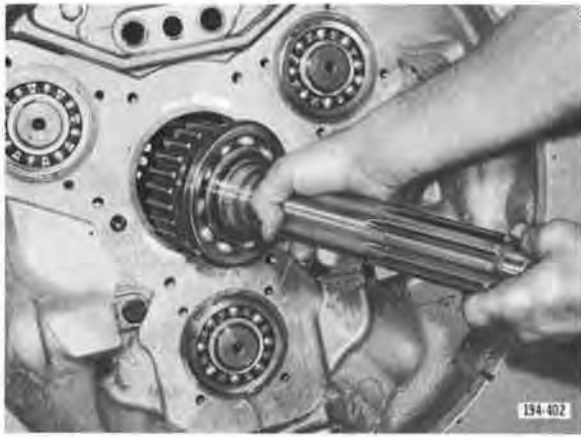


Figure 5-710. Removing Main Drive Pinion

NOTE

Tap on end of pinion, if necessary, with nylon mallet, to loosen the pinion.

16. Remove countershaft front bearing positioning snap rings, using snap ring pliers J-25445 or equivalent. See **Figure 5-711**.



Figure 5-711. Removing Snap Ring

17. Place transmission front case in a vertical position, and remove three front countershaft assemblies. See **Figure 5-712**.



Figure 5-712. Removing Countershaft Assemblies

Rear Case Disassembly

1. Remove rear countershaft rear bearing cover capscrews. See **Figure 5-713**.

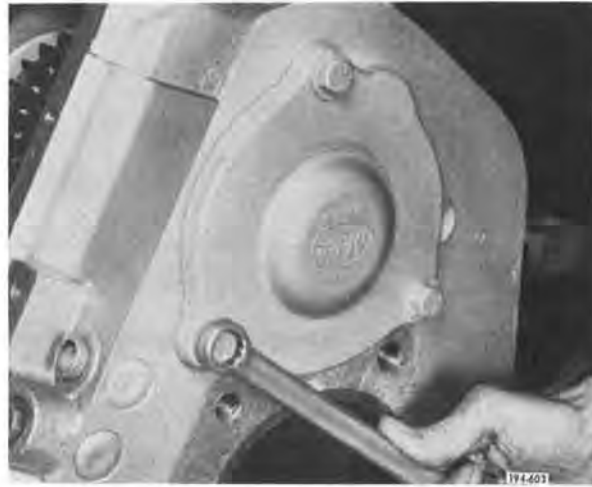


Figure 5-713. Removing Capscrews

2. Remove rear countershaft rear bearing cover. See **Figure 5-714**.



Figure 5-714. Removing Bearing Cover

3. Remove rear mainshaft rear bearing cover capscrews. See **Figure 5-715**.

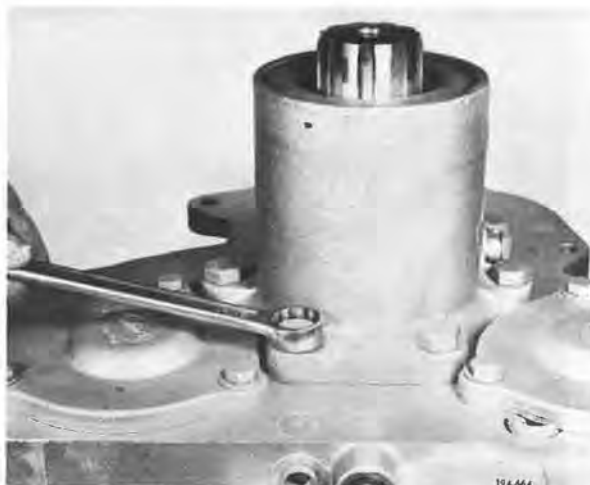


Figure 5-715. Removing Capscrew

4. Remove rear mainshaft rear bearing cover. See **Figure 5-716**.

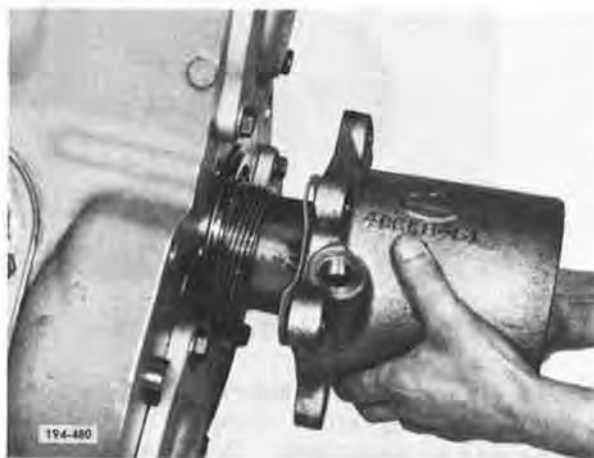


Figure 5-716. Removing Cover

5. Note location of any hollow rear counter-shafts for rear mounted P.T.O., so that unit can be reassembled with shafts in same positions. If factory installed, the letter "O" will be stamped on the case next to each such Shaft (see **Figure 5-717**). If field installed the same mark should be stamped into the case by the mechanic. In **Figure 5-717** note pencil pointing to the "O" and the P.T.O. quill shaft being removed from the hollow shaft.

6. Remove wire previously installed for safety, and remove the Direct Hi-range sliding clutch and its shift fork as an assembly. See **Figure 5-718**.



Figure 5-717. Rear Countershaft for P.T.O.



Figure 5-718. Removing Clutch and Shift Fork

7. Remove Hi-range gear snap ring through the rear case front opening using snap ring pliers J-6435 or equivalent. See **Figure 5-719**.

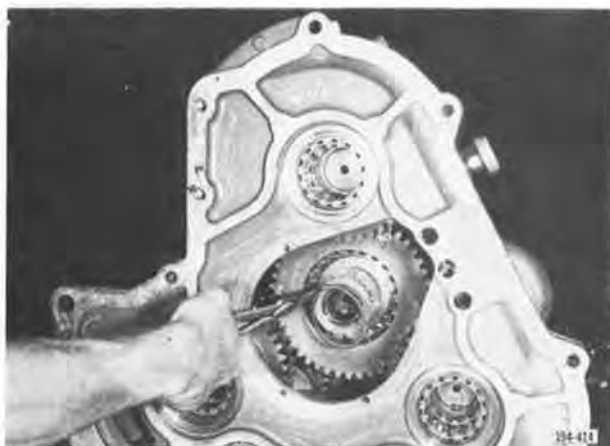


Figure 5-719. Removing Snap Ring

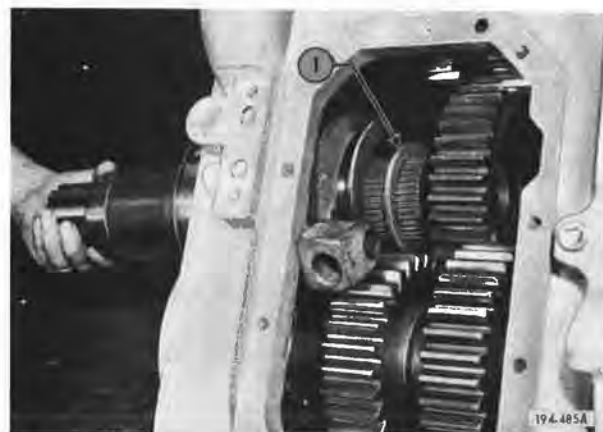
8. Remove Hi-range gear front thrust washer. See Figure 5-720.



Figure 5-720. Removing Thrust Washer

9. Slide reverse sliding gear rearward to engage it with the three reverse idler gears.

10. Partially withdraw rear mainshaft from the case by sliding it rearward, and at the same time remove the Hi-range gear rear thrust washer from the mainshaft. See Figure 5-721.



1. Hi-range Gear Rear Thrust Washer

Figure 5-721. Removing Mainshaft and Washer

11. Remove rear mainshaft the rest of the way. See Figure 5-722.

WARNING

Support the mainshaft to prevent injury which could result from dropping it.



Figure 5-722. Removing Rear Mainshaft

12. Remove Hi-range gear through front opening of rear case. See Figure 5-723.



Figure 5-723. Removing Gear

13. Remove rear countershaft rear bearing retaining snap ring, using snap ring pliers J-25445 or equivalent. See Figure 5-724.



Figure 5-724. Removing Snap Ring

14. Drive rear countershaft rearward, using a suitable driver, to provide access to rear bearing positioning snap ring. See Figure 5-725.



Figure 5-725. Driving Countershaft Rearward

15. Position the first clamping half of tool S593C to engage the snap ring, as shown in Figure 5-726. Note pencil pointing to snap ring and corresponding groove in tool.



Figure 5-726. Installing First Clamping Half

16. Install puller section of tool S593C and second clamping half. See Figure 5-727.

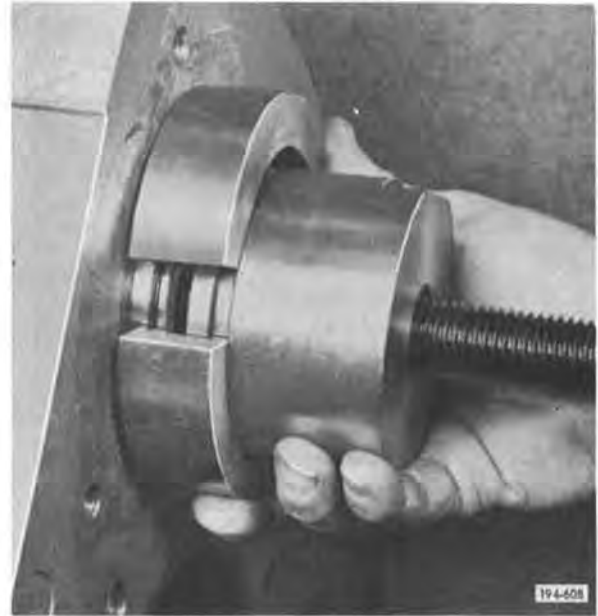


Figure 5-727. Installing Puller and Second Clamping Half

17. Slide the sleeve over the assembly to secure the two clamping halves together. See Figure 5-728.

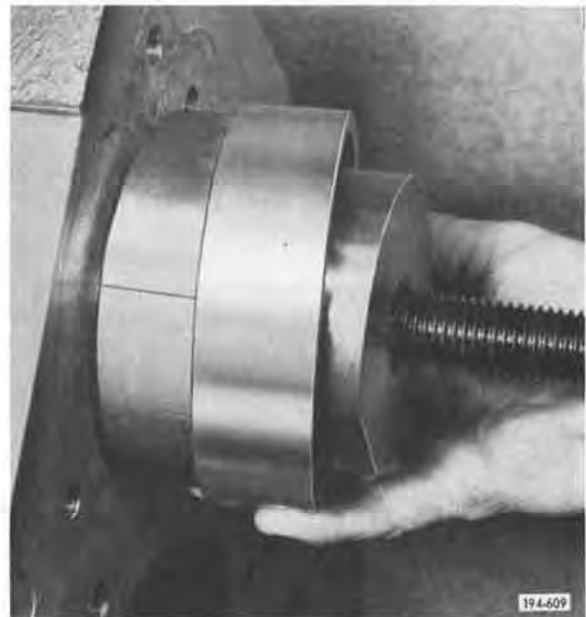


Figure 5-728. Installing Sleeve

18. Tighten threaded shaft of the puller until bearing is removed from rear countershaft. See Figures 5-729 and 5-730.

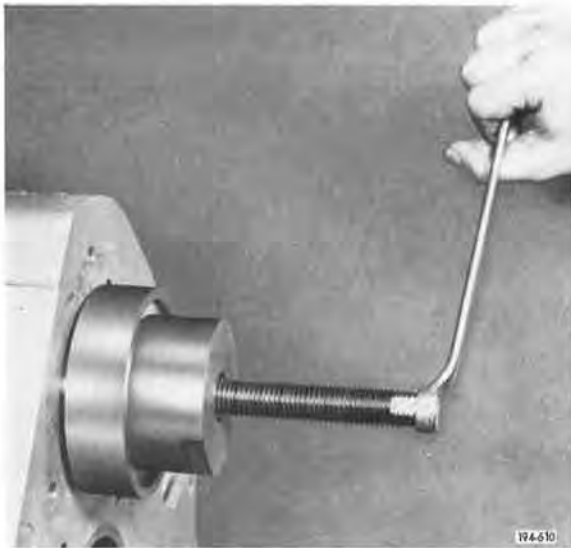


Figure 5-729. Tightening Puller



Figure 5-730. Bearing Removed

19. Remove three rear countershaft assemblies from case. See **Figure 5-731**.



Figure 5-731. Removing Countershaft

20. Remove reverse gear and its shift fork. See **Figure 5-732**.

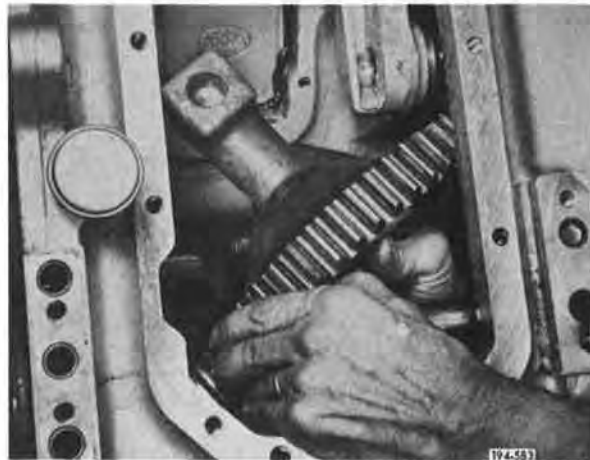


Figure 5-732. Removing Reverse Gear and Shift Fork

21. Remove front countershaft rear bearing retaining snap rings (using snap ring pliers J-4646 or equivalent) and bearings from front of rear case. See **Figure 5-733**.



Figure 5-733. Removing Snap Rings and Bearings

22. Punch holes in the reverse idler shaft expansion plugs, and remove plugs. See **Figure 5-734**.



Figure 5-734. Removing Expansion Plug

23. Install tool J28668 into the internal threads of reverse idler shaft. See Figure 5-735.



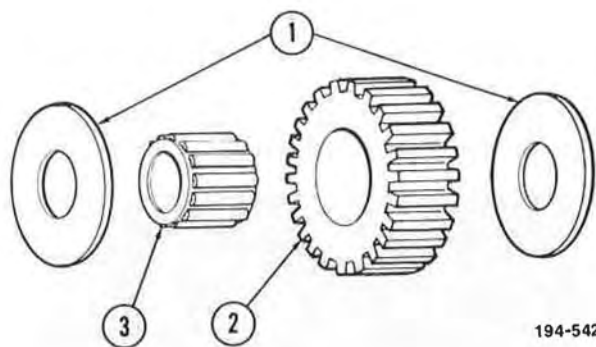
Figure 5-735. Installing Tool

24. Tighten threaded shaft of tool, and withdraw reverse idler shaft. See Figure 5-736.

25. Remove reverse idler gear, bearing, and thrust washers. See Figures 5-737 and 5-738.



Figure 5-736. Withdrawing Shaft



- 1. Thrust Washers
- 2. Idler Gear
- 3. Roller Bearing

Figure 5-737. Exploded View of Reverse Idler Gear Assembly



Figure 5-738. Removing Gear

Main Drive Pinion Disassembly

1. Remove bearing retaining spirolax snap ring. See **Figure 5-739**.



Figure 5-739. Removing Snap Ring

2. Press main drive pinion bearing off of the shaft. See **Figure 5-740**.



Figure 5-740. Pressing Bearing Off Shaft

Main Drive Pinion Bearing Cover Disassembly

1. Remove oil seal by driving it out of housing with a punch and a hammer. See **Figure 5-741**.



Figure 5-741. Removing Oil Seal

Front Mainshaft Disassembly

1. Remove front mainshaft front spigot bearing using tool CG-250. See **Figure 5-742**.



Figure 5-742. Removing Bearing

2. Remove fourth/fifth speed sliding clutch. See **Figure 5-743**.

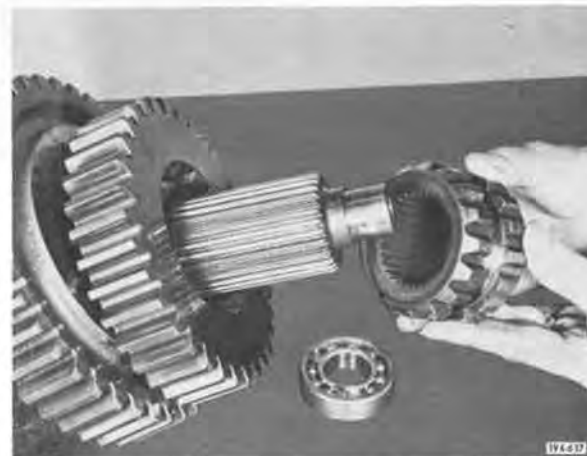


Figure 5-743. Removing Clutch

3. Remove fourth speed gear retaining snap ring, using snap ring pliers J-29045 or equivalent. See Figure 5-744.

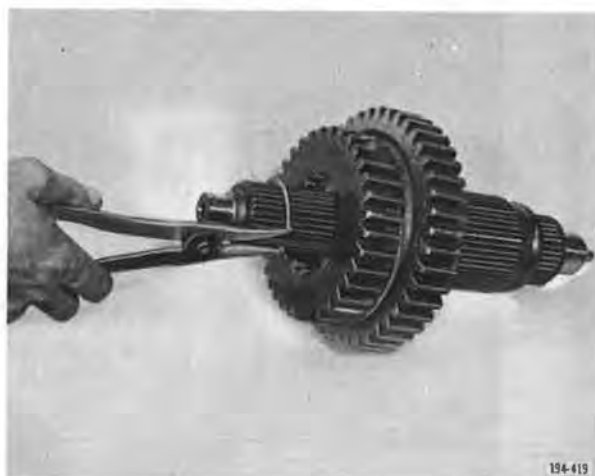


Figure 5-744. Removing Snap Ring

4. Remove fourth speed gear splined thrust washer and flanged thrust washer. See Figure 5-745.



Figure 5-745. Removing Thrust Washers

5. Remove fourth speed gear and third speed gear flanged thrust washer. See Figure 5-746.

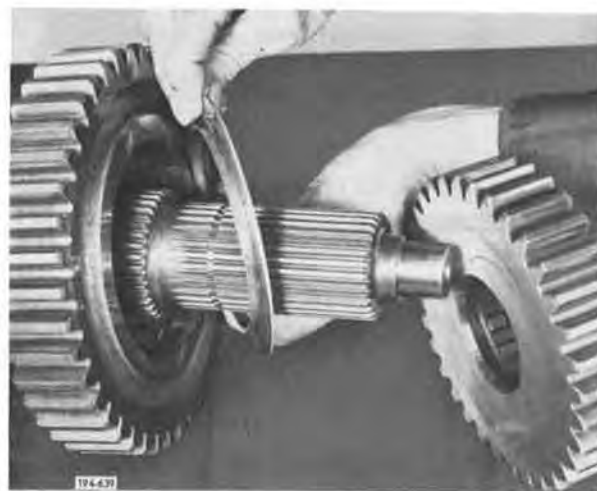


Figure 5-746. Removing Gear and Washer

6. Remove third speed gear. See Figure 5-747.



Figure 5-747. Removing Gear

7. Remove second/third speed sliding clutch. Note oil hole. See Figure 5-748.



Figure 5-748. Removing Clutch

Rear Mainshaft Disassembly

1. Remove rear mainshaft front bearing retaining spirolox snap ring. See Figure 5-749.



Figure 5-749. Removing Snap Ring

2. Remove rear mainshaft front bearing, using tool S-501. See Figure 5-750.



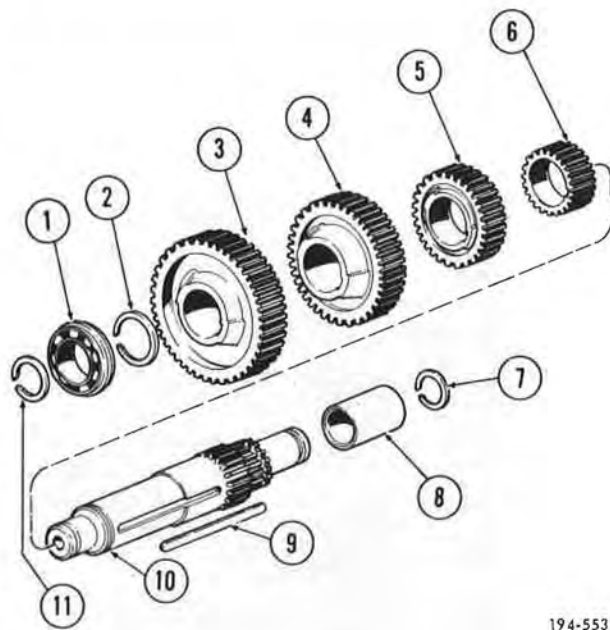
Figure 5-750. Removing Bearing

3. Place rear mainshaft assembly in a press, and press off rear bearing, speedometer gear, rear spacer, and rear bearing cover bearing inner race all at once. See Figure 5-751.



Figure 5-751. Pressing Off Bearing, Gear, Spacer and Inner Race

Front Countershaft Disassembly



- | | |
|-----------------------------|---------------------------------|
| 1. Bearing | 7. Retaining Snap Ring |
| 2. Gear Retaining Snap Ring | 8. Bearing Inner Race |
| 3. Fifth Speed Gear | 9. Key |
| 4. Fourth Speed Gear | 10. Front Countershaft |
| 5. Third Speed Gear | 11. Bearing Retaining Snap Ring |
| 6. Second Speed Gear | |

Figure 5-752. Exploded View of Front Countershaft

1. Remove front countershaft front bearing retaining snap ring, using snap ring pliers J-25445, or equivalent. See **Figure 5-753**.



Figure 5-753. Removing Snap Ring

2. Remove front countershaft front bearing using tool S593C. See **Figure 5-754**.

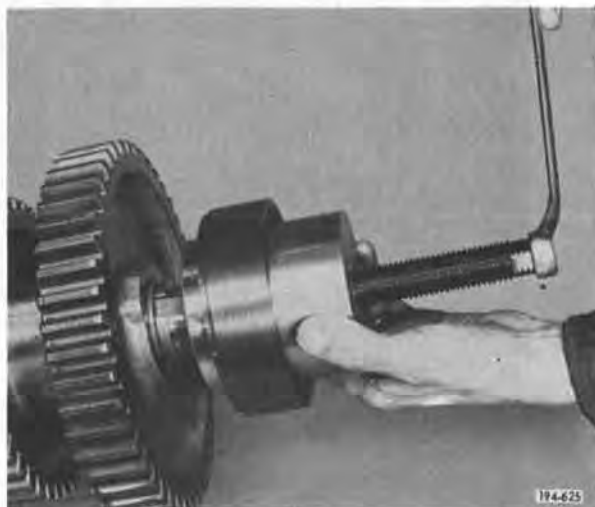


Figure 5-754. Removing Bearing

3. Remove front countershaft gear retaining snap ring, using snap ring pliers J-25445 or equivalent. See **Figure 5-755**.

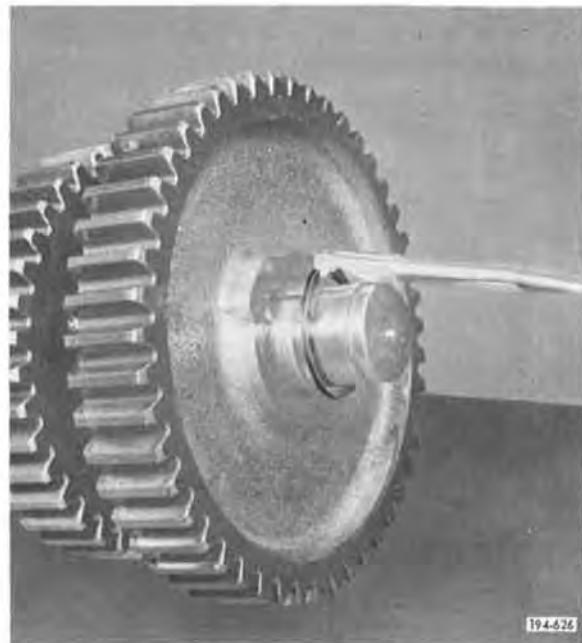


Figure 5-755. Removing Snap Ring

4. Remove bearing inner race retaining snap ring from rear of front countershaft, using snap ring pliers J-24339 or equivalent. See **Figure 5-755A**.



Figure 5-755A. Removing Snap Ring

5. Remove bearing inner race from rear of front countershaft using tool S500. See Figure 5-756.



Figure 5-756. Removing Race

6. Place front countershaft assembly in a press, and press the gears off one at a time, starting with fifth speed gear. See Figure 5-757.

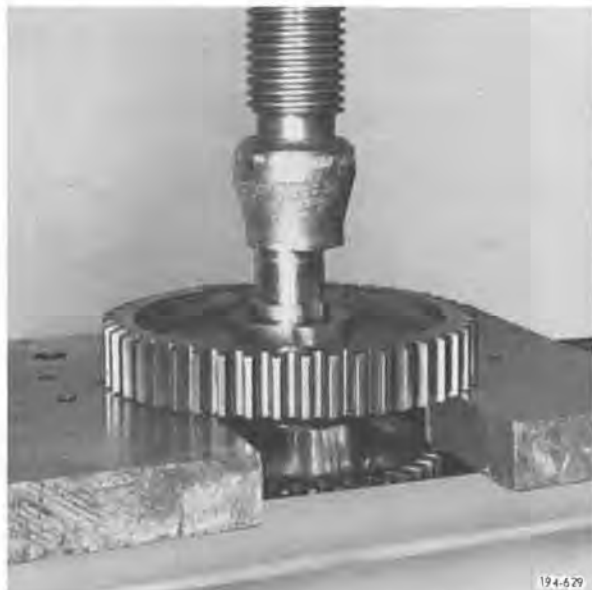
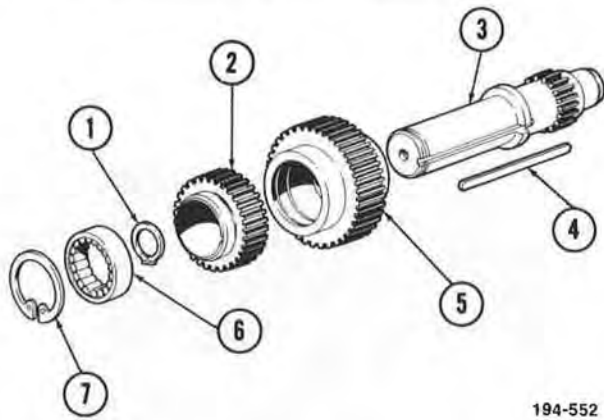


Figure 5-757. Pressing Gears Off

Rear Countershaft Disassembly



1. Gear Retaining Snap Ring
2. Direct Gear
3. Rear Countershaft
4. Key
5. Hi-range Gear Ring
6. Bearing
7. Bearing Retaining Snap Ring

Figure 5-758. Exploded View of Rear Countershaft

1. Remove rear countershaft front bearing retaining snap ring, using snap ring pliers J-4646 or equivalent. See Figure 5-759.



Figure 5-759. Removing Snap Ring

2. Remove rear countershaft front bearing using tool CG-270. See Figure 5-760.

3. Remove rear countershaft gear retaining snap ring, using snap ring pliers J-6435 or equivalent. See Figure 5-761.

4. Press the gears off of the rear countershaft. See Figure 5-762.

Rear Mainshaft Rear Bearing Cover Disassembly

1. Remove rear bearing cover oil seal, using a hammer and punch to drive it out from the inside. See Figure 5-763.



Figure 5-760. Removing Bearing



Figure 5-763. Removing Oil Seal

2. Remove rear bearing cover bearing retaining snap ring (using snap ring pliers J-4646 or equivalent) and bearing. See Figure 5-764.



Figure 5-761. Removing Snap Ring



Figure 5-764. Removing Snap Ring and Bearing

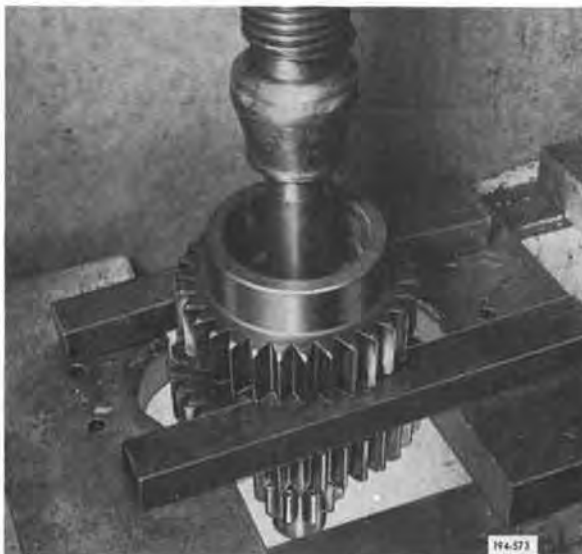
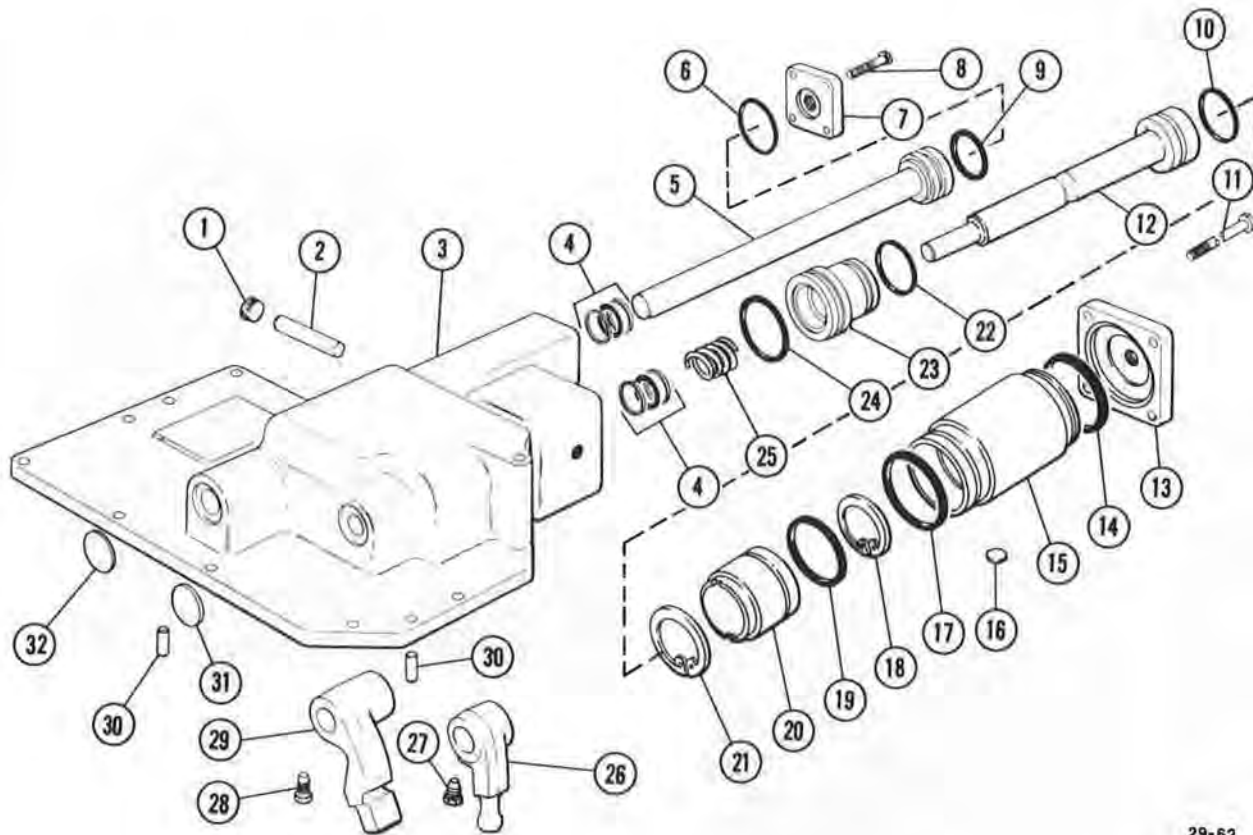


Figure 5-762. Pressing Gears Off of Rear Countershaft

Air Shift Cover Disassembly (Current Production)

(TRDL1070 Serial #7F1122, produced April, 1977 and up, and TRDLG1070 Serial #7F1260, produced April, 1977 and up)



29-62

- | | | |
|-----------------------------|----------------------------|-----------------------------|
| 1. Plug | 12. Hi /Direct Shift Rail | 23. Direct Piston |
| 2. Interlock Plunger | 13. Hi /Direct Shift Cover | 24. O-ring |
| 3. Shift Cover | 14. O-ring | 25. Spring (See Note Below) |
| 4. O-ring with Teflon Rings | 15. Shift Cylinder | 26. Hi/Direct Shifter |
| 5. Reverse Shift Rail | 16. Breather | 27. Setscrew |
| 6. O-ring | 17. O-ring | 28. Setscrew |
| 7. Reverse Shift Cover | 18. Snap Ring | 29. Reverse Shifter |
| 8. Capscrew | 19. O-ring | 30. Dowel Pin |
| 9. O-ring | 20. Hi -range Piston | 31. Expansion Plug |
| 10. O-ring | 21. Snap Ring | 32. Expansion Plug |
| 11. Capscrew | 22. O-ring | |

Figure 5-765. Exploded View of Air Shift Cover Assembly
(Current Production)

NOTE TRDL1070 only

A spring (Item 25 in Figure 5-765) was added to the Air Shift Cover Assembly starting with serial number 8S6796, produced October, 1978, and up.

1. Place both shift rails in neutral position.

2. Remove reverse shifter setscrew. See Figure 5-766.



Figure 5-766. Removing Setscrew

3. Remove reverse shift cover capscrews. See Figure 5-767.



Figure 5-767. Removing Capscrews

4. Remove reverse shift cover and o-ring. See Figure 5-768.



Figure 5-768. Removing Cover and O-ring

5. Slide reverse shift rail rearward out of cover, and, as it moves, remove reverse shifter through bottom opening. See Figure 5-769.



Figure 5-769. Removing Shift Rail and Shifter

6. Remove o-ring from reverse shift rail. See Figure 5-770.



Figure 5-770. Removing O-ring

7. Remove interlock plunger plug from air shift cover. See Figure 5-771.



Figure 5-771. Removing Plug

8. Remove interlock plunger from air shift cover. See Figure 5-772.



Figure 5-772. Removing Plunger

9. Remove Hi/Direct shift cover capscrews. See Figure 5-773.



Figure 5-773. Removing Capscrews

10. Remove Hi/Direct shift cover. See Figure 5-774.



Figure 5-774. Removing Cover

11. Remove Hi/Direct shift cover o-ring. See Figure 5-775.



Figure 5-775. Removing O-ring

12. Remove Hi/Direct shift cylinder from air shift cover. See Figure 5-776.



Figure 5-776. Removing Shift Cylinder

13. Remove Hi-range piston from Hi/Direct shift cylinder. See Figure 5-777.



Figure 5-777. Removing Piston

14. Remove snap ring from inside Hi/Direct shift cylinder, using snap ring pliers J-24339 or equivalent. See Figure 5-778.



Figure 5-778. Removing Snap Ring

15. Remove o-ring from end of Hi/Direct shift cylinder. See Figure 5-779.



Figure 5-779. Removing O-ring

16. Remove snap ring from inside Hi-range piston, using snap ring pliers J-24339 or equivalent. See Figure 5-780.

17. Remove o-ring from Hi-range piston. See Figure 5-781.

18. Remove Hi/Direct shifter setscrew. See Figure 5-782.



Figure 5-780. Removing Snap Ring



Figure 5-781. Removing O-ring



Figure 5-782. Removing Setscrew

19. Slide Hi/Direct shift rail rearward out of cover, and, as it moves, remove Hi/Direct shifter through bottom opening. See Figure 5-783.

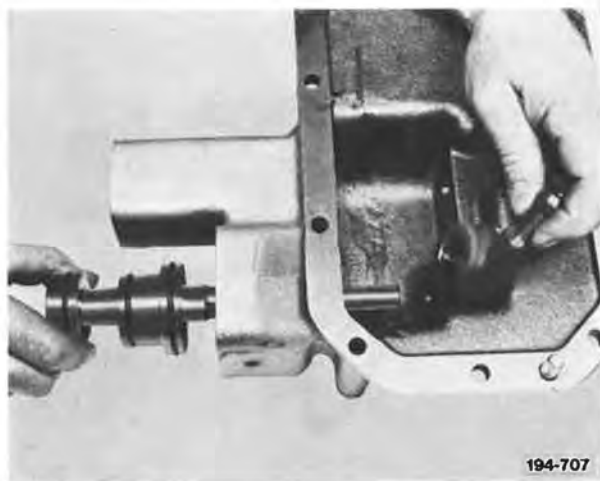


Figure 5-783. Removing Shift Rail and Shifter 20. (TRDL1070 only) (Serial Number 8S6796 and up) Remove spring from Hi/Direct shift rail.

21. Remove Direct piston from Hi/Direct shift rail. See Figure 5-784.



Figure 5-784. Removing Piston

22. Remove o-ring from Hi/Direct shift rail. See Figure 5-785.



Figure 5-785. Removing O-ring

23. Remove o-rings from Direct piston. See Figure 5-786.



Figure 5-786. Removing O-rings

24. Remove o-ring and two Teflon rings from both the reverse opening and the Hi/Direct opening of the shift cover. See Figure 5-787.



Figure 5-787. Removing O-ring and Teflon Rings

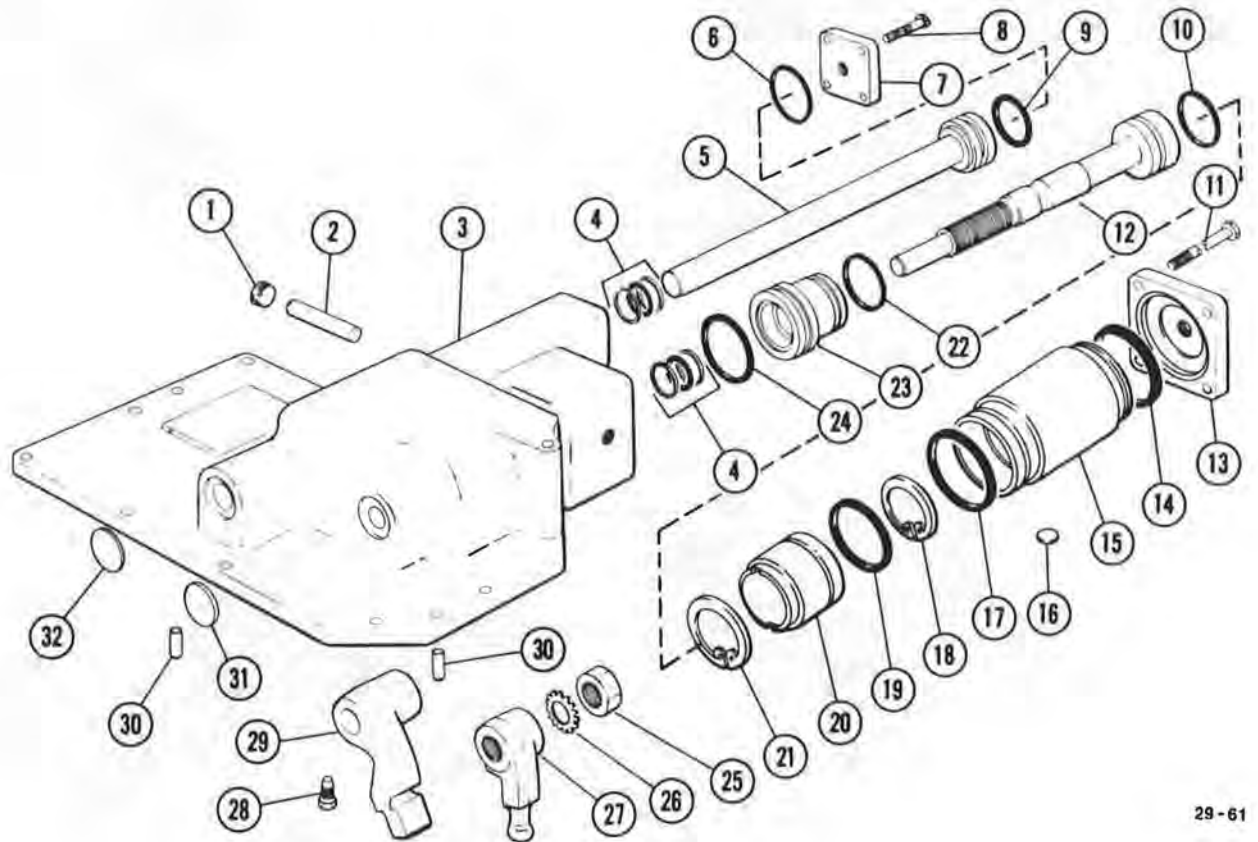
25. Clean air breather in Hi/Direct shift cylinder. See Figure 5-788.



Figure 5-788. Air Breather

Air Shift Cover Disassembly (Non-Current Production)

(TRDL1070 prior to Serial #7F1122, produced April, 1977, and TRDLG1070 prior to Serial #7F1260, produced April, 1977)



29-61

- | | | |
|-----------------------------|---------------------------|-----------------------|
| 1. Plug | 12. Hi/Direct Shift Rail | 23. Direct Piston |
| 2. Interlock Plunger | 13. Hi/Direct Shift Cover | 24. O-ring |
| 3. Shift Cover | 14. O-ring | 25. Locknut |
| 4. O-ring with Teflon Rings | 15. Shift Cylinder | 26. Lockwasher |
| 5. Reverse Shift Rail | 16. Breather | 27. Hi/Direct Shifter |
| 6. O-ring | 17. O-ring | 28. Setscrew |
| 7. Reverse Shift Cover | 18. Snap Ring | 29. Reverse Shifter |
| 8. Capscrew | 19. O-ring | 30. Dowel Pin |
| 9. O-ring | 20. Hi-range Piston | 31. Expansion Plug |
| 10. O-ring | 21. Snap Ring | 32. Expansion Plug |
| 11. Capscrew | 22. O-ring | |

Figure 5-789. Exploded View of Air Shift Cover Assembly
(Non-Current Production)

1. Place both shift rails in neutral position.

2. Remove reverse shifter setscrew. See **Figure 5-790.**



Figure 5-790. Removing Setscrew

3. Remove reverse shift cover capscrews. See **Figure 5-791**.



Figure 5-791. Removing Capscrews

4. Remove reverse shift cover and o-ring. See **Figure 5-792**.



Figure 5-792. Removing Cover and O-ring

5. Slide reverse shift rail rearward out of cover, and, as it moves, remove reverse shifter through bottom opening. See **Figure 5-793**.



Figure 5-793. Removing Shift Rail and Shifter

6. Remove o-ring from reverse shift rail. See **Figure 5-794**.



Figure 5-794. Removing O-ring

7. Remove interlock plunger plug from air shift cover. See **Figure 5-795**.



Figure 5-795. Removing Plug

8. Remove interlock plunger from air shift cover. See **Figure 5-796**.



Figure 5-796. Removing Plunger

9. Remove Hi /Direct shift cover capscrews. See Figure 5-797.



Figure 5-797. Removing Capscrews

10. Remove Hi/Direct shift cover. See Figure 5-798.



Figure 5-798. Removing Cover

11. Remove Hi/Direct shift cover o-ring. See Figure 5-799.



Figure 5-799. Removing O-ring

12. Remove Hi/Direct shift cylinder from air shift cover. See Figure 5-800.



Figure 5-800. Removing Shift Cylinder

13. Remove Hi-range piston from Hi/Direct shift cylinder. See Figure 5-801.



Figure 5-801. Removing Piston

14. Remove snap ring from inside Hi/Direct shift cylinder, using snap ring pliers J-24339 or equivalent. See Figure 5-802.



194-703

Figure 5-802. Removing Snap Ring

15. Remove o-ring from end of Hi/Direct shift cylinder. See Figure 5-803.



194-701

Figure 5-803. Removing O-ring

16. Remove snap ring from inside Hi-range piston, using snap ring pliers J-24339 or equivalent. See Figure 5-804.

17. Remove O-ring from Hi-range piston. See Figure 5-805.

18. Loosen Hi/Direct shifter locknut. See Figure 5-806.



194-704

Figure 5-804. Removing Snap Ring



194-705

Figure 5-805. Removing O-ring



194-897

Figure 5-806. Loosening Locknut

19. Turn Hi/Direct shift rail to unscrew locknut and Hi/Direct shifter, slide shift rail rearward out of cover, and at the same time, remove locknut, lockwasher, and shifter.

20. Remove Direct piston from Hi/Direct shift rail.

21. Remove o-ring from Hi/Direct shift rail. See Figure 5-807.



Figure 5-807. Removing O-ring

22. Remove o-rings from Direct piston. See Figure 5-808.



Figure 5-808. Removing O-rings

23. Remove o-ring and two Teflon rings from both the reverse opening and the Hi/Direct opening of the shift cover. See Figure 5-809.



Figure 5-809. Removing O-ring and Teflon Rings

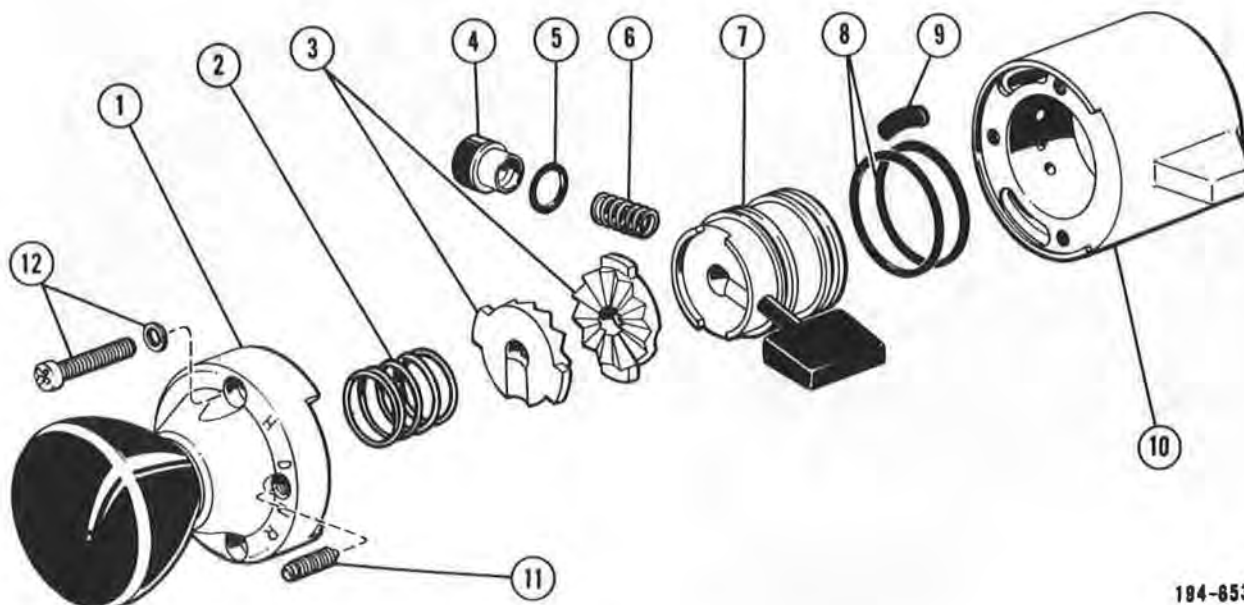
24. Clean air breather in Hi/Direct shift cylinder. See Figure 5-810.



Figure 5-810. Air Breather

25. Punch a hole in the Hi/Direct shift rail expansion plug, and remove it.

Selectair Valve Disassembly



194-653

- | | |
|-------------------------|--------------------|
| 1. Cover | 7. Rotor |
| 2. Detent Spring | 8. O-rings |
| 3. Detent Wafers | 9. Gasket |
| 4. Exhaust Valve | 10. Valve Body |
| 5. Exhaust Valve O-ring | 11. Detent Plunger |
| 6. Exhaust Valve Spring | 12. Screw |

Figure 5-811. Exploded View of Selectair Valve

1. Disconnect air lines from valve. For ease of reassembly, tag each line with the number that is stamped on the bottom of the valve.

2. Remove valve from shift lever.

3. Loosen and remove the three Phillips head screws that hold the cover. See Figure 5-812.

CAUTION

The cover provides compression for the detent spring. Screws should be loosened evenly to prevent jamming or cocking.



Figure 5-812. Removing Screws

4. Remove cover from valve body. See Figure 5-813.



Figure 5-813. Removing Cover

5. Remove detent wafer from cover. See Figure 5-814.

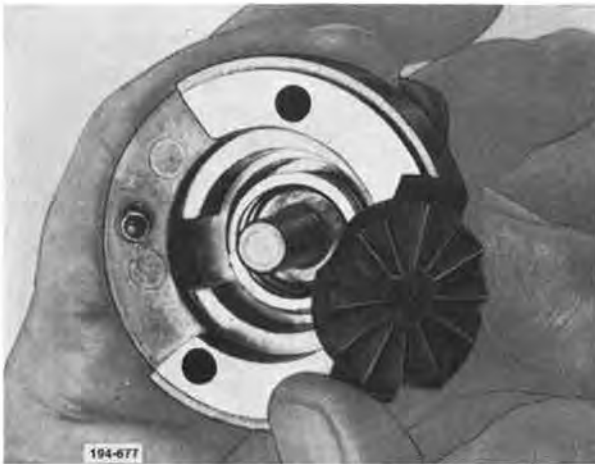


Figure 5-814. Removing Detent Wafer

6. Remove spring from cover. See Figure 5-815.



Figure 5-815. Removing Spring

7. Remove detent wafer from top of rotor. See Figure 5-816.



Figure 5-816. Removing Detent Wafer

8. Remove rotor from valve body. See Figure 5-817.

NOTE

Exhaust valve is spring loaded, and could pop out and become lost.

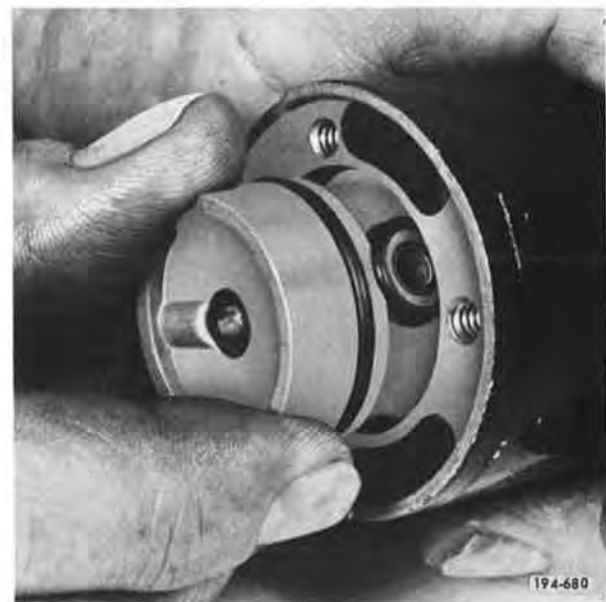


Figure 5-817. Removing Rotor

9. Remove exhaust valve from rotor. See Figure 5-818.



Figure 5-818. Removing Valve

10. Remove exhaust valve spring. See Figure 5-819.



Figure 5-819. Removing Spring

11. Remove exhaust valve o-ring. See Figure 5-820.



Figure 5-820. Removing O-ring

12. Remove both o-rings from rotor. See Figure 5-821.



Figure 5-821. Removing O-rings

13. Remove both rubber gaskets from valve body. See Figure 5-822.



Figure 5-822. Removing Gaskets

14. Remove detent plunger from cover. See Figures 5-823 and 5-824.



Figure 5-823. Loosening Plunger



Figure 5-824. Removing Plunger

INSPECTION AND CLEANING

Clean case, covers, and all other parts of the transmission thoroughly, using a suitable cleaning solvent, to remove all grease, oil, and foreign matter. Dry parts with moisture-free compressed air.

Bearings

Soak bearings in a suitable cleaning solvent to loosen all hardened grease and foreign matter. Strike bearings flat against block of wood several times and again immerse in cleaning solvent, turning races slowly. Repeat these operations until bearings are clean, and then blow them dry with filtered, moisture-free compressed air.

CAUTION

Do not spin bearings with compressed air, as damage to the bearings may result.

Inspect bearings for flaking, cracks, fractures, cavities, indentations, measurable wear, brinelling, fretting, corrosion, nicking, and cage failures. If any of these are apparent in any amount, they should be replaced.

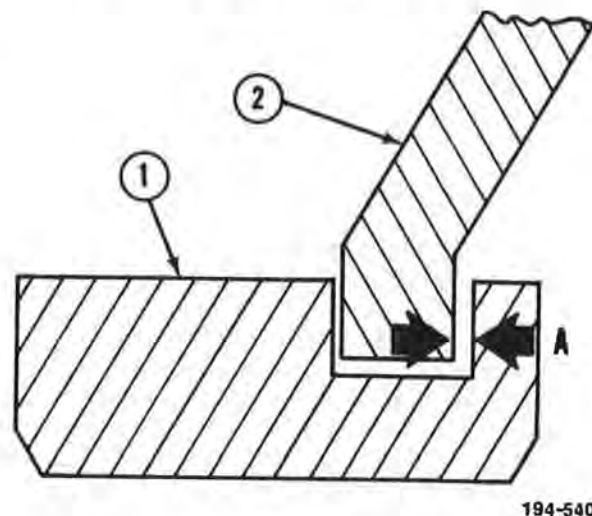
Gears

Replace gears if teeth show any sign of abrasive wear, scratching (except for normal manufacturing tool marks), ridging, scoring, surface fatigue, pitting, spalling, corrosive wear, digging in, and cracking. Gears should also be inspected by Magnaflux or similar system for cracks which would not otherwise be visible.

Shifter Forks, Sliding Clutches, and Shift Rails

Replace forks and/or clutches if side clearance in groove is in excess of specified limits, as shown in the Torque and Tolerance Table, Item 15. See **Figure 5-825**.

Replace shift rails if cracked in either the poppet or stake screw holes. In the case of wear, if the clearance between the shift rail and the mating housing bore exceeds 0.010 inch maximum, check to determine which member is worn before replacing. Shaft wear may be checked by comparing shaft diameter at an "unwearing" point as against the wear point. Refer to Torque and Tolerance Table, Item 18. See **Figure 5-826**.



1. Clutch A. Wear Tolerance Reference
2. Fork

Figure 5-825. Fork and Clutch Detail

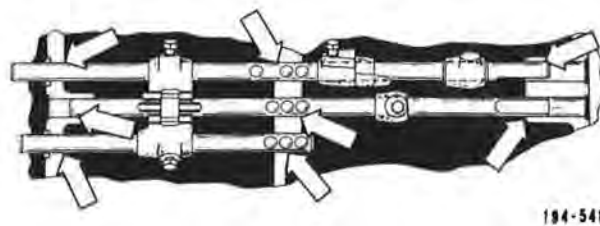


Figure 5-826. Shift Rail Wear Points

Vane Oil Pump

Replace oil pump parts if they are scored or chipped, or if vane is loose in its mating bore in excess of 0.006 inch. Refer to Torque and Tolerance Table, Item 19.

Oil Seals

When an overhaul is required, replace all oil seals. Care must be taken to be sure that the sealing surface of the seal is not damaged, turned back, or cut. A nick on the shaft surface will cut the seal. Remove sharp edges that could damage the seal (chamfer edges if possible). Press seals into housing with smooth, uniform pressure to prevent cocking the seal. Be careful when installing a shaft through a new seal. The shaft should be lubricated before inserting through a seal. Splines, keyways, or holes in shafts can damage seals unless care is taken. The sealing surface of seals should be manually lubricated to provide lubrication during "start-up" period before normal lubrication occurs.

Measuring Oil Pump Pressure

Pressure of the oil pump is low, and therefore difficult to measure. A functional check of the pump should be made prior to installing the transmission cover. This can be accomplished by pouring oil into the pump pickup trough while revolving the main drive pinion clockwise. If the pump is functioning, oil will appear at various outlets along the mainshaft. This practice will also assure initial prime to the pump and oil passages.

Selectair Valve

Clean all metal parts in a suitable solvent. Wash rubber and plastic parts with soap and water. Rinse all parts thoroughly, and blow dry with low pressure compressed air. Inspect for any signs of wear. In the case of rubber parts, if any one is worn, it is recommended that all be replaced. Inspect for any nicks, scratches, or rough edges or surfaces, that could damage O-rings. Also check for any cracks in any of the metal or plastic parts.

General Inspection

Replace cases found to be cracked. Check all other parts for wear and damage. Replace all parts as required. Replace all gaskets, O-rings, staked nuts, or any part that shows mutilation. Test and replace poppet springs that have lost their tension. Refer to Torque and Tolerance Table, Item 16. Clean up any threads that show mutilation. Repair stripped threads by using Heli-Coil or equivalent repair parts.

Repairing Worn Bearing Bores

Worn bearing bores are caused by the bearing outer races turning in their respective inserts and the bearing retaining rings wearing the inserts. When worn bearing bores are encountered, follow the instructions contained in **Figure 5-827**.

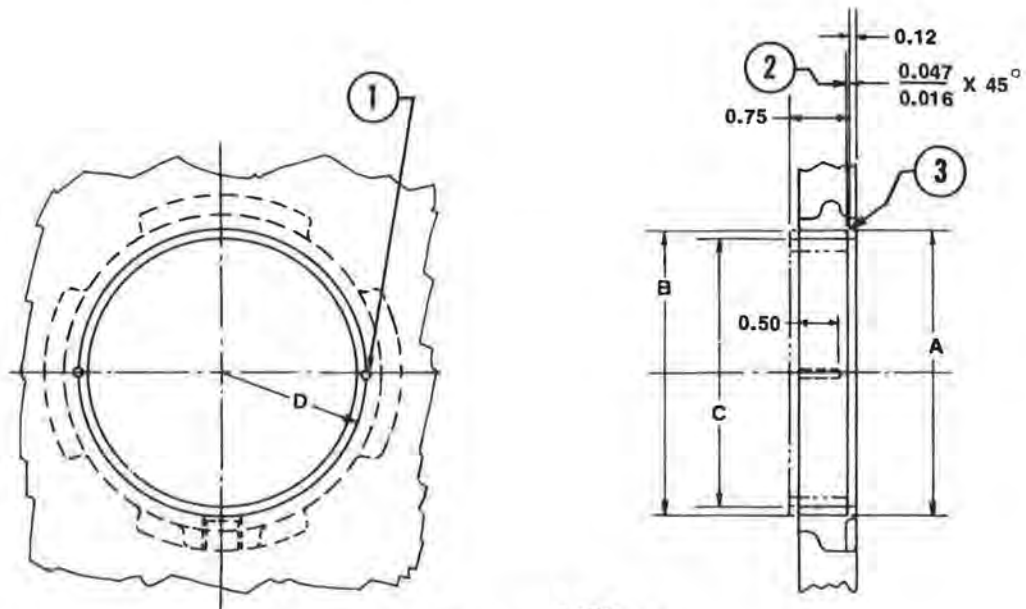
To prevent bearings turning and causing insert wear, position respective cover in place and inspect for correct cover to case clearance. See **Figures 5-828 through 5-831**. Replace cover if necessary.

If the clearance between the main driving pinion cover and case is 0.015 inch or more, use cover gasket 628KB310-P2 which is 0.031 inch thick.

If the clearance between the main driving pinion cover and case is less than 0.015 inch, use cover gasket 628KB310-P1 which is 0.016 inch thick.

If the clearance between the mainshaft rear cover and case is 0.015 inch or more, use cover gasket 628KB312A-P1 which is 0.031 inch thick.

If the clearance between the mainshaft rear cover and case is less than 0.015 inch, use cover gasket 628KB312A-P2 which is 0.016 inch thick.



1. DRILL & REAM $\frac{0.1245}{0.1240}$ DIA.
FOR TWO PINS, 31AX 289
2. ON SLEEVE
3. $\frac{0.016}{0.000}$ R. IN CASE

INSTRUCTIONS

1. APPLY LOCTITE TO SLEEVE AND PRESS INTO CASE.
2. FACE SLEEVE FLUSH WITH CASE.
3. DRILL AND REAM FOR 2 STRAIGHT PINS.
4. INSTALL 2 STRAIGHT PINS.
5. BORE TO 'C' DIMENSION.

NOTE:

SLEEVES TO BE MADE FROM
LOW CARBON STEEL TUBING
S.A.E. J403 NO. 1010 OR EQUAL
(E.G. 1018, 1020, 1112, 1118)

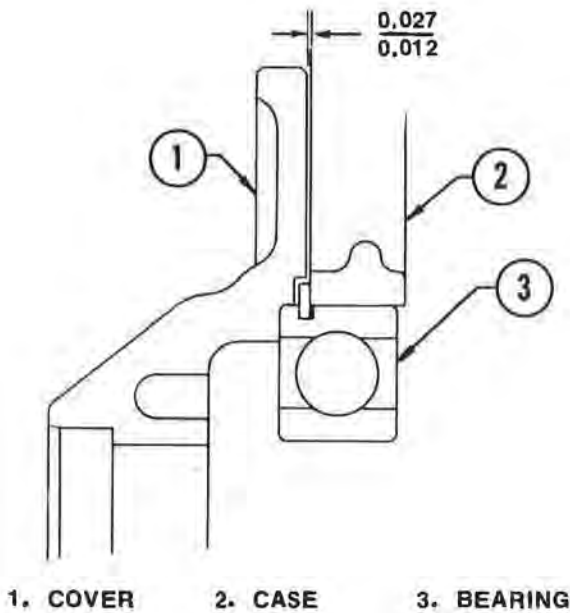
CAUTION

SLEEVES MUST BE BORED
CONCENTRIC WITHIN 0.002 IN.
OF EACH OTHER.

PART NO.	BORE LOCATION	A CASE BORE	B SLEEVE O.D.	C BEARING BORE	D PIN HOLE R.
281KB 562A AUXILIARY CASE	COUNTERSHAFT	3.794/3.793	3.7950/3.7945	3.544/3.543	1.897
	MAINSHAFT	5.172/5.171	5.1730/5.1725	4.922/4.921	2.586
284KB 5159B REAR CASE	COUNTERSHAFT	3.400/3.399	3.4010/3.4005	3.150/3.149	1.700
	MAINSHAFT	5.172/5.171	5.1730/5.1725	4.922/4.921	2.586
284KB 5163 FRONT CASE	COUNTERSHAFT	3.794/3.793	3.7950/3.7945	3.544/3.543	1.897
	MAINSHAFT	5.172/5.171	5.1730/5.1725	4.922/4.921	2.586

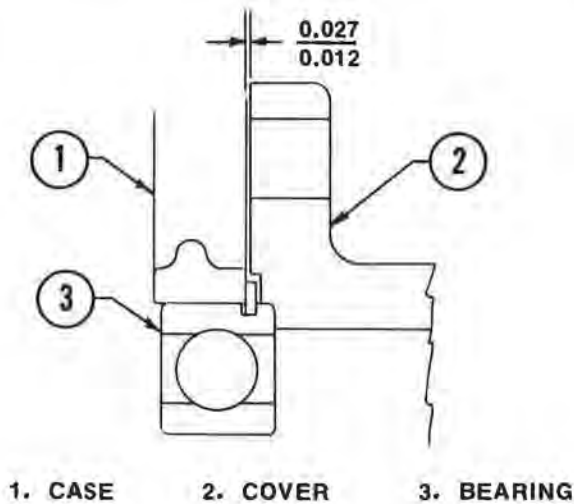
194-713

Figure 5-827. Bearing Bore Repair



194-714

Figure 5-828. Main Drive Pinion Cover Clearance



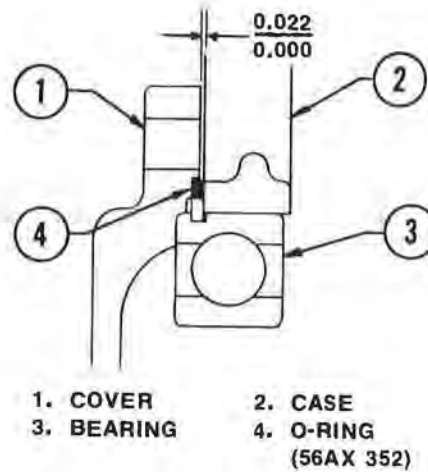
194-715

Figure 5-829. Mainshaft Rear Cover Clearance

GENERAL INSTRUCTIONS FOR REASSEMBLY

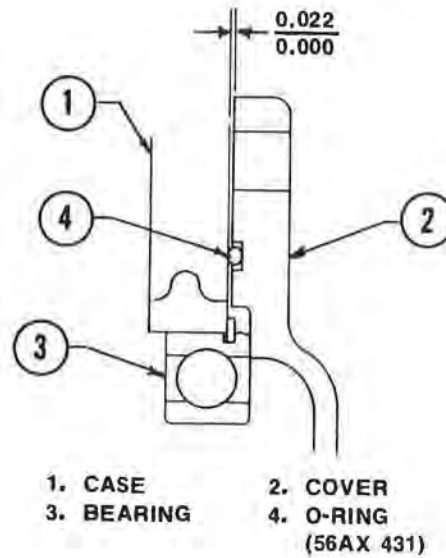
Refer to Torque and Tolerance Table for fits and limits.

All working metal parts, especially the bearings, should be coated with SAE30 oil while the transmission is being reassembled. This



194-716

Figure 5-830. Countershaft Front Cover Clearance



194-717

Figure 5-831. Countershaft Rear Cover Clearance

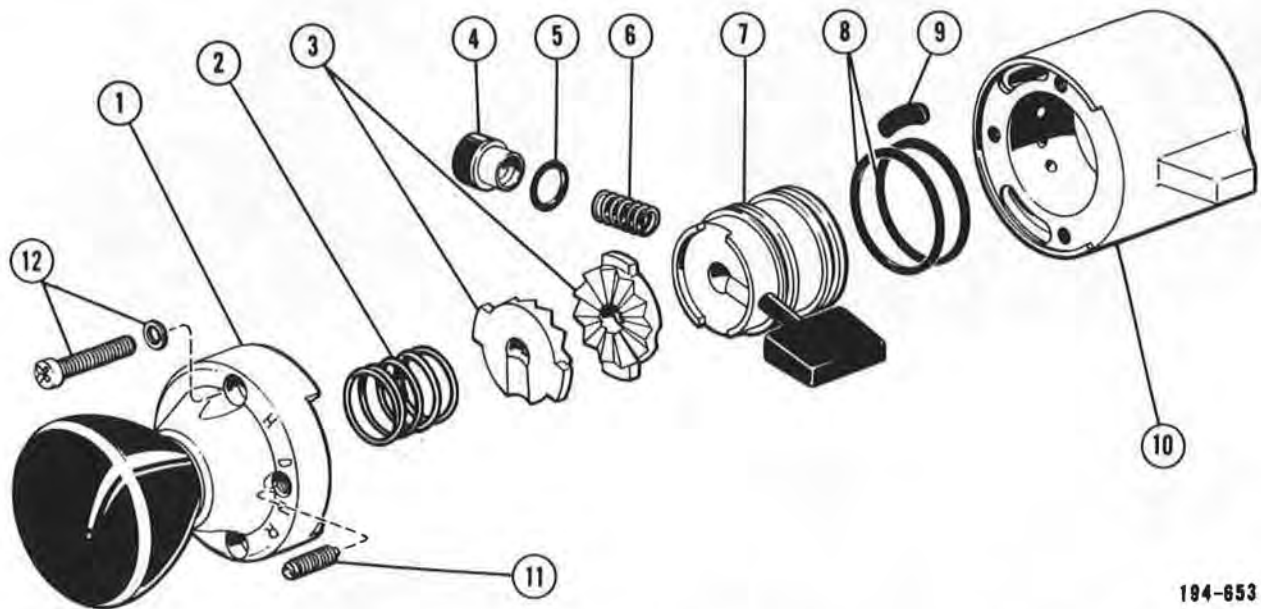
will insure immediate lubrication when first starting, and will prevent seizing of these parts.

When installing bearings, use proper bearing drivers. Do not apply force to an unloaded race, because bearing damage can result (even though not visible or evident at the time) which will cause premature bearing failure. Apply pressure evenly to prevent cocking the bearing.

As moving parts are assembled, check frequently to see that they move freely.

REASSEMBLY

Selectair Valve Reassembly



- | | | |
|------------------|-------------------------|--------------------|
| 1. Cover | 5. Exhaust Valve O-Ring | 9. Gasket |
| 2. Detent Spring | 6. Exhaust Valve Spring | 10. Valve Body |
| 3. Detent Wafers | 7. Rotor | 11. Detent Plunger |
| 4. Exhaust Valve | 8. O-Rings | 12. Screw |

Figure 5-832. Exploded View of Selectair Valve

Lubrication: On plastic detents, use Sun Oil C-8-91-T, Sunaplex 781, Texaco Marfax "O" grease, or equivalent. On all rubber to metal surfaces, use Dow Corning #55 Pneumatic grease (MIL-G-4343B) or equivalent. On all metal to metal surfaces, use Fiske Lubriplate 107, or equivalent.

1. Insert detent plunger into cover and screw plunger in until its tip just protrudes through bottom of cover. See Figures 5-833 and 5-834.



Figure 5-833. Installing Plunger



Figure 5-834. Tightening Plunger

2. Install both rubber gaskets onto their slots in valve body. See Figure 5-835.

3. Install both o-rings onto rotor. See Figure 5-836.



Figure 5-835. Installing Gaskets



Figure 5-838. Installing Spring



Figure 5-836. Installing O-rings

4. Install exhaust valve o-ring. See Figure 5-837.



Figure 5-837. Installing O-ring

5. Install exhaust valve spring. See Figure 5-838.



Figure 5-839. Installing Valve

7. Hold exhaust valve in place against its spring, and install rotor into valve body. See Figure 5-840.



Figure 5-840. Installing Rotor

8. Install one detent wafer onto top of rotor. See **Figure 5-841**.

CAUTION

Depression in back of detent wafer must align with raised portion in top of rotor, and wafer tangs must align with slots in top of rotor, to prevent detent wafer from cracking.



Figure 5-841. Installing Lower Detent Wafer

9. Place the other detent wafer on top of the one just installed, aligning depression in the top detent wafer with the two tangs of the bottom wafer. See **Figure 5-842**.



Figure 5-842. Installing Top Detent Wafer

10. Align handle of rotor directly over reference extension of valve body.

11. Install spring into cover. See **Figure 5-843**.



Figure 5-843. Installing Spring

12. Bring two halves together, aligning rotor handle with slot provided for it in cover. See **Figure 5-844**.



Figure 5-844. Installing Cover

13. Press two halves together manually, compressing detent spring, and rotate each half slightly until tangs of top detent wafer seat themselves in slots provided in cover assembly.

14. Continue holding two halves together to maintain alignment, and install the cover screws. See **Figure 5-845**.



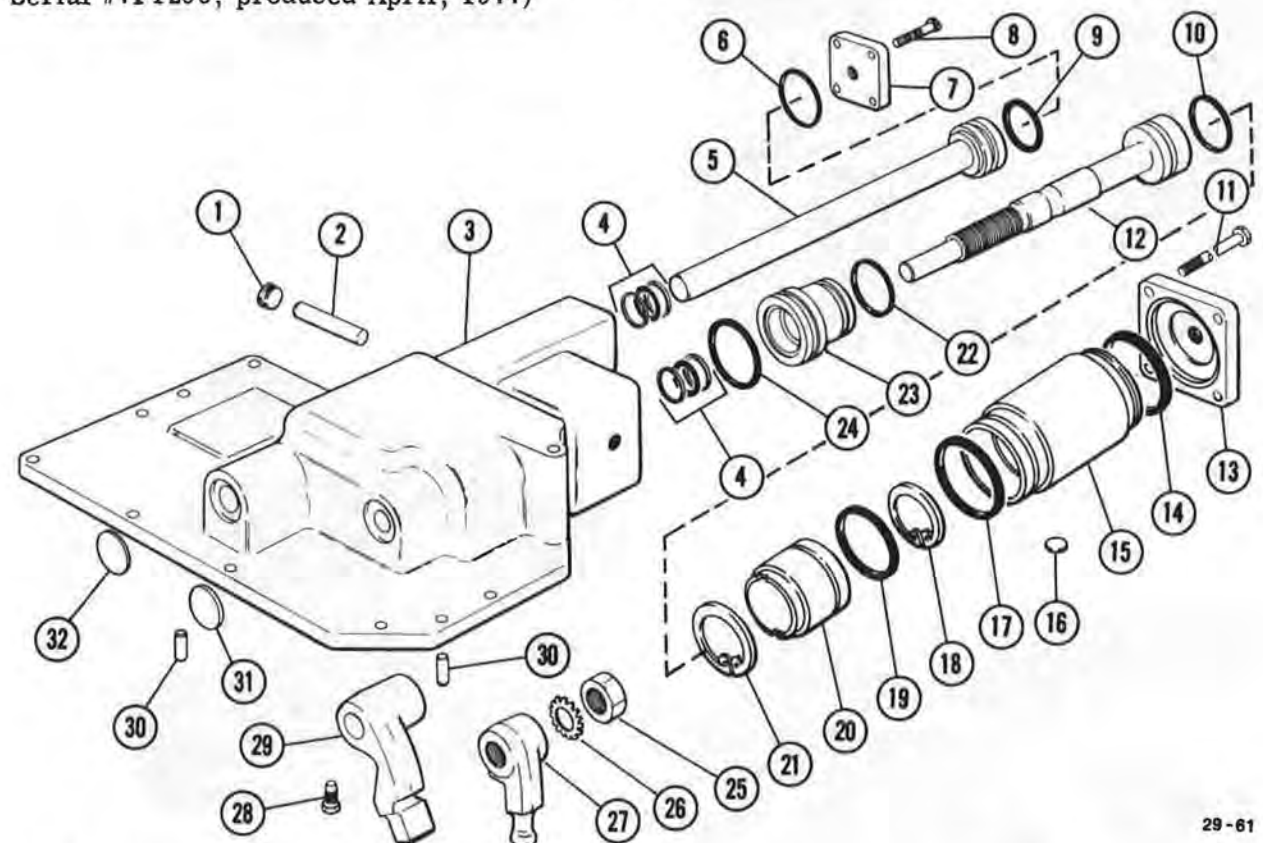
Figure 5-845. Installing Screws

Air Shift Cover Reassembly (Non-Current Production)

(TRDL1070 prior to Serial #7F1122, produced April, 1977, and TRDLG1070 prior to Serial #7F1260, produced April, 1977)

15. Adjust detent plunger so that it provides added resistance to movement of the lever between Direct and Neutral positions.

16. Connect air lines to valve, and install valve on shift lever.



29-81

- | | | |
|-----------------------------|---------------------------|------------------------------|
| 1. Plug | 12. Hi/Direct Shift Rail | 23. Direct Piston |
| 2. Interlock Plunger | 13. Hi/Direct Shift Cover | 24. O-ring |
| 3. Shift Cover | 14. O-ring | 25. Locknut |
| 4. O-ring with Teflon Rings | 15. Shift Cylinder | 26. Lockwasher |
| 5. Reverse Shift Rail | 16. Breather | 27. Hi/Direct Shifter |
| 6. O-ring | 17. O-ring | 28. Setscrew |
| 7. Reverse Shift Cover | 18. Snap Ring | 29. Reverse Shifter |
| 8. Capscrew | 19. O-ring | 30. Dowel Pin |
| 9. O-ring | 20. Hi-Range Piston | 31. Expansion Plug |
| 10. O-ring | 21. Snap Ring | 32. Expansion Plug |
| 11. Capscrew | 22. O-ring | |

Figure 5-846. Exploded View of Air Shift Cover Assembly (Non-Current Production)

NOTE

Lubricate o-rings with a multi-purpose grease meeting Mack specification MG-C before installation.

1. Install o-ring and two Teflon rings in both the reverse opening and the Hi/Direct opening of shift cover. See **Figure 5-847**.



Figure 5-847. Installing O-ring and Teflon Rings

2. Install o-rings onto Direct piston. See **Figure 5-848**.



Figure 5-848. Installing O-rings

3. Install o-ring onto Hi/Direct shift rail. See **Figure 5-849**,

4. Install Direct piston onto Hi/Direct shift rail, small end first.

5. Insert Hi/Direct shift rail into shift cover, and at the same time, install locknut, lockwasher, and Hi/Direct shifter.



Figure 5-849. Installing O-ring

6. Turn Hi/Direct shift rail to screw it into and through the locknut, lockwasher, and shifter. Leave locknut loose for adjustment later.

7. Install o-ring onto Hi-range piston. See **Figure 5-850**.



Figure 5-850. Installing O-ring

8. Install snap ring into inside of Hi-range piston, using snap ring pliers J-24339 or equivalent. See **Figure 5-851**.



Figure 5-851. Installing Snap Ring

9. Install o-ring onto end of Hi/Direct shift cylinder that is nearest the air breather. See **Figure 5-852**.



Figure 5-852. Installing O-ring

10. Install snap ring into inside of Hi/Direct shift cylinder, using snap ring pliers J-24339 or equivalent. See **Figure 5-853**.



Figure 5-853. Installing Snap Ring

11. Install Hi-range piston into Hi/Direct shift cylinder. See **Figure 5-854**.



Figure 5-854. Installing Piston

12. Install Hi/Direct shift cylinder onto shift cover, by sliding it over the end of the Hi/Direct shift rail. See **Figure 5-855**.



Figure 5-855. Installing Shift Cylinder

13. Install o-ring onto end of Hi/Direct shift cylinder. See **Figure 5-856**.



Figure 5-856. Installing O-ring

14. Install Hi/Direct shift cover onto Hi/Direct shift cylinder. See Figure 5-857.



Figure 5-857. Installing Cover

15. Install Hi/Direct shift cover capscrews, and tighten to recommended torque. Refer to Torque and Tolerance Table, Item 2. See Figure 5-858.



Figure 5-858. Installing Capscrews

16. Place Hi/Direct shift rail in neutral position, and install interlock plunger. See Figure 5-859.



Figure 5-859. Installing Plunger

17. Install interlock plunger plug into shift cover. See Figure 5-860.

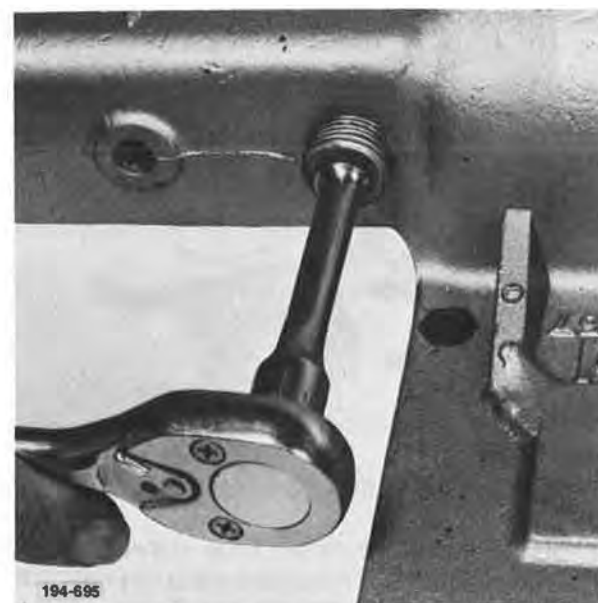


Figure 5-860. Installing Plug

18. Install o-ring onto reverse shift rail. See **Figure 5-861**.



Figure 5-861. Installing O-ring

19. Slide reverse shift rail into shift cover and, at the same time, install reverse shifter. See **Figure 5-862**.



Figure 5-862. Installing Shift Rail and Shifter

20. Install reverse shift cover o-ring and reverse shift cover. See **Figure 5-863**.



Figure 5-863. Installing Cover and O-ring

21. Install reverse shift cover capscrews, and tighten to recommended torque. Refer to Torque and Tolerance Table, Item 14. See **Figure 5-864**.

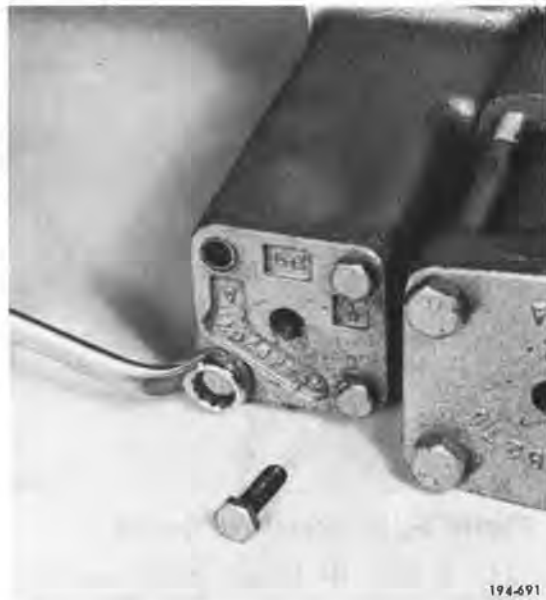


Figure 5-864. Installing Capscrews

22. Install reverse shifter setscrew, and tighten to recommended torque. Refer to Torque and Tolerance Table, Item 8. See **Figure 5-865**.

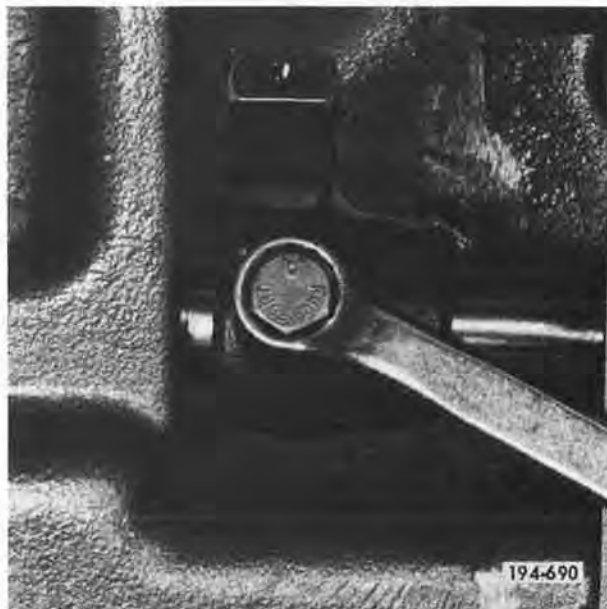


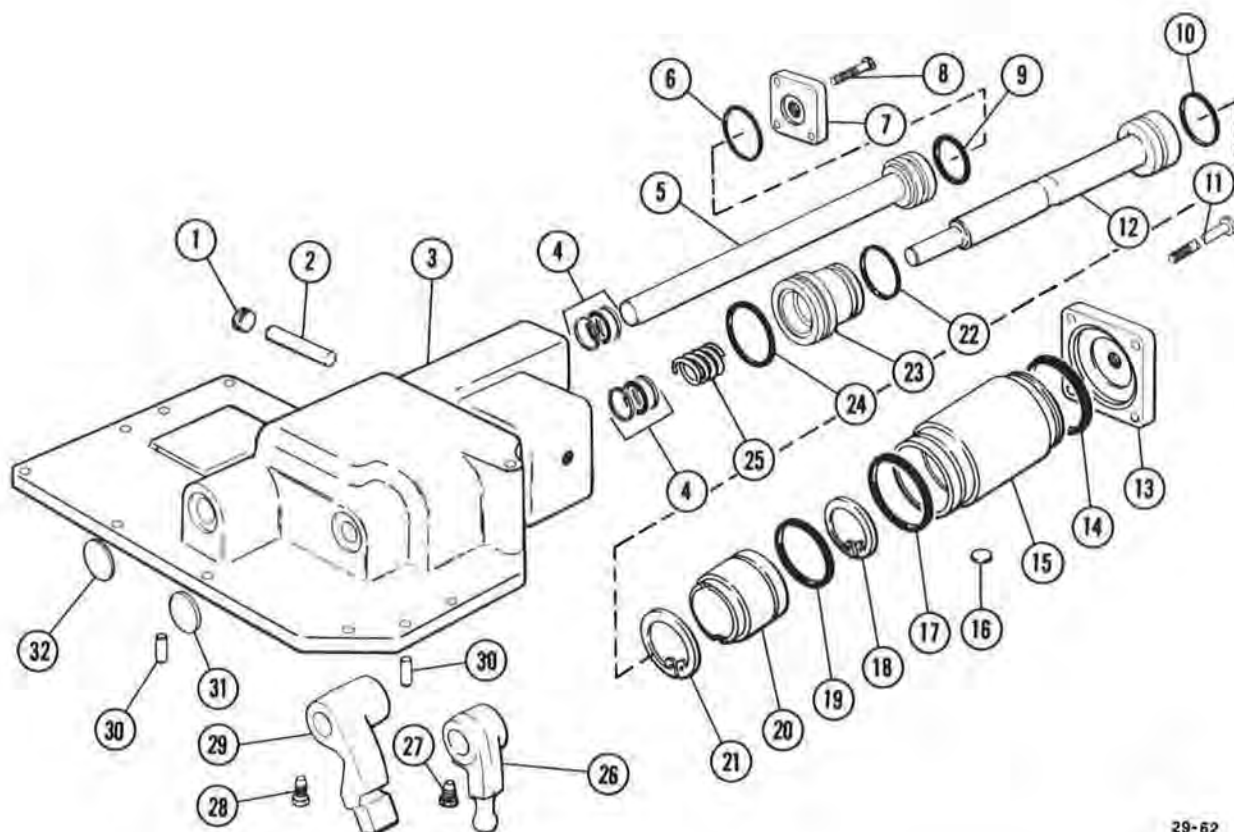
Figure 5-865. Installing Setscrew

NOTE

Do Not Install expansion plug (Item 31 in **Figure 5-846**) at this time, so that Lo Direct shifter may be adjusted later.

Air Shift Cover Reassembly (Current Production)

(TRDL1070 Serial #7F1122, produced April, 1977 and up, and TRDLG1070 Serial #7F1260, produced April 1977 and up)



29-62

- | | | |
|-----------------------------|----------------------------|-----------------------------|
| 1. Plug | 12. Hi /Direct Shift Rail | 23. Direct Piston |
| 2. Interlock Plunger | 13. Hi /Direct Shift Cover | 24. O-Ring |
| 3. Shift Cover | 14. O-Ring | 25. Spring (See Note Below) |
| 4. O-Ring with Teflon Rings | 15. Shift Cylinder | 26. Hi/Direct Shifter |
| 5. Reverse Shift Rail | 16. Breather | 27. Setscrew |
| 6. O-Ring | 17. O-Ring | 28. Setscrew |
| 7. Reverse Shift Cover | 18. Snap Ring | 29. Reverse Shifter |
| 8. Capscrew | 19. O-Ring | 30. Dowel Pin |
| 9. O-Ring | 20. Hi -Range Piston | 31. Expansion Plug |
| 10. O-Ring | 21. Snap Ring | 32. Expansion Plug |
| 11. Capscrew | 22. O-Ring | |

Figure 5-866. Exploded View of Air Shift Cover Assembly
(Current Production)

NOTE
(TRDL1070 only)

A spring (Item 25 in Figure 5-866) was added to the Air Shift Cover Assembly starting with Serial Number 8S6796, produced October, 1978 and up.

NOTE

Lubricate o-rings with a multi-purpose grease meeting Mack specification MG-C before installation.

1. Install o-ring and two Teflon rings in both the reverse opening and the Hi/Direct opening of shift cover. See **Figure 5-867**.



Figure 5-867. Installing O-ring and Teflon Rings

2. Install o-rings onto Direct piston. See **Figure 5-868**.



Figure 5-868. Installing O-rings

3. Install o-ring onto Hi/Direct shift rail. See **Figure 5-869**.



Figure 5-869. Installing O-ring

4. Install Direct piston onto Hi/Direct shift rail. See **Figure 5-870**.



Figure 5-870. Installing Piston

5. (TRDL1070 only) (Serial Number 8S6796 and up) Install spring onto Hi/Direct shift rail.

6. Insert Hi/Direct shift rail into shift cover, and at the same time, install Hi/Direct shifter onto shift rail. See **Figure 5-871**.

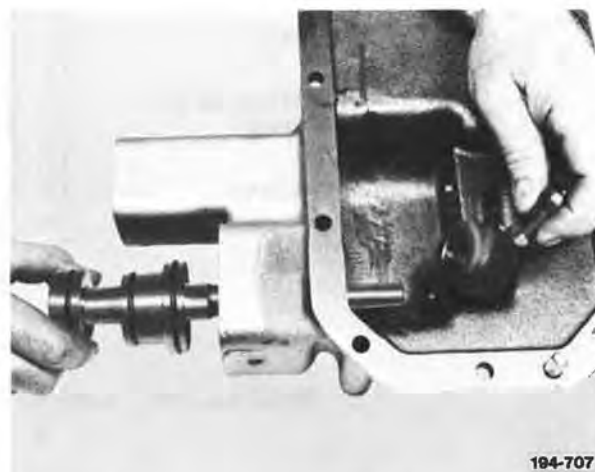


Figure 5-871. Installing Shift Rail and Shifter

7. Install Hi/Direct shifter setscrew, and tighten to recommended torque. Refer to Torque and Tolerance Table, Item 8. See **Figure 5-872**.



Figure 5-872. Installing Setscrew

8. Install o-ring onto Hi-range piston. See **Figure 5-873**.



Figure 5-873. Installing O-ring

9. Install snap ring onto inside of Hi-range piston, using snap ring pliers J-24339 or equivalent. See **Figure 5-874**.



Figure 5-874. Installing Snap Ring

10. Install o-ring onto end of Hi Direct shift cylinder that is nearest the air breather. See **Figure 5-876**.



Figure 5-876. Installing O-ring

11. Install snap ring into inside of Hi /Direct shift cylinder, using snap ring pliers J-24339 or equivalent. See **Figure 5-877**.



Figure 5-877. Installing Snap Ring

12. Install Hi-range piston into Hi Direct shift cylinder. See **Figure 5-878**.



Figure 5-878. Installing Piston

13. Install Hi/Direct shift cylinder onto shift cover, by sliding it over the end of the Hi/Direct shift rail. See **Figure 5-879**.



Figure 5-879. Installing Shift Cylinder

14. Install o-ring onto end of Hi/Direct shift cylinder. See **Figure 5-880**.



Figure 5-880. Installing O-ring

15. Install Hi/Direct shift cover onto Hi/Direct shift cylinder. See **Figure 5-881**.



Figure 5-881. Installing Cover

16. Install Hi/Direct shift cover capscrews, and tighten to recommended torque. Refer to Torque and Tolerance Table, Item 2. See **Figure 5-882**.

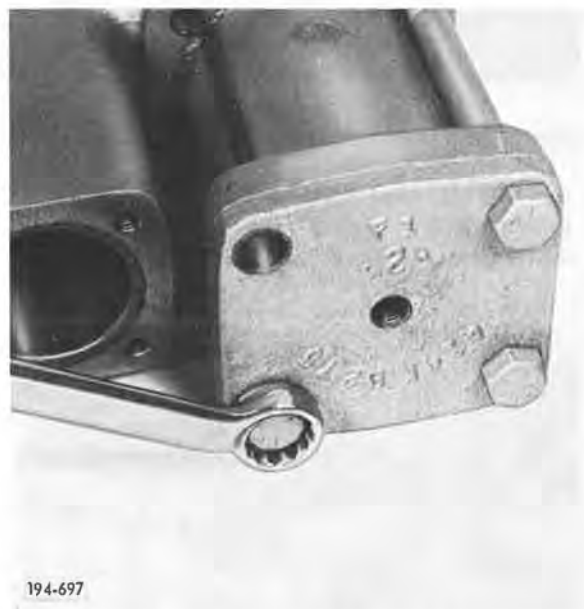


Figure 5-882. Installing Capscrews

17. Place Hi/Direct shift rail in neutral position, and install interlock plunger. See **Figure 5-883**.



Figure 5-883. Installing Plunger

18. Install interlock plunger plug into shift cover. See **Figure 5-884**.



Figure 5-884. Installing Plug

19. Install o-ring onto reverse shift rail. See **Figure 5-885**.



Figure 5-885. Installing O-ring

20. Slide reverse shift rail into shift cover and, at the same time, install reverse shifter. See **Figure 5-886**.



Figure 5-886. Installing Shift Rail and Shifter

21. Install reverse shift cover o-ring and reverse shift cover. See **Figure 5-887**.



Figure 5-887. Installing Cover and O-ring

22. Install reverse shift cover capscrews, and tighten to recommended torque. Refer to Torque and Tolerance Table, Item 14. See **Figure 5-888**.



Figure 5-888. Installing Capscrews

23. Install reverse shifter setscrew, and tighten to recommended torque. Refer to Torque and Tolerance Table, Item 8. See **Figure 5-889**.



Figure 5-889. Installing Setscrew

Rear Mainshaft Rear Bearing Cover Reassembly

1. Install bearing and snap ring into rear mainshaft rear bearing cover. See Figure 5-890.



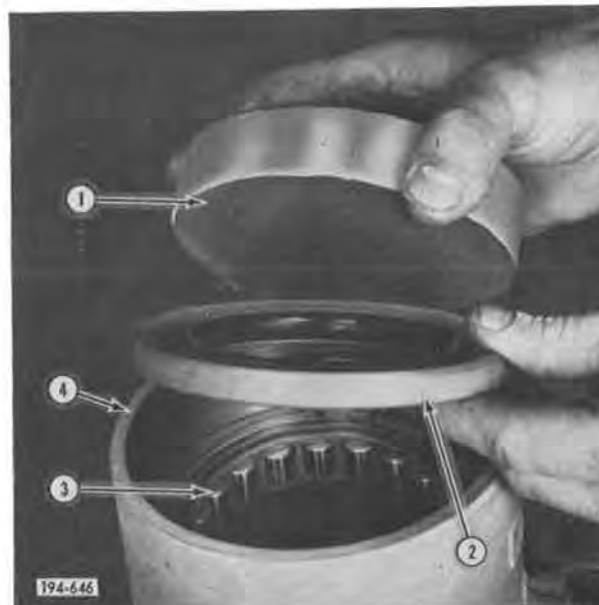
Figure 5-890. Installing Bearing and Snap Ring

2. Apply a bead of sealer to shoulder where seal will seat. Use Silastic RTV732 (Mack 243SX32) or equivalent. See Figure 5-891.



Figure 5-891. Applying Sealer

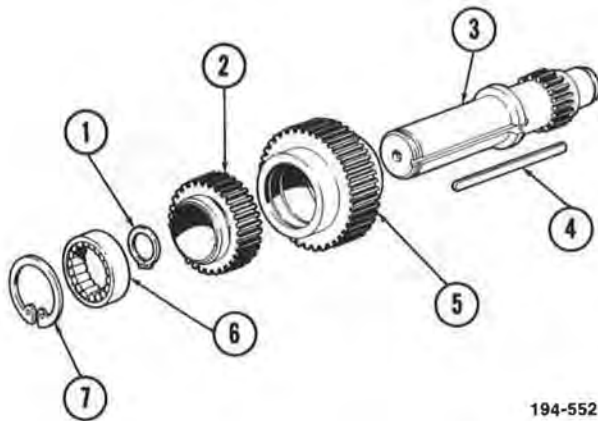
3. Press oil seal into rear bearing cover, using a suitable driver and press, until seal seats on shoulder. See Figure 5-892.



1. Driver 3. Bearing
2. Oil Seal 4. Rear Bearing Cover

Figure 5-892. Installing Seal

Rear Countershaft Reassembly



194-552

- | | |
|-----------------------------|--------------------------------|
| 1. Gear Retaining Snap Ring | 5. Hi-Range Gear |
| 2. Direct Gear | 6. Bearing |
| 3. Rear Countershaft | 7. Bearing Retaining Snap Ring |
| 4. Key | |

Figure 5-893. Exploded View of Rear Countershaft

NOTE

Gears (2 and 5) have an interference fit with rear countershaft (3) and, for best results, should be heated before being pressed on. Using heat lamp or hot oil, heat gears to 270 to 300° F. (132 to 149° C.) for a period of not more than 30 minutes.

1. Insert gear key into countershaft keyway.
2. Apply a light coat of oil to the countershaft.
3. Align the Hi-range gear with the large hub facing away from reverse gear, and press gear onto shaft until it seats against shoulder on shaft.

NOTE

Align keyway of gear carefully with key. Guard against shaving key or raising burr on key. Before final seating of gear, inspect for and remove any burrs between gear and its mating surface.

4. Apply another coat of oil to the countershaft.

5. Align Direct gear with large hub facing away from Hi-range gear, and press onto shaft until it seats against Hi-range gear. Refer to previous NOTE. See Figure 5-894.

NOTE

Notice pencils pointing to areas where there must not be any burrs.



Figure 5-894. Pressing Gears onto Countershaft

6. Install gear retaining snap ring, using snap ring pliers J-6435 or equivalent. See Figure 5-895.



Figure 5-895. Installing Snap Ring

7. Install rear countershaft front bearing.
See Figure 5-896.



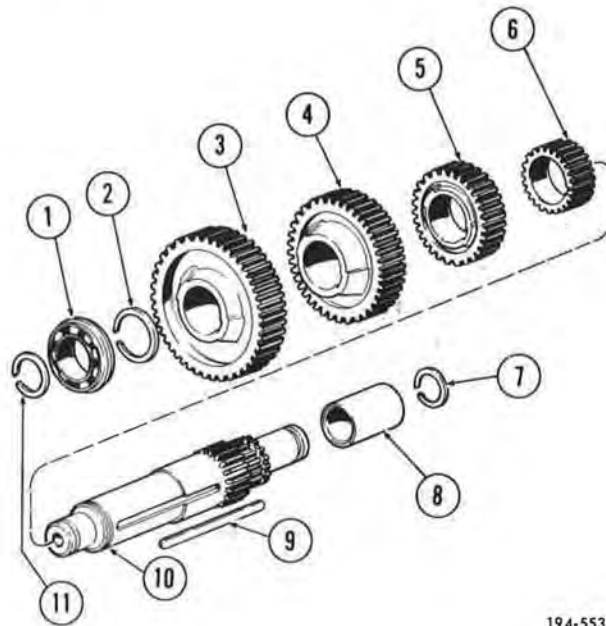
Figure 5-896. Installing Bearing

8. Install front bearing retaining snap ring using snap ring pliers J-4646 or equivalent.
See Figure 5-897.



Figure 5-897. Installing Snap Ring

Front Countershaft Reassembly



1. Bearing
2. Gear Retaining Snap Ring
3. Fifth Speed Gear
4. Fourth Speed Gear
5. Third Speed Gear
6. Second Speed Gear
7. Retaining Snap Ring
8. Bearing Inner Race
9. Key
10. Front Countershaft
11. Bearing Retaining Snap Ring

Figure 5-898. Exploded View of Front Countershaft

NOTE

Gears have an interference fit with front countershaft and, for best results, should be heated before being pressed on. Using heat lamp or hot oil, heat gears to 270 to 300° F. (132 to 149° C.) for a period of not more than 30 minutes.

1. Insert gear key into countershaft keyway.

2. Apply a light coat of oil to the countershaft.

3. Align keyway of second speed gear with key, and press gear onto shaft.

NOTE

Align keyway of gears carefully with key. Guard against shaving key or raising burr on key. Before final seating of each gear, inspect for and remove any burrs between gear and its mating surface.

4. Repeat procedure with remaining gears. Fourth speed gear hub to be toward front (away from third speed gear). Main drive gear (fifth speed gear) hub to be toward rear (next to fourth speed gear hub). See Figure 5-899.

NOTE

Notice pencil pointing to area where there must not be any burrs.

5. Install gear retaining snap ring, using snap ring pliers J-25445 or equivalent. See Figure 5-900.



Figure 5-899. Pressing Gears onto Countershaft

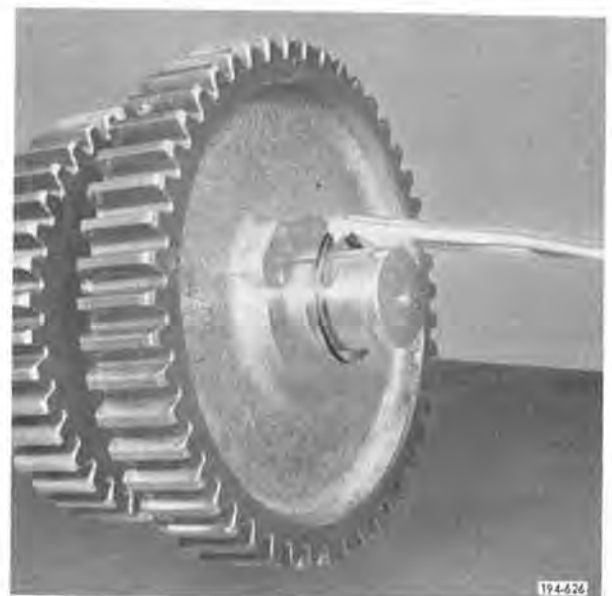


Figure 5-900. Installing Snap Ring

6. Install front countershaft front bearing, being careful to apply force to the inner race only. A soft mallet or suitable driving sleeve may be used. See **Figure 5-901**.

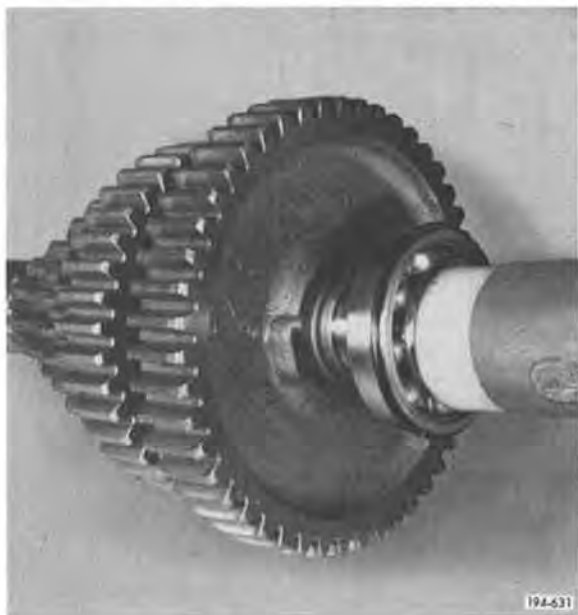


Figure 5-901. Installing Bearing

7. Install front bearing retaining snap ring, using snap ring pliers J-25445 or equivalent. See **Figure 5-902**.



Figure 5-902. Installing Snap Ring

8. Install bearing inner race on rear of front countershaft, driving it on carefully using a soft mallet or a suitable driving sleeve.

9. Install inner race retaining snap ring, using snap ring pliers J-24339 or equivalent. See **Figure 5-903**.



Figure 5-903. Installing Snap Ring

Rear Mainshaft Reassembly

1. Press rear mainshaft rear bearing onto shaft. See **Figure 5-904**.



Figure 5-904. Pressing Bearing onto Mainshaft

2. Slide speedometer gear and spacer onto rear mainshaft. See **Figure 5-905**.



Figure 5-905. Installing Gear and Spacer

3. Press rear bearing cover bearing inner race onto rear mainshaft. See Figure 5-906.

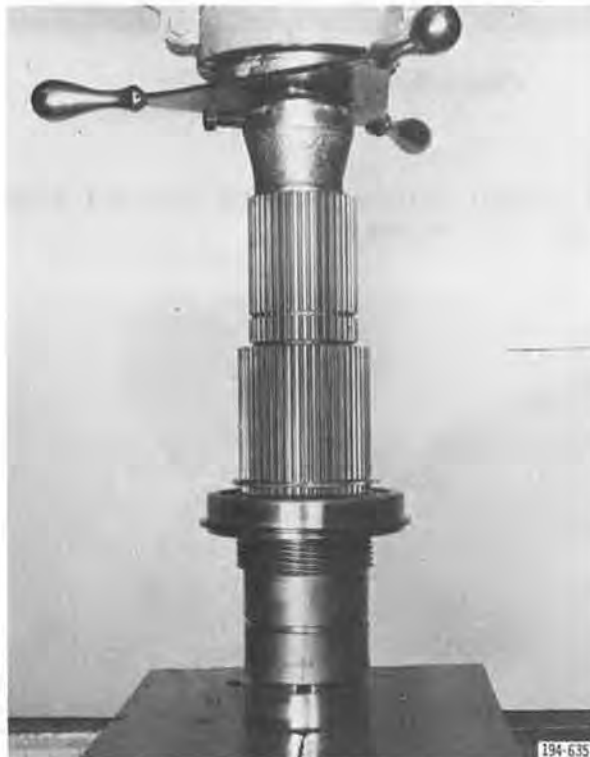


Figure 5-906. Pressing Race onto Mainshaft

4. Install rear mainshaft front bearing, using suitable driver and soft mallet. See Figure 5-907.



Figure 5-907. Installing Bearing

5. Install rear mainshaft front bearing retaining snap ring. See Figure 5-908.



Figure 5-908. Installing Snap Ring

Front Mainshaft Reassembly

Since mainshaft third speed gear will be needed for timing the front countershafts, do not assemble the front mainshaft at this time.

Main Drive Pinion Bearing Cover Reassembly

1. Apply a bead of sealer to shoulder where the seal will seat. Use Silastic RTV732 (Mack 243SX32) or equivalent. See Figure 5-909.

Main Drive Pinion Reassembly

1. Press main drive pinion bearing onto main drive pinion shaft. Be sure outer race snap ring is positioned toward pilot end of pinion (away from pinion gear teeth). See Figure 5-912.



Figure 5-909. Applying Sealer

2. Place seal in position and select an appropriate driver. See Figure 5-910.



Figure 5-910. Placing Seal in Position

3. Place assembly in a press, and press seal into cover, until it seats on shoulder. See Figure 5-911.



Figure 5-911. Pressing Seal into Cover



Figure 5-912. Installing Bearing

2. Install bearing retaining spirollox snap ring. See Figure 5-913.



Figure 5-913. Installing Snap Ring

Rear Case Reassembly

1. Insert expansion plug into reverse idler shaft. See **Figure 5-914**.



Figure 5-914. Inserting Expansion Plug

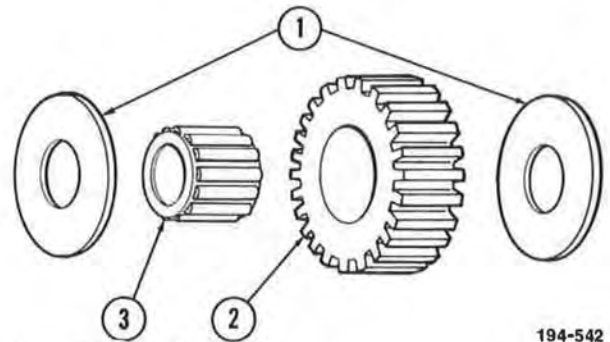
2. Install expansion plug by driving it downward with a driver. Driver to be cylindrical in shape, with a diameter the same as the expansion plug, and a flat (not rounded) end.

3. Insert reverse idler shaft partially into rear case, taking care to align flats on end of shaft with centerline of countershaft bore. See **Figure 5-915**.



Figure 5-915. Alignment of Idler Shaft

4. Install reverse idler gear, bearing, and thrust washers into rear case. See **Figures 5-916 and 5-917**.



- 1. Thrust Washers
- 2. Idler Gear
- 3. Bearing

Figure 5-916. Exploded View of Reverse Idler Gear Assembly



Figure 5-917. Installing Reverse Idler Gear Assembly

NOTE

Install with rounded edge of teeth of reverse idler gear forward.

5. Drive reverse idler shaft part way into rear case with a soft mallet, being sure that reverse idler gear, bearing, and thrust washers are in proper alignment for shaft to go through them. See **Figure 5-918**.



Figure 5-918. Installing Shaft

6. Apply appropriate sealer around the outer edge of shaft where it meets the case. See **Figure 5-919**.



Figure 5-919. Applying Sealer

7. Drive reverse idler shaft the rest of the way into case, until relief is flush with case.

8. Measure reverse idler gear end play with a feeler gauge. See **Figure 5-920**. Refer to Torque and Tolerance Table, Item 20. If end play is not within tolerance, replace washers. If still not correct, replace reverse idler gear. If still not within tolerance, case must be replaced.

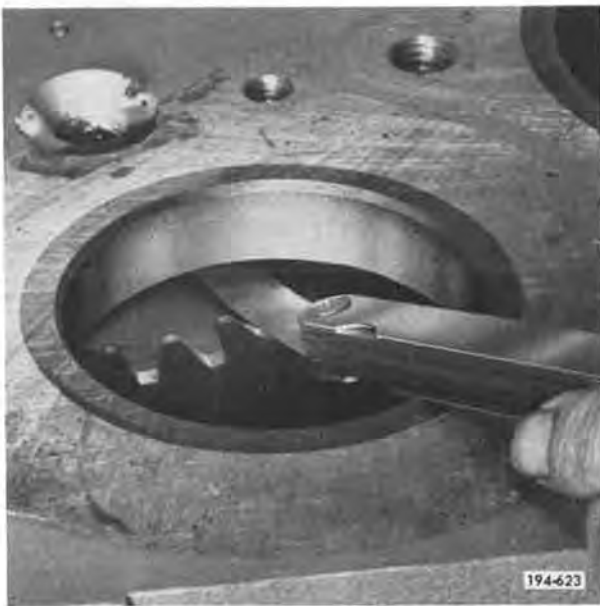


Figure 5-920. Measuring End Play

9. Apply appropriate sealer to end of reverse idler shaft, including around expansion plug. See **Figure 5-921**.



Figure 5-921. Applying Sealer

10. Install front countershaft rear bearings and retaining snap rings, using snap ring pliers J-4646 or equivalent. See **Figure 5-922**.



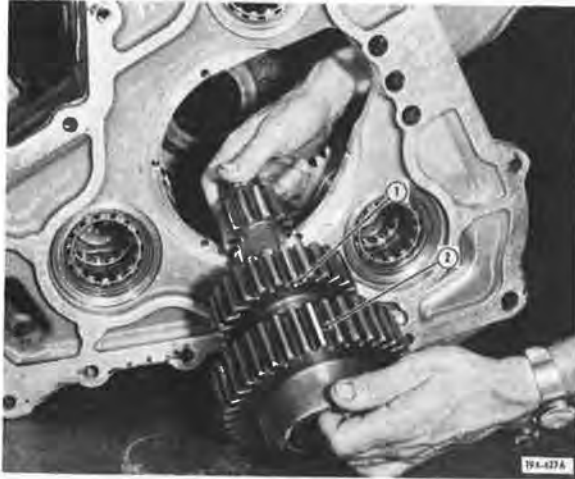
Figure 5-922. Installing Bearing and Snap Rings

11. Install reverse gear and its shift fork. See **Figure 5-923**.



Figure 5-923. Installing Reverse Gear and Shift Fork

12. Locate timing O-marks on the rear countershaft Hi-range gears, and, with yellow paint, mark direct gear tooth top land that is directly in line with each such O-mark. Then install there rear countershaft assemblies into case. See **Figure 5-924**.



- 1. Timing Mark
- 2. Yellow Paint Marking

Figure 5-924. Installing Rear Countershaft

13. Place a block of metal at front end of rear countershaft, to provide a solid base, and install rear countershaft rear bearing using a suitable driving sleeve. Apply force to the inner race only. See **Figure 5-925**.

NOTE

Notice pencil pointing to block of metal temporarily installed.



Figure 5-925. Installing Bearing

14. Place rear countershafts in position, and install rear bearing retaining snap ring, using snap ring pliers J-25445 or equivalent. See **Figure 5-926**.

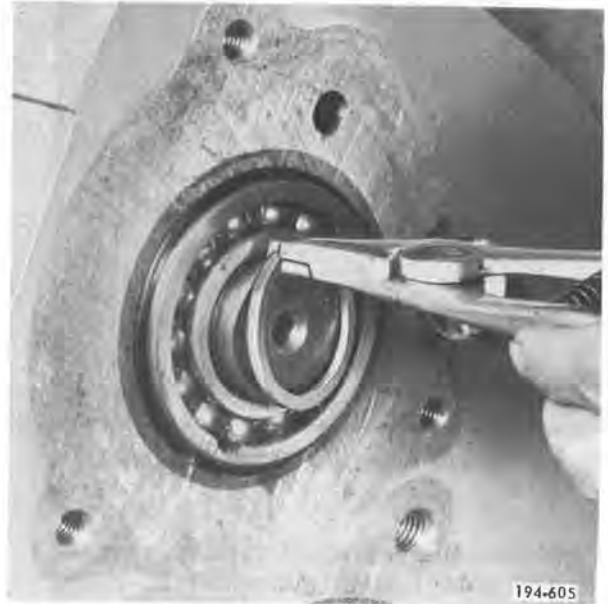


Figure 5-926. Installing Snap Ring

15. Install Hi-range gear, and temporarily position it between countershaft direct gear and Hi-range gear. See **Figure 5-927**.



Figure 5-927. Installing Gear

16. Start rear mainshaft into rear case through rear bearing opening. See **Figure 5-928**.

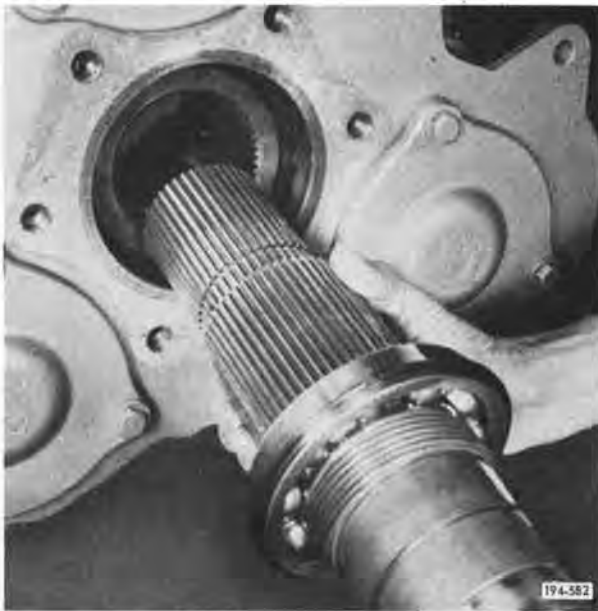
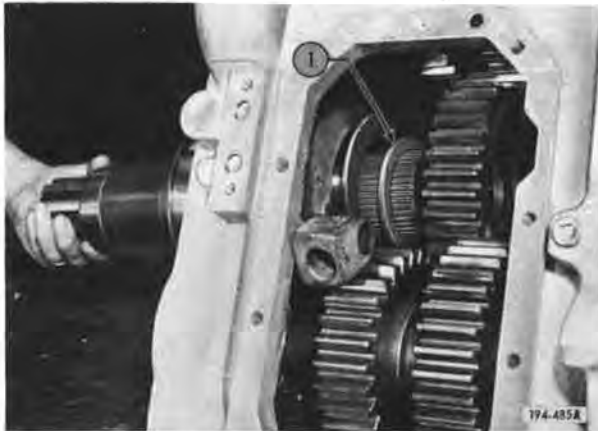


Figure 5-928. Inserting Rear Mainshaft

17. Advance shaft carefully through reverse gear, and then install mainshaft Hi-range gear rear thrust washer onto shaft. See Figure 5-929.



1. Hi-Range Gear Rear Thrust Washer

Figure 5-929. Installing Mainshaft and Washer

18. Continue advancing shaft through Hi-range gear until rear bearing positioning snap ring seats against case.

19. Install O-ring in countershaft rear bearing cover. See Figure 5-930.

20. Install rear countershaft rear bearing cover. See Figure 5-931.

21. Install rear countershaft rear bearing cover capscrews, and tighten to recommended torque. See Figure 5-932. Refer to Torque and Tolerance Table, Item 7.



Figure 5-930. Installing O-Ring



Figure 5-931. Installing Cover



Figure 5-932. Tightening Capscrew

22. Apply sealer compound and install mainshaft rear bearing cover gasket and cover assembly. See Figure 5-933.

23. Install rear bearing cover capscrews, and tighten to recommended torque. Refer to Torque and Tolerance Table, Item 12. See Figure 5-934.



Figure 5-933. Installing Cover and Gasket

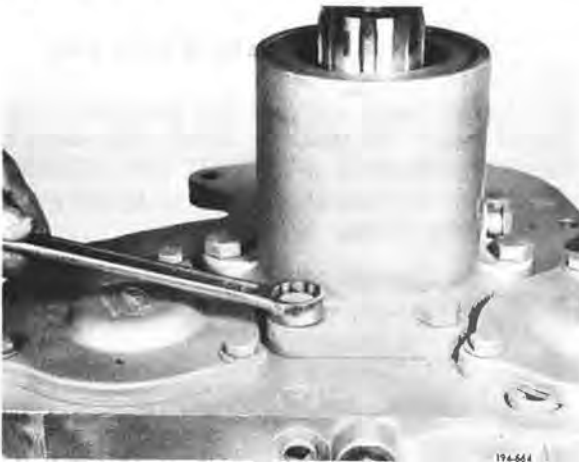


Figure 5-934. Installing Capscrews

24. Disengage reverse gear from its idler gears.

25. Locate three O-marks on face of mainshaft Hi-range gear, and locate painted timing marks on countershaft direct gears.

26. Place O-marks and painted timing marks in alignment, and engage mainshaft Hi-range gear. See Figure 5-935.



1. Mainshaft Hi-range Gear Timing Marks
2. Countershaft Direct Gear Timing Marks

Figure 5-935. Timing Mark Alignment

27. Through rear case front opening, install Hi-range gear front thrust washer. See Figure 5-936.



Figure 5-936. Installing Thrust Washer

28. Install Hi-range gear retaining snap ring, using snap ring pliers J-6435 or equivalent. See Figure 5-937.

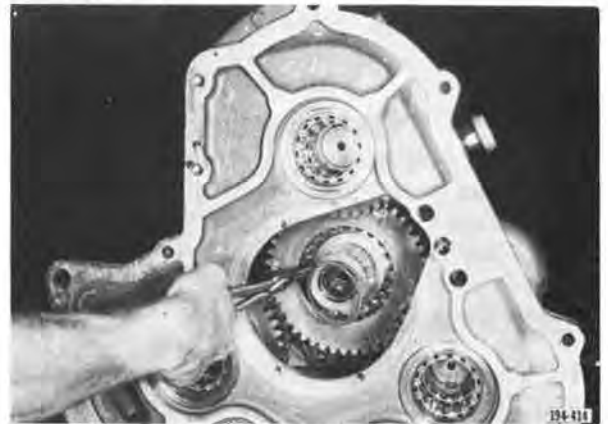


Figure 5-937. Installing Snap Ring

29. Install Direct/Hi-range sliding clutch and its shift fork as an assembly. See Figure 5-938.



Figure 5-938. Installing Sliding Clutch and Shift Fork

30. Install a wire to hold the Direct/Hi-range shift fork from sliding forward. See Figure 5-939.

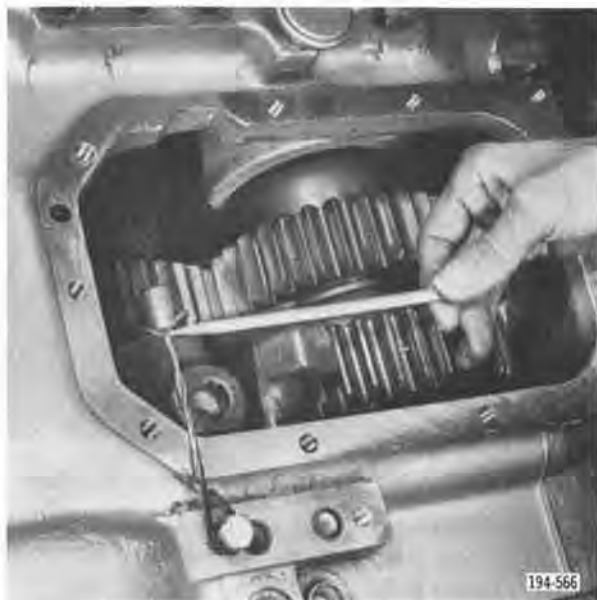


Figure 5-939. Wire Holding Shift Fork

WARNING

Direct/Hi-range sliding clutch and shift fork could fall out of case and cause injury, if they are not secured.

Front Case Reassembly

1. Position transmission front case in a vertical position, and install three front countershafts. See Figure 5-940.



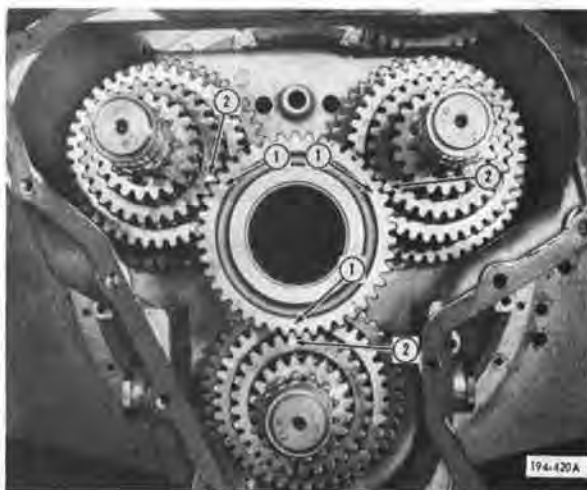
Figure 5-940. Installing Countershafts

2. Position front case horizontally. Install front countershaft bearing positioning snap rings in outer race of bearings, using snap ring pliers J-25445 or equivalent, then tap countershafts rearward until positioning snap ring seats against case. See Figure 5-941.



Figure 5-941. Installing Snap Ring

3. Temporarily install front mainshaft third speed gear, so that the three alignment O-marks on face of gear mate with alignment O-marks on countershaft third speed gears. See Figure 5-942.



1. Front Mainshaft Third Speed Gear Timing Marks
2. Front Countershaft Third Speed Gear Timing Marks

Figure 5-942. Third Speed Gear Temporarily Installed

4. Install main drive pinion assembly into place. See Figure 5-943.

NOTE

After main drive pinion is installed, the countershafts are timed and held in alignment by the main drive pinion. Therefore, the third speed gear can now be removed from the case and set aside until reassembling the front mainshaft.

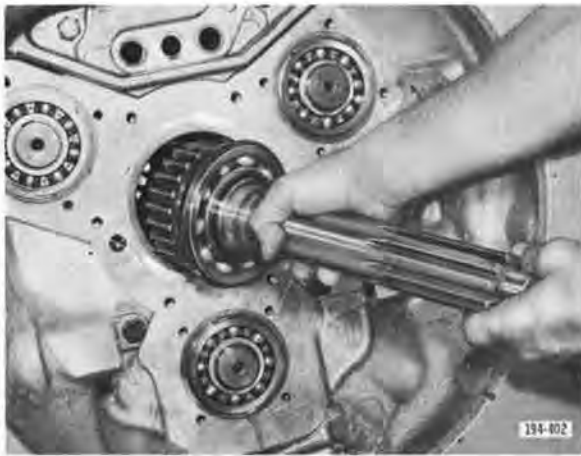


Figure 5-943. Installing Main Drive Pinion

5. Place oil pump vane into its bore in main drive pinion. See **Figure 5-944**.

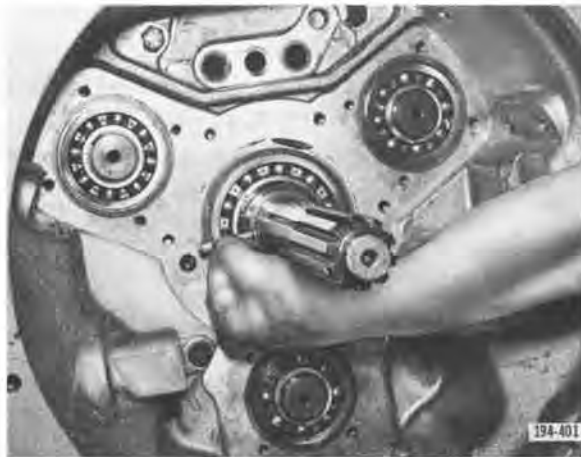


Figure 5-944. Installing Pump Vane

NOTE

Vane should be flush with the right-hand side of the pinion shaft, and protruding slightly from the left-hand side (as observed from the front of transmission). This will assure alignment of the vane with the eccentric bore in the cover when the cover is installed.

6. Install main drive pinion bearing cover gasket. See **Figure 5-945**.

NOTE

Notice pencil pointing to oil hole in gasket, which must align with oil hole in front case.

CAUTION

Improper gasket placement will block oil supply to oil pump, causing wear and internal damage.

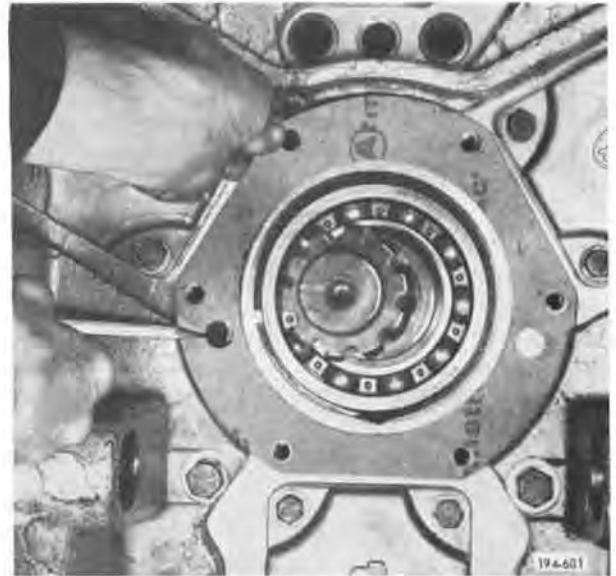


Figure 5-945. Installing Gasket

7. For pull-type clutch application only: Install main drive pinion bearing cover, using Tool J23796 to protect sealing lip of oil seal. See **Figure 5-946**.



1. Tool J23796 For Use With Pull-Type Clutches Only

Figure 5-946. Installing Cover

8. For push-type clutch application only: Install main drive pinion bearing cover, using care not to damage sealing lip of oil seal. No special tool is required. See **Figure 5-947**.

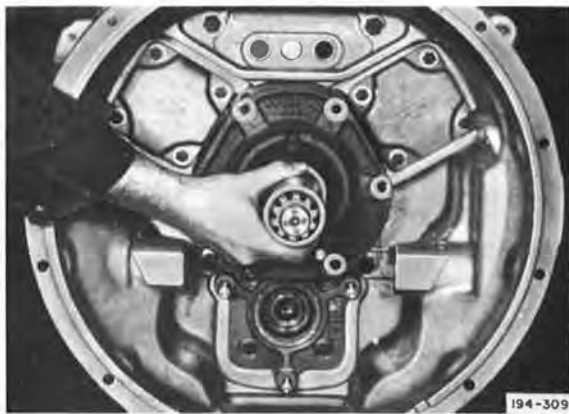


Figure 5-947. Installing Cover

9. Install main drive pinion cover capscrews, and tighten to recommended torque. See Figure 5-948. Refer to Torque and Tolerance Table, Item 6.

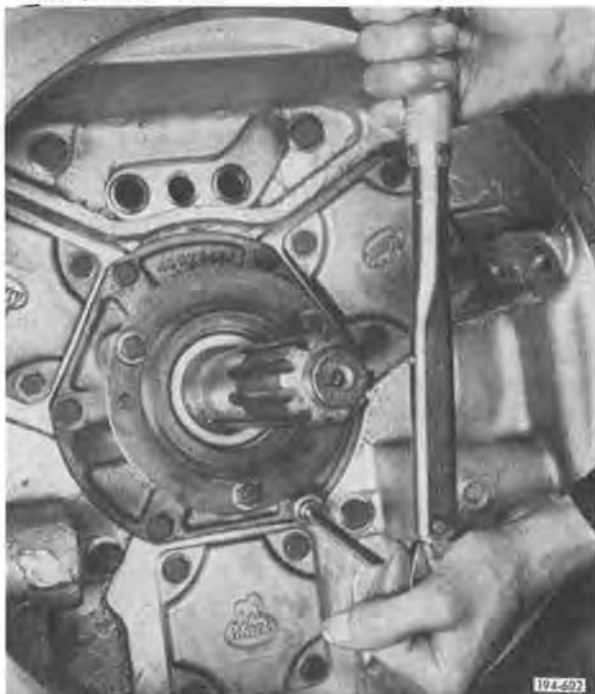


Figure 5-948. Torquing Capscrews

10. Install O-ring in each of three front countershaft front bearing covers. See Figure 5-949.



Figure 5-949. Installing O-Ring

11. Install front countershaft front bearing covers. See Figure 5-950.

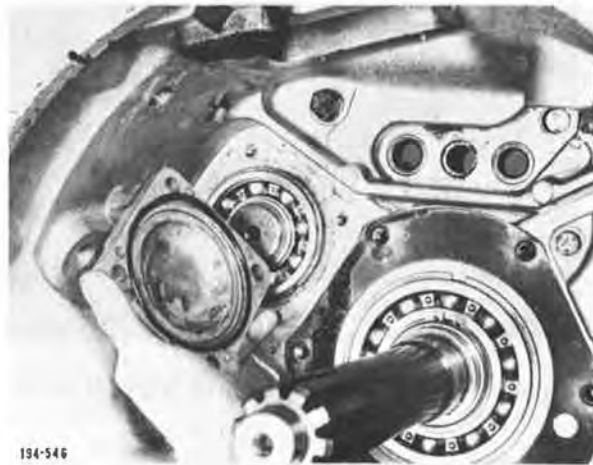


Figure 5-950. Installing Cover

12. Install capscrews into cover, and tighten to correct torque. See Figure 5-951. Refer to Torque and Tolerance Table, Item 5.



Figure 5-951. Torquing Capscrews

13. Install second/third speed sliding clutch onto front mainshaft. See Figure 5-952.

NOTE

Notice pencil pointing to oil hole, which must be clean and open for oil to pass through.



Figure 5-952. Installing Sliding Clutch

14. Install third speed gear onto front mainshaft. See **Figure 5-953**.



Figure 5-953. Installing Gear

15. Install third speed gear flanged thrust washer, and fourth speed gear. See **Figure 5-954**.

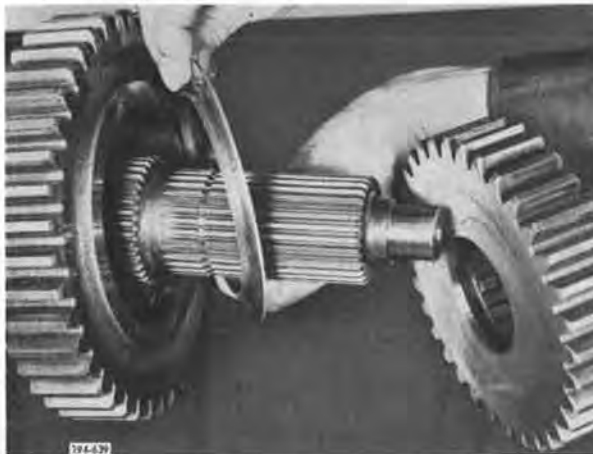


Figure 5-954. Installing Thrust Washer and Gear

16. Install fourth speed gear flanged thrust washer, and fourth speed gear splined thrust washer. See **Figure 5-955**.



Figure 5-955. Installing Thrust Washers

17. Install fourth speed gear retaining snap ring, using snap ring pliers J-29045 or equivalent. See **Figure 5-956**.

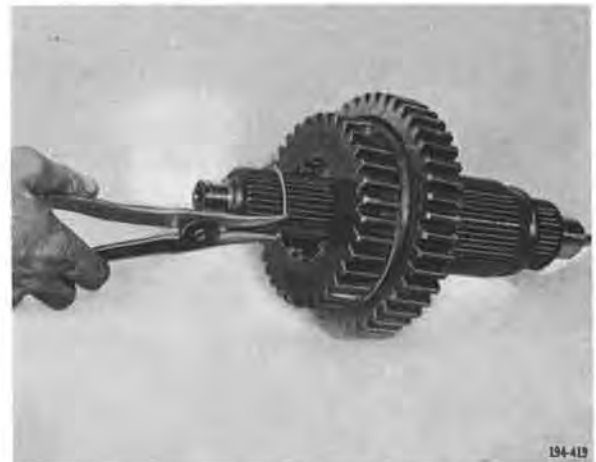


Figure 5-956. Installing Snap Ring

18. Install fourth/fifth speed sliding clutch. See **Figure 5-957**.

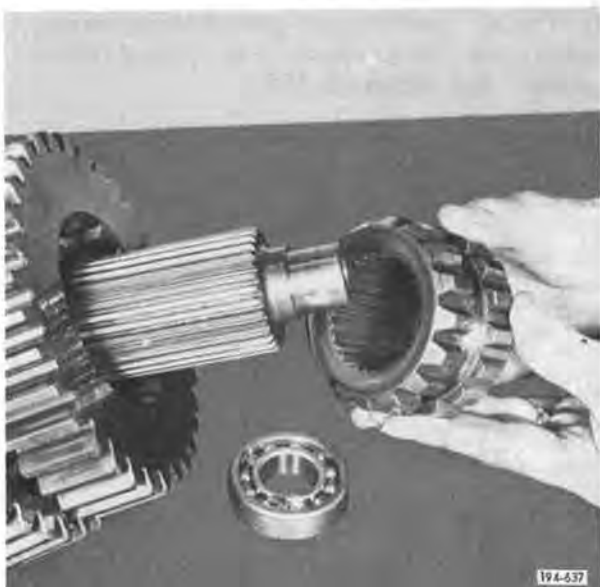


Figure 5-957. Installing Clutch



Figure 5-959. Installing Mainshaft

19. Install spigot bearing onto front of front mainshaft, using a soft mallet or a suitable driving sleeve. Apply force to the inner race only. See **Figure 5-958**.

21. Apply a light coat of grease to front face of second speed gear, and then place second speed gear thrust washer onto front face of gear. Grease will hold washer in position during installation. See **Figure 5-960**.

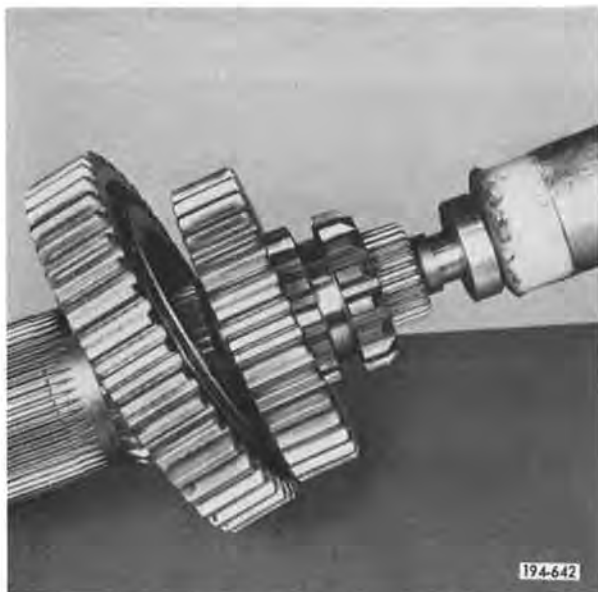


Figure 5-958. Installing Bearing



Figure 5-960. Installing Thrust Washer

20. Install front mainshaft into front case. Advance mainshaft all the way forward to completely seat spigot bearing into main drive pinion. See **Figure 5-959**.

22. Install second speed gear (beveled side of clutch teeth toward front of transmission), and engage with countershaft second speed gears. See **Figure 5-961**.

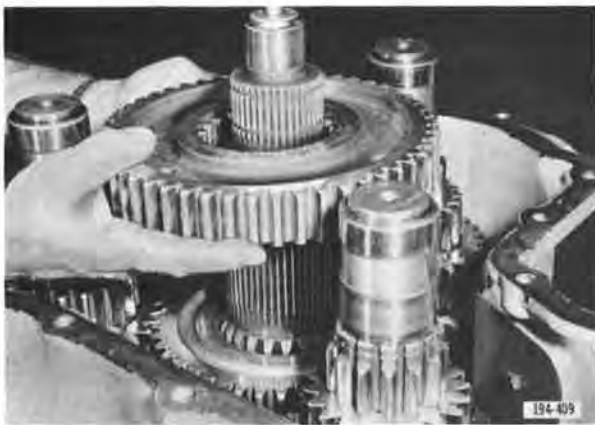


Figure 5-961. Installing Gear

23. Secure first speed gear thrust washer to front face of first speed gear with a light coat of grease, and then install first speed gear (beveled side of clutch teeth toward rear of transmission) with its thrust washer and engage with countershaft first speed gear. See **Figure 5-962**.



Figure 5-962. Installing Gear

24. Install first speed gear sliding clutch. See **Figure 5-963**.



Figure 5-963. Installing Clutch

25. Install front countershaft selective thrust washers on three countershafts. See **Figure 5-964**.



Figure 5-964. Installing Washers

26. Install front countershaft selective thrust washer retaining snap rings, using snap ring pliers J-6435 or equivalent. See **Figure 5-965**.



Figure 5-965. Installing Snap Rings

27. Check countershaft end-play clearance (each countershaft) by inserting a feeler gauge between mainshaft first speed gear and countershaft selective thrust washer. Hold each thrust washer squarely against its snap ring when inserting feeler gauge. Refer to Torque and Tolerance Table, Item 17 for correct end-play and for selective thrust washer thicknesses used to obtain correct end-play. If too much end play is measured,

use thicker washer; if too little end-play is measured, use thinner washer. See **Figure 5-966**.



Figure 5-966. Measuring End-Play

28. If front mainshaft rear oil tube was removed previously, install it now using a suitable driver. See **Figure 5-967**.



Figure 5-967. Installing Oil Tube

29. Install mainshaft Hi-range main drive gear. See **Figure 5-968**.

30. Install Hi-range main drive gear retaining snap ring, using snap ring pliers J-6435 or equivalent. See **Figure 5-969**.



Figure 5-968. Installing Gear



Figure 5-969. Installing Snap Ring

Main Components Reassembly

1. Install a new front case to rear case gasket. See **Figure 5-970**.



Figure 5-970. Installing Gasket

2. Install front case to rear case, with the aid of a hoist. See **Figure 5-971**.

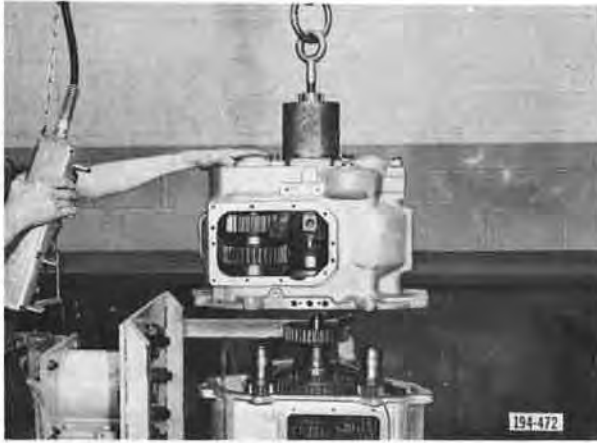


Figure 5-971. Installing Rear Case

WARNING

Keep hands clear of mating surfaces when installing front case to rear case, to avoid serious personal injury.

3. Install front case to rear case capscrews and dowel bolts and nuts. Tighten to recommended torque. See Figures 5-972 and 5-973. Refer to Torque and Tolerance Table, Items 9 and 10.



Figure 5-972. Installing Dowel Bolt



Figure 5-973. Installing Capscrew

4. Remove wire previously installed to hold Direct/Hi-range shift fork. See Figure 5-974.

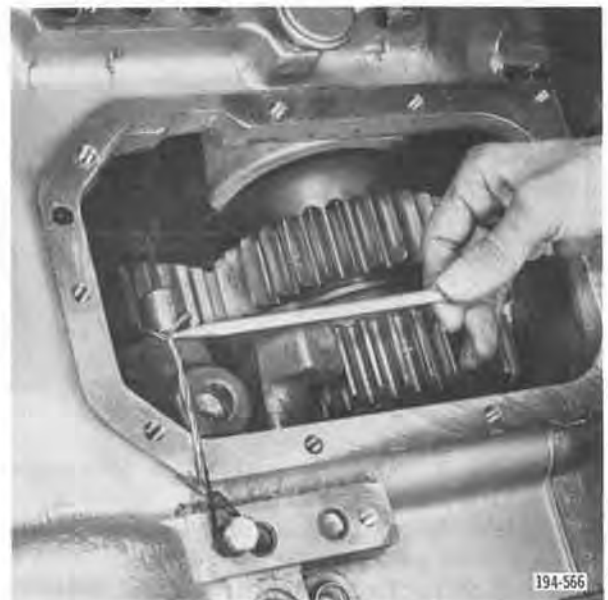


Figure 5-974. Wire Holding Shift Fork

5. Install drive flange (or yoke) on rear mainshaft splines. See Figure 5-975.



Figure 5-975. Installing Drive Flange

6. Lubricate threads of drive flange (or yoke) clamp plate screw, and install clamp plate and screw. See **Figure 5-976**.



Figure 5-976. Lubricating Screw

7. Place two sliding clutches into engaged position, which will lock up assembly, and tighten drive flange (or yoke) clamp plate capscrew to recommended torque. See **Figure 5-977**. Refer to Torque and Tolerance Table, Item 13.

8. Install second /third speed shift fork onto second /third speed sliding clutch. See **Figure 5-978**.

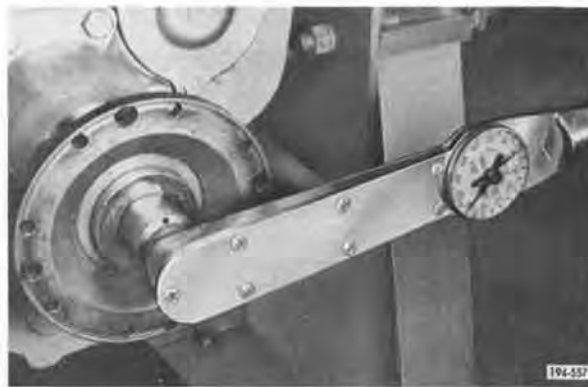


Figure 5-977. Torquing Capscrew



Figure 5-978. Installing Shift Fork

9. Install first speed shift fork onto first speed sliding clutch. See **Figure 5-979**.

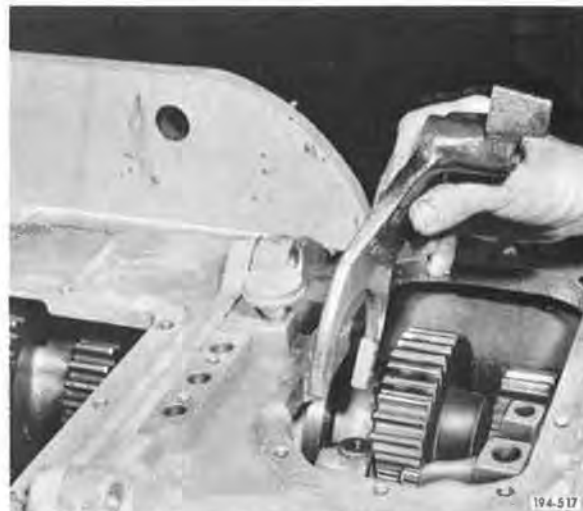


Figure 5-979 Installing Shift Fork

10. Slide second /third speed shift rail through front of case, and install second /third speed shifter onto rail. See **Figure 5-980**.



Figure 5-980. Installing Shifter

11. Advance rail through intermediate bore of case and second/third speed shift fork, until rail reaches neutral position. Install setscrew into second/third speed shifter, and tighten to recommended torque. See Figure 5-981. Refer to Torque and Tolerance Table, Item 8.



Figure 5-981. Installing Setscrew

12. Slide first speed shift rail through front of case, and install first speed shifter and reverse lockout spacer onto rail. See Figure 5-982.

13. Advance rail through intermediate bore of case and first speed shift fork, until rail reaches neutral position. Install first speed shifter setscrew and tighten to recommended torque. Refer to Torque and Tolerance Table, Item 8.



Figure 5-982. Installing Shifter and Spacer

14. Install setscrews into second/third speed shift fork and first speed shift fork, and tighten to recommended torque. See Figure 5-983. Refer to Torque and Tolerance Table Item 8.



Figure 5-983. Installing Setscrew

15. Install fourth/fifth speed shift fork onto fourth/fifth speed sliding clutch. See Figure 5-984.



Figure 5-984. Installing Shift Fork

16. Slide fourth fifth speed shift rail through front of case, into and through hub of fourth/fifth speed shift fork, into intermediate bore of case, until rail reaches neutral position. See Figure 5-985.



Figure 5-985. Installing Shift Rail

17. Install setscrew into fourth/fifth speed shift fork, and tighten to recommended torque. See Figure 5-986. Refer to Torque and Tolerance Table, Item 8.



Figure 5-986. Installing Setscrew

18. Place expansion plug in position at front of second/third speed shift rail. See Figure 5-987.



Figure 5-987. Positioning Expansion Plug

19. Install expansion plug by driving it rearward with a driver. Driver to be cylindrical in shape, with a diameter the same as the expansion plug, and a flat (not rounded) end.

20. Install clutch brake onto input shaft. See Figure 5-988.



Figure 5-988. Installing Clutch Brake

21. Insert clutch release stub shaft into clutch release yoke, place in position in bell housing, and tap stub shaft into housing.

22. Install setscrew and tighten to recommended torque. See Figure 5-989. Refer to Torque and Tolerance Table, Item 1.

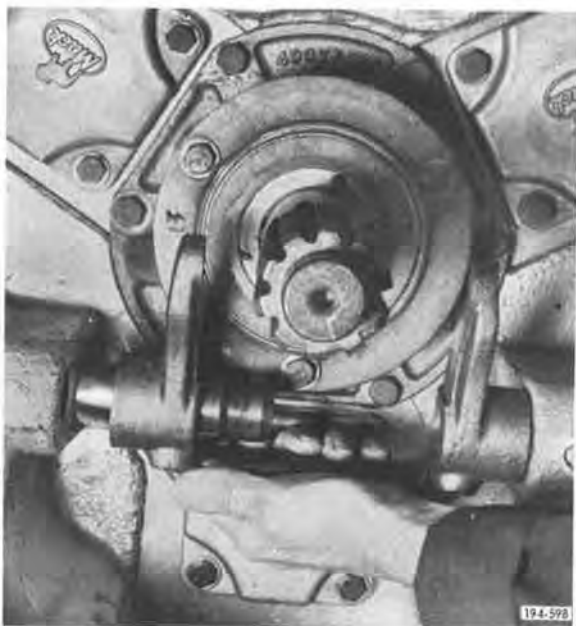


Figure 5-989. Installing Yoke and Stub Shaft

23. Tap splined clutch release shaft into housing from outside of housing. Insert Woodruff key. See Figure 5-990.



Figure 5-990. Installing Key

24. Tap splined clutch release shaft to seat Woodruff key in keyway of clutch release yoke.

25. Install setscrew and tighten to recommended torque. See Figure 5-991. Refer to Torque and Tolerance Table, Item 1.

26. Install poppet balls and poppet springs. See Figure 5-992.

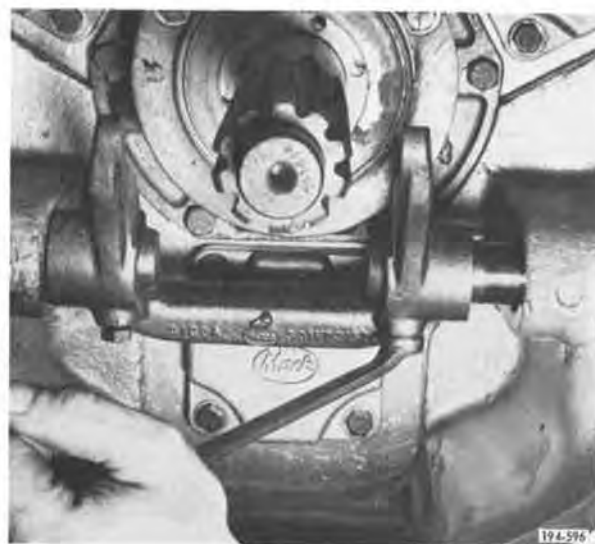


Figure 5-991. Installing Setscrew



Figure 5-992. Installing Ball and Spring

27. Install poppet ball cover with capscrews, and tighten to recommended torque. See Figure 5-993. Refer to Torque and Tolerance Table, Item 4.

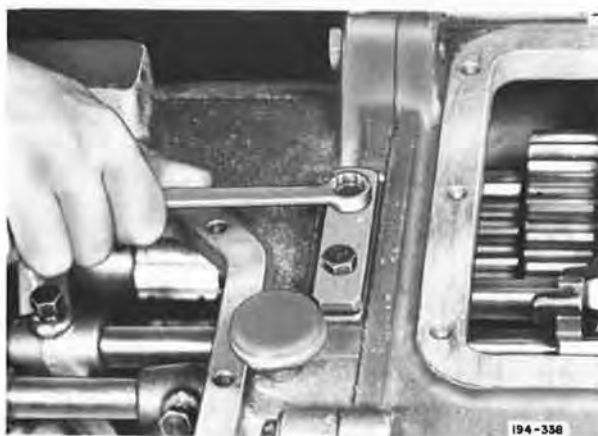


Figure 5-993. Installing Cover

28. Install front case top cover gasket. See Figure 5-994.



Figure 5-994. Installing Gasket

29. Install front case top cover. See Figure 5-995.



Figure 5-995. Installing Cover

30. Install front case top cover capscrews, and tighten to recommended torque. See Figure 5-996. Refer to Torque and Tolerance Table, Item 3.



Figure 5-996. Installing Capscrew

AIR SHIFT COVER (NON-CURRENT PRODUCTION)

ADJUSTMENT AND INSTALLATION

1. Temporarily install air shift cover assembly on rear case. See Figure 5-997.



Figure 5-997. Installing Cover

2. Connect air lines to Hi-range and Direct fittings of shift cover, and apply equal air to both sides.

3. Insert screw driver into slot provided in forward end of Hi Direct shift rail. See Figure 5-998.



1. Air Lines

Figure 5-998. Adjusting Rail

4. Turn shift rail clockwise with screwdriver and at the same time rotate output flange (or yoke) until gear clash is heard.

5. Now turn shift rail counter-clockwise, counting number of turns until gear clash is obtained.

6. Turn shift rail clockwise again half the number of turns counted from gear clash to gear clash. Shift rail will now be in neutral position.

7. Disconnect air lines and remove shift cover.

8. Lock Hi/Direct shifter in neutral position by tightening the locknut. See Figure 5-999.

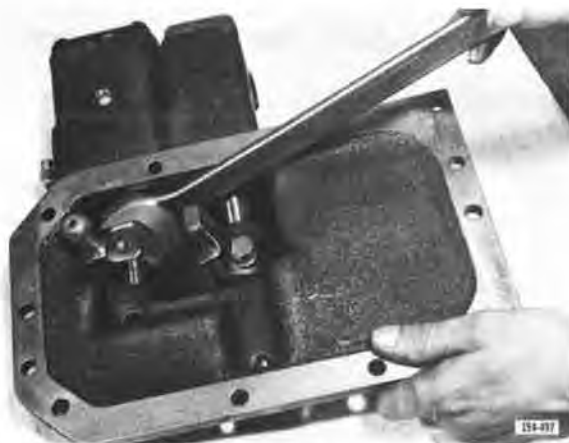


Figure 5-999. Tightening Nut

9. Install expansion plug into shift cover at front end of Hi/Direct shift rail. This plug was previously omitted. (Item 31 in Figure 5-846).

10. Install air shift cover gasket. See Figure 5-1000.



Figure 5-1000. Installing Gasket

11. Install air shift cover, being careful to be sure shift levers engage shift forks. See Figure 5-1001.



Figure 5-1001. Installing Cover

12. Install air shift cover capscrews, and tighten to recommended torque. See Figure 5-1004. Refer to Torque and Tolerance Table, Item 3.

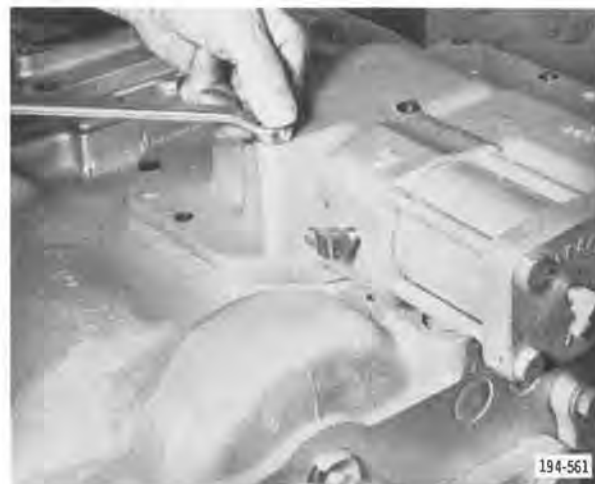


Figure 5-1004. Installing Capscrews

**AIR SHIFT COVER
(CURRENT PRODUCTION)**

INSTALLATION

1. Install air shift cover gasket. See Figure 5-1005.



Figure 5-1005. Installing Gasket

2. Install air shift cover, being careful to be sure shift levers engage shift forks. See Figure 5-1006.

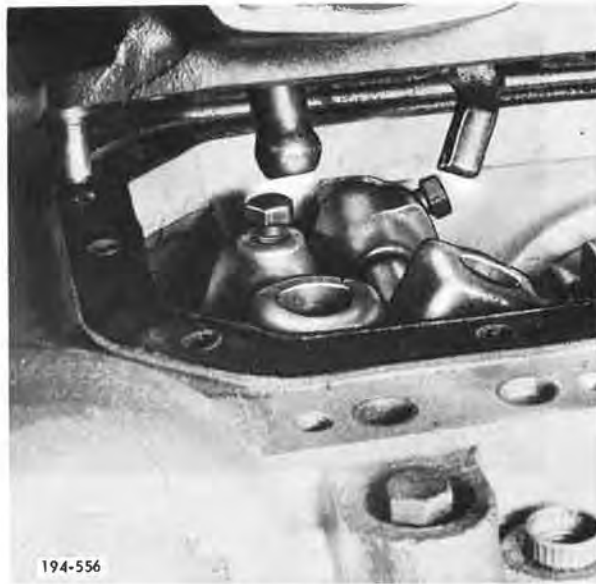


Figure 5-1006. Installing Cover

3. Install air shift cover capscrews, and tighten to recommended torque. See Figure 5-1007. Refer to Torque and Tolerance Table, Item 3.

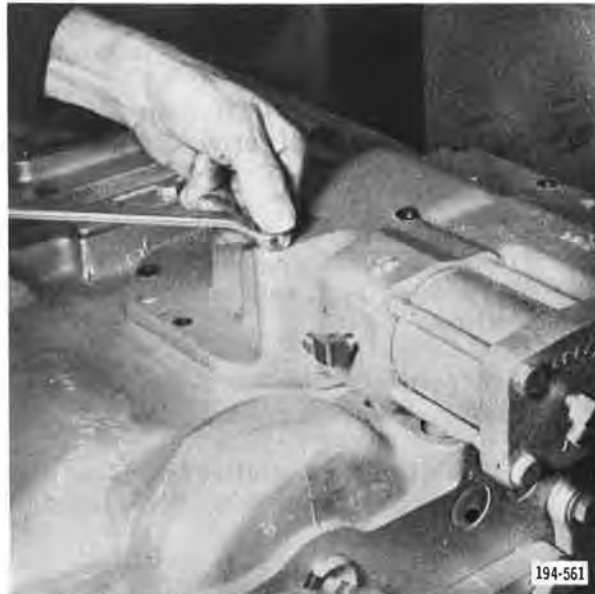


Figure 5-1007. Installing Capscrews

TORQUE AND TOLERANCE TABLE

Screw Torques

<u>Item</u>	<u>Location</u>	<u>Lb. Ft.</u>
1	Clutch release yoke setscrew	13 to 21
2	Hi/Direct shift cylinder cover capscrews	24 to 30
3	Transmission case top cover capscrews	24 to 30
4	Poppet ball cover capscrews	24 to 30
5	Countershaft front cover capscrews	24 to 30
6	Main drive pinion bearing cover capscrews	36 to 44
7	Countershaft rear cover capscrews	36 to 44
8	Shifter and shift fork setscrews	41 to 49
9	Front case to rear case capscrews	56 to 70
10	Front case to rear case dowel bolts	66 to 80
11	Bell housing to main case capscrews	76 to 86
12	Mainshaft rear cover capscrews	96 to 120
13	Mainshaft drive flange (or yoke) clamp plate capscrow	474 to 574
		<u>Lb. In.</u>
14	Reverse shift cylinder cover capscrews	81 to 101

Tolerances

15	All Forks in Sliding Clutches			
		Minimum New	Maximum New	Maximum Wear
	Side Clearance	0.005	0.020	0.050*

* If unit has experienced disengagement, side clearance must not exceed 0.030 maximum.

16	Shift rail poppet springs	
	Free Height.	2.25 inches
	Test at 1-17/32 inches.	42.4 pounds

17	<u>Thrust Washer</u>	<u>Available Thickness</u>
	First Speed Gear: Select correct thickness to obtain 0.025 to 0.035 inch mainshaft gear end play.	0.143 inch 0.158 inch 0.173 inch 0.188 inch 0.203 inch 0.218 inch 0.233 inch 0.248 inch 0.263 inch
	NOTE	
	The 0.025 to 0.035 inch mainshaft gear end play cannot vary more than 0.005 inch among the three countershaft measurements.	

18	Shift rail to mating housing bore	0.010 inch maximum
19	Oil pump vane to mating bore	0.006 inch maximum
20	Reverse idler gear end play	0.003 inch minimum to 0.023 inch maximum

TOOLS

S500	Front Countershaft Rear Bearing Inner Race Removal Tool
S501	Rear Mainshaft Front Bearing Removal Tool
S593C	Rear Countershaft Rear Bearing, and Front Countershaft Front Bearing Removal Tool

Above tools available from:

Shel's Supply and Equipment Company
496-504 Orange Avenue
West Haven, Connecticut 06516
Phone (203) 934-8544

J-23796	Main Drive Pinion Bearing Cover Installation Tool
J-28668	Reverse Idler Shaft Removal Tool
J-29031	Drive Flange Removal Tool
J-4646	Snap Ring Pliers
J-6435	Snap Ring Pliers
J-24339	Snap Ring Pliers
J-25445	Snap Ring Pliers
J-29045	Snap Ring Pliers

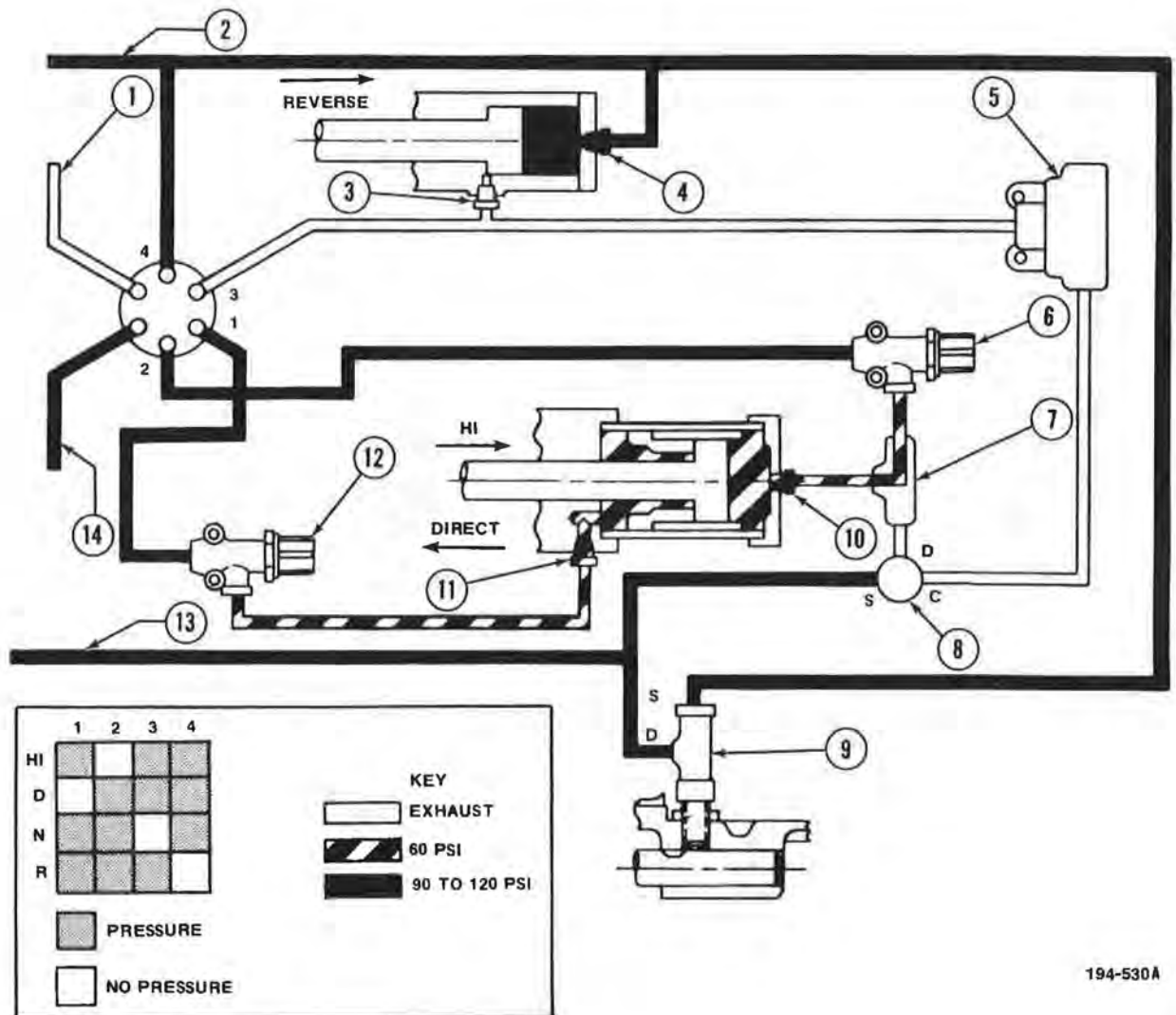
Above tools available from:

Kent Moore Corporation
1501 South Jackson Street
Jackson, Michigan 49203
Phone (517) 784-8561

CG-250	Front Mainshaft Front Spigot Bearing Removal Tool
CG-270	Rear Countershaft Front Bearing Removal Tool

Above tools available from:

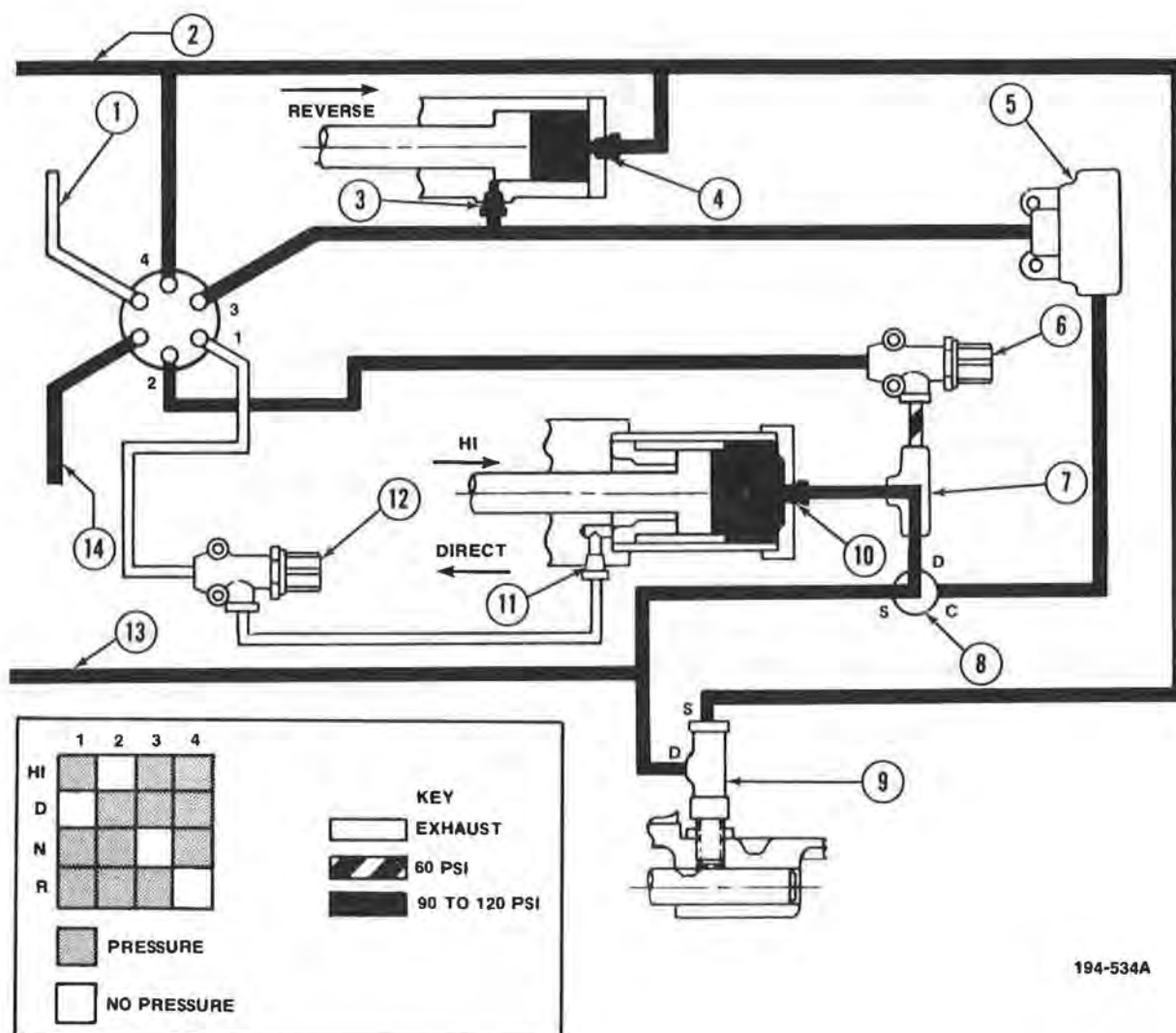
Snap-On Tools Corp.
Kenosha, Wisconsin 53140
Phone (414) 654-8681



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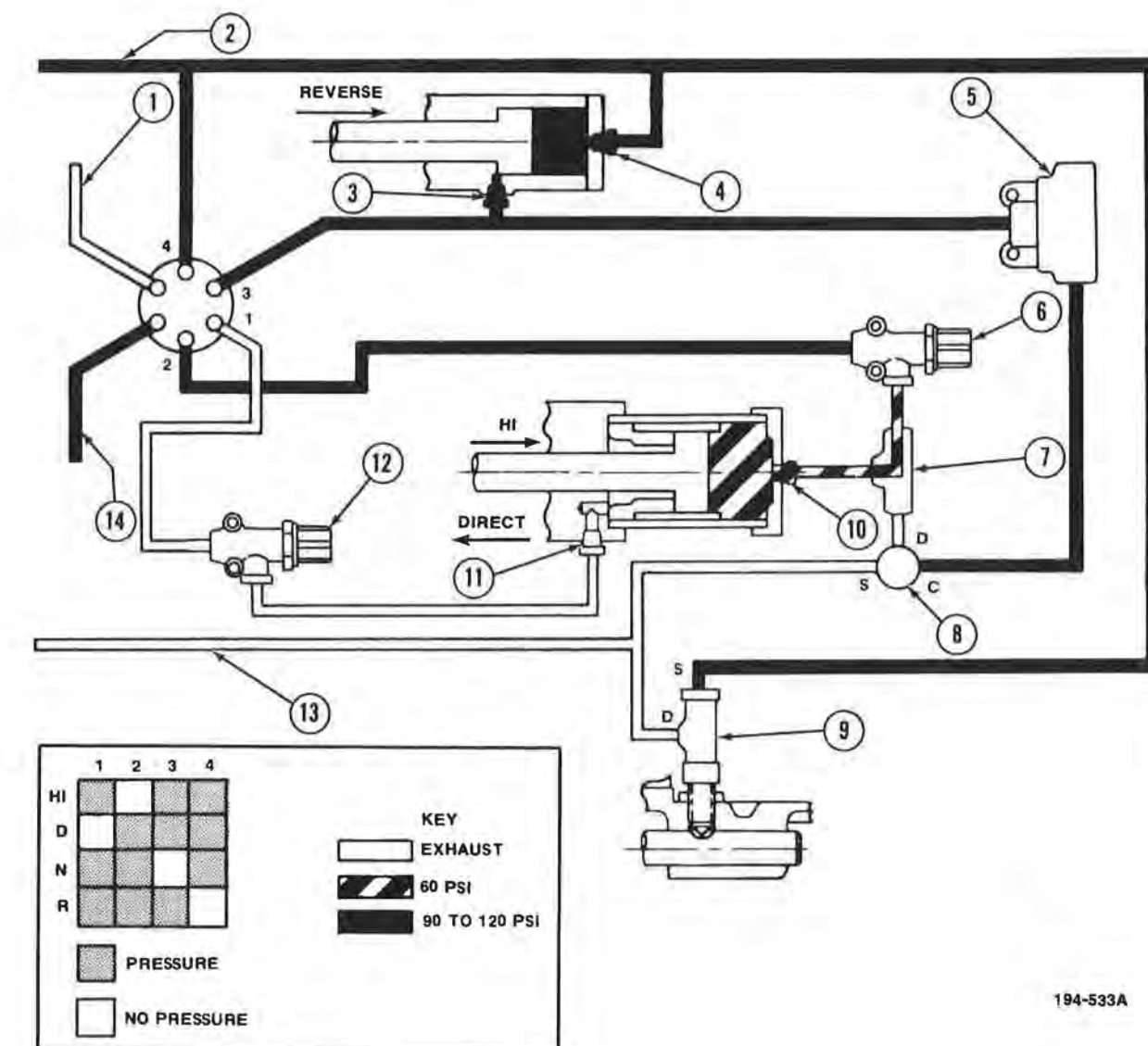
- | | |
|---|---|
| 1. Exhaust Air Line | 11. Port #1 |
| 2. To Torque Limiting Valve (when used) | 12. Pressure Reducing Valve (60 P.S.I.) |
| 3. Port #3 | 13. To Dual Speed Governor (when used) |
| 4. Port #4 | 14. Supply Air Line |
| 5. Quick Release Valve | |
| 6. Pressure Reducing Valve (60 P.S.I.) | |
| 7. Double Check Valve | |
| 8. Synchro. Valve | |
| 9. Control Valve (shown open) | |
| 10. Port #2 | |
- D. Delivery
C. Control
S. Supply

Figure 5-1008, TRDLG1070 Air Control System Schematic for Neutral



- | | |
|---|---|
| 1. Exhaust Air Line | 11. Port #1 |
| 2. To Torque Limiting Valve (when used) | 12. Pressure Reducing Valve (60 P.S.I.) |
| 3. Port #3 | 13. To Dual Speed Governor (when used) |
| 4. Port #4 | 14. Supply Air Line |
| 5. Quick Release Valve | |
| 6. Pressure Reducing Valve (60 P.S.I.) | |
| 7. Double Check Valve | |
| 8. Synchro. Valve | |
| 9. Control Valve (shown open) | |
| 10. Port #2 | |
- D. Delivery
C. Control
S. Supply

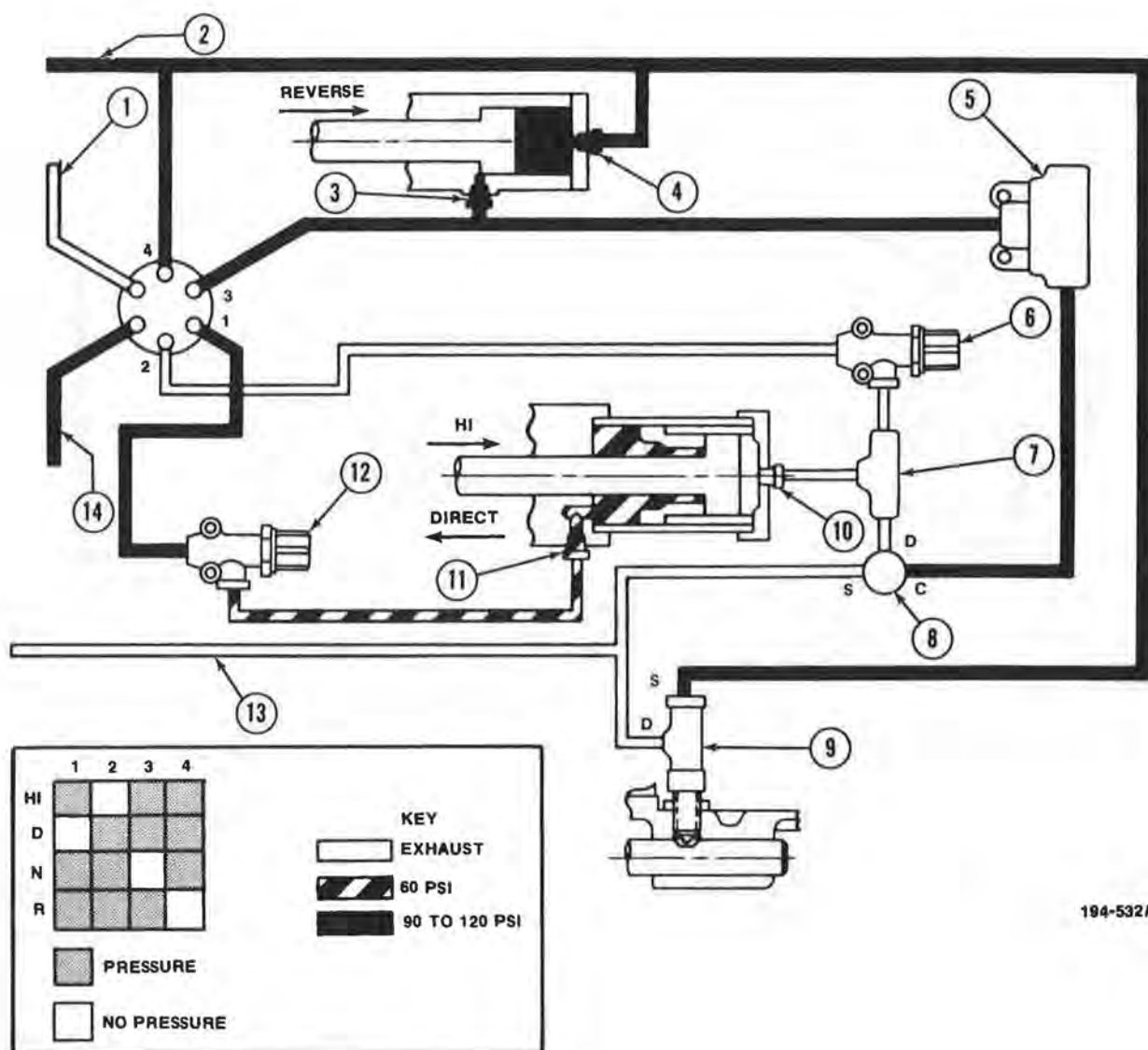
Figure 5-1009, TRDLG1070 Air Control System Schematic for First, Second, and Third Direct



- | | |
|---|---|
| 1. Exhaust Air Line | 11. Port #1 |
| 2. To Torque Limiting Valve (when used) | 12. Pressure Reducing Valve (60 P.S.I.) |
| 3. Port #3 | 13. To Dual Speed Governor (when used) |
| 4. Port #4 | 14. Supply Air Line |
| 5. Quick Release Valve | |
| 6. Pressure Reducing Valve (60 P.S.I.) | |
| 7. Double Check Valve | |
| 8. Synchro. Valve | |
| 9. Control Valve (shown closed) | |
| 10. Port #2 | |
- D. Delivery
C. Control
S. Supply

Figure 5-1011. TRDLG1070 Air Control System Schematic for Fourth and Fifth Direct

Air is off at Dual Speed Governor - engine will be limited to 1800 R.P.M.

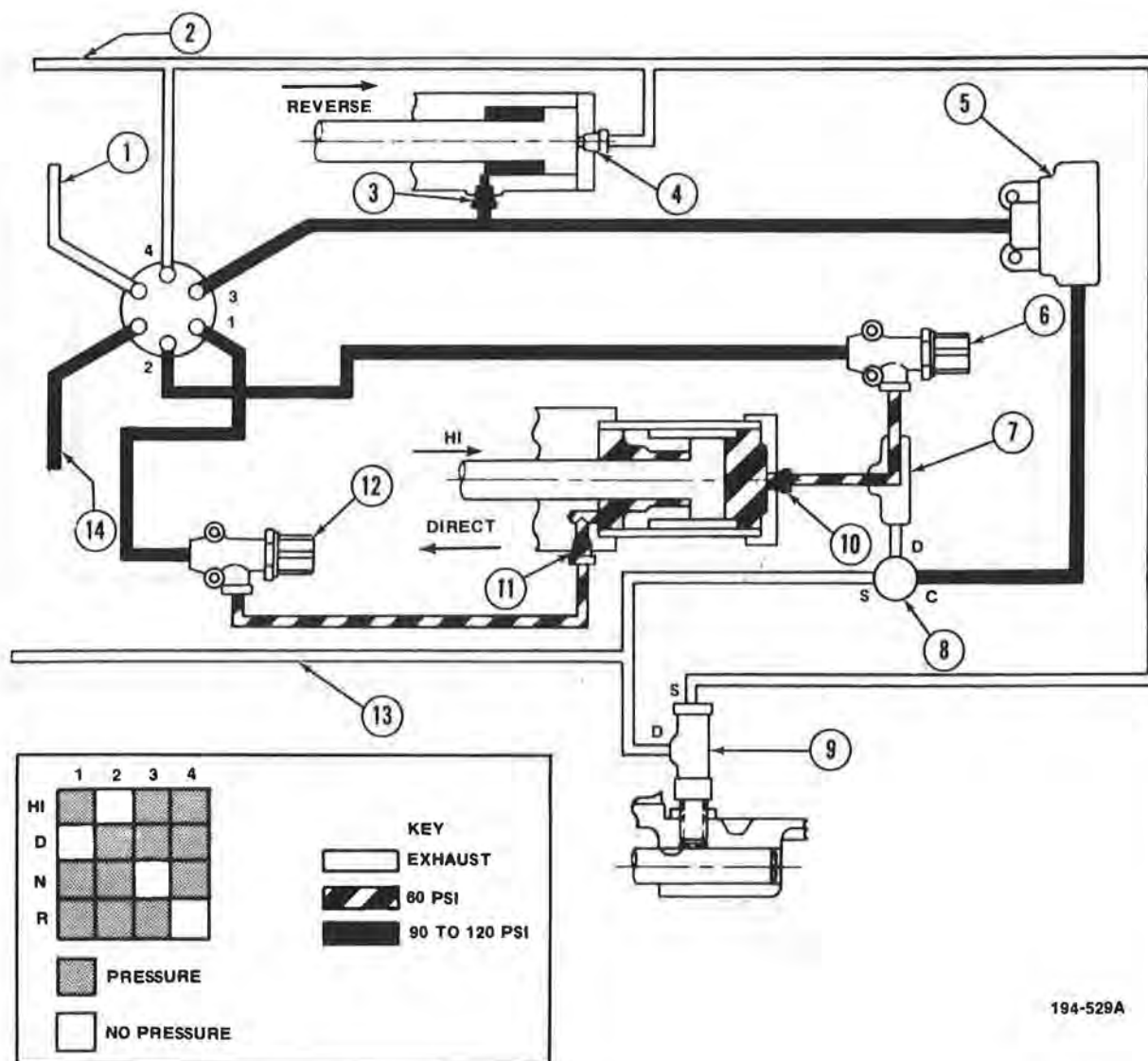


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- | | |
|---|---|
| 1. Exhaust Air Line | 11. Port #1 |
| 2. To Torque Limiting Valve (when used) | 12. Pressure Reducing Valve (60 P.S.I.) |
| 3. Port #3 | 13. To Dual Speed Governor (when used) |
| 4. Port #4 | 14. Supply Air Line |
| 5. Quick Release Valve | |
| 6. Pressure Reducing Valve (60 P.S.I.) | |
| 7. Double Check Valve | |
| 8. Synchro. Valve | D. Delivery |
| 9. Control Valve (shown closed) | C. Control |
| 10. Port #2 | S. Supply |

Figure 5-1012. TRDLG1070 Air Control System Schematic for Fourth and Fifth Overgear

Air is off at Dual Speed Governor - engine will be limited to 1800 R.P.M.

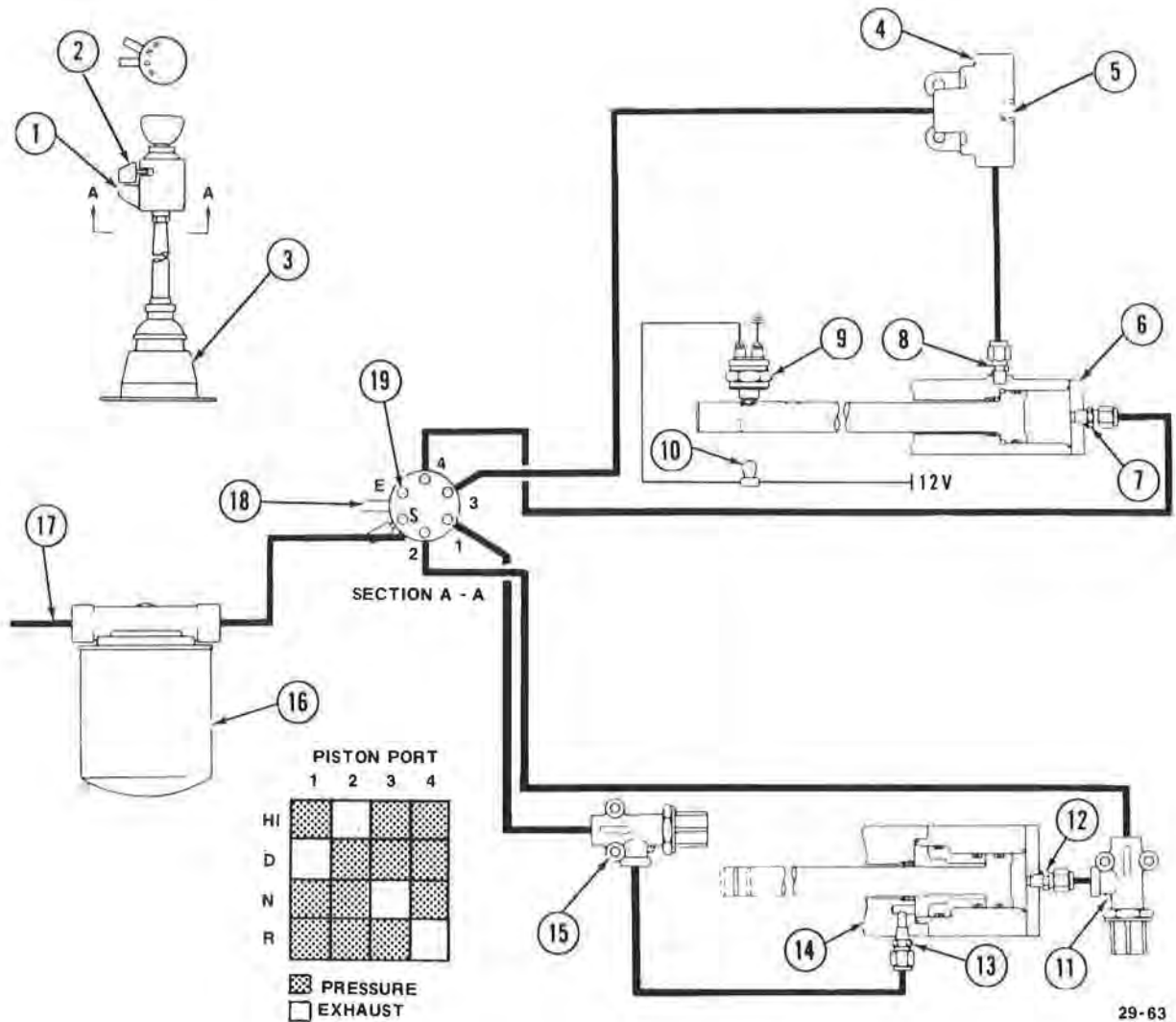


194-529A

- | | |
|---|---|
| 1. Exhaust Air Line | 11. Port #1 |
| 2. To Torque Limiting Valve (when used) | 12. Pressure Reducing Valve (60 P.S.I.) |
| 3. Port #3 | 13. To Dual Speed Governor (when used) |
| 4. Port #4 | 14. Supply Air Line |
| 5. Quick Release Valve | |
| 6. Pressure Reducing Valve (60 P.S.I.) | |
| 7. Double Check Valve | |
| 8. Synchro. Valve | |
| 9. Control Valve (shown open) | D. Delivery |
| 10. Port #2 | C. Control |
| | S. Supply |

Figure 5-1013, TRDLG1070 Air Control System Schematic for Reverse

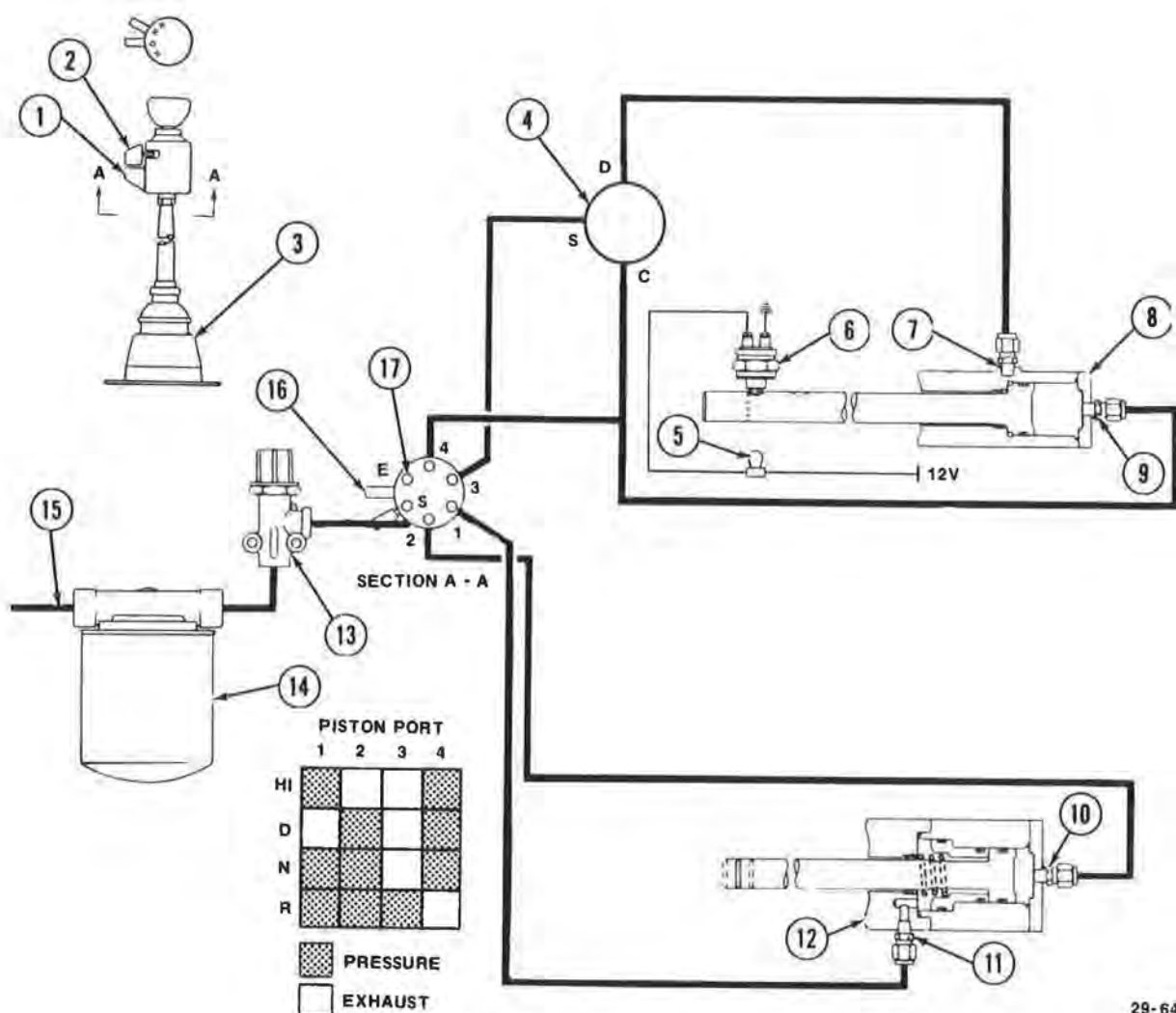
Air is off at Dual Speed Governor - engine will be limited to 1800 R.P.M.



29-63

1. Selectair Valve Reference Locator
2. Selectair Valve Select Lever
3. Gear Shift Lever
4. Quick Release Valve
5. Exhaust
6. Reverse Shift Cylinder
7. Port #4
8. Port #3
9. Back-Up Switch (normally open)
10. Amber Indicator Light (on in reverse)
11. Pressure Reducing Valve (60 P. S. I. delivery)
12. Port #2
13. Port #1
14. Hi/Direct Shift Cylinder
15. Pressure Reducing Valve (60 P. S. I. delivery)
16. Air Filter
17. Air Supply
18. Selectair Valve
19. Exhaust

Figure 5-1014. Air Control System Schematic (TRDL1070 prior to Serial Number 8S6796, produced October, 1978)



29-64

1. Selectair Valve Reference Locator
2. Selectair Valve Select Lever
3. Gear Shift Lever
4. Inversion Valve
5. Amber Indicator Light (on in reverse)
6. Back-Up Switch (normally open)
7. Port #3
8. Reverse Shift Cylinder
9. Port #4
10. Port #2
11. Port #1
12. Hi/Direct Shift Cylinder
13. Pressure Reducing Valve (70 P.S.I. delivery)
14. Air Filter
15. Air Supply
16. Selectair Valve
17. Exhaust

Figure 5-1015. Air Control System Schematic
(TRDL1070 Serial Number 8S6796, produced October, 1978 and up)

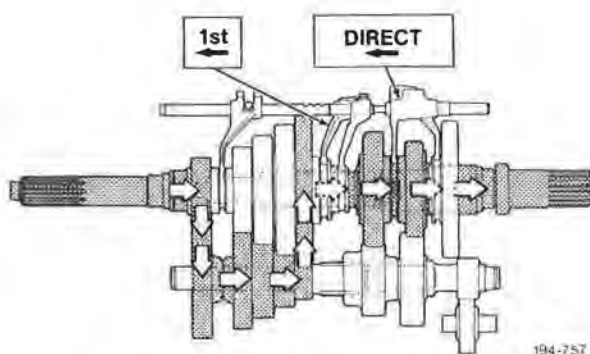


Figure 5-1016. First Speed Direct

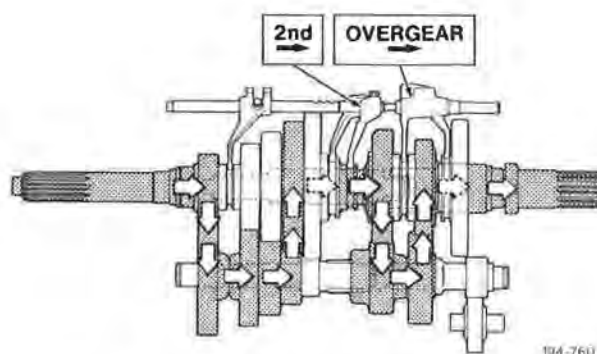


Figure 5-1019. Second Speed Overgear
(TRDL1070 only)

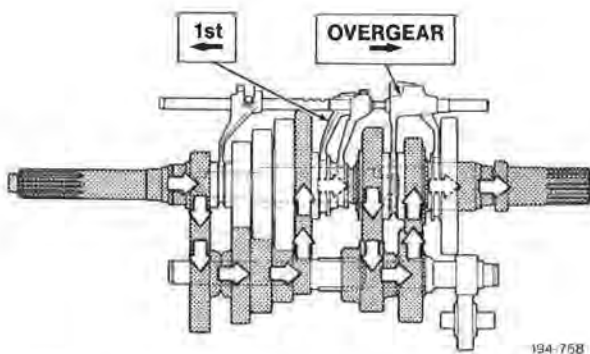


Figure 5-1017. First Speed Overgear
(TRDL1070 only)

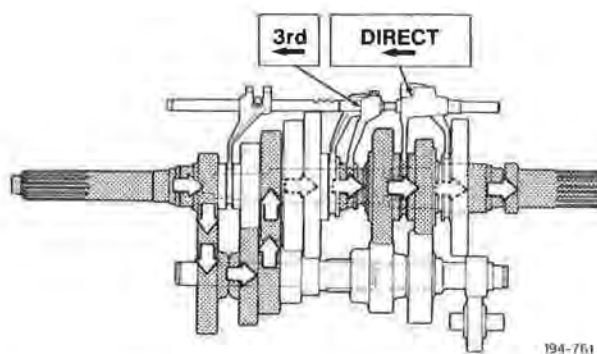


Figure 5-1020. Third Speed Direct

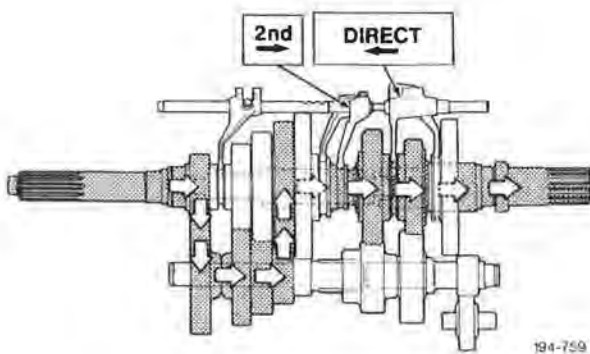


Figure 5-1018. Second Speed Direct

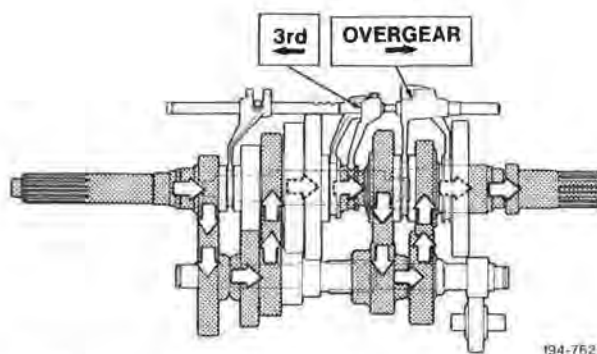


Figure 5-1021. Third Speed Overgear
(TRDL1070 only)

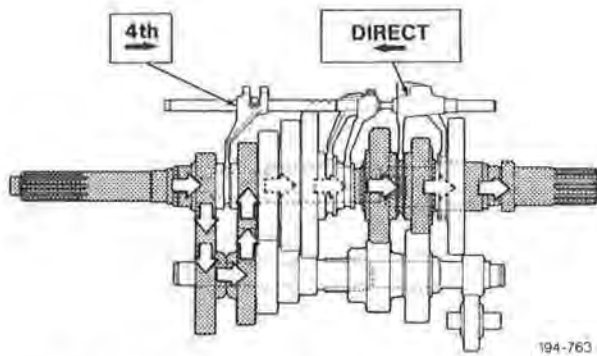


Figure5-1022. Fourth Speed Direct

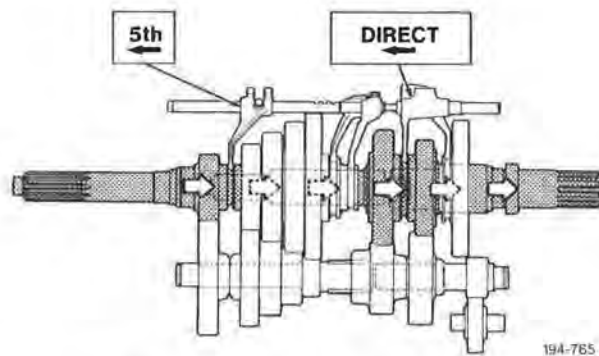


Figure5-1024. Fifth Speed Direct

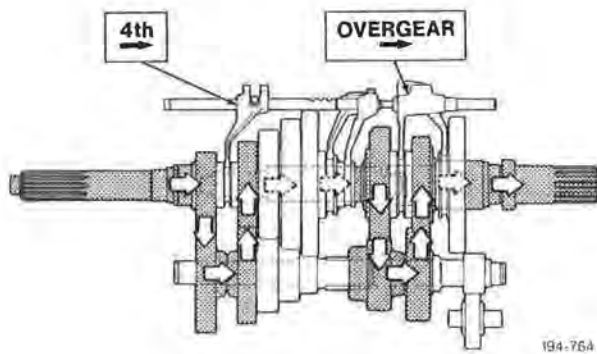


Figure5-1023, Fourth Speed Overgear

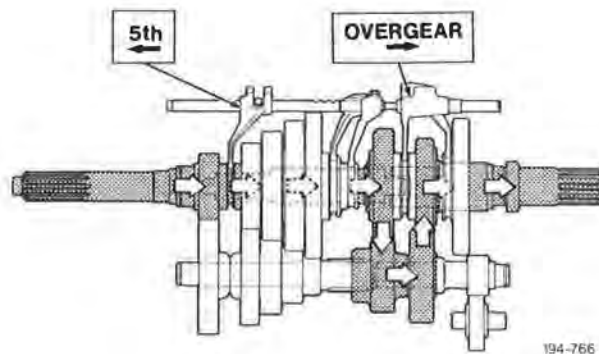


Figure5-1025. Fifth Speed Overgear

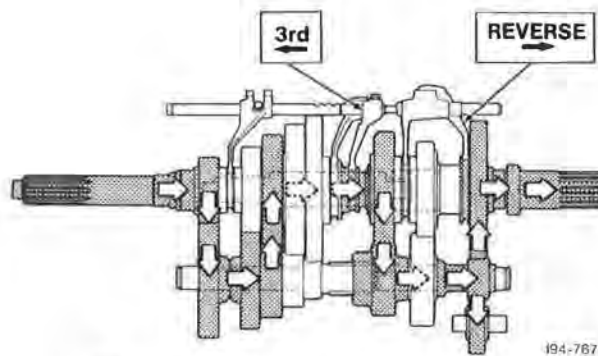
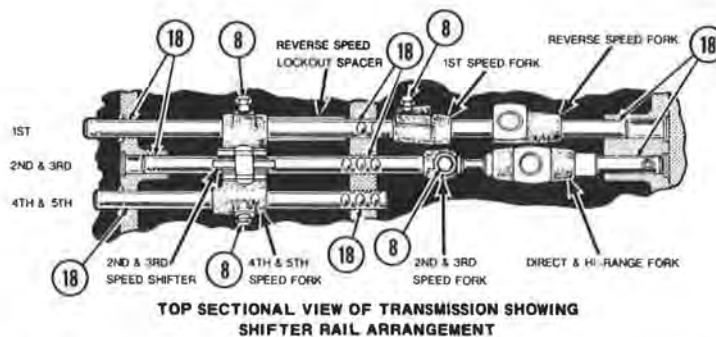
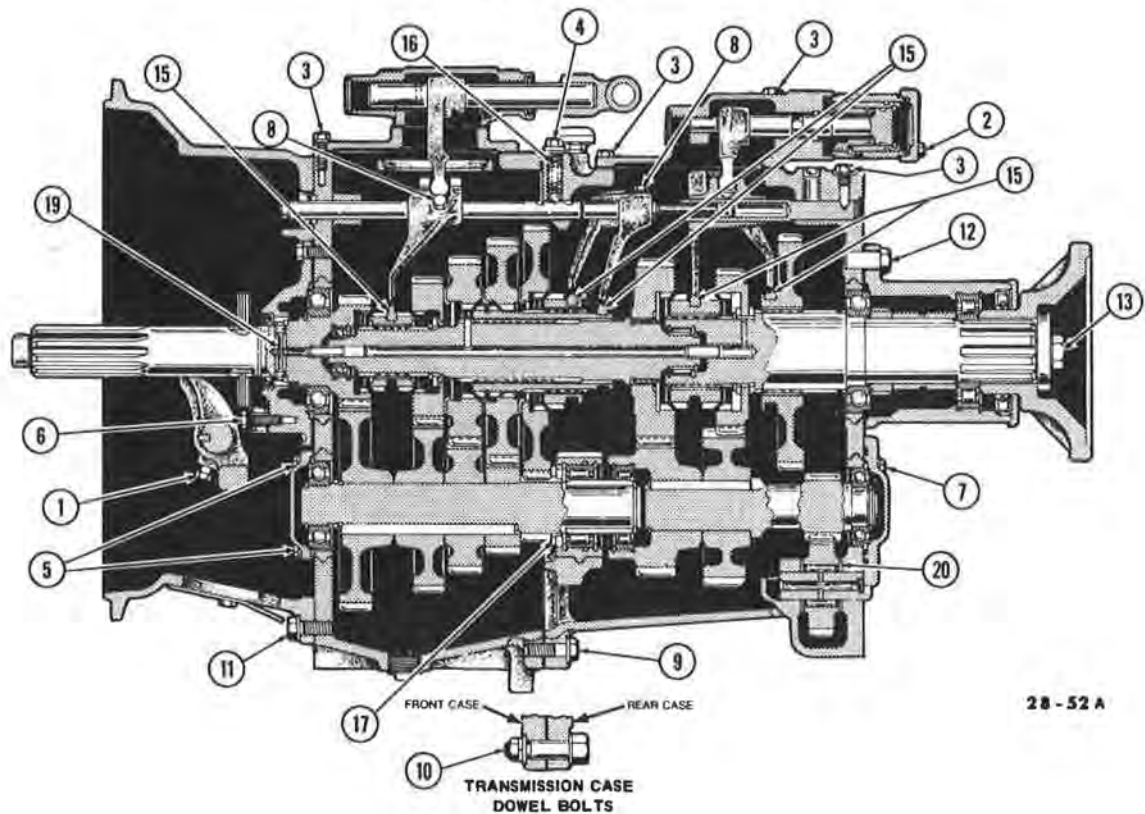
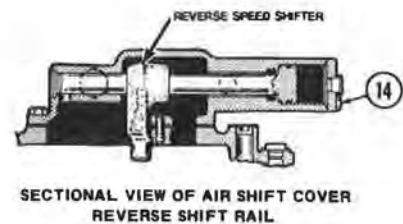


Figure 5-1026. Reverse (using Third)

TRDL 1070 10 SPEED TRDLG 1070 7 SPEED TRIPLE COUNTERSHAFT TRANSMISSION (AIR SHIFT)



**CALLOUTS REFER TO
TORQUE AND TOLERANCE
TABLE ITEM NUMBERS**



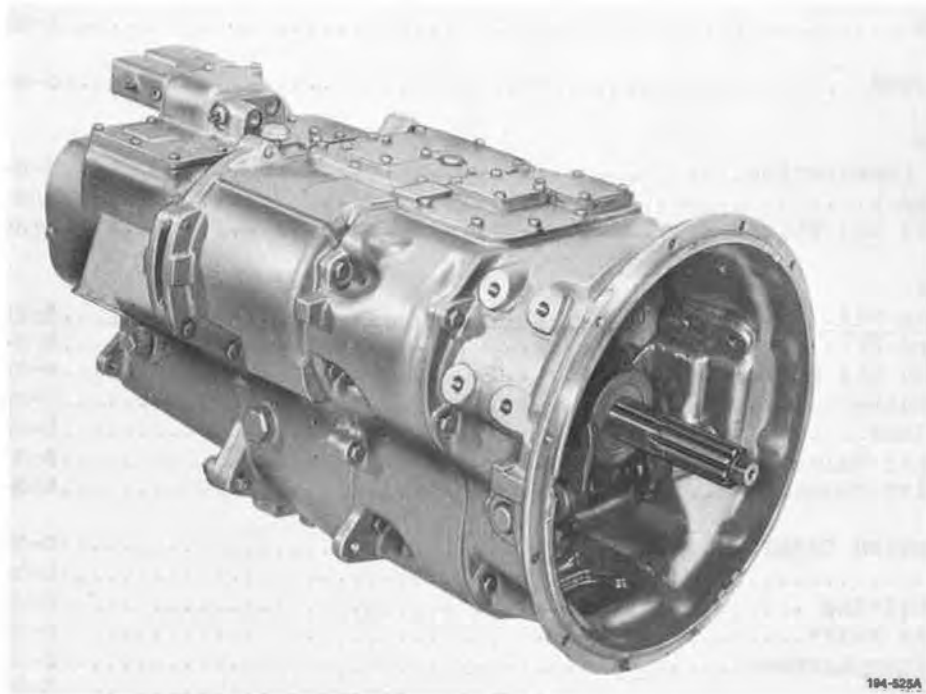
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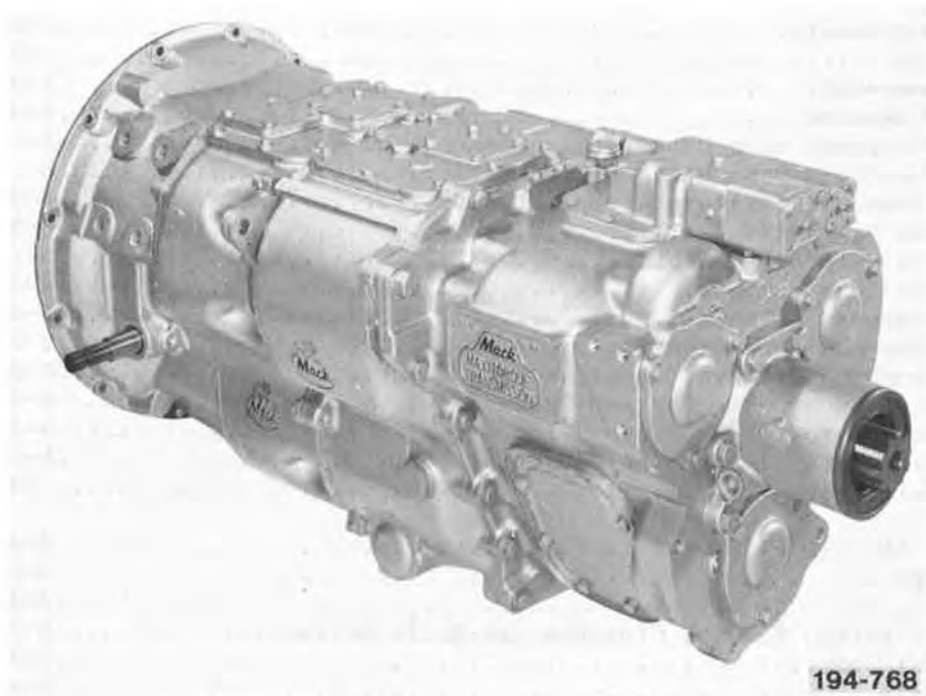
NOTES

MACK AIR SHIFT MAXITORQUE TRANSMISSION
TRTXL107 and TRTXL1070

Twelve Speed Series



194-525A



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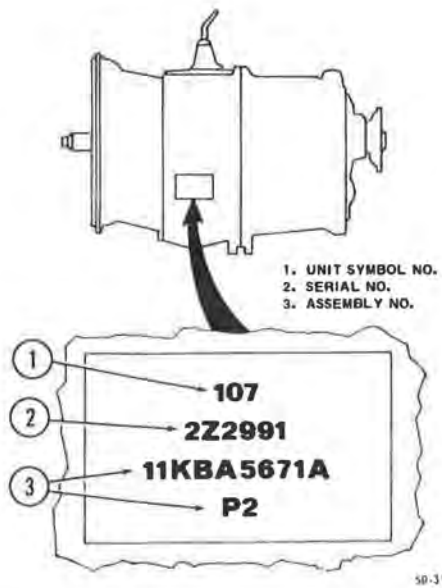
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NOTE

The illustrations contained in this publication are typical, and not necessarily exact. When working on these transmissions, the mechanic may find small differences between his unit and the illustrations.

TRANSMISSION IDENTIFICATION



The transmission identification stamping will be found on the left hand side of the main box case, as shown above.

MACK AIR SHIFT MAXITORQUE TRANSMISSIONS
TRTXL107 and TRTXL1070

Twelve Speed Series

DESCRIPTION

The TRTXL107 and TRTXL1070 are triple countershaft, non-synchronized units providing twelve forward speeds and five reverse speeds. They consist of a main box gear set of five forward speeds, an integrated air shifted rear compound providing a ratio split for each of the five main box speeds, and a manually shifted front compound providing a direct and a lo-range for the first speed of the main box. Due to an interlock, lo-range in the front compound can be selected only when the main box is in first gear.

The main difference between the two transmissions is that the rear compound in the TRTXL107 provides a direct and a lo-range, whereas the rear compound in the TRTXL1070 provides a direct and an overgear.

Two manually shifted control levers are provided, one for the main box, and one for the front compound. The rear compound is controlled by an air control valve (Selectair Valve) mounted on the main box gear shift lever. This valve has a finger-operated flipper to direct air pressure to the shift cylinders in the air shift cover, for shifting the rear compound into direct, lo/hi range, reverse, and neutral for P.T.O. operation.

Reverse is located in the rear compound. It is engaged by placing the Selectair valve in reverse position, and then placing the main box shift lever in one of the five forward speeds.

The three countershafts are equally spaced around the mainshafts. This design distributes the load equally among the countershafts, thus keeping normal deflection and gear tooth loading to a minimum. See Figure 1.

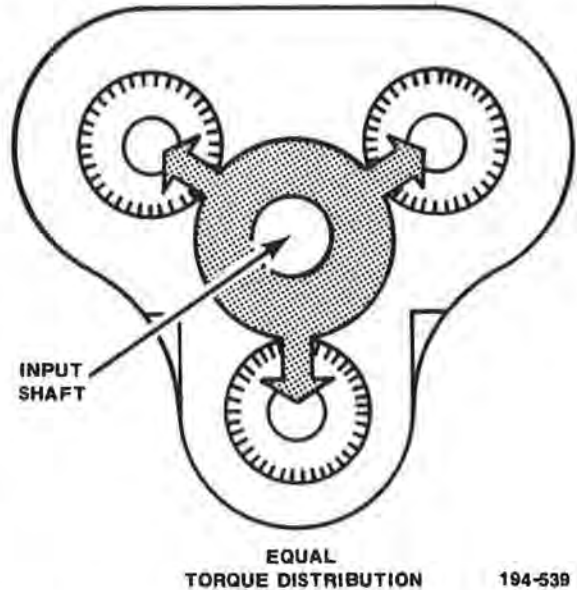


Figure 1. Torque Distribution

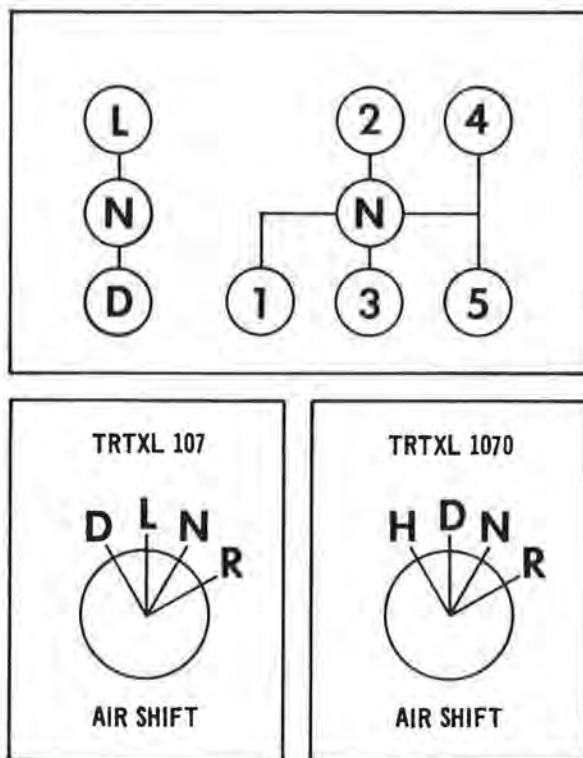
The mainshaft gears are either splined to the mainshaft, or self-centering among the three countershafts, thus eliminating the need for gear bushings.

All mainshaft gears are of the spur type design and, with the exception of the reverse sliding gear, are in constant mesh with the countershaft gears.

Other than reverse gear, shifting for the forward speeds is done by sliding clutches. Reverse is obtained by engaging the reverse sliding spur gear with the three reverse idler gears.

2

Gearset, Make.....	Mack
Type.....	Three Countershaft
Controls.....	Two-lever manual with air shifted rear compound
Speeds.....	Forward: Twelve
	Reverse: Five
Bell Housing, Type.....	Separable, Aluminum
Case, Material.....	Aluminum, with steel inserts at bearing bores
Lubrication.....	Gear throw-off and pump feed
Pump, Type.....	Built-in reciprocating vane
P.T.O. Openings:	
Left Side.....	Std. S.A.E. 8 hole
Right Side.....	Std. S.A.E. 6 hole
Oil Capacity.....	28 pints
Oil Type.....	SAE90 or 80W-90
	(See TS494 - Maintenance and Lubrication Manual for proper Mack specification)



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FRONT COMPOUND	MAIN BOX	TRTXL 107	
		UNDER DRIVE SPLITTER	RATIO
L	1	L	18.56
		D	14.44
		R	(61.65)
D	1	L	11.04
		D	8.59
		R	(36.66)
D	2	L	6.42
		D	4.99
		R	21.32
D	3	L	3.65
		D	2.84
		R	12.11
D	4	L	2.13
		D	1.66
		R	7.07
D	5	L	1.29
		D	1.00
		R	4.27

() RATIOS IN PARENTHESIS ARE NOT FUNCTIONAL TO OPERATIONS 36-59

36-59

Figure 2. Shift Pattern for
TRTXL107 and TRTXL1070

Figure 3. Gear Ratios for TRTXL107

FRONT COMPOUND	MAIN BOX	TRTXL 1070	
		OVER DRIVE SPLITTER	RATIO
L	1	D	14.44
		H	11.23
		R	(47.96)
D	1	D	8.59
		H	6.68
		R	(28.52)
D	2	D	4.99
		H	3.89
		R	16.59
D	3	D	2.84
		H	2.21
		R	9.42
D	4	D	1.66
		H	1.29
		R	5.50
D	5	D	1.00
		H	.78
		R	3.32

() RATIOS IN PARENTHESIS ARE NOT FUNCTIONAL TO OPERATIONS 36-60

Figure 4. Gear Ratios for TRTXL1070



SPLASH LUBRICATION

194-536

Figure 5. Gear Lubrication

Oil Pump

(TRTXL1070, Serial No. 903151, and later)

The front compound main drive pinion spigot bearing is provided with additional lubrication. A simple eccentric shuttle type pump is built into the front compound main drive pinion.

As the pinion rotates, the pump vane reciprocates in its eccentric housing, thus forcing lubricant to the spigot bearing via a drilled passage.

Oil Pump

(TRTXL1070 prior to Serial No. 903151 and all TRTXL107

The sliding clutches and mainshaft gears are provided with pressurized lubrication. A simple eccentric shuttle type pump is built into the front compound main drive pinion. As the pinion rotates, the pump vane reciprocates in its eccentric housing, thus forcing lubricant under pressure through rifle-drilled holes in the mainshaft to the sliding clutches and mainshaft gears. See Figure 6.

LUBRICATION

Splash Lubrication

All rotating and sliding parts of the transmission are bathed in oil from gear throw-off when in operation. See Figure 5.

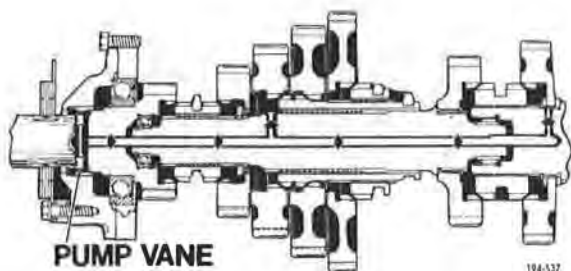


Figure 6. Pressure Lubrication

To supply the pump, oil from gear throw-off is collected by a trough located above the main drive pinion, and is then gravity fed to the pump.

Magnetic Oil Filter

A magnetic oil filter plug, located on the right hand side of the main case, removes ferrous metallic particles. The filter consists of an integral open trough and baffle arrangement, with a removable sheet metal cover. At the bottom of the baffle, a tapped hole in the case accommodates a large hex head plug with a built-in magnet. See Figure 7.



Figure 7. Magnetic Oil Filter

The oil from gear throw-off is collected by the filter, and is channeled past the magnetic plug, which pulls ferrous metal particles out of the passing oil and holds them. After passing the magnet, clean and particle-free oil then rises to the outlet near the top of the filter,

and drops down into the transmission case. A magnetic drain plug is also provided at the bottom of the case.

Early production TRTXL107 transmissions were equipped with an additional magnetic oil filter, located on the left hand side of the main case.

This plug was eliminated, starting with transmission Serial No. 9W8615.

MAINTENANCE

Checking Oil

To check the oil in the transmission, remove the fill plug on the right hand side of the case. The oil should be level with the bottom of the filler plug hole. The oil should be checked when it is hot, as when coming in from a run, and with the vehicle in a level position. Check the oil at the intervals specified in the Maintenance and Lubrication Manual. Add oil, if needed, until the oil begins to run out of the filler hole. Use oil of the proper specification as outlined in the Maintenance and Lubrication Manual.

CAUTION

Be sure to add oil to the transmission through the filler plug hole, NOT the magnetic filter plug hole. Severe damage could occur due to low oil level if the transmission is filled through the wrong hole.

Changing Oil

To change oil, remove the magnetic drain plug and drain the oil from the case while hot. If necessary, also flush the case with flushing oil and drain thoroughly. Clean and replace the magnetic drain plug. Remove the fill plug, and fill the transmission with the proper specification of oil (as outlined in the Maintenance and Lubrication Manual) to the level of the bottom of the filler hole. See the preceding CAUTION note. Reinstall the filler plug. Change oil at the intervals specified in the Maintenance and Lubrication Manual, or more often if conditions warrant it.

Magnetic Oil Filter

The magnetic oil filter plug should be removed and cleaned every time the oil is changed. Also clean the trough inside, and then reinstall the magnetic plug.

Air Breather

The breather, located on the top of the transmission, should be cleaned with a suitable solvent and checked for unobstructed air flow every time the oil is changed.

Air Filter

The transmission air filter for the air shift system should be replaced at every Mack "C" and "D" Inspection (refer to TS494 - Maintenance and Lubrication Manual). See Figure 8.

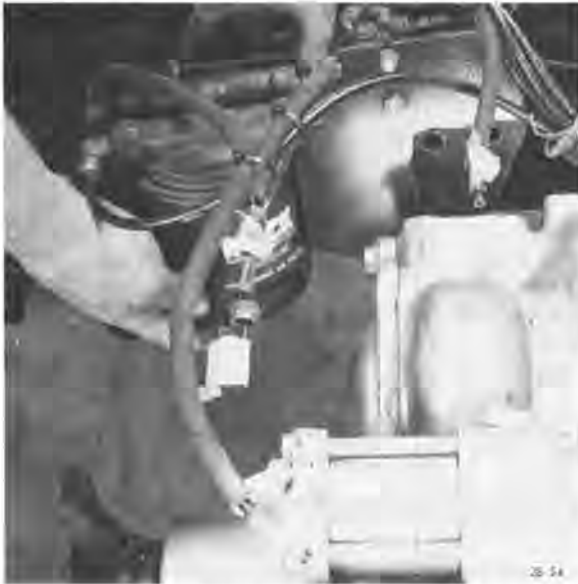


Figure 8. Transmission Air Filter

Selectair Valve

The Selectair Valve, located on the transmission main box gear shift lever, should be disassembled for cleaning, inspection, and lubrication at every Mack "C" and "D" Inspection (refer to TS494 - Maintenance and Lubrication Manual).

Refer to the Selectair Valve sections under DISASSEMBLY, INSPECTION AND CLEANING, and REASSEMBLY for the proper procedures and lubricants.

Air Shift Cover

The Air Shift Cover should be disassembled for cleaning, inspection, and lubrication at every Mack "C" and "D" Inspection (refer to TS494 - Maintenance and Lubrication Manual).

Refer to the Air Shift Cover sections under DISASSEMBLY and REASSEMBLY for the proper procedures and lubricants.

TROUBLE SHOOTING CHART

The following Trouble Shooting Chart is provided as an aid to assist in diagnosing and repairing the more common transmission complaints. It is not intended to include every possible cause - only those that most frequently occur.

Care should be exercised by the mechanic, when dealing with complaints of transmission problems, to be sure to eliminate all other possible sources of trouble before removing the transmission. Noise problems in particular are often assumed to be the fault of the transmission, while actually the noise comes from the axle, propeller shafts, universal joints, engine or clutch.

TROUBLE SHOOTING CHART

Symptom	Probable Cause	Remedy
Noisy	<ul style="list-style-type: none"> a. Low oil level b. Wrong oil used c. Side mounted PTO installed too tight or too loose d. Loose bell housing to flywheel housing cap-screws e. Torsional vibrations from engine and/or rear axle f. Excessive mainshaft gear endplay g. Gears worn, chipped, rough, cracked h. Bearings worn, cracked, corroded, galled, etc. 	<ul style="list-style-type: none"> a. Fill to correct level b. Drain and refill with correct oil c. Reinstall PTO correctly d. Install new capscrews using Loctite e. Install coaxial dampened disc clutch and/or driveline vibration damper f. Adjust using correct selective thrust washers g. Replace gears h. Replace bearings
Hard Shifting	<ul style="list-style-type: none"> a. Improperly adjusted clutch, clutch linkage, clutch brake, or shift linkage b. Low oil level c. Wrong oil used d. Incorrect driving practices e. Remote shift linkage not lubricated f. Shift lever binding or interference g. Poppet balls binding in their holes h. Loose setscrews in shifters or shift forks i. Worn shift rail bores j. Worn spigot bearing k. Clutch brake ears broken l. Clutch discs worn into main drive pinion 	<ul style="list-style-type: none"> a. Adjust properly b. Fill to correct level c. Drain and refill with correct oil d. Educate driver e. Clean and lubricate f. Relieve binding or interference g. Clean holes and balls h. Tighten to correct torque i. Install bushings j. Replace bearing k. Replace clutch brake l. Replace clutch discs and main drive pinion
Slow Air Shift	<ul style="list-style-type: none"> a. Low system air pressure b. Restricted or clogged air filter c. Restricted air lines (bent, squeezed, twisted, etc.) d. Air lines too small e. Defective pressure protection, pressure reducing or quick release valve f. Clogged shift cylinder breather g. Defective O-rings in air shift cylinders h. Scored air shift cylinders or pistons 	<ul style="list-style-type: none"> a. Wait for pressure to build back up to normal b. Replace air filter c. Reroute and/or replace air lines d. Replace with correct size air lines e. Replace valve f. Clean or replace breather g. Replace O-rings h. Repair or replace cylinders or pistons

TROUBLE SHOOTING CHART (Continued)

Symptom	Probable Cause	Remedy
Gear Disengagement (jumping out of gear)	<ul style="list-style-type: none"> a. Improperly adjusted remote control linkage b. Shift lever interference c. Excessive length and/or weight of gear shift lever and/or knob d. Worn or loose mounting insulators e. Loose, broken or missing capscrews between main case, clutch housing, and flywheel housing f. Weak or broken shifter rail poppet springs g. Bent or worn shifter forks h. Broken snap rings i. Shift rail bent or poppet notches worn j. Excessive mainshaft gear endplay k. Worn taper or chipped teeth on sliding clutch teeth l. Worn spigot bearing m. Engine flywheel housing misalignment 	<ul style="list-style-type: none"> a. Adjust properly b. Remove interference c. Replace with standard lever and/or knob d. Replace insulators e. Tighten or replace capscrews f. Replace springs g. Replace forks h. Replace snap rings i. Replace shift rail j. Adjust using correct selective thrust washers k. Replace sliding clutch l. Replace bearing m. Realign properly
Rear Compound Gear Disengagement	<ul style="list-style-type: none"> a. Improper carrier or driveline angles b. Loose Lo/Hi shifter adjusting nut in air shift cover 	<ul style="list-style-type: none"> a. Correct the carrier or driveline angles b. Adjust shifter and tighten nut
Oil Leaks	<ul style="list-style-type: none"> a. Drain plug, fill plug, or magnetic plug loose b. Oil level too high c. Improper lubricant used d. Loose or missing capscrews e. Clogged breather f. Shift rail expansion plugs loose or missing g. Gaskets or O-rings broken, shifted, or squeezed out of position h. Worn oil seals i. O-rings in air shift cover leaking air pressure into transmission 	<ul style="list-style-type: none"> a. Tighten plugs b. Fill to correct level c. Drain and refill with correct oil d. Tighten or replace e. Clean or replace f. Replace expansion plugs g. Replace gaskets and O-rings h. Replace seals i. Replace O-rings

TROUBLE SHOOTING CHART (Continued)

Symptom	Probable Cause	Remedy
Bearing Failure	<ul style="list-style-type: none"> a. Dirt in System b. Wrong grade of oil, or contaminated oil c. Excessive vibrations d. Binding or seized propeller shaft slip yoke e. Improper bearing clamping f. Improper bearing installation 	<ul style="list-style-type: none"> a. Clean and replace as necessary b. Drain and refill with correct oil c. Eliminate vibrations d. Clean and replace as needed e. Reclamp using correct procedures f. Replace using correct procedures

NOTE

The TRTXL107 and TRTXL1070 transmissions are available with the gear shift levers located either forward (on the front compound) or rearward (on the main box). All cab-over-engine chassis, as well as conventional chassis with 6 cylinder engines, use the forward controls version, while conventional chassis with V-8 engines use the rearward controls version.

DISASSEMBLY

Main Components Disassembly

NOTE

Unless a complete overhaul is necessary, remove only those parts required to gain access to the faulty parts. Do not disturb parts having heavy press fits (interference fits) unless replacement is necessary. In that case, use proper press setups and pullers, so that usable parts are not damaged.

1. Remove air lines from air shift cover. For easier reassembly, tag each air line with the same number stamped near the fitting on the air shift cover. See Figure 9.



Figure 9. Removing Air Lines

2. Drain lubricant and remove transmission from vehicle. Clean it externally and mount unit in overhaul stand.

3. Remove clutch release yoke set-screws.

4. Drive splined clutch release shaft inward, and remove Woodruff key. See Figure 10.



Figure 10. Removing Woodruff Key

5. Drive splined clutch release shaft outward, and remove.

6. Slide clutch release stub shaft inward, and remove it with clutch release yoke. See Figure 11.

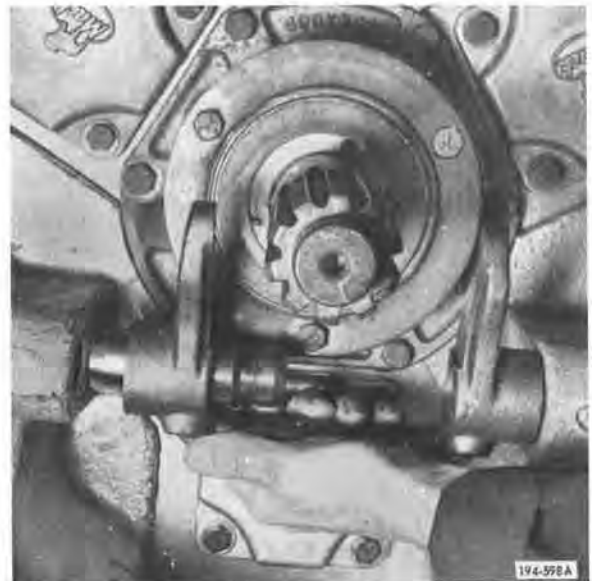


Figure 11. Removing Yoke and Stub Shaft

7. Remove clutch brake from input shaft. See Figure 12.



Figure 12. Removing Clutch Brake

10. Remove front compound poppet spring and ball. See Figure 14.



Figure 14. Removing Spring and Ball

8. Remove front compound top cover capscrews.

9. Remove front compound top cover. See Figure 13.



Figure 13. Removing Cover

11. Remove main box top cover capscrews.

12. Remove main box top cover. See Figure 15.

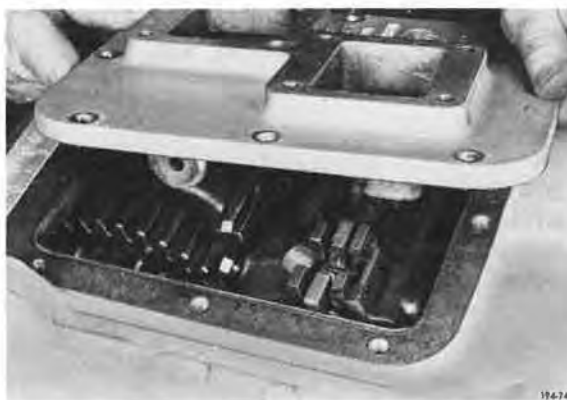


Figure 15. Removing Cover

13. Remove air shift cover cap-screws.

14. Remove air shift cover. See Figure 16.



Figure 16. Removing Air Shift Cover

15. Remove shifter rail poppet ball cover capscrews and cover. See Figure 17.

WARNING

Cover is spring-loaded. Remove cover evenly and carefully to prevent damage or injury.



Figure 17. Removing Cover

16. Remove poppet springs and poppet balls. See Figure 18.



Figure 18. Removing Poppet Springs and Balls

17. (Rearward controls only) Remove front compound shifter setscrew. See Figure 19.



Figure 19. Removing Setscrew

18. (Rearward controls only) Remove front compound shifter from shift rail. See Figure 20.



Figure 20. Removing Shifter

19. Remove front compound shift fork setscrew. See Figure 21.



Figure 21. Removing Setscrew

20. Remove front compound shift rail by sliding it forward. See Figure 22.



Figure 22. Removing Shift Rail

21. Remove front compound shift fork. See Figure 23.



Figure 23. Removing Shift Fork

22. (Forward controls only) Remove shifter setscrews and shifters from front compound. See Figure 24.



Figure 24. Removing Setscrew and Shifter

23. (Forward controls only) Remove reverse speed lockout spacer along with first speed shifter.



Figure 25. Removing Spacer and Shifter

24. Position transmission vertically.

25. Remove the two front compound case to main case capscrews, located inside the front compound case. See Figure 26.



Figure 26. Removing Capscrews

26. Remove the front compound case to main case capscrews, located on the outside of the cases. See Figure 27.



Figure 27. Removing Capscrews

27. Remove main case and rear case from front compound case, using a hoist and a lifting eye. Keep cases in good alignment while separating, to prevent binding which could damage bearings. See Figure 28.

NOTE

If cases do not separate easily, gently pry them apart with a prybar, using non-mating surfaces located at various points around the outside of the transmission.

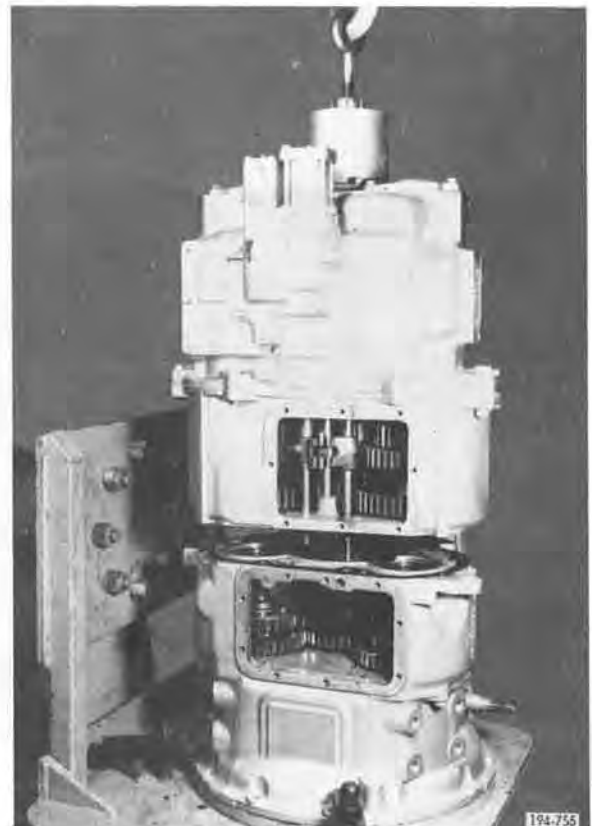


Figure 28. Removing Main Case and Rear Case

28. Remove setscrews from first speed shift fork and second/third speed shift fork. See Figure 29.



Figure 29. Removing Setscrew

29. Remove setscrew from fourth/fifth speed shift fork. See Figure 30.



Figure 30. Removing Setscrew

30. Slide fourth/fifth speed shift rail forward out of main box, and at the same time remove fourth/fifth speed shift fork. See Figures 31 and 32.

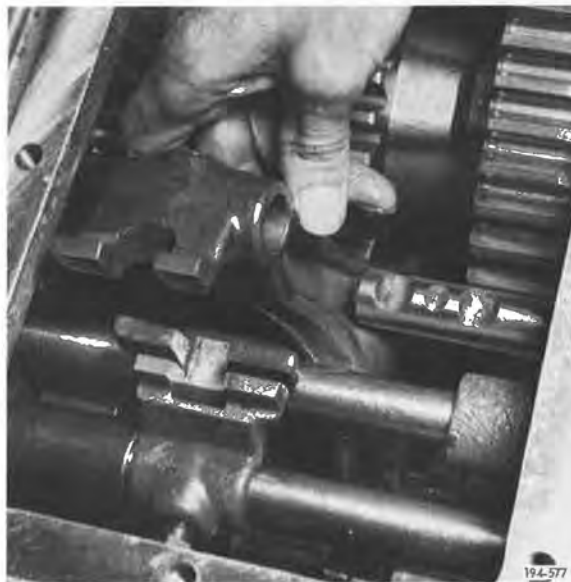


Figure 31. Sliding Shift Rail Forward



Figure 32. Removing Shift Fork

31. (Forward controls only) Remove first speed shift rail, and second/third speed shift rail, by sliding them forward out of the case.

32. (Rearward controls only) Remove first speed shifter setscrew, slide first speed shift rail forward out of case, and remove first speed shifter and reverse lockout spacer. See Figure 33.



Figure 33. Removing Shifter and Spacer

33. Remove first speed shift fork. See Figure 34.



Figure 34. Removing Shift Fork

34. (Rearward controls only) Remove second/third speed shifter setscrew. See Figure 35.



Figure 35. Removing Setscrew

35. (Rearward controls only) Slide second/third speed shift rail forward out of case, and remove second/third speed shifter. See Figure 36.



Figure 36. Removing Shifter

36. Remove second/third speed shift fork. See Figure 37.



Figure 37. Removing Shift Fork

37. Place two sliding clutches into engaged position, which will lock up mainshaft, to make it easier to remove drive flange (or yoke) assembly.

38. Remove drive flange (or yoke) clamp plate capscrew and clamp plate. See Figure 38.



Figure 38. Removing Capscrew

39. Install puller J-29031 or equivalent and remove drive flange (or yoke) from rear mainshaft splines. See Figure 39.

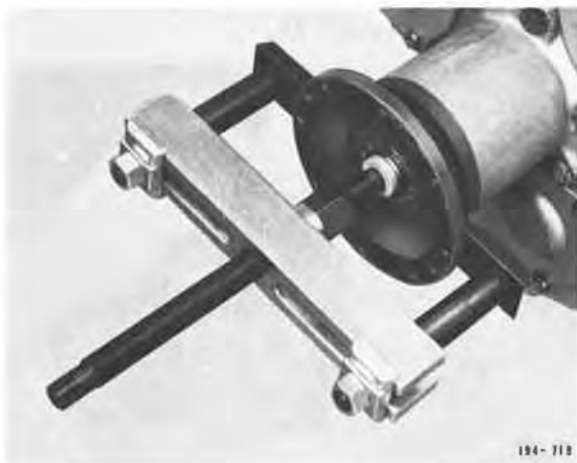


Figure 39. Removing Drive Flange

40. With transmission in a vertical position, remove main case to rear case capscrews. See Figure 40.



Figure 40. Removing Capscrews

41. Loosen main case to rear case dowel bolt nuts. See Figure 41.



Figure 41. Loosening Dowel Bolt Nuts

42. With nuts still engaging dowel bolt threads, drive dowel bolts out. See Figure 42.

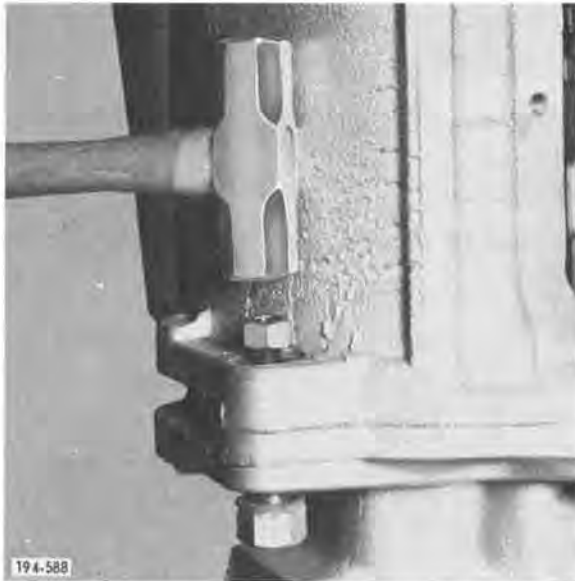


Figure 42. Removing Dowel Bolt

43. Secure Lo/Hi shift fork in position, using a piece of wire. This will prevent it from sliding forward. See Figure 43.

WARNING

Lo/Hi sliding clutch and shift fork could fall out of case and cause injury if they are not secured.

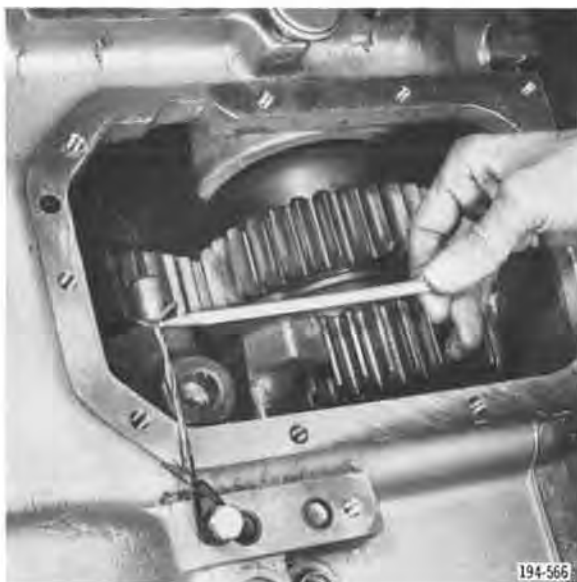


Figure 43. Wire Holding Shift Fork

44. Remove rear case from front case, using a hoist and a lifting eye. Keep cases in good alignment while separating, to prevent binding which could damage bearings. See Figure 44.

NOTE

If cases do not separate easily, gently pry them apart with a prybar, using non-mating surfaces located at various points around the outside of the transmission.

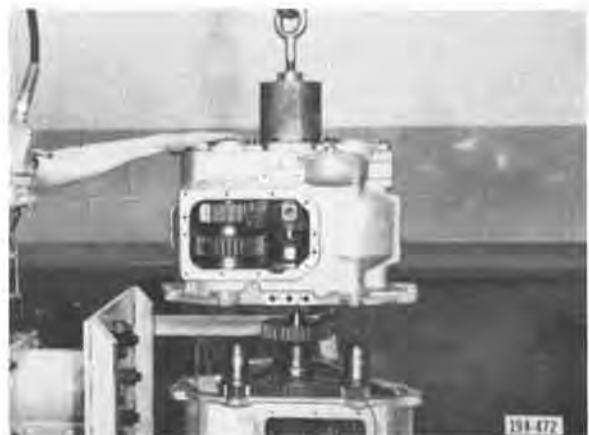
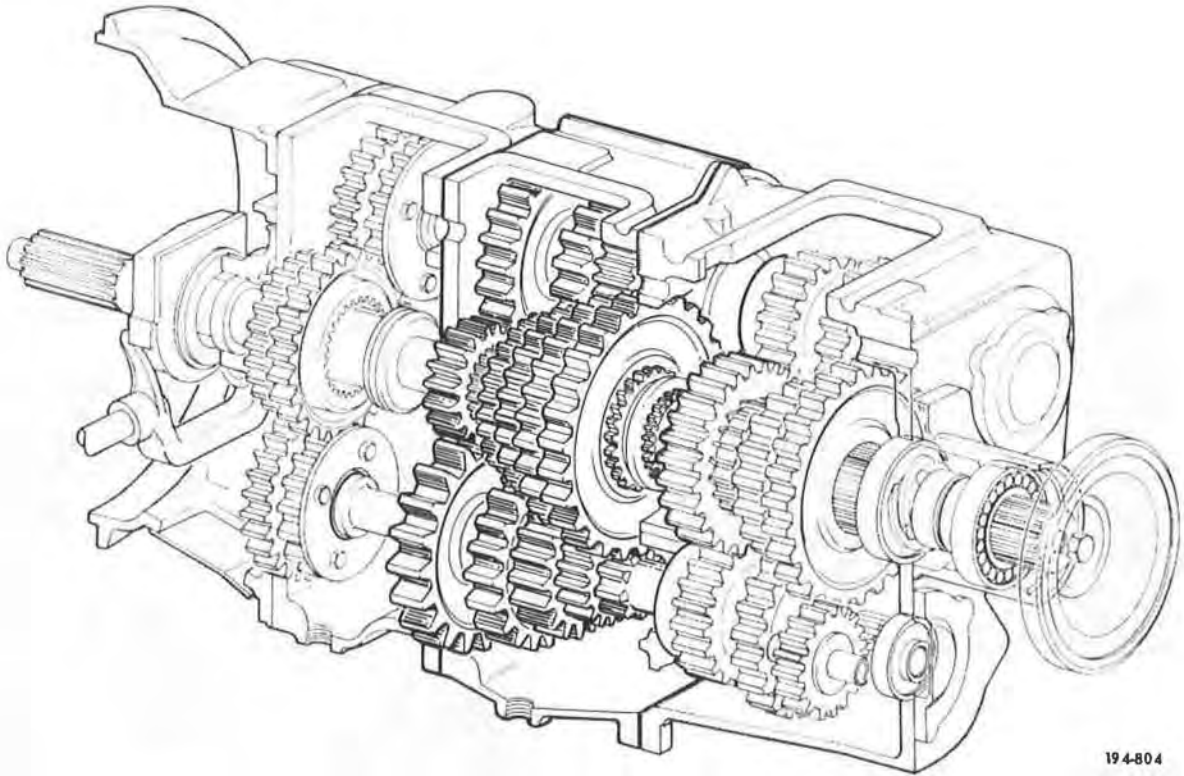


Figure 44. Removing Rear Case

NOTES

Main Box Disassembly



1. With main box horizontal, remove main drive pinion bearing cover cap-screws.

2. Remove main drive pinion bearing cover. See Figure 45.

3. Remove main drive pinion assembly from main box. See Figure 46.

NOTE

Tap on end of pinion, if necessary, with nylon mallet, to loosen the pinion.



Figure 45. Removing Cover



Figure 46. Removing Main Drive Pinion

4. Remove the countershaft front bearing dished retaining ring. See Figures 47 and 48.



Figure 47. Starting Removal of Retaining Ring



Figure 48. Removing Retaining Ring

5. Place main box in a vertical position, and remove mainshaft oil tube, only if necessary to replace it. Run a tap into the tube, and then insert a capscrew into the threads cut by the tap. The oil tube can then be removed by pulling and twisting the capscrew. See Figure 49.



Figure 49. Mainshaft Oil Tube

6. Remove compound main drive gear retaining snap ring, using snap ring pliers J-6435 or equivalent. See Figure 50.



Figure 50. Removing Snap Ring

NOTE

Beginning with Serial Number 903151, TRTXL1070 transmissions are built without oil transfer tubes and without drilled oil passages in the main drive pinion and mainshafts.

7. Remove compound main drive gear.
See Figure 51.

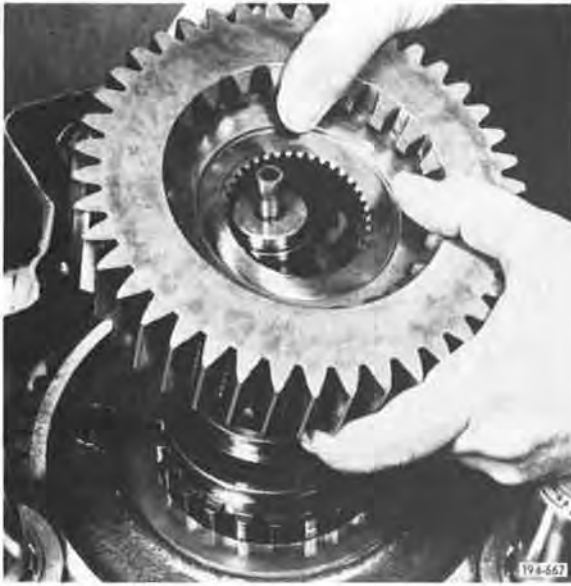


Figure 51. Removing Gear

8. Remove countershaft selective thrust washer snap rings, using snap ring pliers J-6435 or equivalent. See Figure 52.



Figure 52. Removing Snap Rings

9. Remove countershaft selective thrust washers. See Figure 53.



Figure 53. Removing Thrust Washer

10. Remove first speed gear sliding clutch. See Figure 54.

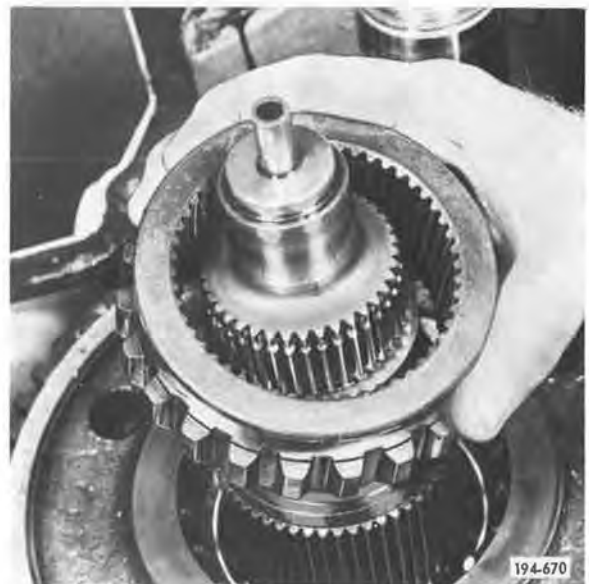


Figure 54. Removing Sliding Clutch

NOTE

Establish a way of keeping each selective thrust washer with its respective countershaft for reassembly.

11. Remove first speed gear and its thrust washer. See Figure 55.



- 1. First Speed Gear
- 2. First Speed Gear Thrust Washer

Figure 55. Removing Gear

13. Remove mainshaft assembly. See Figure 57.



Figure 57. Removing Mainshaft Assembly

14. Remove three countershaft assemblies. See Figure 58.



Figure 58. Removing Countershaft Assemblies

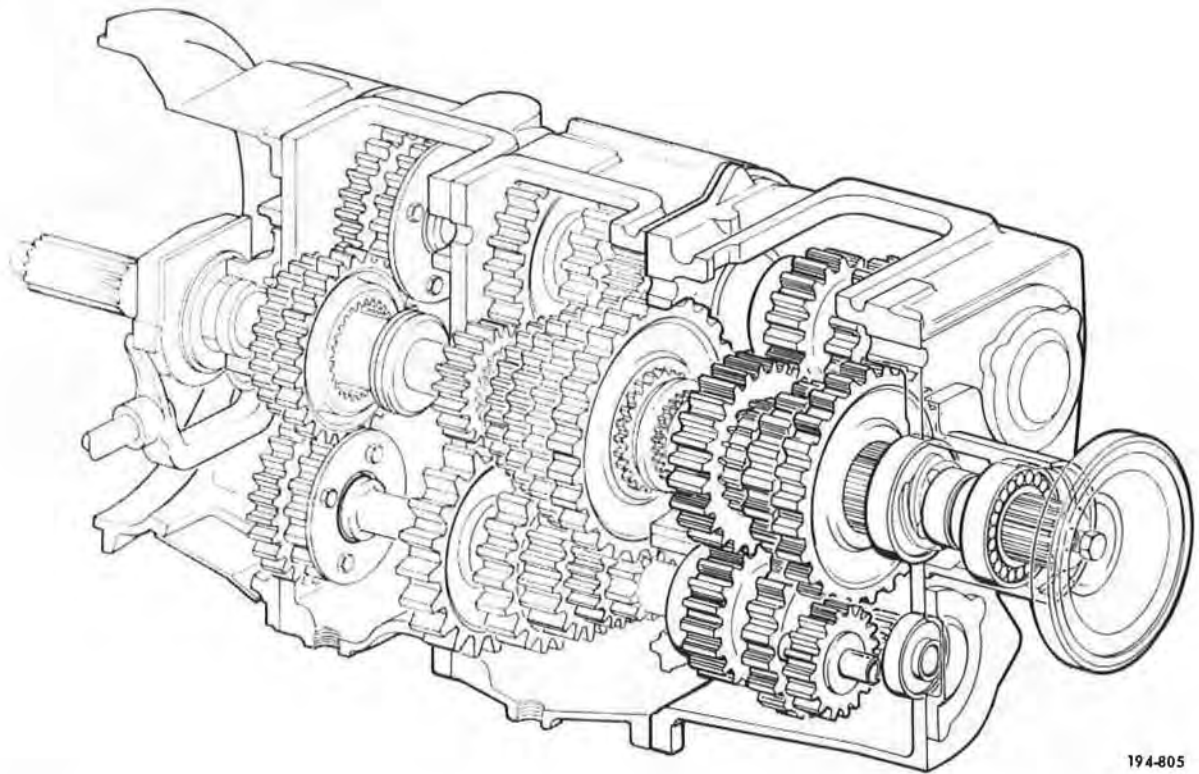
12. Remove second speed gear and its thrust washer. See Figure 56.



- 1. Second Speed Gear
- 2. Second Speed Gear Thrust Washer

Figure 56. Removing Gear

Rear Compound Disassembly



1. Remove rear countershaft rear bearing cover capscrews.

3. Remove rear mainshaft rear bearing cover capscrews.

2. Remove rear countershaft rear bearing covers. See Figure 59.

4. Remove rear mainshaft rear bearing cover. See Figure 60.



Figure 59. Removing Bearing Cover

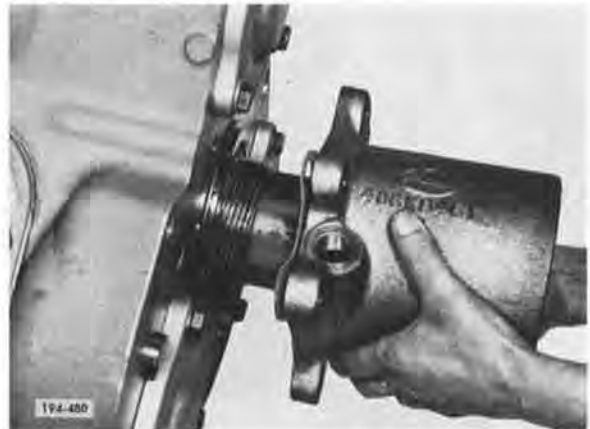


Figure 60. Removing Cover

5. Note location of any hollow rear countershafts for rear mounted P.T.O., so that unit can be reassembled with shafts in same position. If factory installed, the letter "O" will be stamped on the case next to each such shaft, as shown in Figure 61. If field installed, the same mark should be stamped into the case by the mechanic. Note in Figure 61 the pencil pointing to the "O", and the P.T.O. quill shaft being removed from the hollow shaft.



Figure 61. Rear Countershaft for P.T.O.

6. Remove wire previously installed for safety, and remove the Lo/Hi range sliding clutch and shift fork. See Figure 62 for TRTXL107 and Figure 63 for TRTXL1070.



Figure 62. Removing Sliding Clutch (TRTXL107)



Figure 63. Removing Sliding Clutch (TRTXL1070)

7. Remove Lo/Hi range gear snap ring, using snap ring pliers J-6435 or equivalent. See Figure 64 for TRTXL107 and Figure 65 for TRTXL1070.



Figure 64. Removing Snap Ring (TRTXL107)

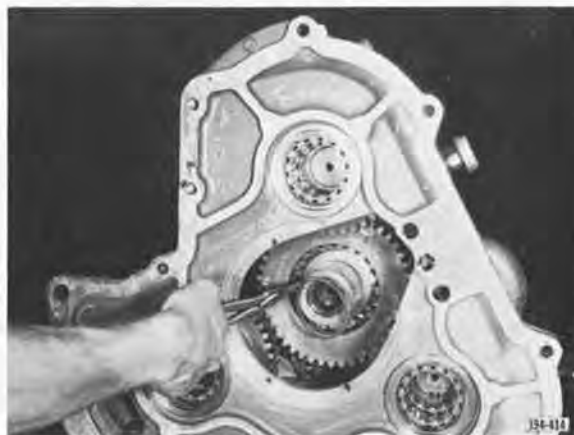


Figure 65. Removing Snap Ring (TRTXL1070)

8. Remove rear compound mainshaft Lo/Hi range gear front thrust washer. See Figure 66 for TRTXL107 and Figure 67 for TRTXL1070.



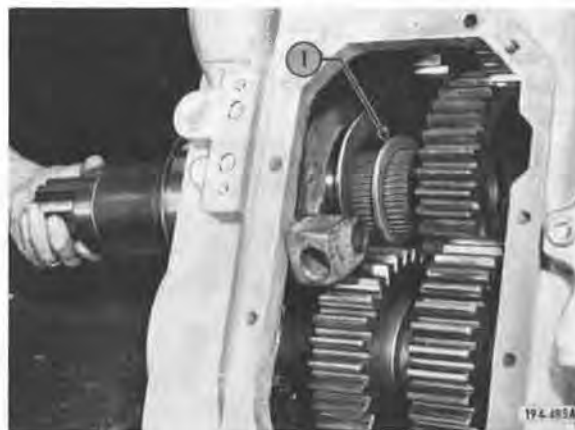
Figure 66. Removing Thrust Washer (TRTXL107)



Figure 67. Removing Thrust Washer (TRTXL1070)

9. Slide reverse gear rearward to engage it with the three reverse idler gears.

10. Partially withdraw rear mainshaft from the case by sliding it rearward, and at the same time remove the rear compound mainshaft Lo/Hi range gear rear thrust washer from the mainshaft. See Figure 68.



1. Rear Thrust Washer

Figure 68. Removing Thrust Washer

WARNING

Support the mainshaft to prevent injury which could result from dropping it.

11. Remove rear mainshaft the rest of the way. See Figure 69.



Figure 69. Removing Rear Mainshaft

12. Remove rear compound mainshaft Lo/Hi range gear through front opening of rear case. See Figure 70 for TRTXL107 and Figure 71 for TRTXL1070.



Figure 70. Removing Gear
(TRTXL107)



Figure 71. Removing Gear
(TRTXL1070)

13. Remove rear countershaft rear bearing retaining snap ring, using snap ring pliers J-25445 or equivalent. See Figure 72.



Figure 72. Removing Snap Ring

14. Drive rear countershaft rearward, using a suitable driver, to provide access to rear bearing positioning snap ring. See Figure 73.

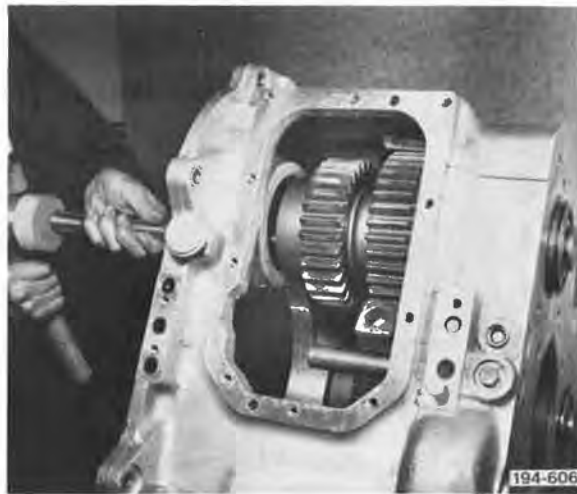


Figure 73. Driving Countershaft
Rearward

15. Position the first clamping half of tool S593C to engage the snap ring, as shown in Figure 74. Note pencil pointing to snap ring and corresponding groove in tool.

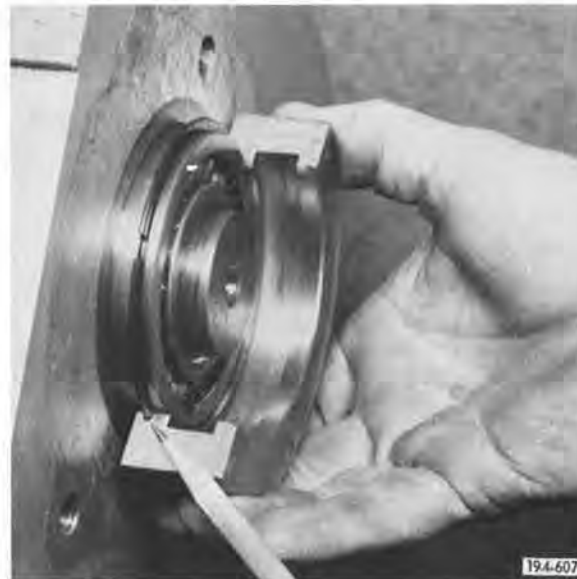


Figure 74. Installing First Clamping
Half

16. Install puller section of tool S593C and second clamping half. See Figure 75.

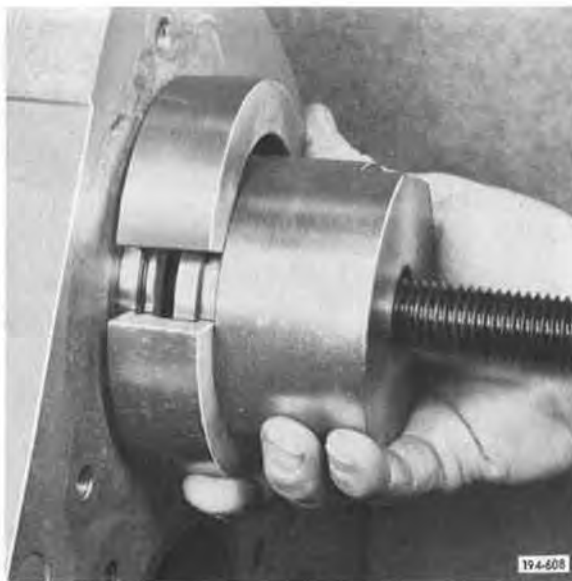


Figure 75. Installing Puller and Second Clamping Half

18. Tighten threaded shaft of puller until bearing is removed. See Figures 77 and 78.

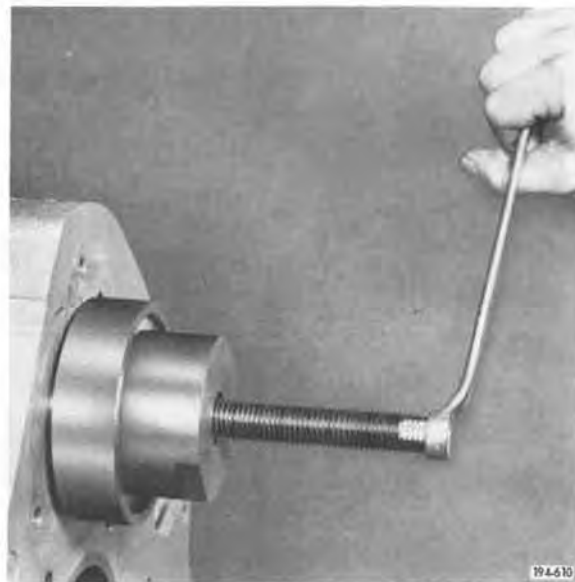


Figure 77. Tightening Puller

17. Slide the sleeve over the assembly to secure the two clamping halves together. See Figure 76.

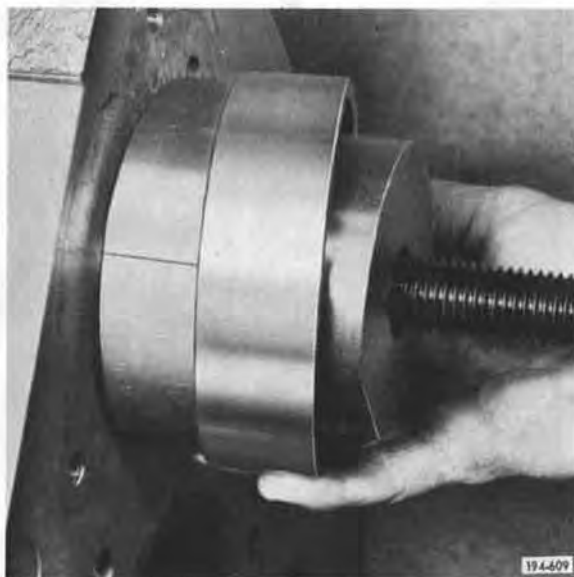


Figure 76. Installing Sleeve



Figure 78. Bearing Removed

19. Remove three rear countershaft assemblies from case. See Figure 79.



Figure 79. Removing Countershaft

21. Remove main box countershaft rear bearing retaining snap rings (using snap ring pliers J-4646 or equivalent) and bearings from front of rear case. See Figure 81.



Figure 81. Removing Snap Rings and Bearings

20. Remove reverse gear and its shifter fork. See Figure 80.

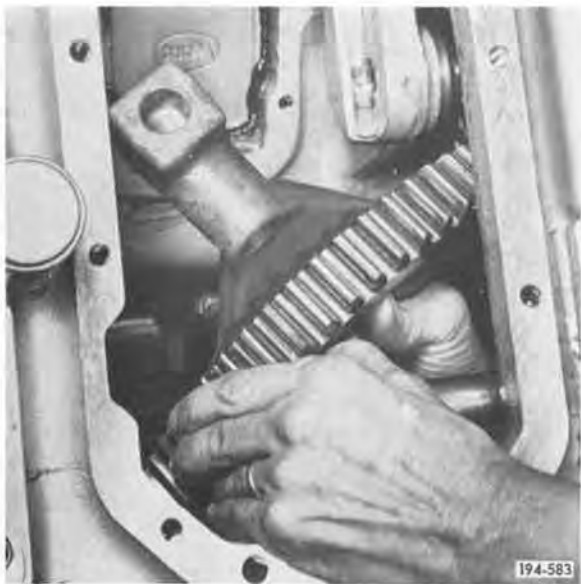


Figure 80. Removing Reverse Gear and Shift Fork

22. Punch holes in the reverse idler shaft expansion plugs, and remove plugs. See Figure 82.



Figure 82. Removing Expansion Plug

23. Install tool J-28668 into the internal threads of reverse idler shaft. See Figure 83.



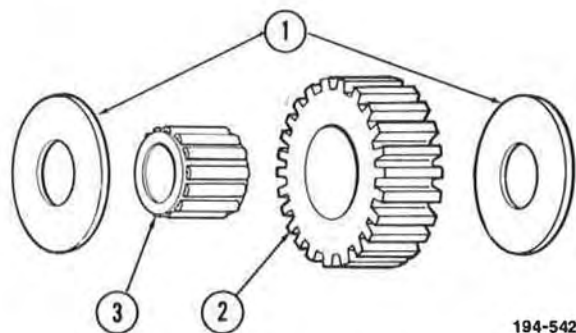
Figure 83. Installing Tool

24. Tighten threaded shaft of tool, and withdraw reverse idler shaft. See Figure 84.



Figure 84. Withdrawing Shaft

25. Remove reverse idler gear, bearing, and thrust washers. See Figures 85 and 86.



- 1. Thrust Washers
- 2. Idler Gear
- 3. Roller Bearing

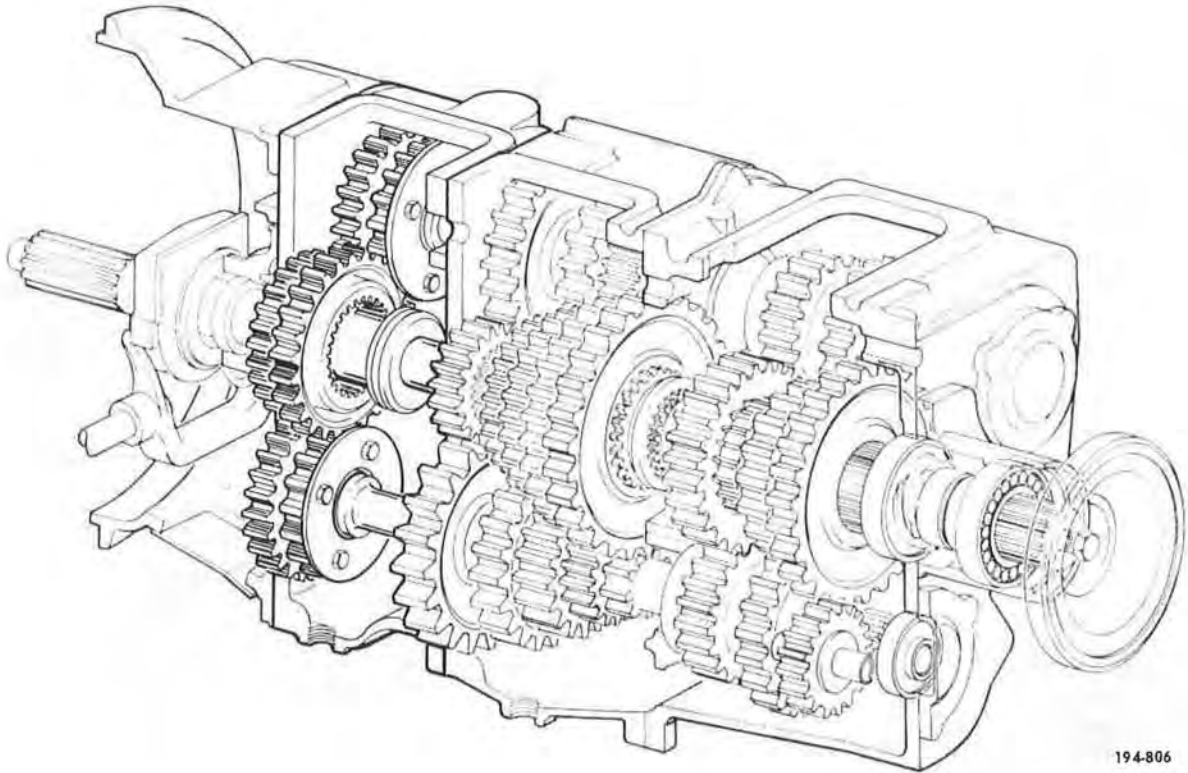
Figure 85. Exploded View of Reverse Idler Gear Assembly



Figure 86. Removing Gear

NOTES

Front Compound Disassembly



194-806

1. Remove front compound main drive pinion bearing cover capscrews.

3. Remove oil pump vane from front compound main drive pinion. See Figure 88.

2. Remove front compound main drive pinion bearing cover. See Figure 87.



194-450A



194-475

Figure 87. Removing Cover

Figure 88. Removing Oil Pump Vane

4. Remove front compound countershaft front bearing covers. See Figure 89.



Figure 89. Removing Cover

5. Remove front bearing positioning snap ring, using pliers J-25445 or equivalent. See Figure 90.



Figure 90. Removing Snap Ring

6. Remove front compound main drive pinion bearing positioning snap ring, using snap ring pliers J-25445, or equivalent. See Figure 91.



Figure 91. Removing Snap Ring

7. Position front compound case vertically.

8. Remove countershaft gear retaining thrust washer capscrews. So that gears cannot turn, place a soft iron wedge between gear teeth. See Figure 92.



Figure 92. Removing Capscrews

9. Remove front compound main drive pinion sliding clutch and Lo-range gear as an assembly. See Figure 93.



Figure 93. Removing Sliding Clutch and Lo-Range Gear

10. Remove front compound main drive pinion. If necessary, tap on main drive pinion with a soft headed mallet, driving it rearward. See Figure 94.



Figure 94. Removing Main Drive Pinion

11. Remove front compound countershaft rear bearing retaining snap rings from case, using snap ring pliers J-4646 or equivalent. See Figure 95.



Figure 95. Removing Snap Ring

12. Using a soft headed mallet, tap on front end of front compound countershafts, driving the shafts rearward and partially through the rear bearing opening. Remove the countershaft rear bearings using tool J-25031-2 or equivalent. See Figure 96.



Figure 96. Removing Bearing

13. Remove the three front compound countershafts from the case. See Figure 97.



Figure 97. Removing Countershaft

Front Compound Main Drive Pinion
Bearing Cover Variations

Main drive pinion bearing covers may be found in three different styles, as shown in Figures 98, 99, and 100.

Figure 98 shows non-current production used on all TRTXL107, and on TRTXL1070 prior to serial number 8R2957. Notice the springs and the flat washers. This arrangement was used with either three piece or two piece clutch brakes.

Figure 99 shows a field conversion arrangement. Notice that the springs have been replaced by spacers, and the flat washers have been removed. The one piece torque limiting clutch brake is used.

Figure 100 shows the current production, used on TRTXL1070, serial number 8R2957 and later. Notice that the cover is one piece, and that the one piece torque limiting clutch brake is again used.

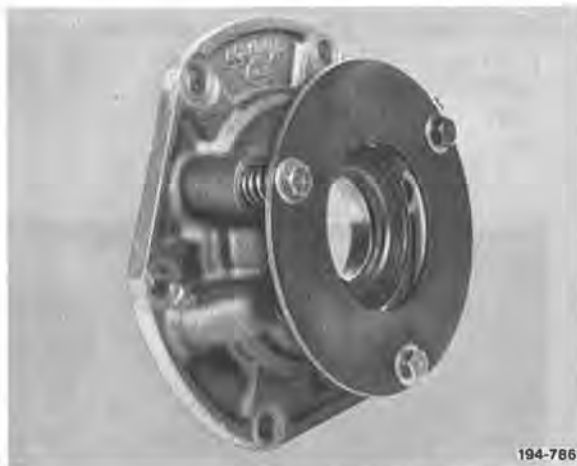


Figure 98. Main Drive Pinion Bearing Cover, Non-Current



Figure 99. Main Drive Pinion Bearing Cover, Field Conversion



Figure 100. Main Drive Pinion Bearing Cover, Current Production

Front Compound Main Drive Pinion
Bearing Cover Disassembly (Non-
Current Production)

(TRTXL107 prior to serial number 7B0736).

SERVICE NOTE

If the non-current style of main drive pinion bearing cover (shown in Figure 98) is found during overhaul, it is recommended that it be replaced with the current production style (shown in Figure 100).

1. Insert sleeve remover J-23387-01 in cover, place spreader jaws behind oil seal, then tighten setscrew to expand the jaws and grip the rear of the seal. See Figure 101.



Figure 101. Installing Tool

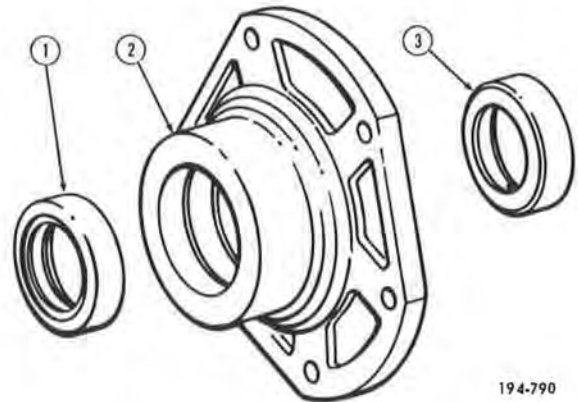
2. Place assembly in a press, and press seal and pump sleeve out of housing. See Figure 102.



Figure 102. Pressing Seal and Sleeve Out of Cover

Front Compound Main Drive Pinion
Bearing Cover Disassembly (Current
Production)

(TRTXL107 serial number 7B0736, and later; and all TRTXL1070)



1. Oil Seal
2. Cover
3. Pump Sleeve

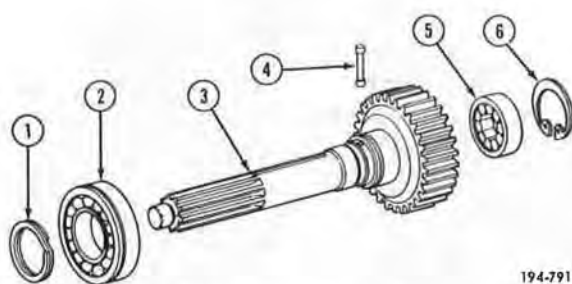
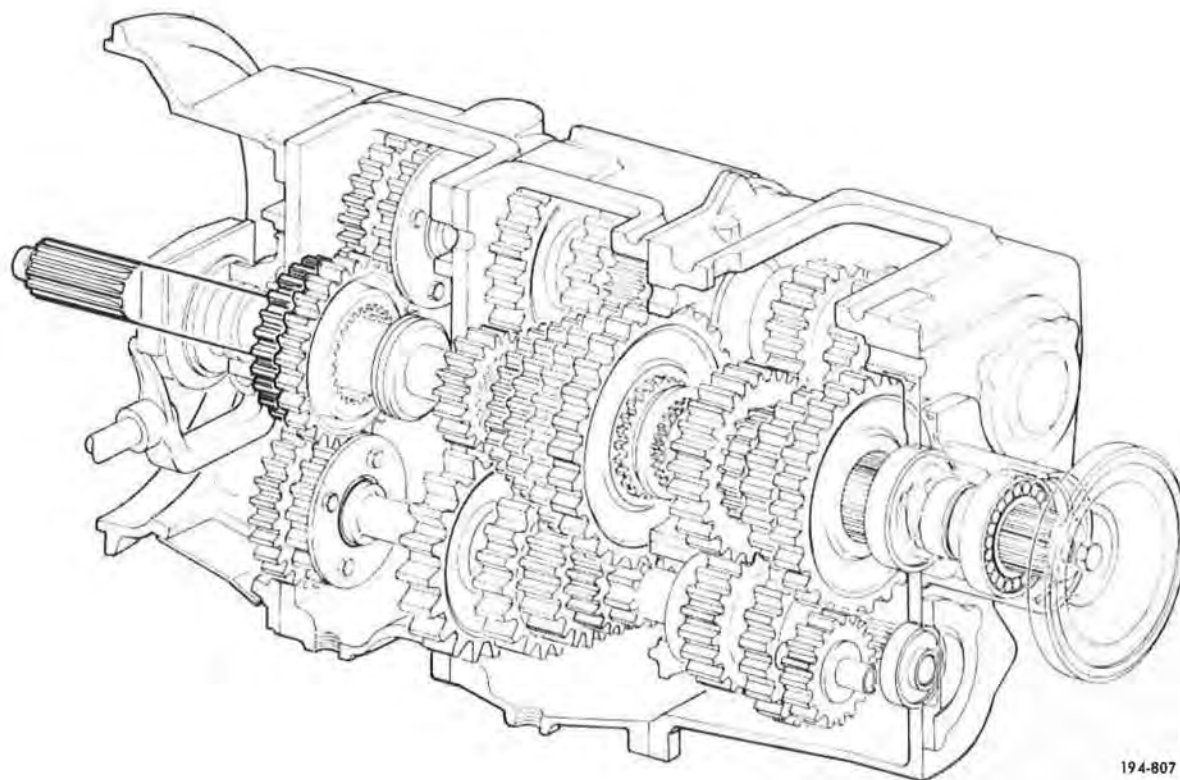
Figure 103. Exploded View of Front Compound Main Drive Pinion Bearing Cover

1. Oil seal is not installed in pump sleeve, and can be removed separately. Remove seal by driving it out of cover with a punch and a hammer. See Figure 104.



Figure 104. Removing Oil Seal

Front Compound Main Drive Pinion Disassembly



1. Spirolox Snap Ring
2. Bearing
3. Main Drive Pinion
4. Oil Pump Vane
5. Spigot Bearing
6. Snap Ring

Figure 105. Exploded View of Front Compound Main Drive Pinion

1. Remove bearing retaining spirollox snap ring. See Figure 106.



Figure 106. Removing Snap Ring

2. Press main drive pinion bearing off of the shaft. See Figure 107.



Figure 107. Pressing Off Bearing

3. Remove spigot bearing retaining snap ring. See Figure 108.

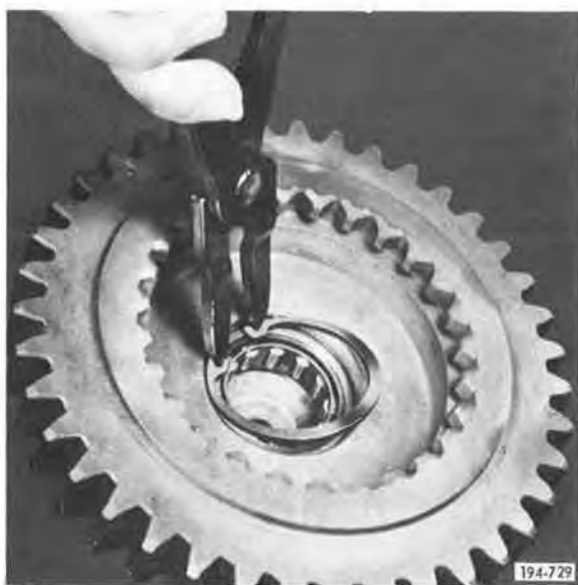


Figure 108. Removing Snap Ring

4. Remove front compound main drive pinion spigot bearing, using puller 956, or equivalent. See Figure 109.

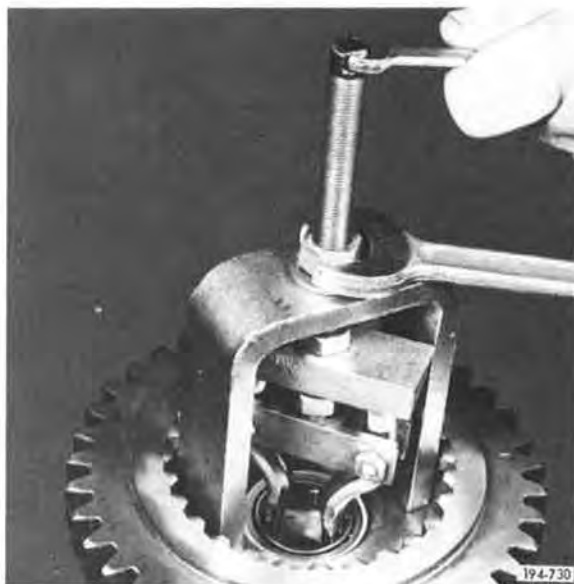
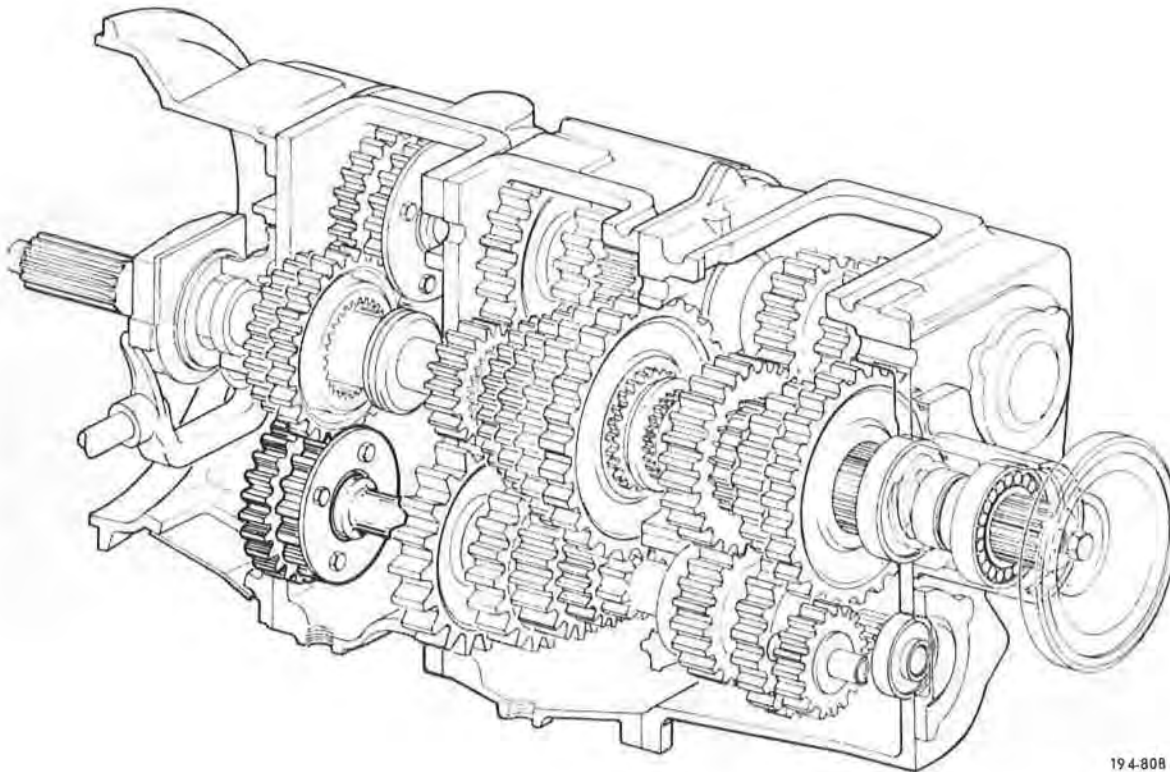
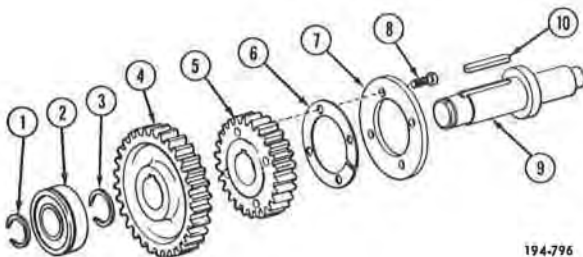


Figure 109. Removing Bearing

Front Compound Countershaft Disassembly



1. Remove front compound countershaft front bearing retaining snap ring, using snap ring pliers J-25445, or equivalent. See Figure 111.



- | | |
|------------------|-----------------|
| 1. Snap Ring | 6. Shim |
| 2. Bearing | 7. Washer |
| 3. Snap Ring | 8. Capscrew |
| 4. Direct Gear | 9. Countershaft |
| 5. Lo-Range Gear | 10. Key |

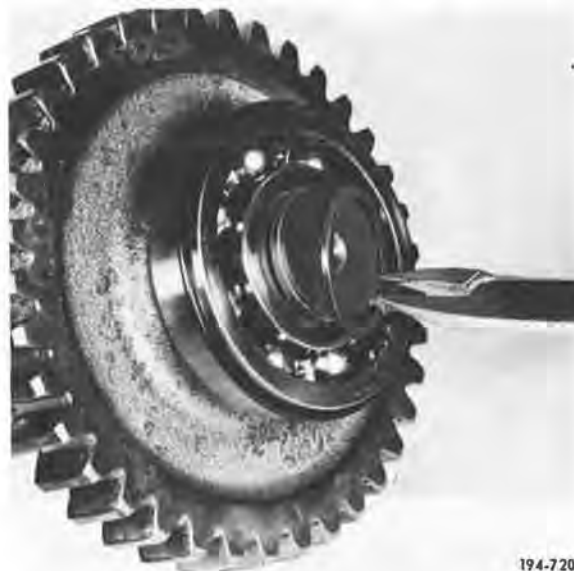


Figure 110. Exploded View of Front Compound Countershaft

Figure 111. Removing Snap Ring

2. Remove front compound counter-shaft front bearing, using puller No. J-25031-2, or equivalent. See Figure 112.

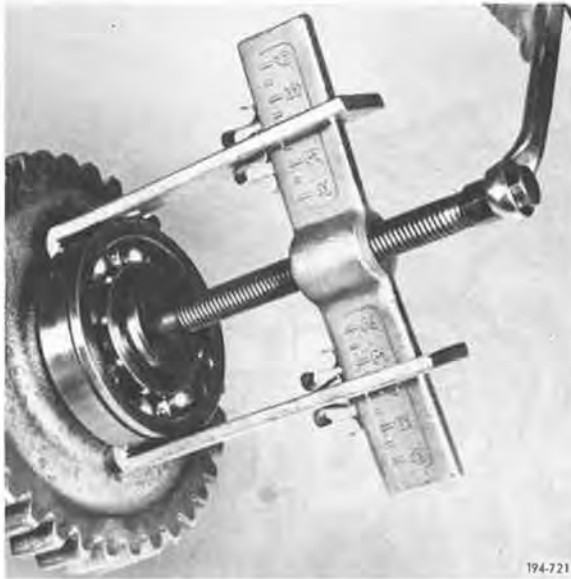


Figure 112. Removing Bearing

4. Press off front compound counter-shaft Direct gear. See Figure 114.



Figure 114. Pressing Off Gear

3. Remove gear retaining snap ring, using snap ring pliers J-25445, or equivalent. See Figure 113.



Figure 113. Removing Snap Ring

5. Press off front compound counter-shaft Lo-Range gear. See Figure 115.

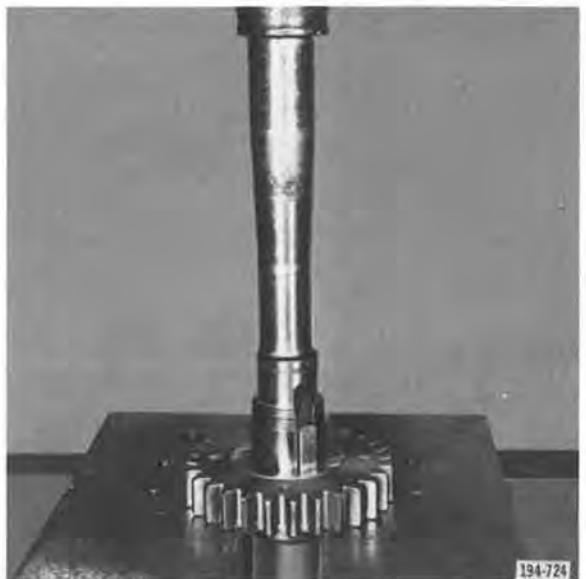
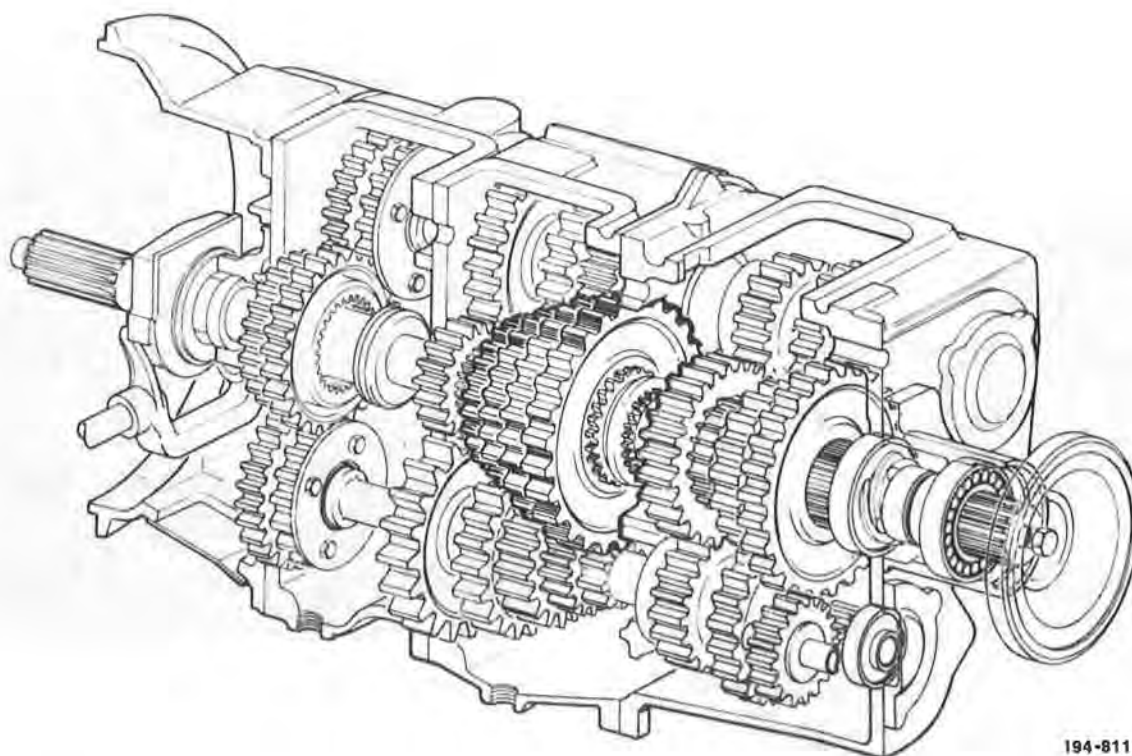
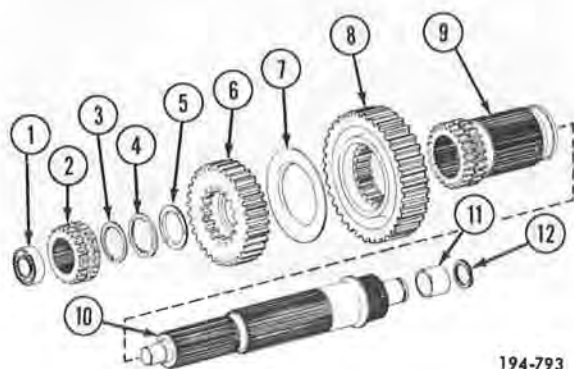


Figure 115. Pressing Off Gear

Main Box Mainshaft Disassembly



194-811



194-793

1. Spigot Bearing
2. 4th/5th Sliding Clutch
3. Snap Ring
4. Splined Thrust Washer
5. Flanged Thrust Washer
6. 4th Speed Gear
7. Flanged Thrust Washer
8. 3rd Speed Gear
9. 2nd/3rd Sliding Clutch
10. Mainshaft
11. Bearing Inner Race
12. Snap Ring

Figure 116. Exploded View of Main Box Mainshaft

1. (TRTXL107 only) Prior to serial number 9X1342, a snap ring was used to retain the mainshaft spigot bearing, and must be removed.

NOTE

TRTXL107 transmissions built after above serial number, and all TRTXL1070 transmissions, do not have a mainshaft spigot bearing retaining snap ring.

2. Remove mainshaft front spigot bearing, using puller CG-250, or equivalent. See Figure 117.



Figure 117. Removing Bearing

3. Remove fourth/fifth speed sliding clutch. See Figure 118.



Figure 118. Removing Clutch

4. Remove fourth speed gear retaining snap ring, using snap ring pliers J-29045, or equivalent. See Figure 119.



Figure 119. Removing Snap Ring

5. Remove fourth speed gear splined thrust washer and flanged thrust washer. See Figure 120.



Figure 120. Removing Thrust Washers

6. Remove fourth speed gear and third speed gear flanged thrust washer. See Figure 121.

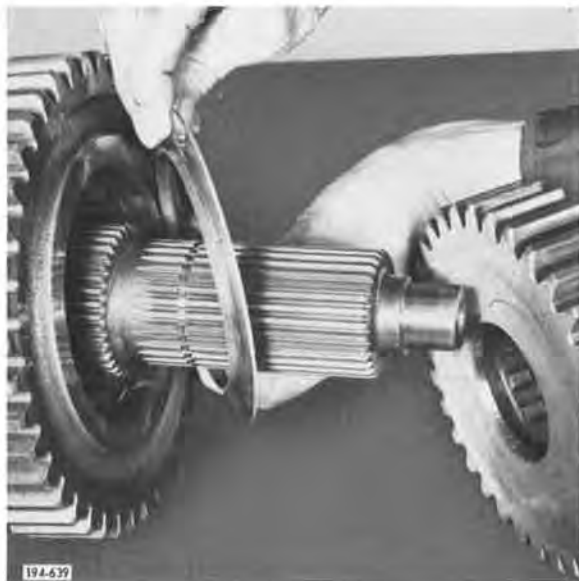


Figure 121. Removing Gear and Washer

7. Remove third speed gear. See Figure 122.

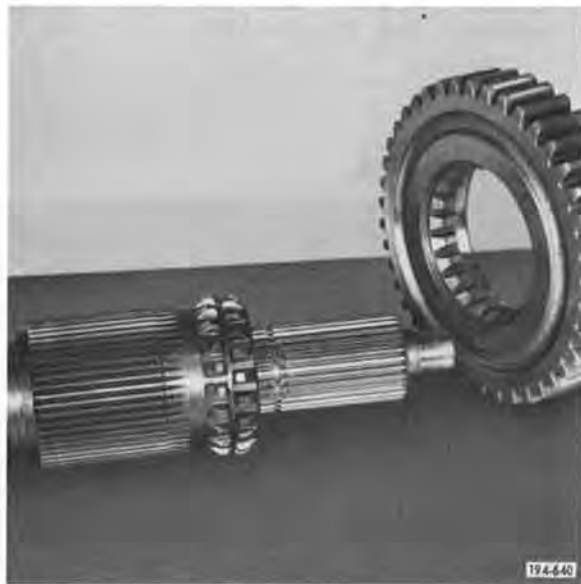


Figure 122. Removing Gear

8. Remove second/third speed sliding clutch. See Figure 123.



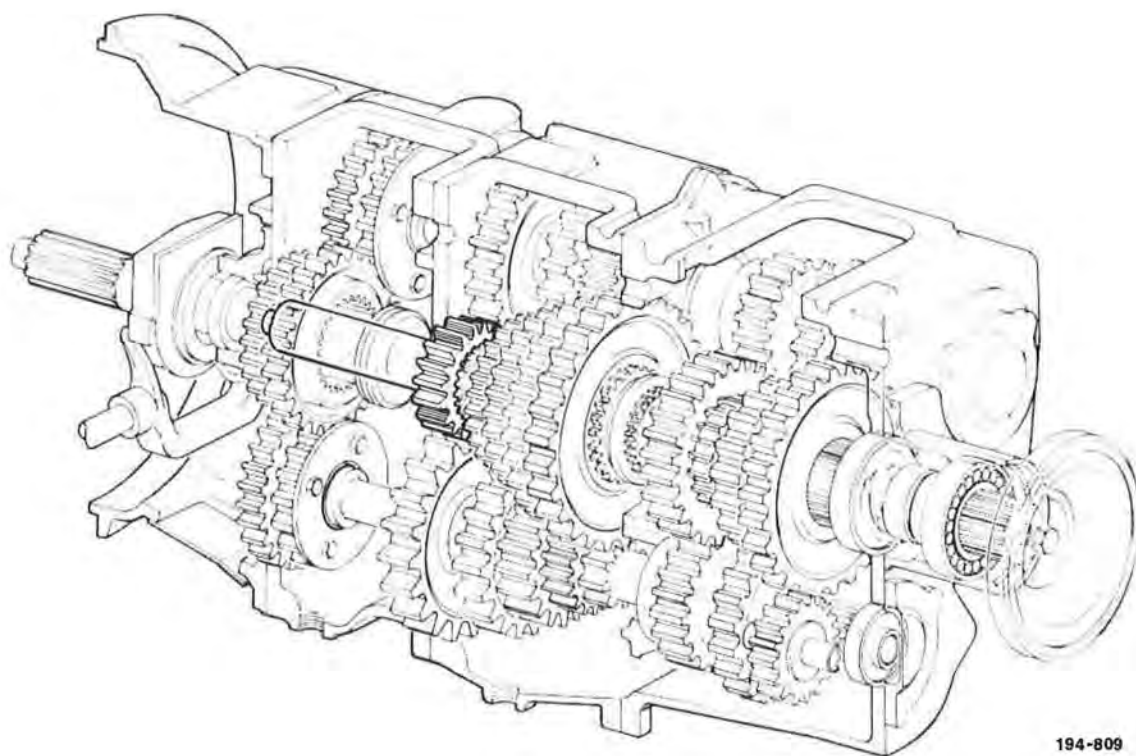
Figure 123. Removing Clutch

NOTE

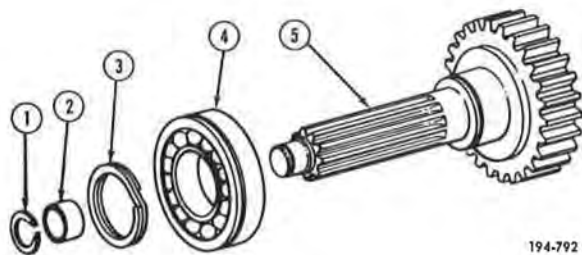
Figure 123 shows non-current production mainshaft, with the pencil pointing to an oil hole. Current production no longer uses oil passages in the mainshaft (TRTXL1070 serial number 903151, and later.)

NOTES

Main Box Main Drive Pinion Disassembly



1. Remove bearing retaining spirollox snap ring. See Figure 125.



1. Snap Ring
2. Bearing Inner Race
3. Spirolox Snap Ring
4. Bearing
5. Main Drive Pinion

Figure 124. Exploded View of Main Box Main Drive Pinion



Figure 125. Removing Snap Ring

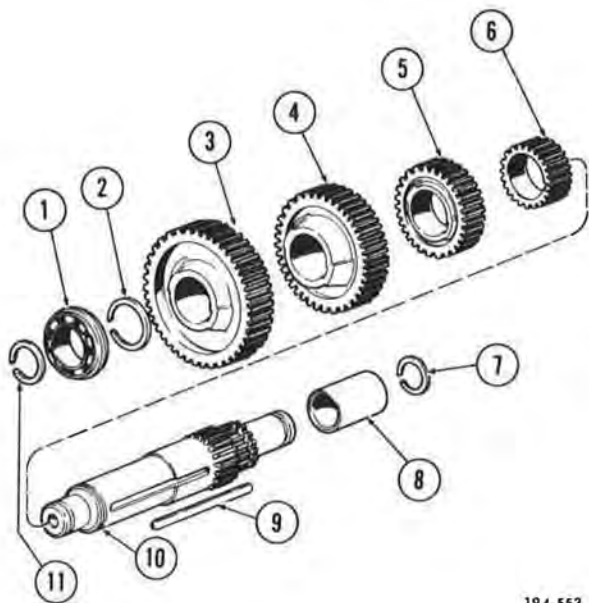
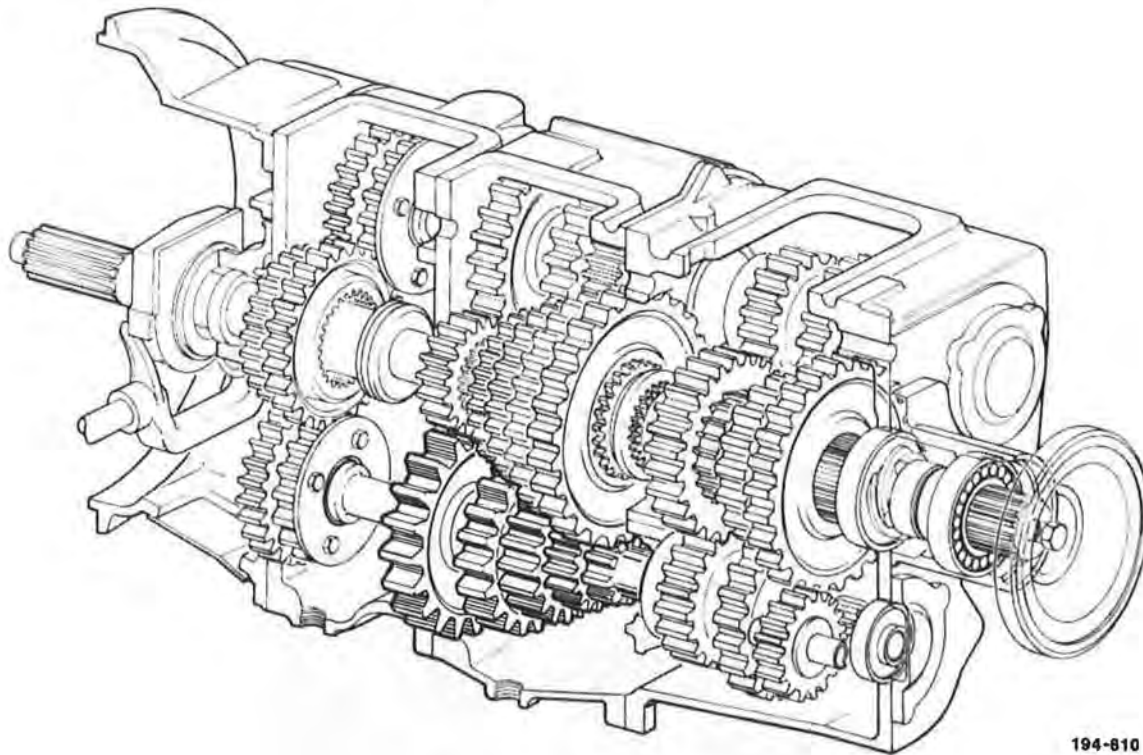
2. Press main drive pinion bearing off of the shaft. See Figure 126.



Figure 126. Pressing Off Bearing

3. If replacing front compound main drive pinion spigot bearing, remove snap ring and bearing inner race from main box main drive pinion.

Main Box Countershaft Disassembly



- | | |
|-----------------------------|---------------------------------|
| 1. Bearing | 8. Bearing Inner Race |
| 2. Gear Retaining Snap Ring | 9. Key |
| 3. Fifth Speed Gear | 10. Front Countershaft |
| 4. Fourth Speed Gear | 11. Bearing Retaining Snap Ring |
| 5. Third Speed Gear | |
| 6. Second Speed Gear | |
| 7. Snap Ring | |

Figure 127. Exploded View of Main Box Countershaft

1. Remove main box countershaft front bearing retaining snap ring, using snap ring pliers J-25445, or equivalent. See Figure 128.



Figure 128. Removing Snap Ring

2. Remove countershaft front bearing, using puller S593C. See Figure 129.

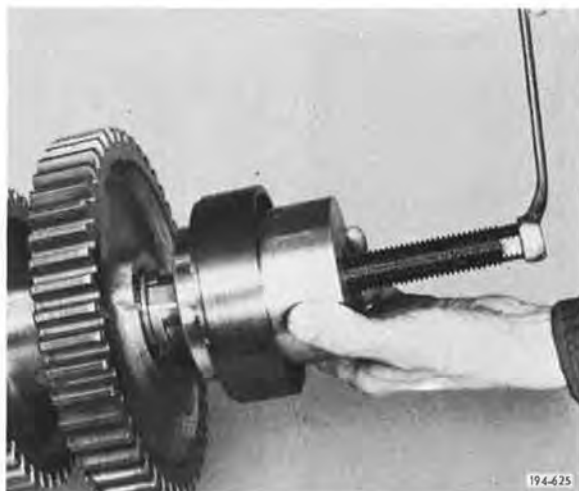


Figure 129. Removing Bearing

4. Remove bearing inner race retaining snap ring from rear of main box countershaft, using snap ring pliers J-24339, or equivalent. See Figure 131.



Figure 131. Removing Snap Ring

3. Remove countershaft gear retaining snap ring, using snap ring pliers J-25445, or equivalent. See Figure 130.

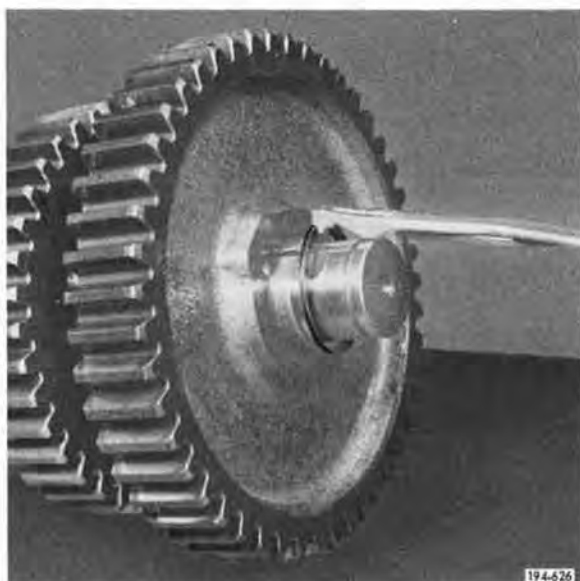


Figure 130. Removing Snap Ring

5. Remove bearing inner race from rear of main box countershaft, using puller S500, or equivalent. See Figure 132.



Figure 132. Removing Race

6. Place main box countershaft in a press, and press off the gears one at a time, starting with fifth speed gear. See Figure 133.

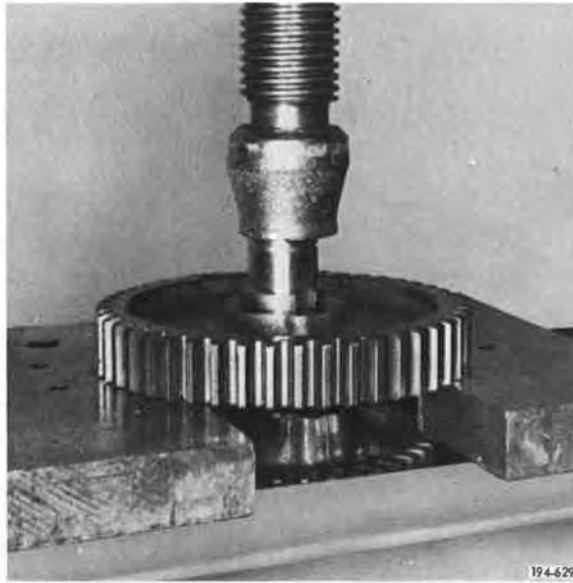
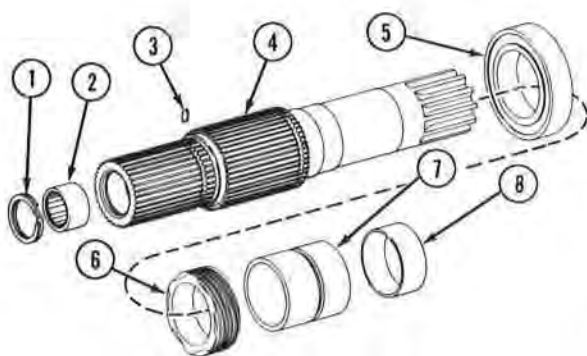
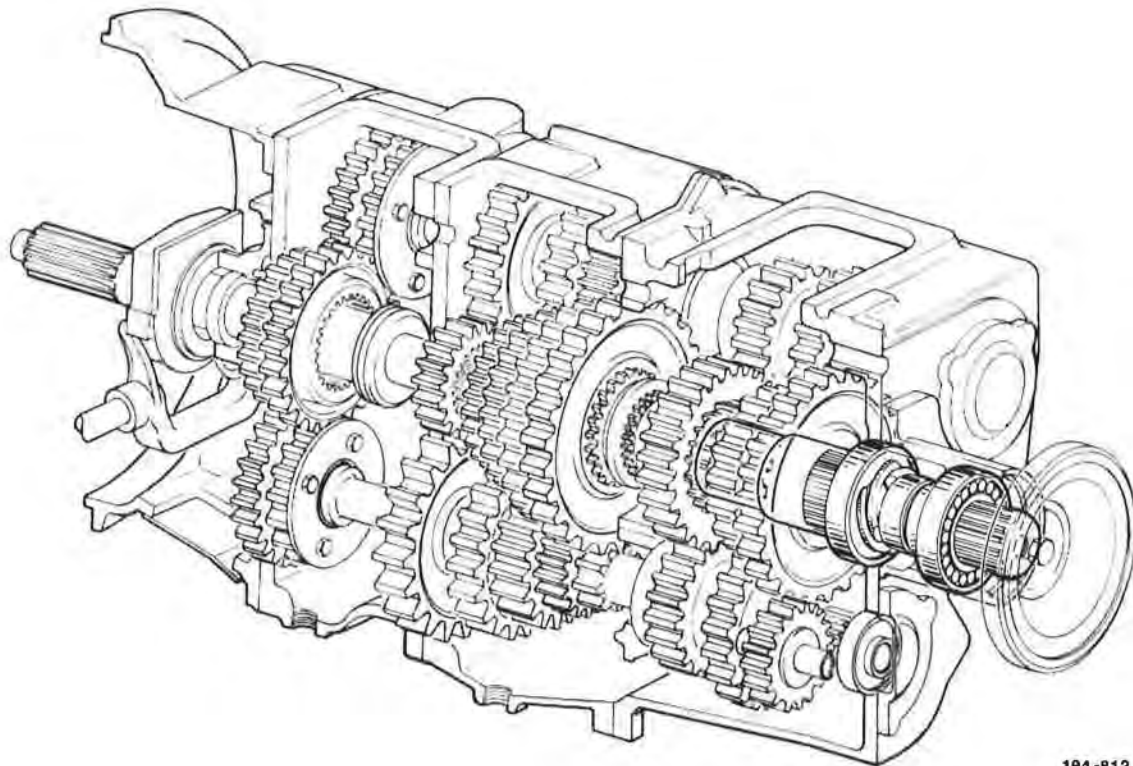


Figure 133. Pressing Gears Off

NOTES

Rear Compound Mainshaft Disassembly



- | | |
|-----------------------|-----------------|
| 1. Spirolox Snap Ring | 6. Speedometer |
| 2. Front Bearing | Gear |
| 3. Pin | 7. Spacer |
| 4. Mainshaft | 8. Bearing Race |
| 5. Rear Bearing | |

Figure 134. Exploded View of Rear Compound Mainshaft

1. Remove rear compound mainshaft front bearing retaining spirollox snap ring. See Figure 135.



Figure 135. Removing Snap Ring

2. Remove rear compound mainshaft front bearing, using puller S501, or equivalent. See Figure 136.



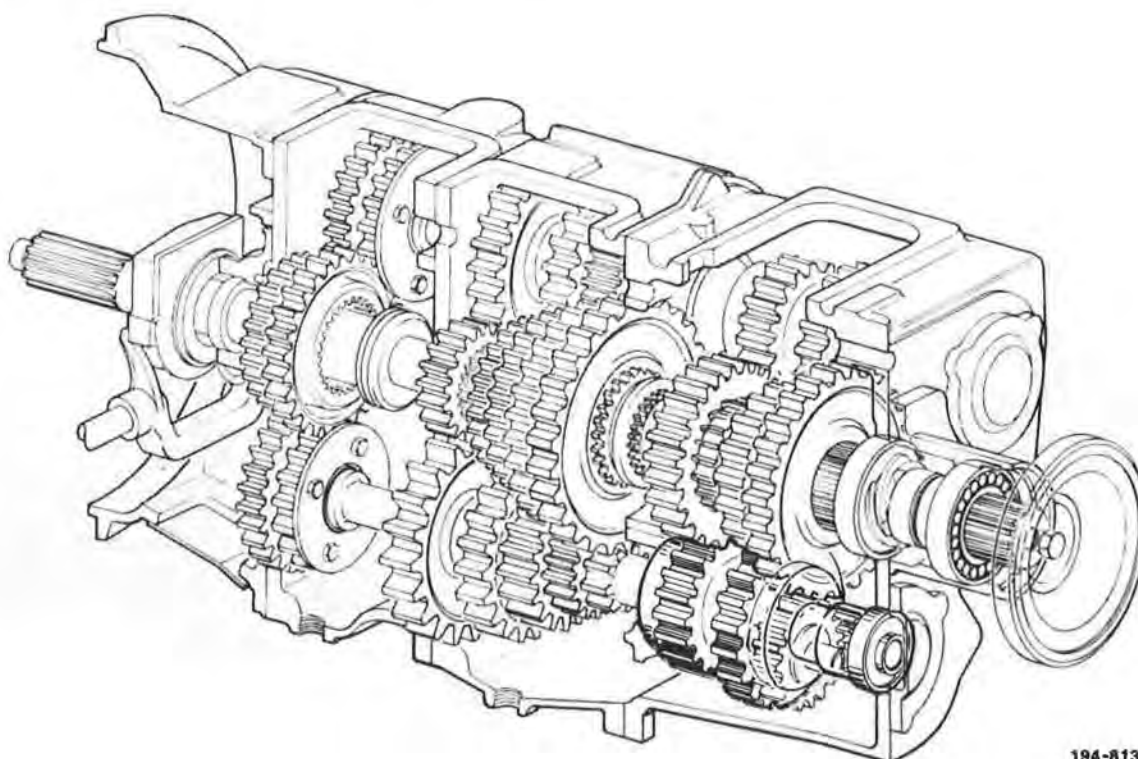
Figure 136. Removing Bearing

3. Place mainshaft in a press, and press off the rear bearing, speedometer gear, spacer, and bearing race. See Figure 137.



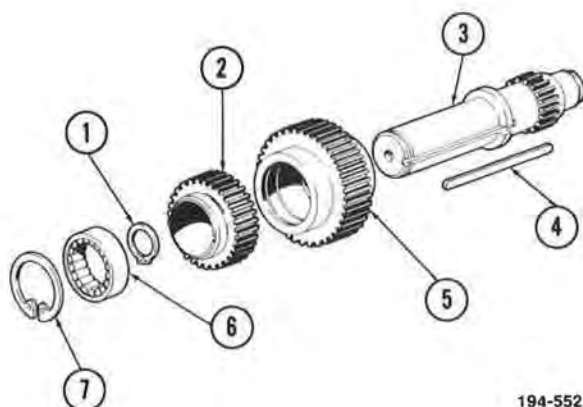
Figure 137. Pressing Off Bearing, Gear, Spacer, and Inner Race

Rear Compound Countershaft Disassembly



194-813

1. Remove rear compound countershaft front bearing retaining snap ring, using snap ring pliers J-4646, or equivalent. See Figure 139.



194-552

1. Gear Retaining Snap Ring
2. Direct Gear
3. Rear Countershaft
4. Key
5. Lo/Hi Range Gear
6. Bearing
7. Bearing Retaining Snap Ring



194-571

Figure 138. Exploded View of Rear Compound Countershaft

Figure 139. Removing Snap Ring

2. Remove countershaft front bearing, using puller CG270, or equivalent. See Figure 140.



Figure 140. Removing Bearing

3. Remove countershaft gear retaining snap ring, using snap ring pliers J-6435, or equivalent. See Figure 141.



Figure 141. Removing Snap Ring

4. Press the gears off of the countershaft. See Figure 142.

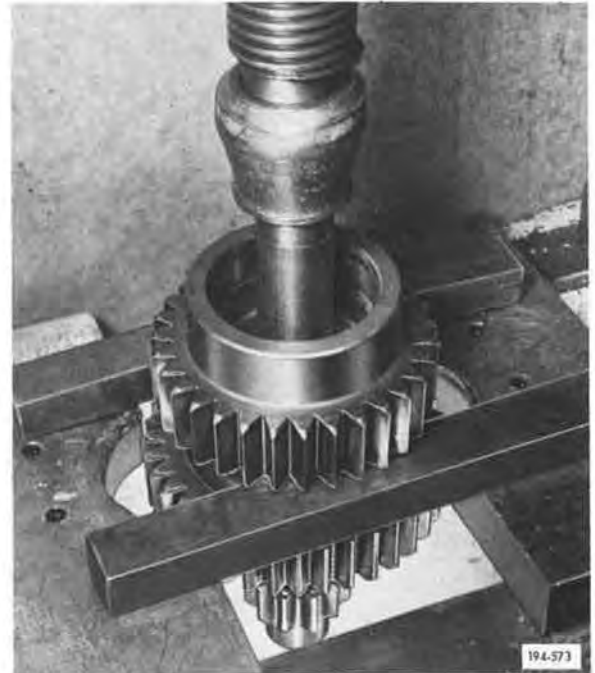
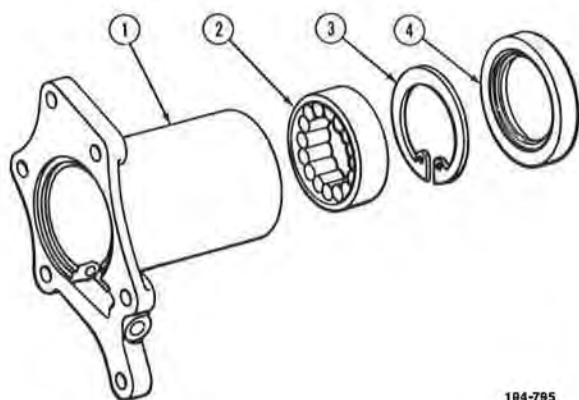
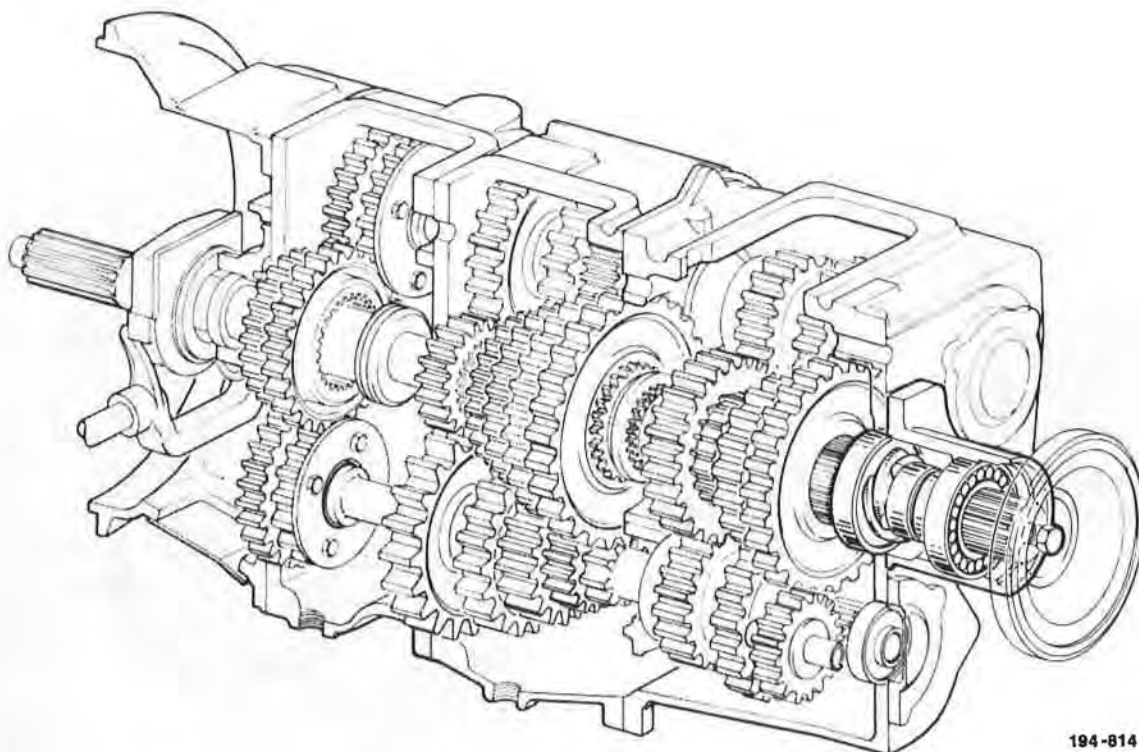


Figure 142. Pressing Off Gears

Rear Compound Mainshaft Rear Bearing Cover Disassembly



- 1. Rear Bearing Cover
- 2. Bearing
- 3. Snap Ring
- 4. Oil Seal

Figure 143. Exploded View of Rear Compound Mainshaft Rear Bearing Cover

1. Remove rear bearing cover oil seal, using a hammer and punch to drive it out from the inside. See Figure 144.



Figure 144. Removing Oil Seal

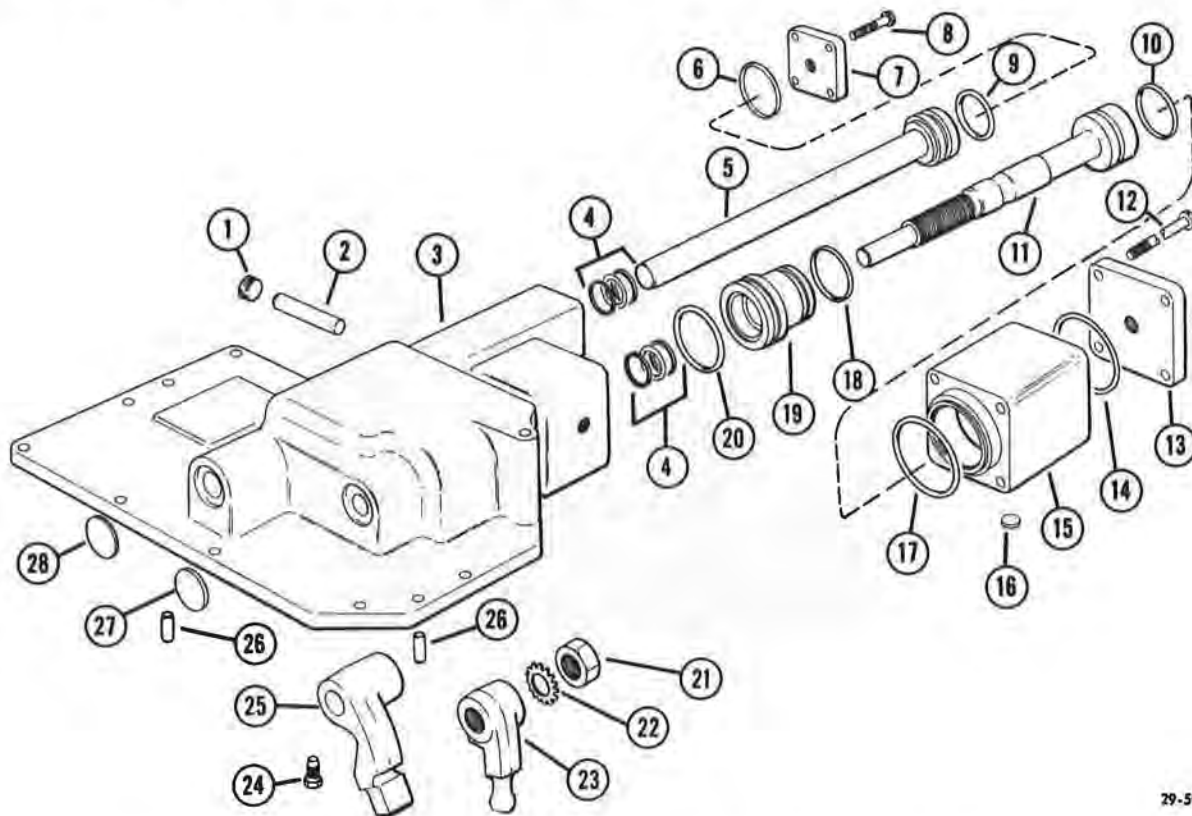
2. Remove bearing retaining snap ring (using snap ring pliers J-4646, or equivalent) and bearing. See Figure 145.



Figure 145. Removing Snap Ring and Bearing

Air Shift Cover Disassembly (Non-Current Production)

(TRTXL107 prior to serial number 9G9071)



29-59A

- | | |
|-----------------------------|--------------------------------|
| 1. Plug | 15. Lo/Direct Shift Cylinder |
| 2. Interlock Plunger | 16. Breather |
| 3. Shift Cover | 17. O-Ring |
| 4. O-Ring with Teflon Rings | 18. O-Ring |
| 5. Reverse Shift Rail | 19. Lo/Direct Shift Piston |
| 6. O-Ring | 20. O-Ring |
| 7. Reverse Shift Cover | 21. Locknut |
| 8. Capscrew | 22. Lockwasher |
| 9. O-Ring | 23. Lo/Direct Shifter |
| 10. O-Ring | 24. Setscrew |
| 11. Lo/Direct Shift Rail | 25. Reverse Shifter |
| 12. Capscrew | 26. Dowel Pin |
| 13. Lo/Direct Shift Cover | 27. Expansion Plug (Lo/Direct) |
| 14. O-Ring | 28. Expansion Plug (Reverse) |

Figure 146. Exploded View of Air Shift Cover
(Non-Current Production)

NOTE

Numbers in parentheses refer to item numbers in Figure 146.

1. Remove reverse shifter setscrew (24) and interlock plunger plug (1).

2. Remove reverse shift cover cap-screws (8), reverse shift cover (7) and O-ring (6).

3. Slide reverse shift rail (5) rearward out of shift cover (3), and at the same time, remove the reverse shifter (25) through bottom opening of shift cover.

4. Remove O-ring (9) from end of reverse shift rail (5).

lockwasher (22), and locknut (21) from bottom opening of shift cover.

5. Remove interlock plunger (2).

11. Remove Lo/Direct shift piston (19) from Lo/Direct shift rail (11).

6. Remove Lo/Direct shift cover cap-screws (12), shift cover (13), and O-ring (14).

12. Remove O-ring (10) from Lo/Direct shift rail (11).

7. Remove Lo/Direct shift cylinder (15) and O-ring (17).

13. Remove O-rings (18 and 20) from Lo/Direct shift piston (19).

8. Loosen Lo/Direct shifter locknut (21).

14. Remove O-ring and Teflon rings (4) from both the reverse opening and the Lo/Direct opening of the shift cover.

9. Turn Lo/Direct shift rail (11) to unscrew locknut (21) and Lo/Direct shifter (23).

15. Clean the air breather (16) in the Lo/Direct shift cylinder (15).

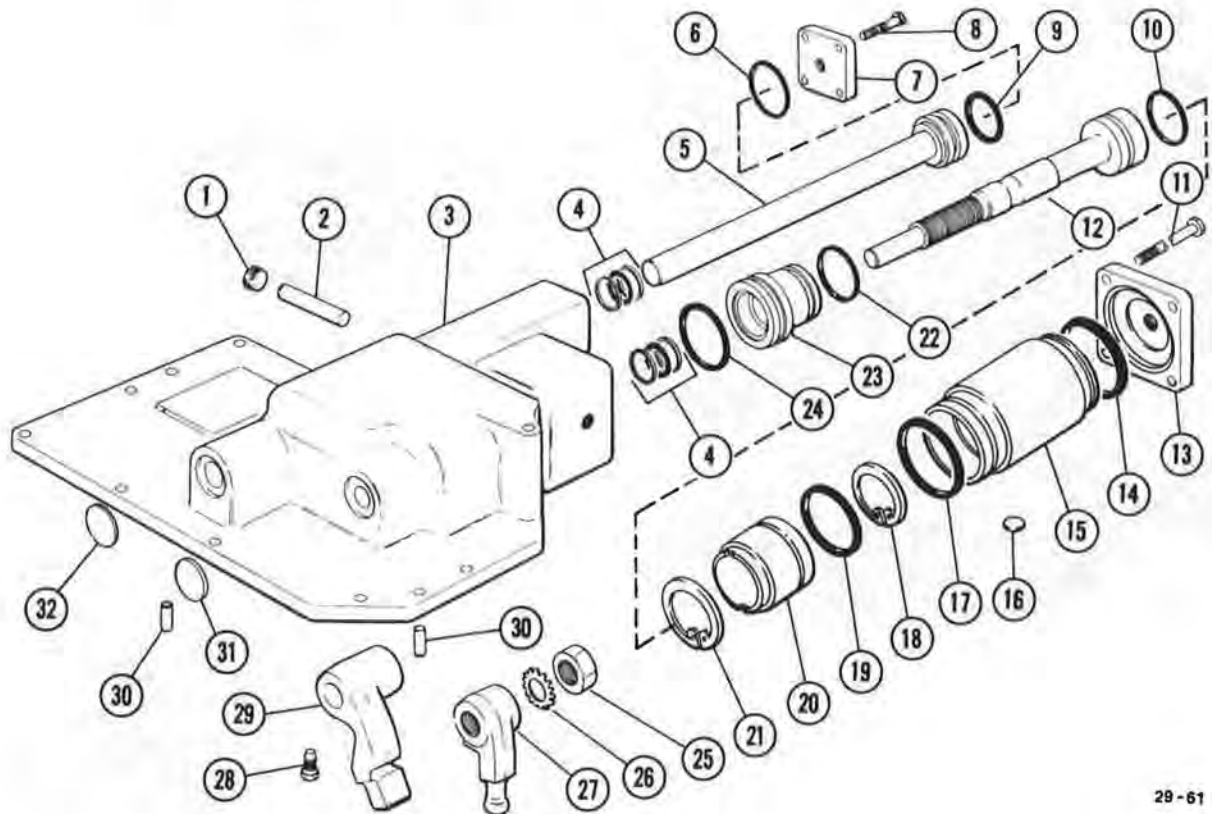
10. Remove Lo/Direct shift rail (11) from shift cover (3), and at the same time remove Lo/Direct shifter (23),

16. Punch a hole in the Lo/Direct expansion plug (27), and remove it.

NOTES

Air Shift Cover Disassembly (Non-Current Production)

(TRTXL107 serial number 9G9071, and later)
(TRTXL1070 prior to serial number 7F0879)



- | | |
|-----------------------------|------------------------|
| 1. Plug | 17. O-Ring |
| 2. Interlock Plunger | 18. Snap Ring |
| 3. Shift Cover | 19. O-Ring |
| 4. O-Ring with Teflon Rings | 20. Lo/Hi Range Piston |
| 5. Reverse Shift Rail | 21. Snap Ring |
| 6. O-Ring | 22. O-Ring |
| 7. Reverse Shift Cover | 23. Direct Piston |
| 8. Capscrew | 24. O-Ring |
| 9. O-Ring | 25. Locknut |
| 10. O-Ring | 26. Lockwasher |
| 11. Capscrew | 27. Lo/Hi Shifter |
| 12. Lo/Hi Shift Rail | 28. Setscrew |
| 13. Lo/Hi Shift Cover | 29. Reverse Shifter |
| 14. O-Ring | 30. Dowel Pin |
| 15. Shift Cylinder | 31. Expansion Plug |
| 16. Breather | 32. Expansion Plug |

Figure 147. Exploded View of Air Shift Cover Assembly
(Non-Current Production)

1. Place both shift rails in neutral position.

2. Remove reverse shifter setscrew. See Figure 148.



Figure 148. Removing Setscrew

3. Remove reverse shift cover cap-screws. See Figure 149.

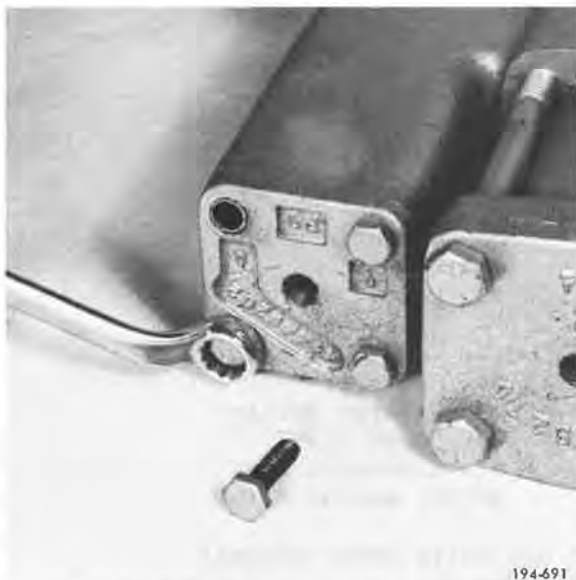


Figure 149. Removing Capscrews

4. Remove reverse shift cover and O-ring. See Figure 150.



Figure 150. Removing Cover and O-Ring

5. Slide reverse shift rail rearward out of cover, and, as it moves, remove reverse shifter through bottom opening. See Figure 151.



Figure 151. Removing Shift Rail and Shifter

6. Remove O-ring from reverse shift rail. See Figure 152.



Figure 152. Removing O-Ring

7. Remove interlock plunger plug from air shift cover. See Figure 153.

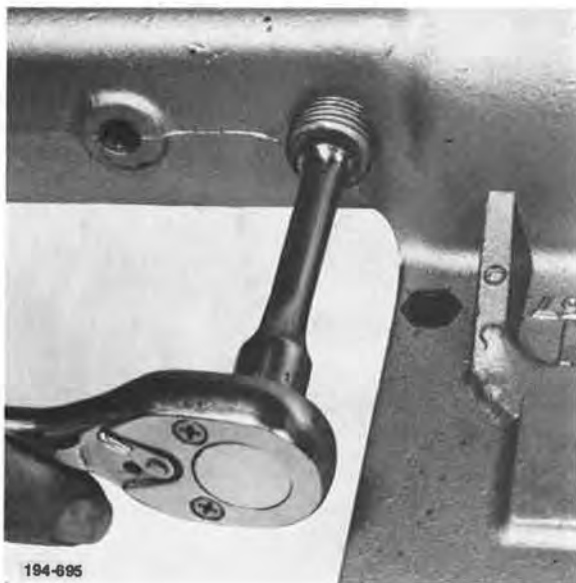


Figure 153. Removing Plug

9. Remove Lo/Hi shift cover cap-screws. See Figure 155.



Figure 155. Removing Capscrews

8. Remove interlock plunger from air shift cover. See Figure 154.



Figure 154. Removing Plunger

10. Remove Lo/Hi shift cover. See Figure 156.



Figure 156. Removing Cover

11. Remove Lo/Hi shift cover O-ring. See Figure 157.



Figure 157. Removing O-Ring

13. Remove Lo/Hi range piston from Lo/Hi shift cylinder. See Figure 159.



Figure 159. Removing Piston

12. Remove Lo/Hi shift cylinder from air shift cover. See Figure 158.



Figure 158. Removing Shift Cylinder

14. Remove snap ring from inside Lo/Hi shift cylinder, using snap ring pliers J-24339 or equivalent. See Figure 160.



Figure 160. Removing Snap Ring

15. Remove O-ring from end of Lo/Hi shift cylinder. See Figure 161.



Figure 161. Removing O-Ring

17. Remove O-ring from Lo/Hi range piston. See Figure 163.



Figure 163. Removing O-Ring

16. Remove snap ring from inside Lo/Hi range piston, using snap ring pliers J-24339 or equivalent. See Figure 162.



Figure 162. Removing Snap Ring

18. Loosen Lo/Hi shifter locknut. See Figure 164.

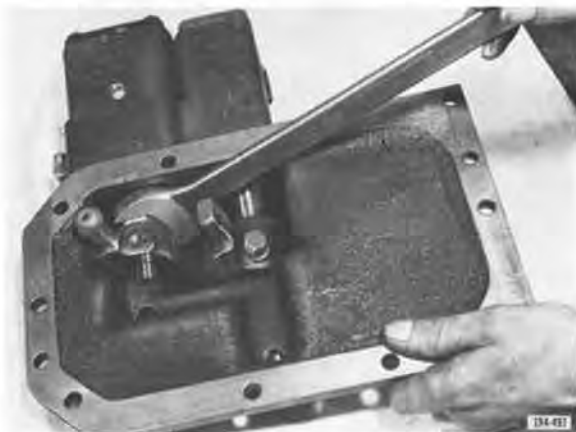


Figure 164. Loosening Locknut

19. Turn Lo/Hi shift rail to unscrew locknut and Lo/Hi shifter, slide shift rail rearward out of cover, and at the same time, remove locknut, lockwasher, and shifter.

20. Remove Direct piston from Lo/Hi shift rail.

21. Remove O-ring from Lo/Hi shift rail. See Figure 165.



Figure 165. Removing O-Ring

22. Remove O-rings from Direct piston. See Figure 166.



Figure 166. Removing O-Rings

23. Remove O-ring and two Teflon rings from both the reverse opening and the Lo/Hi opening of the shift cover. See Figure 167.



Figure 167. Removing O-Ring and Teflon Rings

24. Clean air breather in Lo/Hi shift cylinder. See Figure 168.

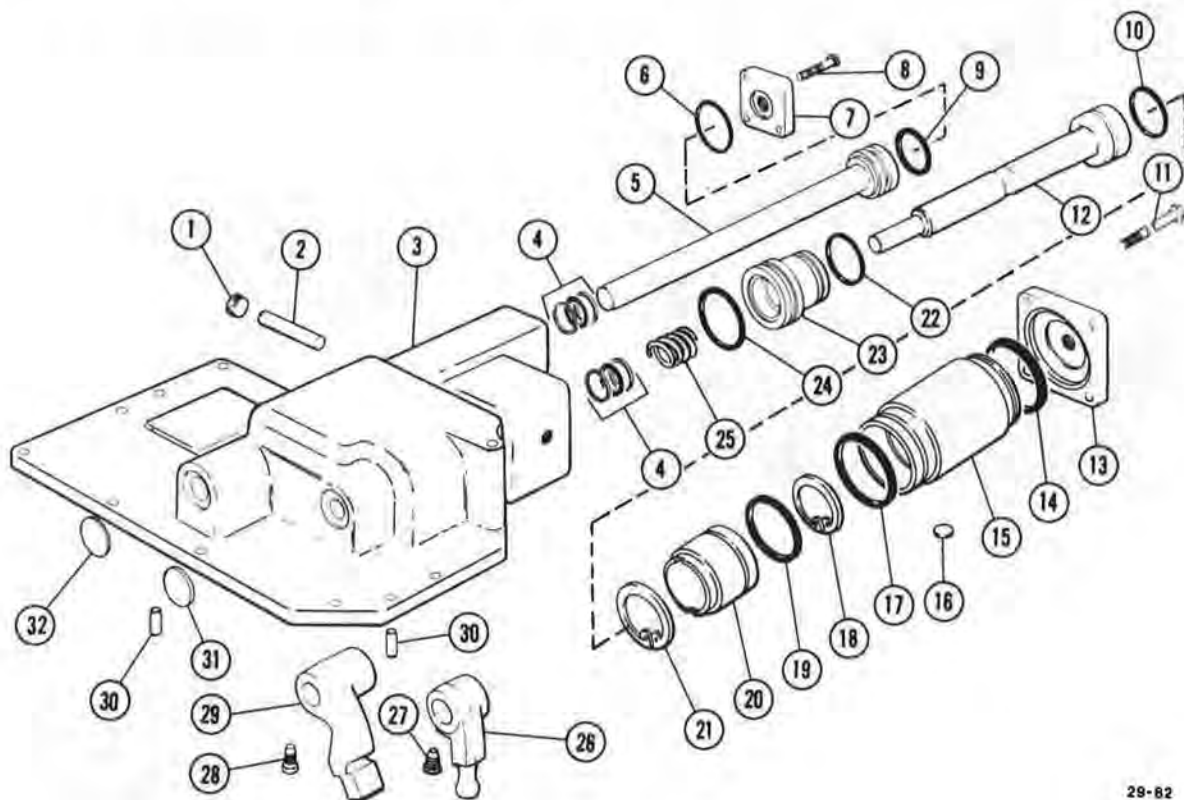


Figure 168. Air Breather

25. Punch a hole in the Lo/Hi shift rail expansion plug, and remove it.

Air Shift Cover Disassembly (Current Production)

(TRTXL1070 serial number 7F0879, and later)



29-82

- | | |
|-----------------------------|-----------------------------|
| 1. Plug | 17. O-Ring |
| 2. Interlock Plunger | 18. Snap Ring |
| 3. Shift Cover | 19. O-Ring |
| 4. O-Ring with Teflon Rings | 20. Hi-Range Piston |
| 5. Reverse Shift Rail | 21. Snap Ring |
| 6. O-Ring | 22. O-Ring |
| 7. Reverse Shift Cover | 23. Direct Piston |
| 8. Capscrew | 24. O-Ring |
| 9. O-Ring | 25. Spring (See Note Below) |
| 10. O-Ring | 26. Hi-Direct Shifter |
| 11. Capscrew | 27. Setscrew |
| 12. Hi/Direct Shift Rail | 28. Setscrew |
| 13. Hi/Direct Shift Cover | 29. Reverse Shifter |
| 14. O-Ring | 30. Dowel Pin |
| 15. Shift Cylinder | 31. Expansion Plug |
| 16. Breather | 32. Expansion Plug |

Figure 169. Exploded View of Air Shift Cover Assembly
(Current Production)

NOTE

A spring (Item 25 in Figure 169) was added to the Air Shift Cover Assembly starting with serial number 8S6798, and later.

1. Place both shift rails in neutral position.

2. Remove reverse shifter setscrew. See Figure 170.



Figure 170. Removing Setscrew

3. Remove reverse shift cover cap-screws. See Figure 171.

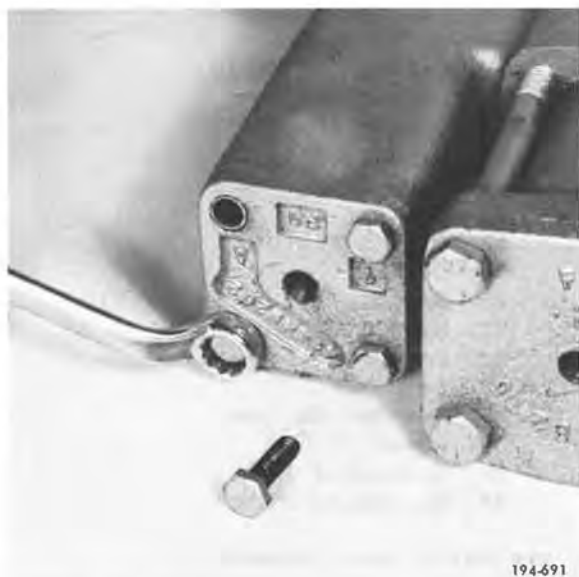


Figure 171. Removing Capscrews

4. Remove reverse shift cover and O-ring. See Figure 172.



Figure 172. Removing Cover and O-Ring

5. Slide reverse shift rail rearward out of cover, and, as it moves, remove reverse shifter through bottom opening. See Figure 173.

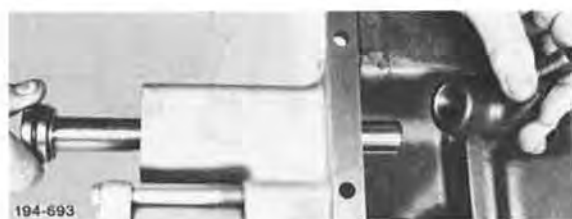


Figure 173. Removing Shift Rail and Shifter

6. Remove O-ring from reverse shift rail. See Figure 174.



Figure 174. Removing O-Ring

7. Remove interlock plunger plug from air shift cover. See Figure 175.



Figure 175. Removing Plug

9. Remove Hi/Direct shift cover cap-screws. See Figure 177.



Figure 177. Removing Capscrews

8. Remove interlock plunger from air shift cover. See Figure 176.



Figure 176. Removing Plunger

10. Remove Hi/Direct shift cover. See Figure 178.



Figure 178. Removing Cover

11. Remove Hi/Direct shift cover O-ring. See Figure 179.



Figure 179. Removing O-Ring

13. Remove Hi-range piston from Hi/Direct shift cylinder. See Figure 181.



Figure 181. Removing Piston

12. Remove Hi/Direct shift cylinder from air shift cover. See Figure 180.

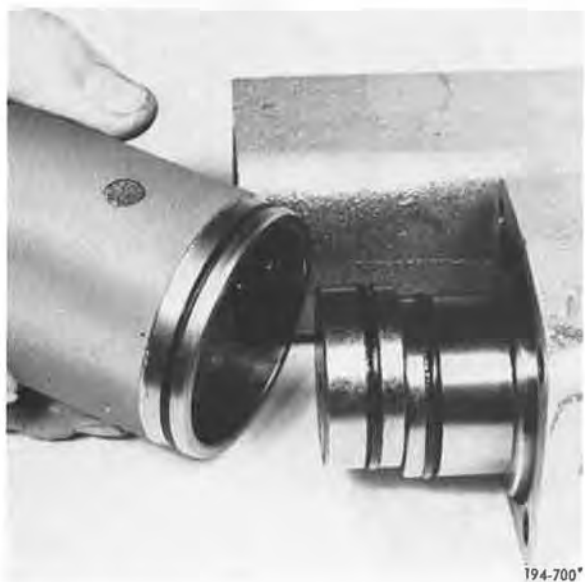


Figure 180. Removing Shift Cylinder

14. Remove snap ring from inside Hi/Direct shift cylinder, using snap ring pliers J-24339 or equivalent. See Figure 182.



Figure 182. Removing Snap Ring

15. Remove O-ring from end of Hi/-Direct shift cylinder. See Figure 183.



Figure 183. Removing O-Ring

17. Remove O-ring from Hi-range piston. See Figure 185.



Figure 185. Removing O-Ring

16. Remove snap ring from inside Hi-range piston, using snap ring pliers J-24339 or equivalent. See Figure 184.



Figure 184. Removing Snap Ring

18. Remove Hi/Direct shifter set-screw. See Figure 186.



Figure 186. Removing Setscrew

19. Slide Hi/Direct shift rail rearward out of cover, and, as it moves, remove Hi/Direct shifter through bottom opening. See Figure 187.

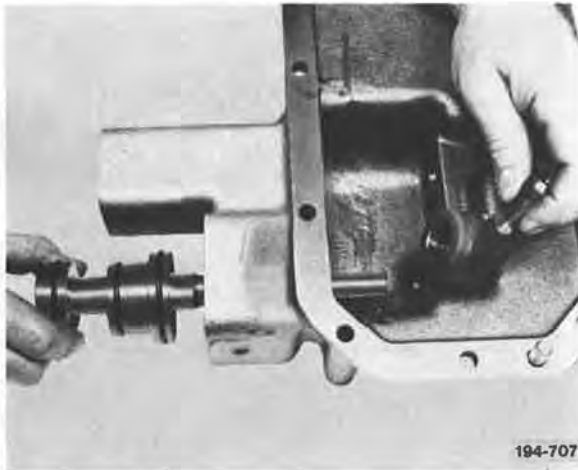


Figure 187. Removing Shift Rail and Shifter

20. (Serial Number 8S6798 and up) Remove spring from Hi/Direct shift rail.

21. Remove Direct piston from Hi/Direct shift rail. See Figure 188.



Figure 188. Removing Piston

22. Remove O-ring from Hi/Direct shift rail. See Figure 189.



Figure 189. Removing O-Ring

23. Remove O-rings from Direct piston. See Figure 190.



Figure 190. Removing O-Rings

24. Remove O-ring and two Teflon rings from both the reverse opening and the Hi/Direct opening of the shift cover. See Figure 191.



Figure 191. Removing O-Ring and Teflon Rings

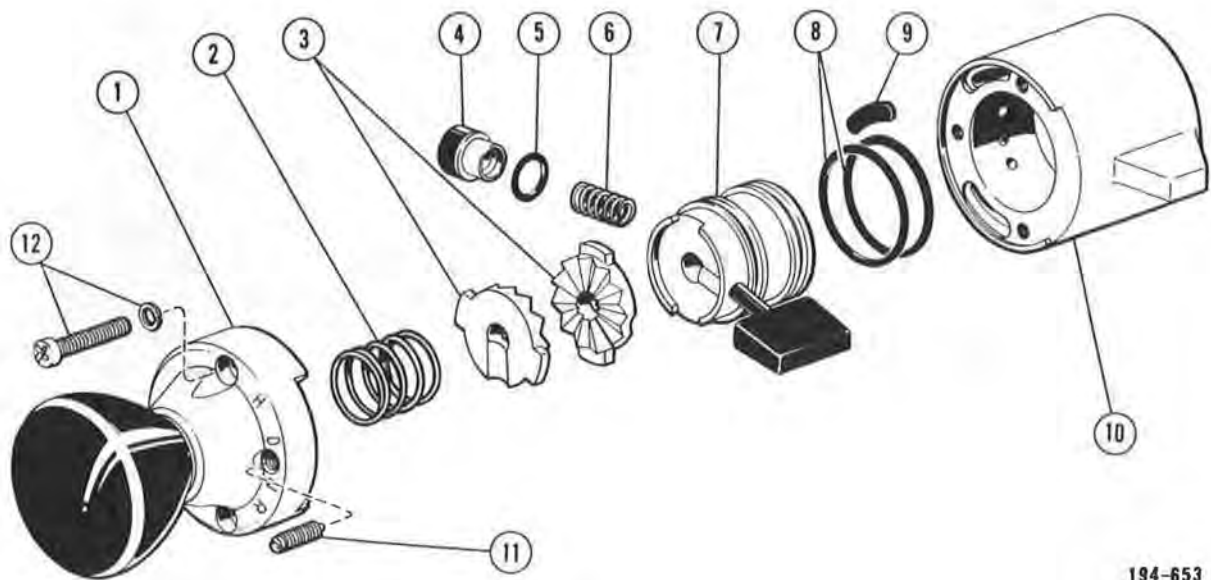
25. Clean air breather in Hi/Direct shift cylinder. See Figure 192.



Figure 192. Air Breather

NOTES

Selectair Valve Disassembly



194-653

1. Cover
2. Detent Spring
3. Detent Wafers
4. Exhaust Valve
5. Exhaust Valve O-Ring
6. Exhaust Valve Spring
7. Rotor
8. O-Rings
9. Gasket
10. Valve Body
11. Detent Plunger
12. Screw

Figure 193. Exploded View of Selectair Valve

1. Disconnect air lines from valve. For ease of reassembly, tag each line with the number that is stamped on the bottom of the valve.

2. Remove valve from shift lever.

CAUTION

The cover provides compression for the detent spring. Screws should be loosened evenly to prevent jamming or cocking.

3. Loosen and remove the three Phillips head screws that hold the cover. See Figure 194.



Figure 194. Removing Screws

4. Remove cover from valve body. See Figure 195.



Figure 195. Removing Cover

5. Remove detent wafer from cover. See Figure 196.

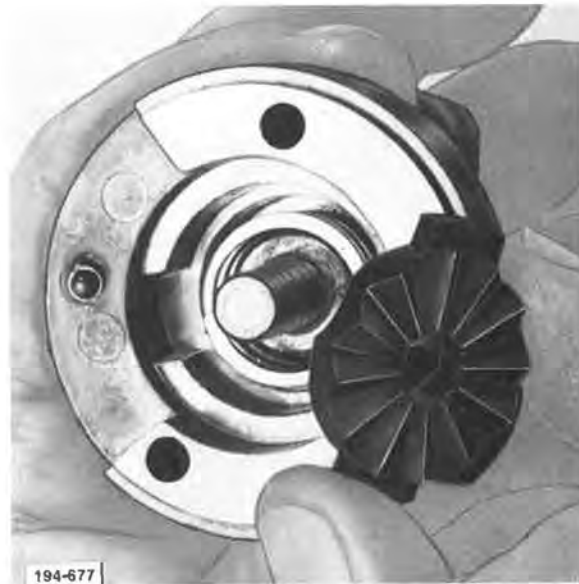


Figure 196. Removing Detent Wafer

6. Remove spring from cover. See Figure 197.



Figure 197. Removing Spring

7. Remove detent wafer from top of rotor. See Figure 198.

8. Remove rotor from valve body. See Figure 199.

NOTE

Exhaust valve is spring loaded, and could pop out and become lost.



Figure 198. Removing Detent Wafer



Figure 199. Removing Rotor

9. Remove exhaust valve from rotor. See Figure 200.

10. Remove exhaust valve spring. See Figure 201.

11. Remove exhaust valve O-ring. See Figure 202.



Figure 200. Removing Valve



Figure 201. Removing Spring



Figure 202. Removing O-Ring

12. Remove both O-rings from rotor. See Figure 203.



Figure 203. Removing O-Rings

14. Remove detent plunger from cover. See Figures 205 and 206.



Figure 205. Loosening Plunger

13. Remove both rubber gaskets from valve body. See Figure 204.



Figure 204. Removing Gaskets



Figure 206. Removing Plunger

INSPECTION AND CLEANING

Clean case, covers, and all other parts of the transmission thoroughly, using a suitable cleaning solvent, to remove all grease, oil, and foreign matter. Dry parts with moisture-free compressed air.

Bearings

Soak bearings in a suitable cleaning solvent to loosen all hardened grease and foreign matter. Strike bearings flat against block of wood several times and again immerse in cleaning solvent, turning races slowly. Repeat these operations until bearings are clean, and then blow them dry with filtered, moisture-free compressed air.

CAUTION

Do not spin bearings with compressed air, as damage to the bearings may result.

Inspect bearings for flaking, cracks, fractures, cavities, indentations, measureable wear, brinelling, fretting, corrosion, nicking, and cage failures. If any of these are apparent in any amount, they should be replaced.

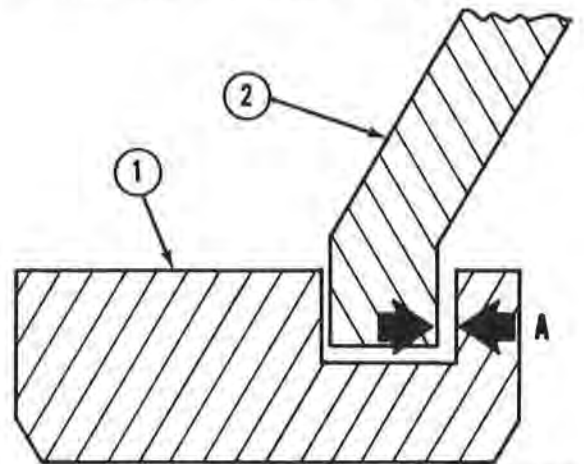
Gears

Replace gears if teeth show any sign of abrasive wear, scratching (except for normal manufacturing tool marks), ridging, scoring, surface fatigue, pitting, spalling, corrosive wear, digging in, and cracking. Gears should also be inspected by Magnaflux or similar system for cracks which would not otherwise be visible.

Shifter Forks, Sliding Clutches, and Shift Rails

Replace forks and/or clutches if side clearance in groove is in excess of specified limits, as shown in the Torque and Tolerance Table, Item 18. See Figure 207.

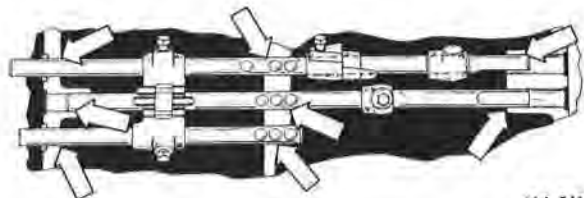
Replace shift rails if cracked in either the poppet or stake screw holes. In the case of wear, if the clearance between the shift rail and the mating housing bore exceeds 0.010 inch maximum, check to determine which member is worn before replacing. Shaft wear may be checked by comparing shaft diameter at an "unwearing" point as against the wear point. Refer to Torque and Tolerance Table, Item 21. See Figure 208.



194-540

1. Clutch A. Wear Tolerance
2. Fork Reference

Figure 207. Fork and Clutch Detail



194-541

Figure 208. Shift Rail Wear Points

Vane Oil Pump

Replace oil pump parts if they are scored or chipped, or if vane is loose in its mating bore in excess of 0.006 inch. Refer to Torque and Tolerance Table, Item 22.

Oil Seals

When an overhaul is required, replace all oil seals. Care must be taken to be sure that the sealing surface of the seal is not damaged, turned back,

or cut. A nick on the shaft surface will cut the seal. Remove sharp edges that could damage the seal (chamfer edges if possible). Press seals into housing with smooth, uniform pressure to prevent cocking the seal. Be careful when installing a shaft through a new seal. The shaft should be lubricated before inserting through a seal. Splines, keyways, or holes in shafts can damage seals unless care is taken. The sealing surface of seals should be manually lubricated to provide lubrication during "start-up" period before normal lubrication occurs.

Measuring Oil Pump Pressure

(TRTXL1070 prior to serial number 903151, and all TRTXL107)

Pressure of the oil pump is low, and therefore difficult to measure. A functional check of the pump should be made prior to installing the transmission cover. This can be accomplished by pouring oil into the pump pickup trough while revolving the main drive pinion clockwise. If the pump is functioning, oil will appear at various outlets along the mainshaft. This practice will also assure initial prime to the pump and oil passages.

Selectair Valve

Clean all metal parts in a suitable solvent. Wash rubber and plastic parts with soap and water. Rinse all parts thoroughly, and blow dry with low pressure compressed air. Inspect for any signs of wear. In the case of rubber parts, if any one is worn, it is recommended that all be replaced. Inspect for any nicks, scratches, or rough edges or surfaces, that could damage O-rings. Also check for any cracks in any of the metal or plastic parts.

General Inspection

Replace cases found to be cracked. Check all other parts for wear and damage. Replace all parts as required. Replace all gaskets, O-rings, staked nuts, or any part that shows mutilation. Test and replace poppet springs that have lost their tension. Refer to Torque and Tolerance Table, Item 19. Clean up any threads that show mutilation. Repair stripped threads by using Heli-Coil or equivalent repair parts.

GENERAL INSTRUCTIONS FOR REASSEMBLY

Refer to Torque and Tolerance Table for fits and limits.

All working metal parts, especially the bearings, should be coated with SAE30 oil while the transmission is being reassembled. This will insure immediate lubrication when first starting, and will prevent seizing of these parts.

When installing bearings, use proper bearing drivers. Do not apply force to any unloaded race, because bearing damage can result (even though not visible or evident at the time) which will cause premature bearing failure. Apply pressure evenly to prevent cocking the bearing.

As moving parts are assembled, check frequently to see that they move freely.

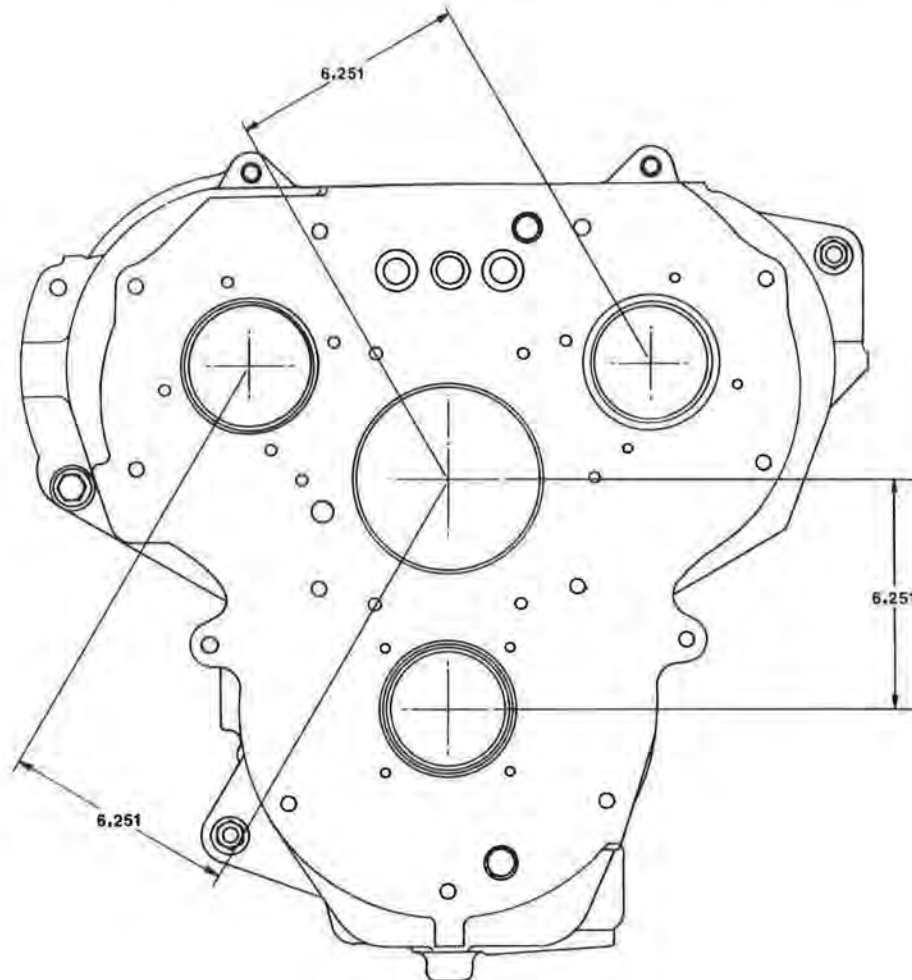
REPAIRING WORN BEARING BORES

Worn bearing bores are caused by the bearing outer races turning in their respective inserts, and the bearing retaining rings wearing the inserts.

When worn bores are encountered, proceed as follows.

NOTE

The basic dimension between the mainshaft bore center and each countershaft bore center is 6.251 inch. See Figure 209.



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Figure 209. Mainshaft Bore to Countershaft Bore Dimension

If all bores are worn so the bore center cannot be positively located, bolt the cases together and use the rear bores for reference.

1. Refer to the dimension table and Figure 210, and counterbore the worn

bore leaving 1/8 inch step as a seat for the sleeve. Machine a 0.000 to 0.030 in. fillet radius at the bottom of the main and countershaft counterbores and a 0.000 to 0.016 in. fillet radius at the bottom of the reverse idler shaft counterbore.

NOTE

Make sleeves from low carbon steel tubing S.A.E. J403 No. 1010 or equal. (e.g., 1018, 1020, 1112, 1118)

2. Put a 0.030 in. x 45° chamfer on the leading edge of the main and countershaft sleeves and a 0.016 to 0.047 in. x 45° chamfer on the leading edge of the reverse idler shaft sleeve.

3. Apply "Loctite" to sleeve outside diameter and press the sleeve into the rebored case until seated against the step.

4. Face the sleeve flush with the case.

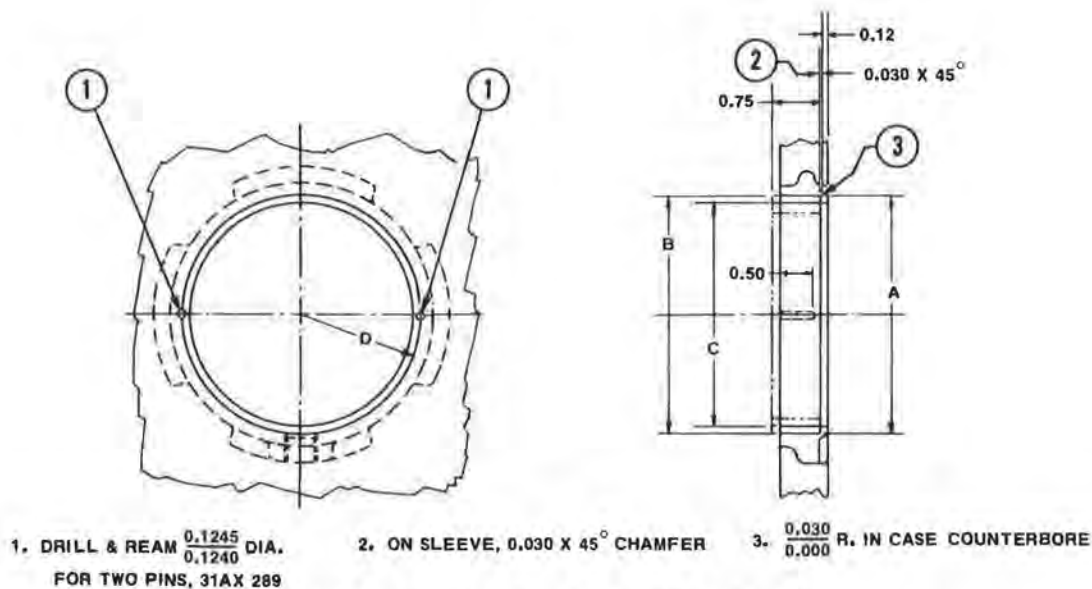
5. Obtain correct pin hole radius from dimension table. Drill and ream two 0.1240 to 0.1245 inch diameter holes 0.50 inch deep, between sleeve O.D. and case.

6. Install two pins, 31AX189 in the pin holes.

CAUTION

Sleeves must be bored concentric within 0.002 in. of each other.

7. Obtain the correct bearing bore from the dimension table and bore the sleeve.



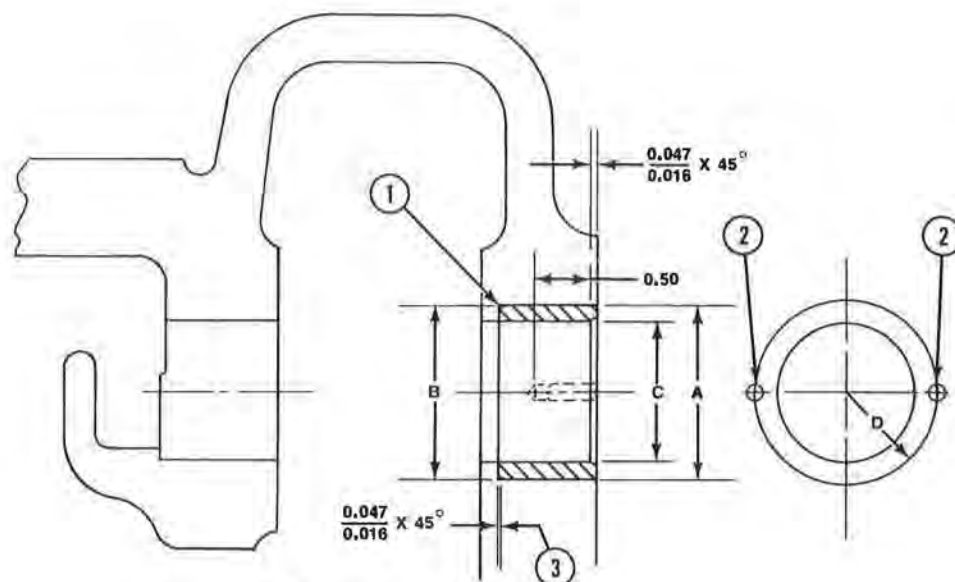
MAIN AND COUNTERSHAFT BEARING BORE REPAIR

DIMENSION TABLE

PART NO.	BORE LOCATION	A CASE BORE	B SLEEVE O.D.	C BEARING BORE	D PIN HOLE R.
281KB582A AUXILIARY CASE	COUNTERSHAFT	3.794/3.793	3.7950/3.7945	3.544/3.543	1.897
	MAINSHAFT	5.172/5.171	5.1730/5.1725	4.922/4.921	2.586
284KB5159B REAR CASE	COUNTERSHAFT	3.400/3.399	3.4010/3.4005	3.150/3.149	1.700
	MAINSHAFT	5.172/5.171	5.1730/5.1725	4.922/4.921	2.586
	REVERSE IDLER SHAFT	1.375/1.374	1.3760/1.3755	1.1255/1.1245	0.688
284KB5168 FRONT CASE	COUNTERSHAFT	3.794/3.793	3.7950/3.7945	3.544/3.543	1.897
	MAINSHAFT	5.172/5.171	5.1730/5.1725	4.922/4.921	2.586

194-798

Figure 210. Main and Countershaft Bearing Bore Repair and Dimension Table



1. $\frac{0.016}{0.000}$ R. IN CASE COUNTERBORE
2. DRILL & REAM $\frac{0.1245}{0.1240}$ DIA. FOR TWO PINS 31AX289
3. ON SLEEVE $\frac{0.047}{0.016}$ X 45° CHAMFER

194-799

Figure 211. Reverse Idler Shaft Bore Repair

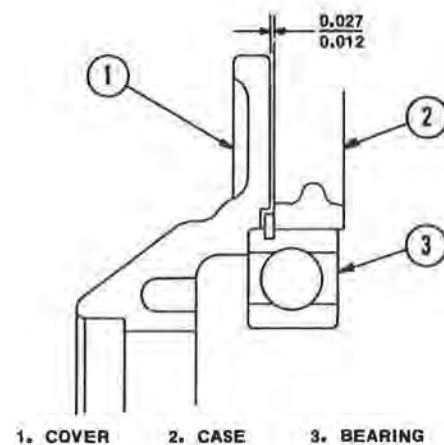
To prevent bearings turning and causing insert wear, position respective cover in place and inspect for correct cover to case clearance. See Figures 212 through 215. Replace cover if necessary.

If the clearance between the main driving pinion cover and case is 0.015 inch or more, use cover gasket 628KB310-P2 which is 0.031 inch thick.

If the clearance between the main driving pinion cover and case is less than 0.015 inch, use cover gasket 628KB310-P1 which is 0.016 inch thick.

If the clearance between the main-shaft rear cover and case is 0.015 inch or more, use cover gasket 628KB312A-P1 which is 0.031 inch thick.

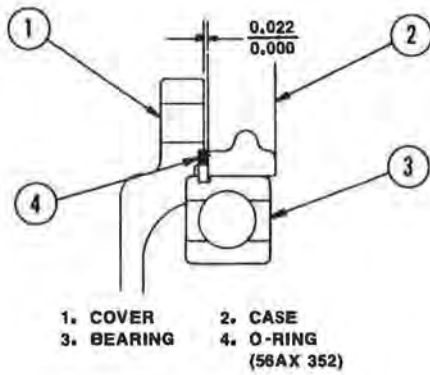
If the clearance between the main-shaft rear cover and case is less than 0.015 inch, use cover gasket 628KB312A-P2 which is 0.016 inch thick.



1. COVER
2. CASE
3. BEARING

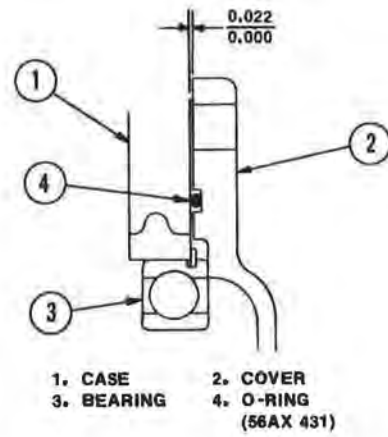
194-800

Figure 212. Main Drive Pinion Cover Clearance



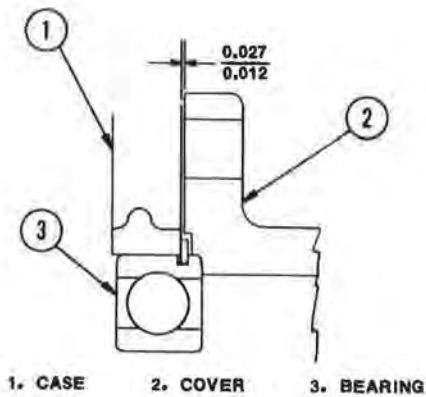
194-802

Figure 213. Countershaft Front Cover Clearance



194-803

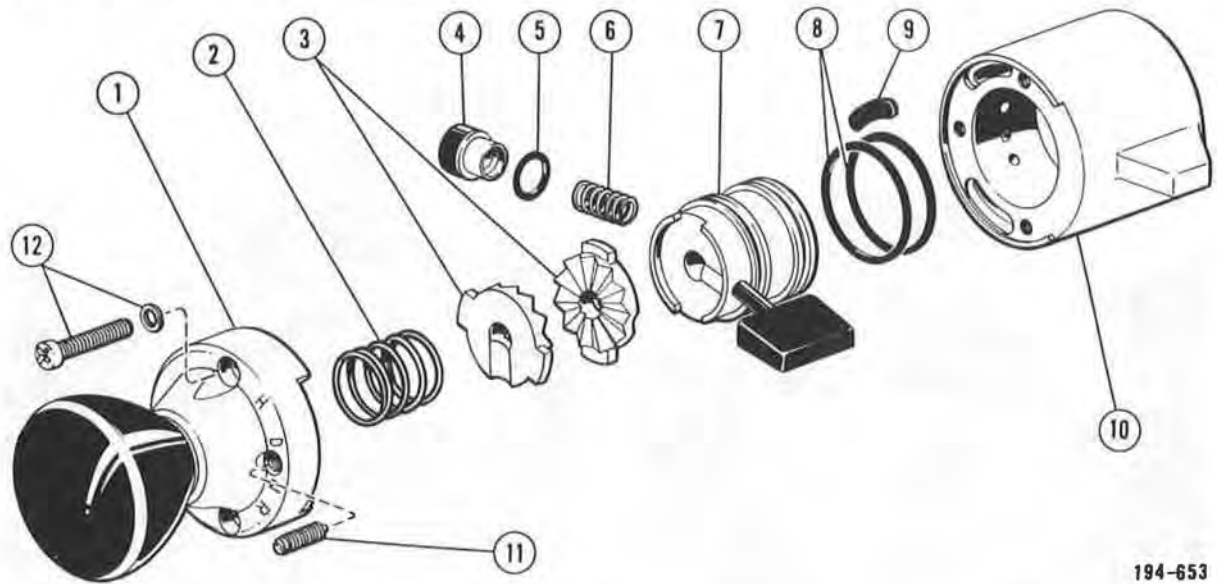
Figure 215. Countershaft Rear Cover Clearance



194-801

Figure 214. Mainshaft Rear Cover Clearance

REASSEMBLY
Selectair Valve Reassembly



194-653

- | | | |
|------------------|-------------------------|--------------------|
| 1. Cover | 5. Exhaust Valve O-Ring | 9. Gasket |
| 2. Detent Spring | 6. Exhaust Valve Spring | 10. Valve Body |
| 3. Detent Wafers | 7. Rotor | 11. Detent Plunger |
| 4. Exhaust Valve | 8. O-Rings | 12. Screw |

Figure 216. Exploded View of Selectair Valve

Lubrication: On plastic detents, use Sun Oil C-8-91-T, Sunaplex 781, Texaco Marfax "0" grease, or equivalent. On all rubber to metal surfaces, use Dow Corning #55 Pneumatic grease (MIL-G-4343B) or equivalent. On all metal to metal surfaces, use Fiske Lubriplate 107, or equivalent.

1. Insert detent plunger into cover and screw plunger in until its tip just protrudes through bottom of cover. See Figures 217 and 218.



194-687
 I k

Figure 217. Installing Plunger



194-686

Figure 218. Tightening Plunger

2. Install both rubber gaskets onto their slots in valve body. See Figure 219.



Figure 219. Installing Gaskets

4. Install exhaust valve O-ring. See Figure 221.



Figure 221. Installing O-Ring

3. Install both O-rings onto rotor. See Figure 220.



Figure 220. Installing O-Rings

5. Install exhaust valve spring. See Figure 222.



Figure 222. Installing Spring

6. Install exhaust valve. See Figure 223.



Figure 223. Installing Valve

7. Hold exhaust valve in place against its spring, and install rotor into valve body. See Figure 224.

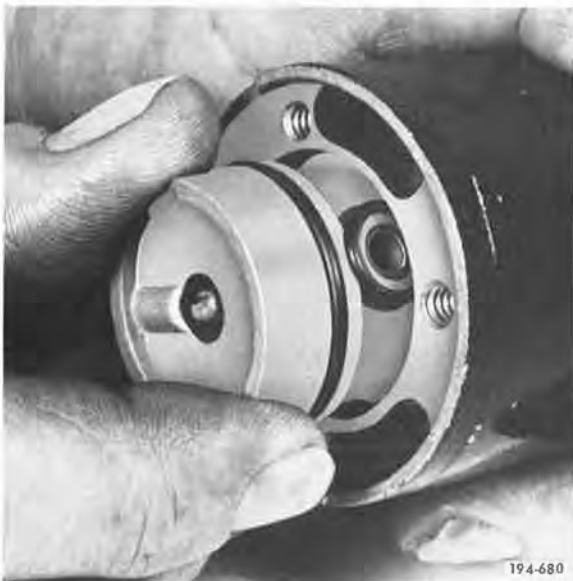


Figure 224. Installing Rotor

CAUTION

Depression in back of detent wafer must align with raised portion in top of rotor, and wafer tangs must align with slots in top of rotor, to prevent detent wafer from cracking.

8. Install one detent wafer onto top of rotor. See Figure 225.



Figure 225. Installing Lower Detent Wafer

9. Place the other detent wafer on top of the one just installed, aligning depression in the top detent wafer with the two tangs of the bottom wafer. See Figure 226.



Figure 226. Installing Top Detent Wafer

10. Align handle of rotor directly over reference extension of valve body.

11. Install spring into cover. See Figure 227.



Figure 227. Installing Spring

12. Bring two halves together, aligning rotor handle with slot provided for it in cover. See Figure 228.



Figure 228. Installing Cover

13. Press two halves together manually, compressing detent spring, and rotate each half slightly until tangs of top detent wafer seat themselves in slots provided in cover assembly.

14. Continue holding two halves together to maintain alignment, and install the cover screws. See Figure 229.



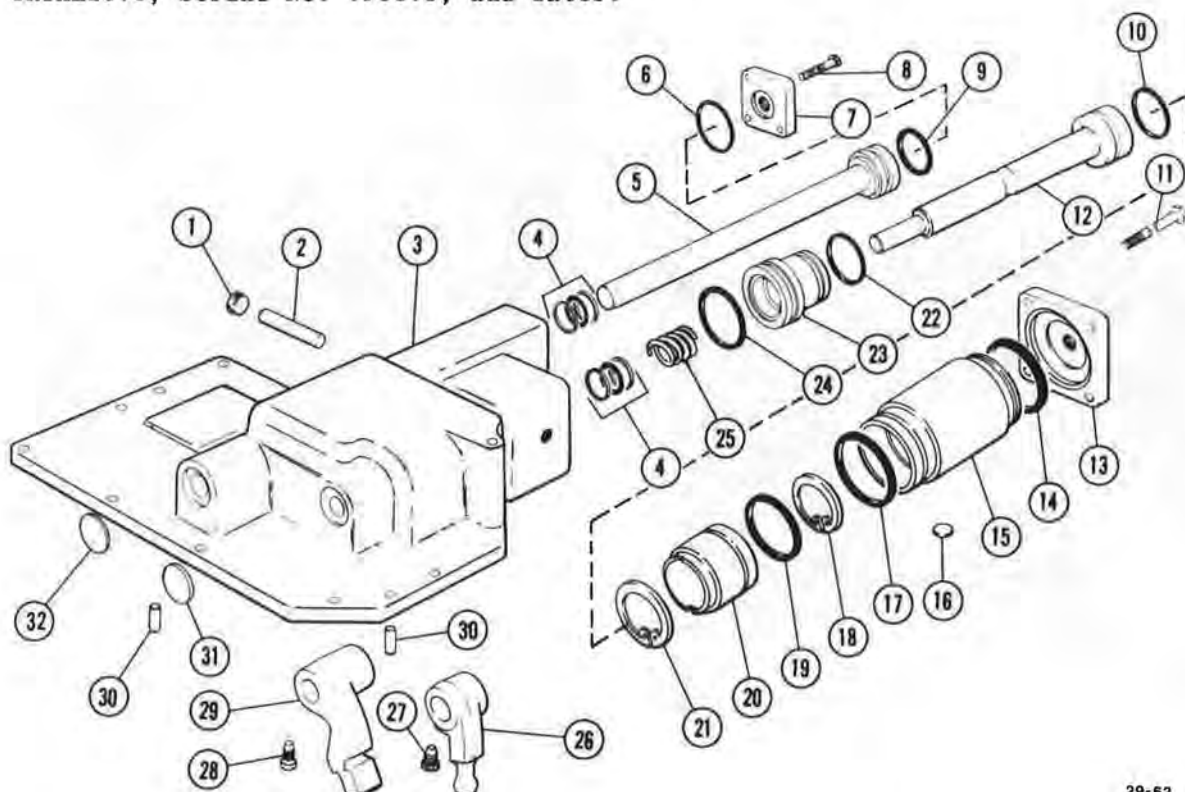
Figure 229. Installing Screws

15. Adjust detent plunger so that it provides added resistance to movement of the lever between Direct and Neutral positions.

16. Connect air lines to valve, and install valve on shift lever.

Air Shift Cover Reassembly (Current Production)

TRTXL1070, Serial No. 7F0879, and later.



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- | | | |
|--------------------------|---------------------------|-----------------------|
| 1. Plug | 12. Hi/Direct Shift Rail | 23. Direct Piston |
| 2. Interlock Plunger | 13. Hi/Direct Shift Cover | 24. O-Ring |
| 3. Shift Cover | 14. O-Ring | 25. Spring |
| 4. O-Ring W/Teflon Rings | 15. Shift Cylinder | (See Note Below) |
| 5. Reverse Shift Rail | 16. Breather | 26. Hi/Direct Shifter |
| 6. O-Ring | 17. O-Ring | 27. Setscrew |
| 7. Reverse Shift Cover | 18. Snap Ring | 28. Setscrew |
| 8. Capscrew | 19. O-Ring | 29. Reverse Shifter |
| 9. O-Ring | 20. Hi-Range Piston | 30. Dowel Pin |
| 10. O-Ring | 21. Snap Ring | 31. Expansion Plug |
| 11. Capscrew | 22. O-Ring | 32. Expansion Plug |

Figure 230. Exploded View of Air Shift Cover Assembly

(Current Production)

NOTE

A spring (Item 25 in Figure 230) was added to the Air Shift Cover Assembly starting with Serial Number 8S-6798, and later.

NOTE

Lubricate O-rings with a multi-purpose grease meeting Mack specification MG-C before installation.

1. Install O-ring and two Teflon rings in both the reverse opening and the Hi/Direct opening of shift cover. See Figure 231.



Figure 231. Installing O-Ring and Teflon Rings

2. Install O-rings onto Direct piston. See Figure 232.



Figure 232. Installing O-Rings

3. Install O-ring onto Hi/Direct shift rail. See Figure 233.



Figure 233. Installing O-Rings

4. Install Direct piston onto Hi/Direct shift rail. See Figure 234.



Figure 234. Installing Piston

5. (Serial Number 8S6798 and later) Install spring onto Hi/Direct shift rail.

6. Insert Hi/Direct shift rail into shift cover, and at the same time, install Hi/Direct shifter onto shift rail. See Figure 235.

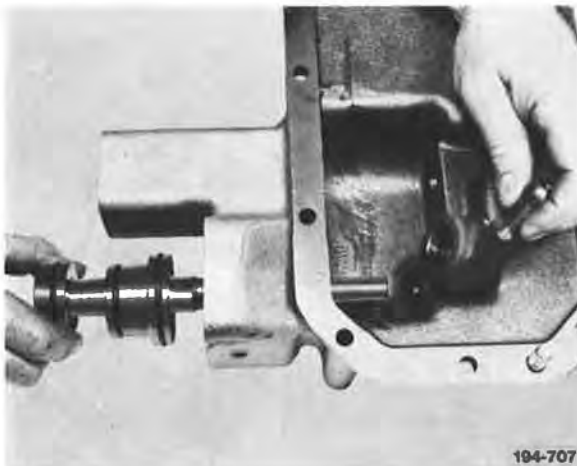


Figure 235. Installing Shift Rail and Shifter

8. Install O-ring onto Hi-range piston. See Figure 237.



Figure 237. Installing O-Ring

7. Install Hi/Direct shifter set-screw, and tighten to 35 to 45 lb. ft. torque. Refer to Torque and Tolerance Table, Item 10. See Figure 236.



Figure 236. Installing Setscrew

9. Install snap ring into inside of Hi-range piston, using snap ring pliers J-24339 or equivalent. See Figure 238.



Figure 238. Installing Snap Ring

10. Install O-ring onto end of Hi/Direct shift cylinder that is nearest the air breather. See Figure 239.



Figure 239. Installing O-Ring

12. Install Hi-range piston into Hi/Direct shift cylinder. See Figure 241.



Figure 241. Installing Piston

11. Install snap ring into inside of Hi/Direct shift cylinder, using snap ring pliers J-24339 or equivalent. See Figure 240.



Figure 240. Installing Snap Ring

13. Install Hi/Direct shift cylinder onto shift cover, by sliding it over the end of the Hi/Direct shift rail. See Figure 242.

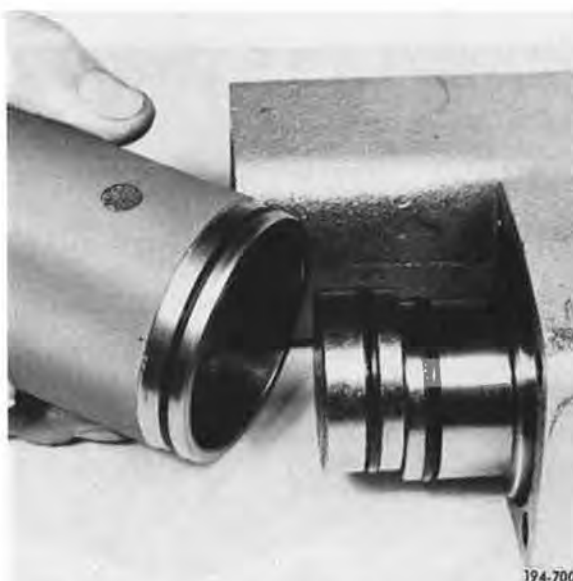


Figure 242. Installing Shift Cylinder

14. Install O-ring onto end of Hi/Direct shift cylinder. See Figure 243.



Figure 243. Installing O-Ring

16. Install Hi/Direct shift cover capscrews, and tighten to 24 to 30 lb. ft. torque. Refer to Torque and Tolerance Table, Item 2. See Figure 245.



Figure 245. Installing Capscrews

15. Install Hi/Direct shift cover onto Hi/Direct shift cylinder. See Figure 244.



Figure 244. Installing Cover

17. Place Hi/Direct shift rail in neutral position, and install interlock plunger. See Figure 246.



Figure 246. Installing Plunger

18. Install interlock plunger plug into shift cover. See Figure 247.



Figure 247. Installing Plug

19. Install O-ring onto reverse shift rail. See Figure 248.



Figure 248. Installing O-Ring

20. Slide reverse shift rail into shift cover and, at the same time, install reverse shifter. See Figure 249.



Figure 249. Installing Shift Rail and Shifter

21. Install reverse shift cover O-ring and reverse shift cover. See Figure 250.



Figure 250. Installing Cover and O-Ring

22. Install reverse shift cover capscrews, and tighten to 81 to 101 lb. in. torque. Refer to Torque and Tolerance Table, Item 17. See Figure 251.



Figure 251. Installing Capscrews

23. Install reverse shifter setscrew, and tighten to 35 to 45 lb. ft. torque. Refer to Torque and Tolerance Table, Item 10. See Figure 252.

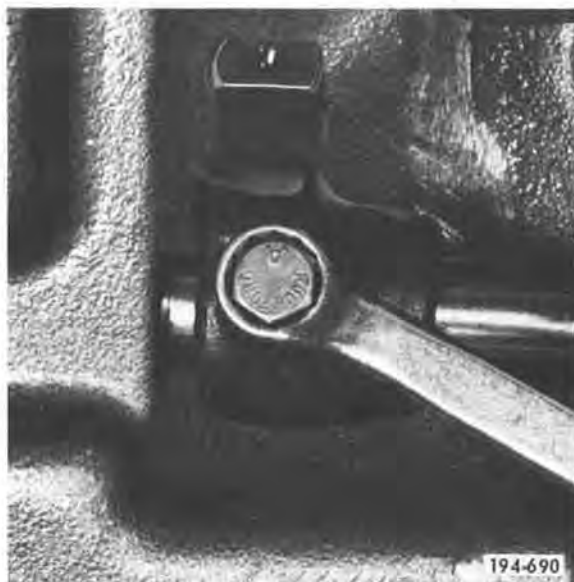


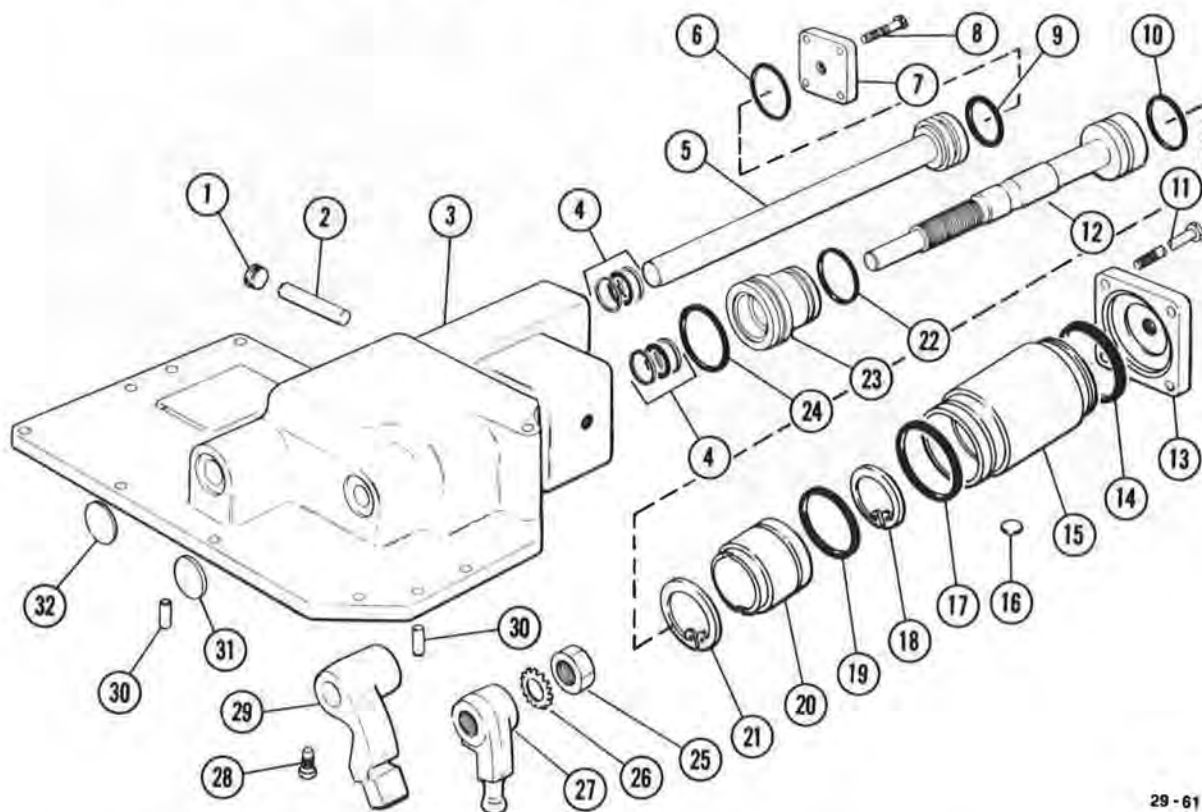
Figure 252. Installing Setscrew

NOTES



Air Shift Cover Reassembly (Non-Current Production)

(TRTXL107, serial number 9G9071, and later)
(TRTXL1070 prior to serial number 7F0879)



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- | | | |
|-----------------------------|------------------------|---------------------|
| 1. Plug | 12. Lo/Hi Shift Rail | 23. Direct Piston |
| 2. Interlock Plunger | 13. Lo/Hi Shift Cover | 24. O-Ring |
| 3. Shift Cover | 14. O-Ring | 25. Locknut |
| 4. O-Ring with Teflon Rings | 15. Shift Cylinder | 26. Lockwasher |
| 5. Reverse Shift Rail | 16. Breather | 27. Lo/Hi Shifter |
| 6. O-Ring | 17. O-Ring | 28. Setscrew |
| 7. Reverse Shift Cover | 18. Snap Ring | 29. Reverse Shifter |
| 8. Capscrew | 19. O-Ring | 30. Dowel Pin |
| 9. O-Ring | 20. Lo/Hi Range Piston | 31. Expansion Plug |
| 10. O-Ring | 21. Snap Ring | 32. Expansion Plug |
| 11. Capscrew | 22. O-Ring | |

Figure 253. Exploded View of Air Shift Cover Assembly
(Non-Current Production)

NOTE

Lubricate O-rings with a multi-purpose grease meeting Mack specification MG-C before installation.

1. Install O-ring and two Teflon rings in both the reverse opening and the Lo/Hi opening of shift cover. See Figure 254.



Figure 254. Installing O-Ring and Teflon Rings

2. Install O-rings onto Direct piston. See Figure 255.



Figure 255. Installing O-Rings

3. Install O-ring onto Lo/Hi shift rail. See Figure 256.



Figure 256. Installing O-Ring

4. Install Direct piston onto Lo/Hi shift rail, small end first.

5. Insert Lo/Hi shift rail into shift cover, and at the same time, install locknut, lockwasher, and Lo/Hi shifter.

6. Turn Lo/Hi shift rail to screw it into and through the locknut, lockwasher, and shifter. Leave locknut loose for adjustment later.

7. Install O-ring onto Lo/Hi range piston. See Figure 257.



Figure 257. Installing O-Ring

8. Install snap ring into inside of Lo/Hi range piston, using snap ring pliers J-24339 or equivalent. See Figure 258.



Figure 258. Installing Snap Ring

10. Install snap ring into inside of Lo/Hi shift cylinder, using snap ring pliers J-24339 or equivalent. See Figure 260.



Figure 260. Installing Snap Ring

9. Install O-ring onto end of Lo/Hi shift cylinder that is nearest the air breather. See Figure 259.



Figure 259. Installing O-Ring

11. Install Lo/Hi range piston into Lo/Hi shift cylinder. See Figure 261.



Figure 261. Installing Piston

12. Install Lo/Hi shift cylinder onto shift cover, by sliding it over the end of the Lo/Hi shift rail. See Figure 262.



Figure 262. Installing Shift Cylinder

14. Install Lo/Hi shift cover onto Lo/Hi shift cylinder. See Figure 264.

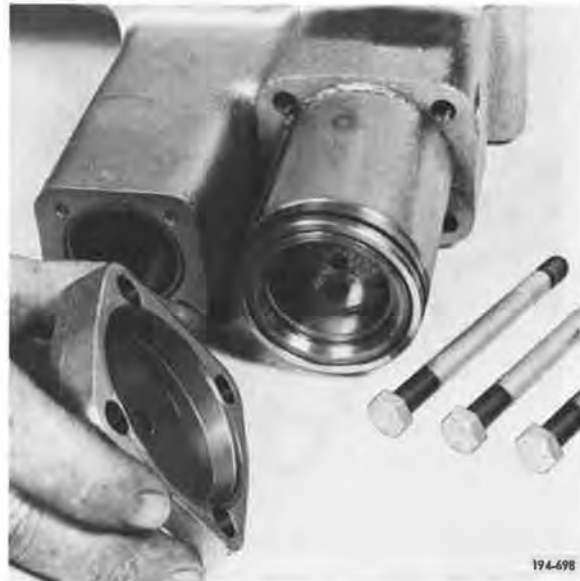


Figure 264. Installing Cover

13. Install O-ring onto end of Lo/Hi shift cylinder. See Figure 263.



Figure 263. Installing O-Ring

15. Install Lo/Hi shift cover cap-screws, and tighten to 24 to 30 lb. ft. torque. Refer to Torque and Tolerance Table, Item 2. See Figure 265.



Figure 265. Installing Capscrews

16. Place Lo/Hi shift rail in neutral position and install interlock plunger. See Figure 266.



Figure 266. Installing Plunger

17. Install interlock plunger plug into shift cover. See Figure 267.



Figure 267. Installing Plug

18. Install O-ring onto reverse shift rail. See Figure 268.



Figure 268. Installing O-Ring

19. Slide reverse shift rail into shift cover and, at the same time, install reverse shifter. See Figure 269.



Figure 269. Installing Shift Rail and Shifter

20. Install reverse shift cover O-ring and reverse shift cover. See Figure 270.



Figure 270. Installing Cover and O-Ring

21. Install reverse shift cover capscrews and tighten to 81 to 101 lb. in. torque. Refer to Torque and Tolerance Table, Item 17. See Figure 271.

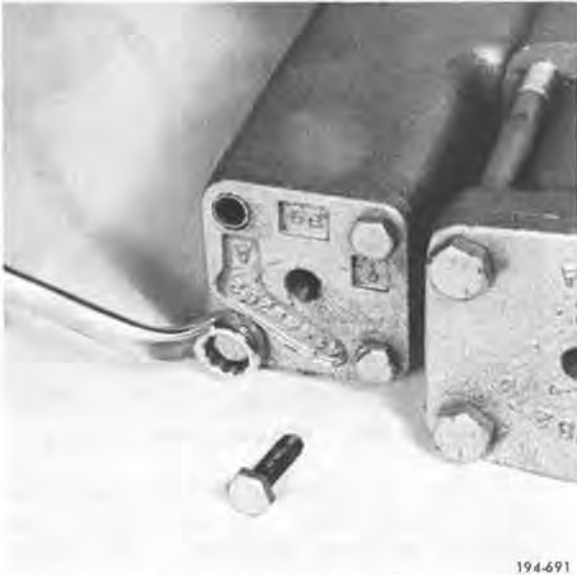


Figure 271. Installing Capscrews

22. Install reverse shifter setscrew, and tighten to 35 to 45 lb. ft. torque. Refer to Torque and Tolerance Table, Item 10. See Figure 272.

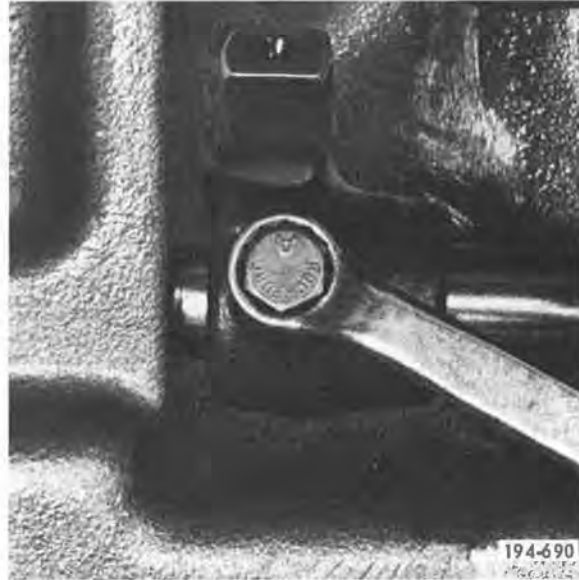


Figure 272. Installing Setscrew

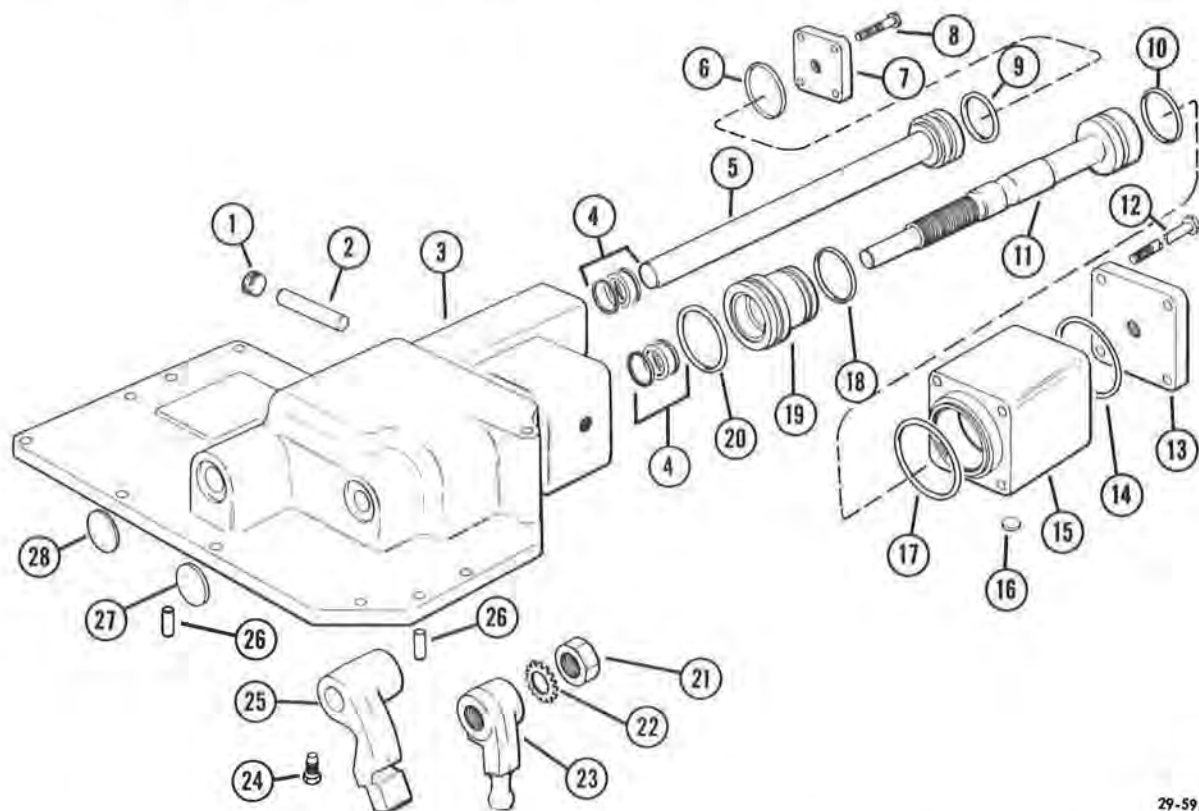
NOTE

Do NOT install expansion plug (Item 31, in Figure 253) at this time, so that Lo/Direct shifter may be adjusted later.

NOTES

Air Shift Cover Reassembly (Non-Current Production)

(TRTXL107 prior to Serial Number 9G9071)



- | | |
|-----------------------------|--------------------------------|
| 1. Plug | 15. Lo/Direct Shift Cylinder |
| 2. Interlock Plunger | 16. Breather |
| 3. Shift Cover | 17. O-Ring |
| 4. O-Ring with Teflon Rings | 18. O-Ring |
| 5. Reverse Shift Rail | 19. Lo/Direct Shift Piston |
| 6. O-Ring | 20. O-Ring |
| 7. Reverse Shift Cover | 21. Locknut |
| 8. Capscrew | 22. Lockwasher |
| 9. O-Ring | 23. Lo/Direct Shifter |
| 10. O-Ring | 24. Setscrew |
| 11. Lo/Direct Shift Rail | 25. Reverse Shifter |
| 12. Capscrew | 26. Dowel Pin |
| 13. Lo/Direct Shift Cover | 27. Expansion Plug (Lo/Direct) |
| 14. O-Ring | 28. Expansion Plug (Reverse) |

Figure 273. Exploded View of Air Shift Cover
(Non-Current Production)

NOTE

Numbers in parentheses refer to item numbers in Figure 273.

NOTE

Lubricate O-rings with a multi-purpose grease meeting Mack specification MG-C before installation.

1. Install O-ring with Teflon rings (4) into both the reverse opening and the Lo/Direct opening of the shift cover.

2. Install O-rings (18 and 20) onto Lo/Direct shift piston (19).

3. Install O-ring (10) onto Lo/Direct shift rail (11).

4. Install Lo/Direct shift piston (19) onto Lo/Direct shift rail (11).

5. Install Lo/Direct shift rail (11) into shift cover (3), and at the same time, install Lo/Direct shifter (23), lockwasher (22) and locknut (21), through bottom opening of shift cover.

6. Turn Lo/Direct shift rail (11) to screw it into and through the locknut (21), lockwasher (22) and Lo/Direct shifter (23). Leave locknut (21) loose for adjustment later.

7. Install O-ring (17) onto Lo/Direct shift cylinder (15).

8. Install Lo/Direct shift cylinder (15) onto shift cover (3) by sliding it over the end of the Lo/Direct shift rail (11).

9. Install O-ring (14) and Lo/Direct shift cover (13) onto Lo/Direct shift cylinder (15).

10. Install capscrews (12) and tighten to 24 to 30 lb. ft. torque. Refer to Torque and Tolerance Table, Item 2.

11. Place Lo/Direct shift rail (11) in neutral position and install interlock plunger (2).

12. Install O-ring (9) onto end of reverse shift rail (5).

13. Slide reverse shift rail (5) into shift cover (3), and at the same time, install reverse shifter (25) through bottom opening of shift cover.

14. Install O-ring (6) and reverse shift cover (7) onto shift cover.

15. Install capscrews (8) and tighten to 81 to 101 lb. in. torque. Refer to Torque and Tolerance Table, Item 17.

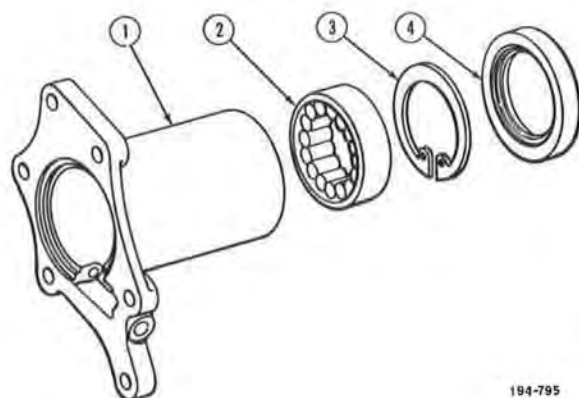
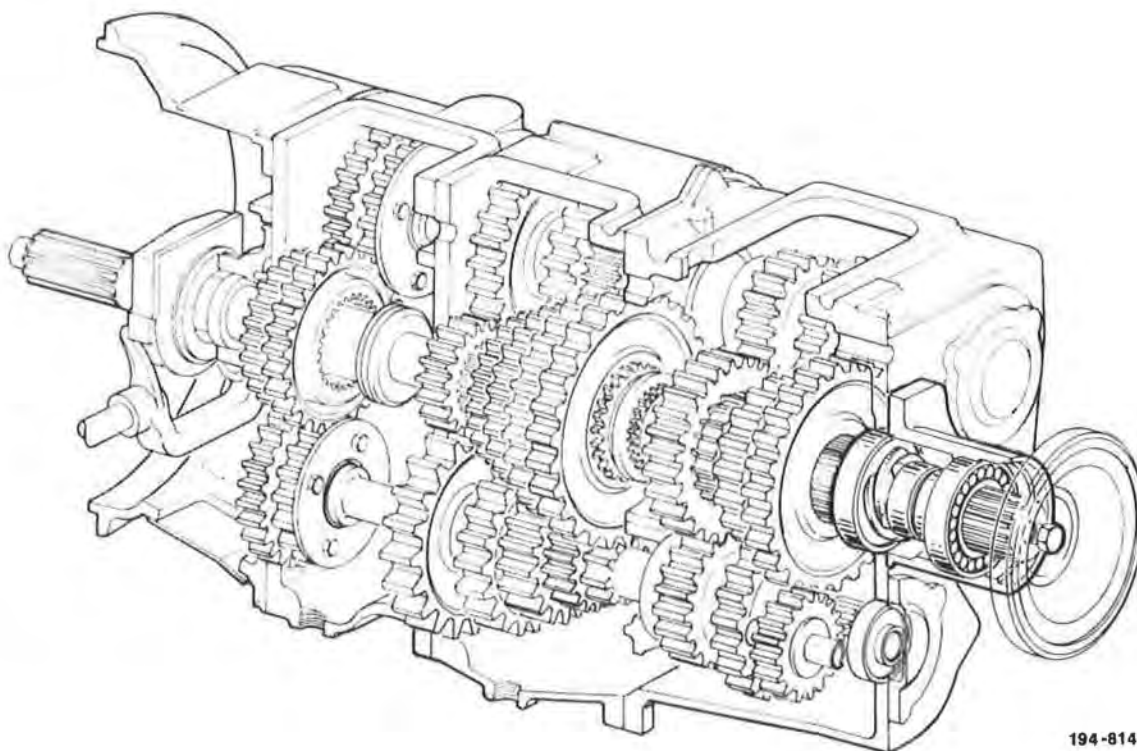
16. Install reverse shifter setscrew (24), and tighten to 35 to 45 lb. ft. torque. Refer to Torque and Tolerance Table, Item 10.

17. Install interlock plunger plug (1).

NOTE

Do NOT install expansion plug (Item 27 in Figure 273) at this time, so that Lo/Direct shifter may be adjusted later.

Rear Compound Mainshaft Rear Bearing Cover Reassembly



1. Rear Bearing Cover
2. Bearing
3. Snap Ring
4. Oil Seal

Figure 274. Exploded View of Rear Compound Mainshaft Rear Bearing Cover

1. Install bearing and snap ring into rear mainshaft rear bearing cover. See Figure 275.



Figure 275. Installing Bearing and Snap Ring

2. Apply a bead of sealer to shoulder where seal will seat. Use Silastic RTV732 (Mack 243SX32) or equivalent. See Figure 276.



Figure 276. Applying Sealer

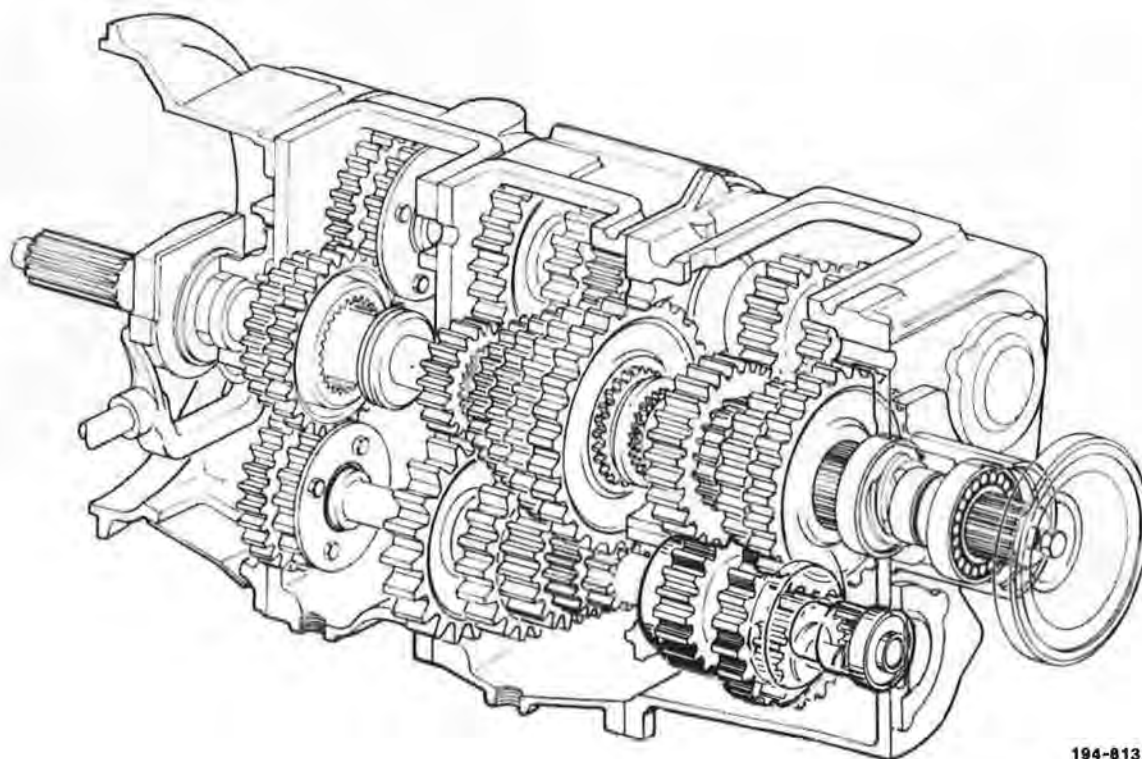
3. Press oil seal into rear bearing cover, using a suitable driver and press until seal seats on shoulder. See Figure 277.



- 1. Driver
- 2. Oil Seal
- 3. Bearing
- 4. Rear Bearing Cover

Figure 277. Installing Seal

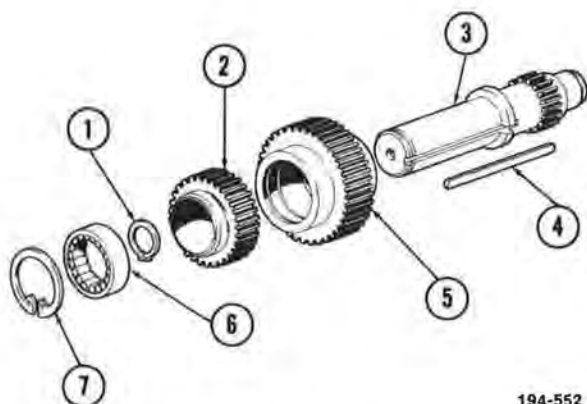
Rear Compound Countershaft Reassembly



194-813

NOTE

Gears (2 and 5) have an interference fit with rear countershaft (3) and, for best results, should be heated before being pressed on. Using heat lamp or hot oil, heat gears to 270 to 300°F. (132 to 149°C.) for a period of not more than 30 minutes.



194-552

- | | |
|-----------------------------|--------------------------------|
| 1. Gear Retaining Snap Ring | 5. Lo/Hi Range Gear |
| 2. Direct Gear | 6. Bearing |
| 3. Rear Countershaft | 7. Bearing Retaining Snap Ring |
| 4. Key | |

1. Insert gear key into countershaft keyway.

2. Apply a light coat of oil to the countershaft.

3. Align the Lo/Hi range gear with the large hub facing away from reverse gear, and press gear onto shaft until it seats against shoulder on shaft.

Figure 278. Exploded View of Rear Countershaft

NOTE

Align keyway of gear carefully with key. Guard against shaving key or raising burr on key. Before final seating of gear, inspect for and remove any burrs between gear and its mating surface.

4. Apply another coat of oil to the countershaft.

5. Align Direct gear with large hub facing away from Lo/Hi range gear, and press onto shaft until it seats against Lo/Hi range gear. Refer to previous NOTE. See Figure 279.

NOTE

Notice pencils pointing to areas where there must not be any burrs.

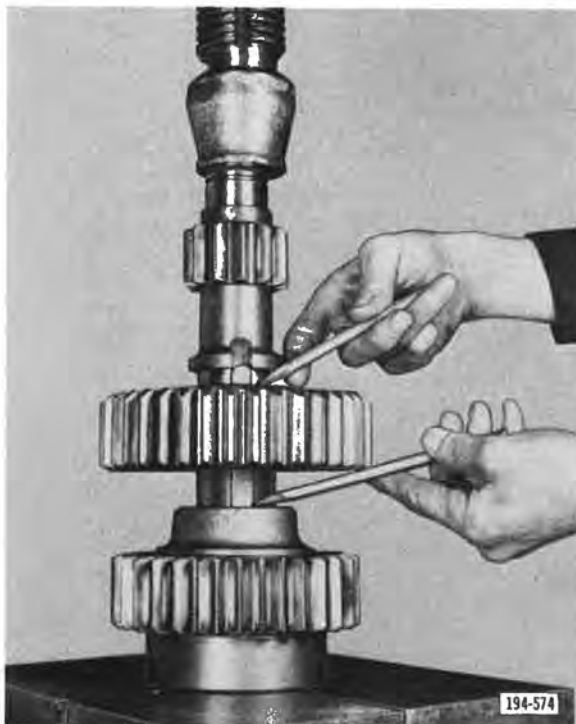


Figure 279. Pressing Gears onto Countershaft

6. Install gear retaining snap ring, using snap ring pliers J-6435 or equivalent. See Figure 280.



Figure 280. Installing Snap Ring

7. Install rear countershaft front bearing. See Figure 281.



Figure 281. Installing Bearing

8. Install front bearing retaining snap ring using snap ring pliers J-4646 or equivalent. See Figure 282.

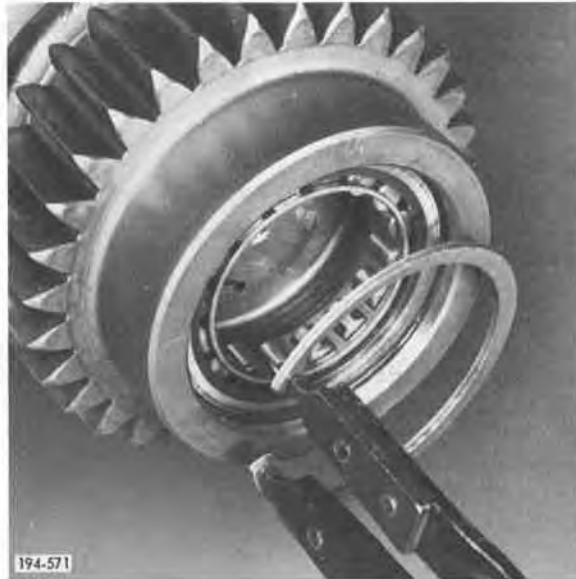
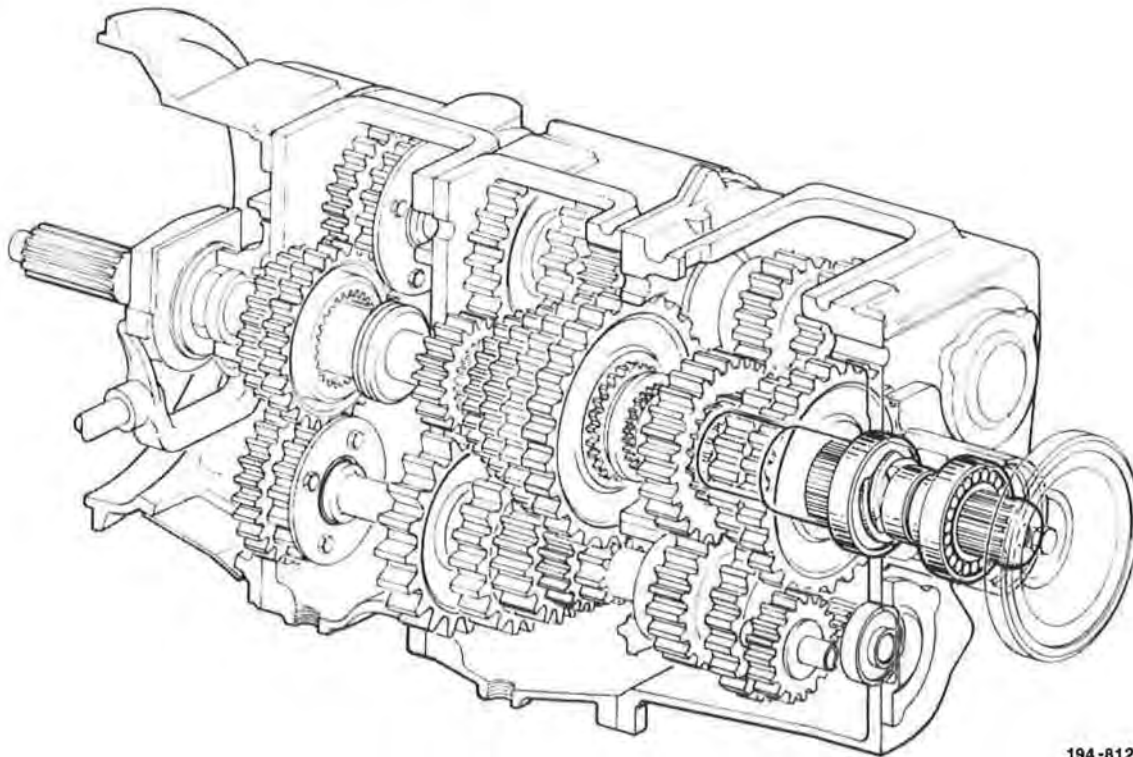


Figure 282. Installing Snap Ring

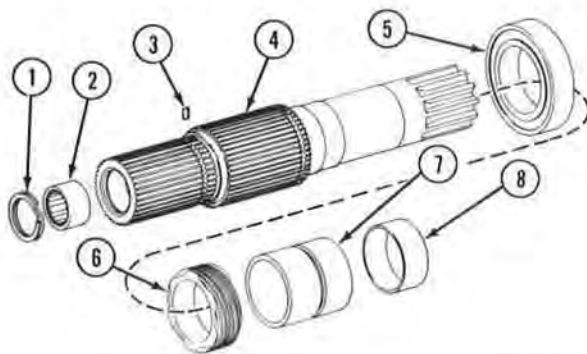
NOTES

Rear Compound Mainshaft Reassembly



194-812

1. Press rear compound mainshaft rear bearing onto shaft. See Figure 284.



194-794

- | | |
|-----------------------|---------------------|
| 1. Spirolox Snap Ring | 5. Rear Bearing |
| 2. Front Bearing | 6. Speedometer Gear |
| 3. Pin | 7. Spacer |
| 4. Mainshaft | 8. Bearing Race |



194-633

Figure 283. Exploded View of Rear Compound Mainshaft

Figure 284. Pressing Bearing onto Mainshaft

2. Slide speedometer gear and spacer onto rear mainshaft. See Figure 285.



Figure 285. Installing Gear and Spacer

3. Press rear bearing cover bearing inner race onto rear mainshaft. See Figure 286.



Figure 286. Pressing Race onto Mainshaft



Figure 287. Installing Bearing

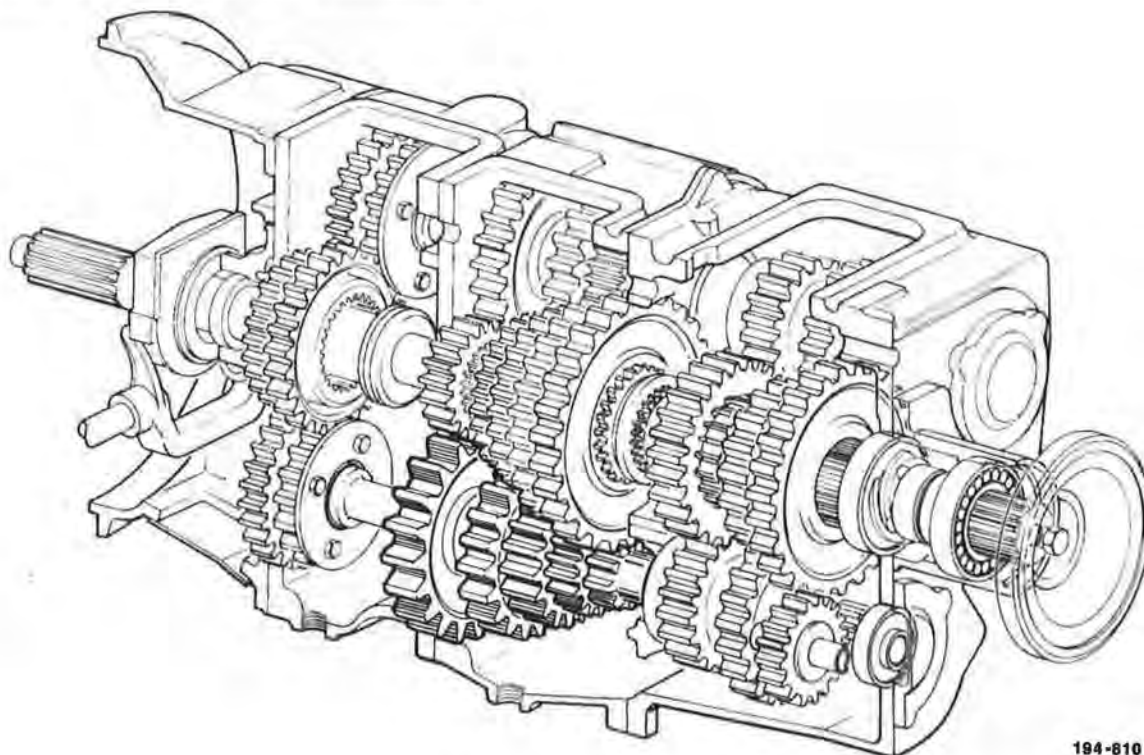
4. Install rear mainshaft front bearing, using suitable driver and soft mallet. See Figure 287.

5. Install rear mainshaft front bearing retaining snap ring. See Figure 288.



Figure 288. Installing Snap Ring

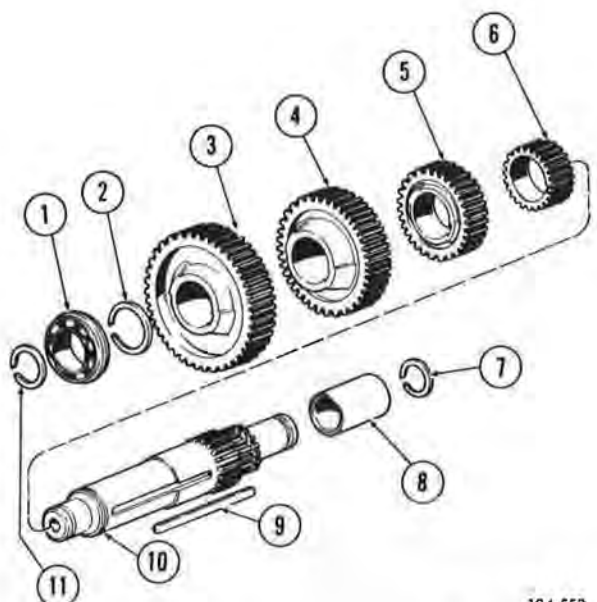
Main Box Countershaft Reassembly



194-810

NOTE

Gears have an interference fit with countershaft and, for best results, should be heated before being pressed on. Using heat lamp or hot oil, heat gears to 270 to 300°F. (132 to 149°C.) for a period of not more than 30 minutes.



194-553

- | | |
|-----------------------------|---------------------------------|
| 1. Bearing | 7. Snap Ring |
| 2. Gear Retaining Snap Ring | 8. Bearing Inner Race |
| 3. Fifth Speed Gear | 9. Key |
| 4. Fourth Speed Gear | 10. Front Countershaft |
| 5. Third Speed Gear | 11. Bearing Retaining Snap Ring |
| 6. Second Speed Gear | |

1. Insert gear key into countershaft keyway.

2. Apply a light coat of oil to the countershaft.

3. Align keyway of second speed gear with key, and press gear onto shaft.

Figure 289. Exploded View of Main Box Countershaft

NOTE

Align keyway of gear carefully with key. Guard against shaving key or raising burr on key. Before final seating of gear, inspect for and remove any burrs between gear and its mating surface.

4. Repeat procedure with remaining gears. Fourth speed gear hub to be toward front (away from third speed gear). Main drive gear (fifth speed gear) hub to be toward rear (next to fourth speed gear hub). See Figure 290.

NOTE

Notice pencil pointing to area where there must not be any burrs.



Figure 290. Pressing Gears onto Countershaft

5. Install gear retaining snap ring, using snap ring pliers J-25445 or equivalent. See Figure 291.

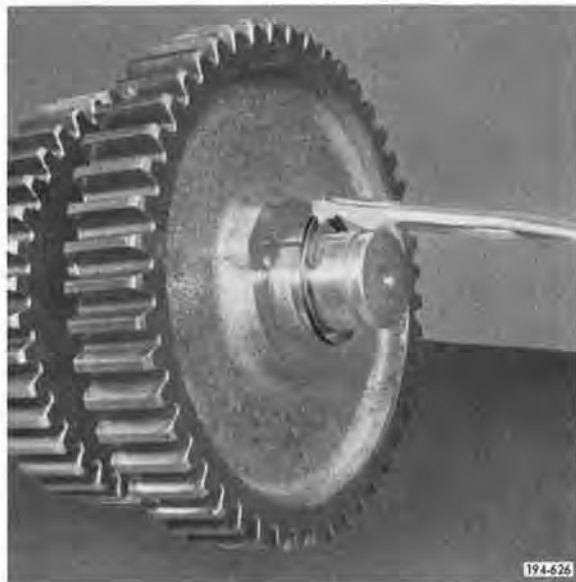


Figure 291. Installing Snap Ring

6. Install countershaft front bearing, being careful to apply force to the inner race only. A soft mallet or suitable driving sleeve may be used. See Figure 292.

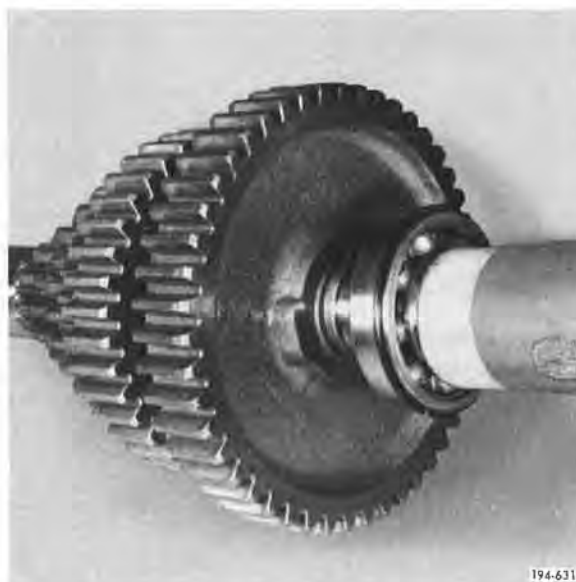


Figure 292. Installing Bearing

7. Install front bearing retaining snap ring, using snap ring pliers J-25445 or equivalent. See Figure 293.



Figure 293. Installing Snap Ring

8. Install bearing inner race on rear of countershaft, driving it on carefully using a soft mallet or a suitable driving sleeve.

9. Install inner race retaining snap ring, using snap ring pliers J-24339 or equivalent. See Figure 294.



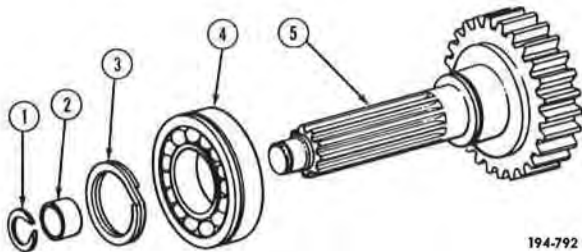
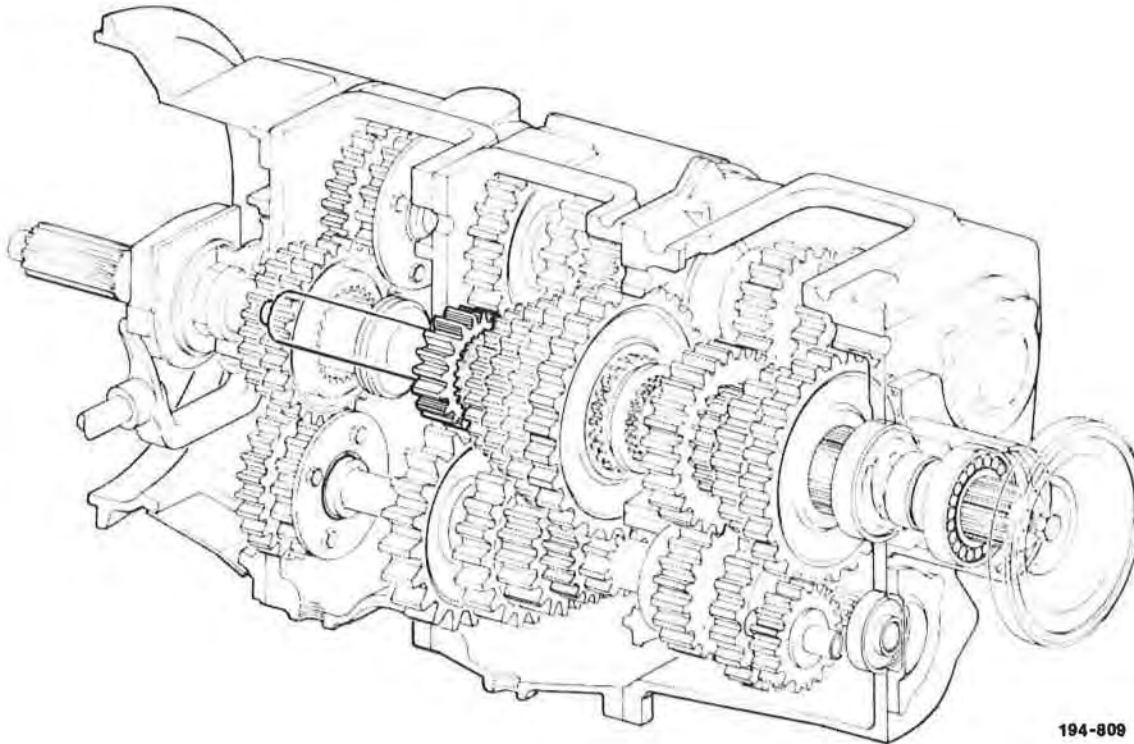
Figure 294. Installing Snap Ring

Main Box Mainshaft Reassembly

Since mainshaft third speed gear will be needed for timing the countershafts, do NOT assemble the main box mainshaft at this time.

NOTES

Main Box Main Drive Pinion Reassembly



1. Snap Ring
2. Bearing Inner Race
3. Spirolox Snap Ring
4. Bearing
5. Main Drive Pinion

Figure 295. Exploded View of Main Box Main Drive Pinion

1. Install front compound main drive pinion spigot bearing inner race onto front of main box main drive pinion, and secure it with its snap ring.

2. Press main drive pinion bearing onto shaft. Be sure outer race snap ring is positioned away from gear teeth. See Figure 296.



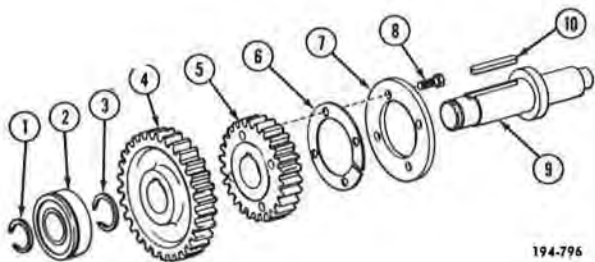
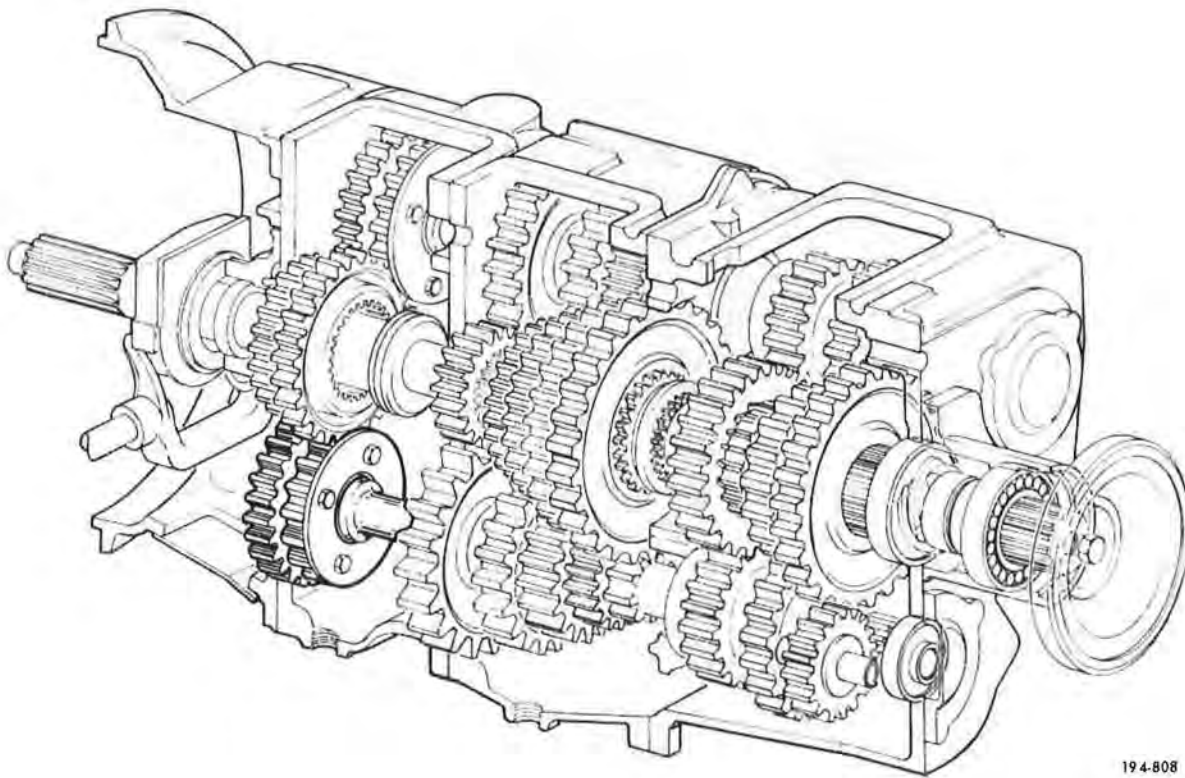
Figure 296. Installing Bearing

3. Install bearing retaining spirolox snap ring. See Figure 297.



Figure 297. Installing Snap Ring

Front Compound Countershaft Reassembly



- | | |
|------------------|-----------------|
| 1. Snap Ring | 6. Shim |
| 2. Bearing | 7. Washer |
| 3. Snap Ring | 8. Capscrew |
| 4. Direct Gear | 9. Countershaft |
| 5. Lo-Range Gear | 10. Key |

Figure 298. Exploded View of Front Compound Countershaft

1. Install key into keyway of countershaft, and tap into place with a hammer. See Figure 299.



Figure 299. Installing Key

NOTE

Gears have an interference fit with front countershaft and, for best results, should be heated before being pressed on. Using heat lamp or hot oil, heat gears to 270 to 300°F. (132 to 149°C.) for a period of not more than 30 minutes.

2. Apply a light coat of oil to the countershaft.

NOTE

Align keyway of gears carefully with key. Guard against shaving key or raising burr on key. Before final seating of each gear, inspect for and remove any burrs between gear and its mating surface.

3. Select a driving sleeve of suitable size to go over the end of the countershaft and rest on the shoulder of the shaft. Align key with keyway, and press shaft into the Lo-Range gear. See Figure 300.

WARNING

Do NOT apply force to end of countershaft. Distortion of the shaft in the rear bearing area will occur, which will cause premature bearing wear.



Figure 300. Pressing Shaft Through Gear

4. Oil shaft again, align key with keyway, and press shaft into Direct gear. Refer to previous NOTES and WARNING. See Figure 301.



Figure 301. Pressing Shaft Through Gear

5. Install gear retaining snap ring, using snap ring pliers J-25445 or equivalent. See Figure 302.



Figure 302. Installing Snap Ring

6. Install front compound counter-shaft front bearing, being careful to apply force to the inner race only. See Figure 303.



Figure 303. Installing Bearing

7. Install front compound counter-shaft front bearing retaining snap ring, using snap ring pliers J-25445, or equivalent. See Figure 304.

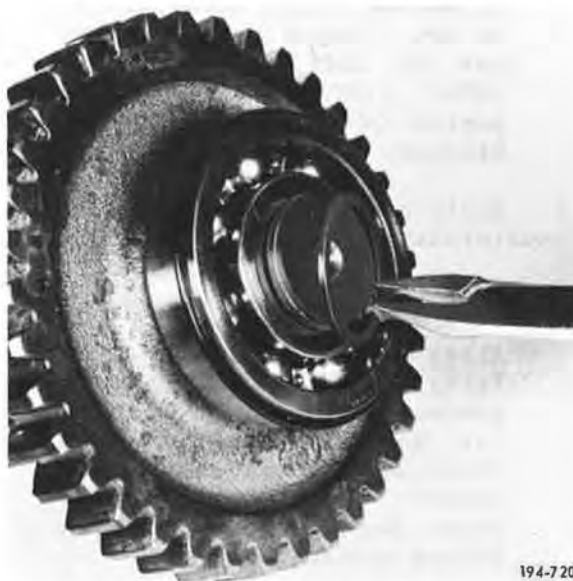
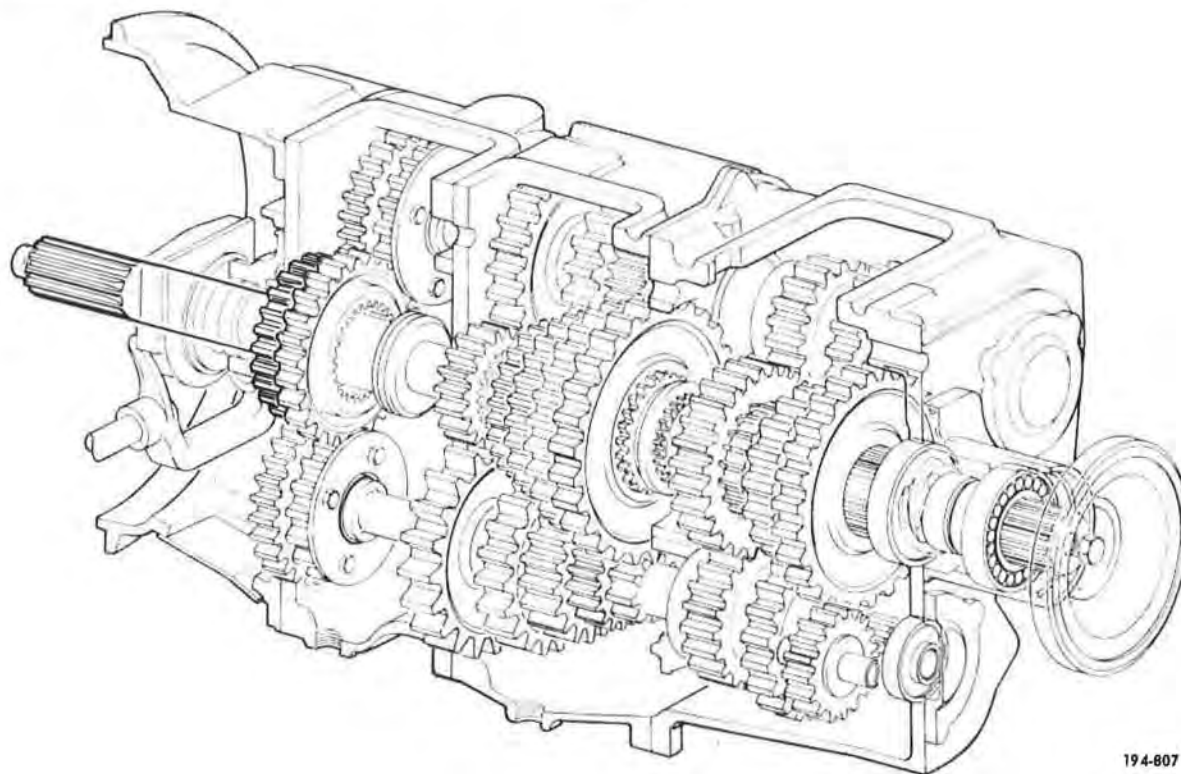


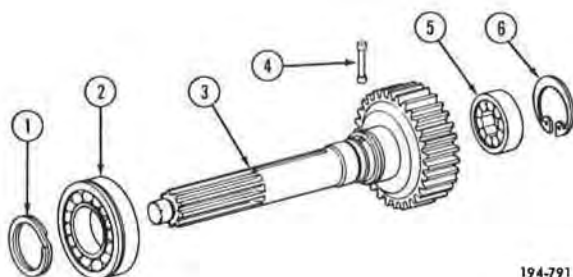
Figure 304. Installing Snap Ring

NOTES

Front Compound Main Drive Pinion Reassembly



194-807



194-791

- | | |
|-----------------------|-------------------|
| 1. Spirolox Snap Ring | 4. Oil Pump Vane |
| 2. Bearing | 5. Spigot Bearing |
| 3. Main Drive Pinion | 6. Snap Ring |

Figure 305. Exploded View of Front Compound Main Drive Pinion

1. Press front compound main drive pinion bearing onto shaft. Be sure outer race snap ring is positioned away from gear teeth. See Figure 306.



194-651

Figure 306. Installing Bearing

2. Install bearing retaining spirollox snap ring. See Figure 307.



Figure 307. Installing Snap Ring



Figure 309. Installing Bearing

3. Place front compound main drive pinion spigot bearing in position, and tap carefully into its seat using an appropriate driver. See Figures 308 and 309.

4. Install spigot bearing retaining snap ring. See Figure 310.



Figure 308. Placing Bearing in Position



Figure 310. Installing Snap Ring

Front Compound Main Drive Pinion
Bearing Cover Reassembly (Non-Current
Production)

(TRTXL107 prior to serial number
7B0736)

SERVICE NOTE

If the non-current style of main drive pinion bearing cover (shown in Figure 311) is found during overhaul, it is recommended that it be replaced with the current production style (shown in Figure 312).

CLEAN SURFACE AND SPREAD 1/8 IN. DIA.
BEAD OF 243SX 26 SILASTIC IN THIS CORNER
OF COVER BORE. PRESS SLEEVE ASSEMBLY
TIGHT AGAINST COVER SHOULDER. WIPE ALL
EXCESS SEALANT FROM AFFECTED AREAS.

OIL SEAL MUST BE PRESSED
FLUSH WITH SLEEVE OUTSIDE
FACE AND WITH LIP IN DIRECTION
SHOWN.

OIL INLET SLOT IN PUMP SLEEVE
MUST REGISTER EXACTLY WITH
PUMP OIL SUPPLY SLOT IN COVER.

194-515

Figure 311. Sectional View of Front
Compound Main Drive Pinion Bearing
Cover (Non-Current Production)

1. Apply gasket sealer to the press
fit outside diameter of a new oil
seal.

2. Place oil pump sleeve on press
table with oil seal counterbore fac-
ing up.

3. With lip of oil seal down, press
oil seal into sleeve until metal
flange of seal is flush with sleeve.

4. Apply a bead of sealer (Silastic
RTV732, Mack 243SX32, or equivalent)
in the corner of the cover bore.

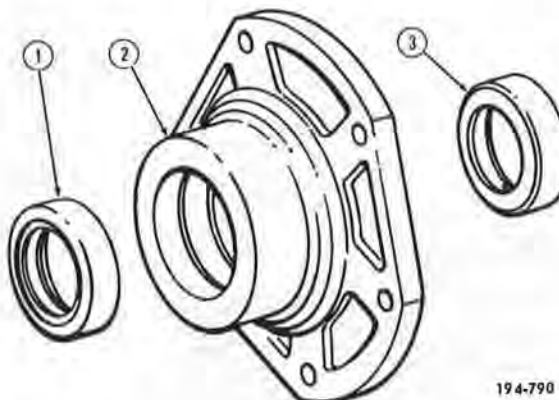
5. Align oil pump sleeve oil inlet
slot with pump oil supply slot in
cover.

6. Press oil pump sleeve assembly
(including oil seal) into cover and
tight against cover shoulder.

7. Wipe off any excess sealant.

Front Compound Main Drive Pinion
Bearing Cover Reassembly (Current
Production)

(TRTXL107 serial number 7B0736,
and later; and all TRTXL1070)



1. Oil Seal
2. Cover
3. Pump Sleeve

Figure 312. Exploded View of Front
Compound Main Drive Pinion Bearing
Cover

1. Apply a bead of sealer to shoulder where the seal will seat. Use Silastic RTV732 (Mack 243SX32) or equivalent. See Figure 313.



Figure 313. Applying Sealer

2. Place seal in position and select an appropriate driver. See Figure 314.



Figure 314. Placing Seal in Position

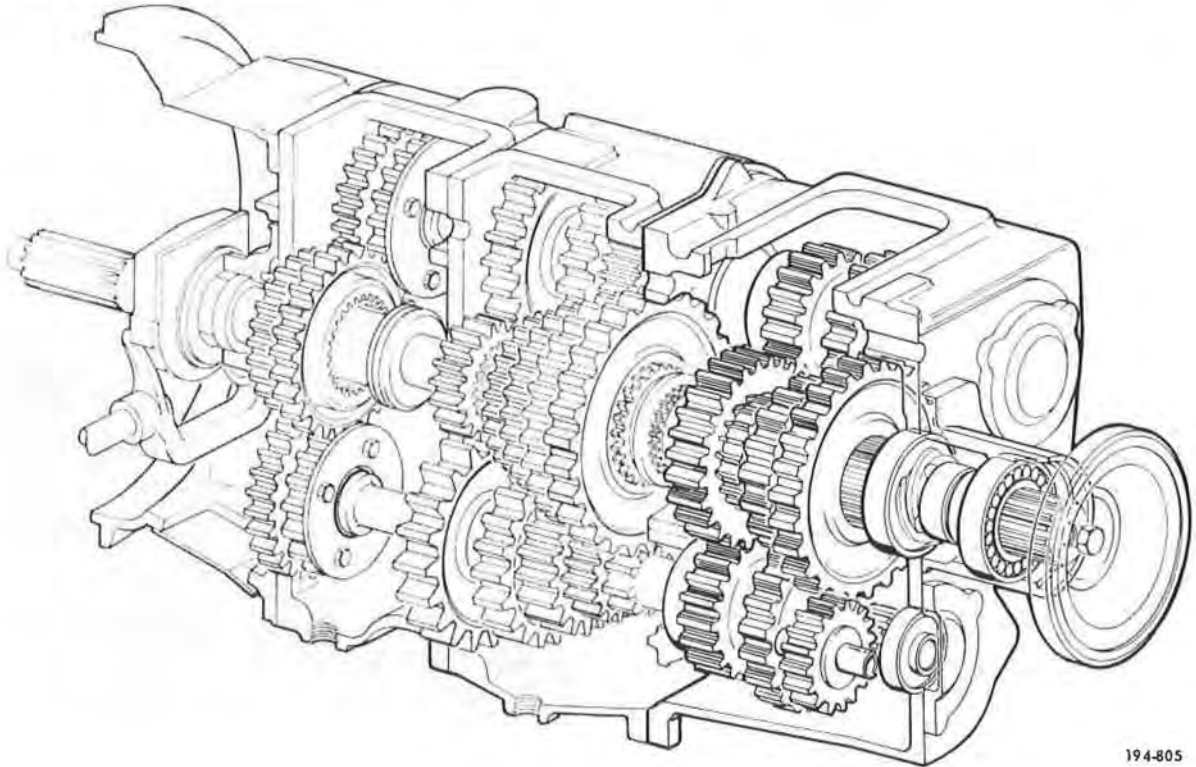
3. Place assembly in a press, and press seal into cover, until it seats on shoulder. See Figure 315.



Figure 315. Pressing Seal into Cover

NOTES

Rear Compound Reassembly



1. Insert expansion plug into reverse idler shaft. See Figure 316.



Figure 316. Inserting Expansion Plug

2. Install expansion plug by driving it downward with a driver. Driver to be cylindrical in shape, with a diameter the same as the expansion plug, and a flat (not rounded) end.

3. Insert reverse idler shaft partially into rear case, taking care to align the flats on the end of the shaft with the centerline of the countershaft bore. See Figure 317.

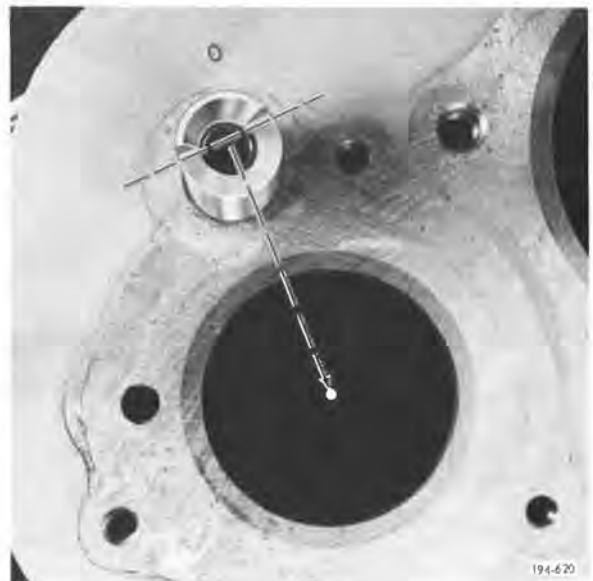
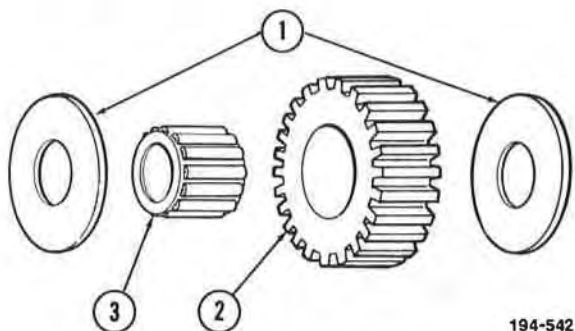


Figure 317. Alignment of Idler Shaft

4. Install reverse idler gear (rounded edge of gear teeth forward), bearing, and thrust washers into rear case. See Figures 318 and 319.



- 1. Thrust Washers
- 2. Idler Gear
- 3. Bearing

194-542

Figure 318. Exploded View of Reverse Idler Gear Assembly



Figure 319. Installing Reverse Idler Gear Assembly

5. Drive reverse idler shaft part way into rear case with a soft mallet, being sure that the reverse idler gear, bearing, and thrust washers are in proper alignment for shaft to go through them. See Figure 320.



Figure 320. Installing Shaft

6. Apply appropriate sealer around the outer edge of the shaft where it meets the case. See Figure 321.



Figure 321. Applying Sealer

7. Drive the reverse idler shaft the rest of the way into the case, until the relief is flush with the case.

8. Measure reverse idler gear end play with a feeler gage. See Figure 322. End play should be 0.003 to 0.023 inches. Refer to Torque and Tolerance Table, Item 23. If end play is not within tolerance, replace thrust washers. If still not correct, replace reverse idler gear. If still not within tolerance, case must be replaced



Figure 322. Measuring End Play

9. Apply appropriate sealer to end of reverse idler shaft, including around expansion plug. See Figure 323.



Figure 323. Applying Sealer

10. Into the front of the rear case, install the main box countershaft rear bearings and retaining snap rings, using snap ring pliers J-4646, or equivalent. See Figure 324.



Figure 324. Installing Bearing and Snap Rings

11. Install reverse gear and its shift fork. Engage reverse gear teeth with the three reverse idler gears. See Figure 325.



Figure 325. Installing Reverse Gear and Shift Fork

12. Locate the timing "O" mark on each of the rear countershaft Lo/Hi range gears. With yellow paint, mark the gear tooth top land on the Direct gear that is directly in line with that "O" mark. Then install the rear countershafts into the rear case. See Figure 326.



- 1. Timing Mark
- 2. Yellow Paint Marking

Figure 326. Installing Rear Countershaft

13. Place a block of metal at front end of rear countershaft, to provide a solid base, and install rear countershaft rear bearing using a suitable driving sleeve. Apply force to the inner race only. See Figure 327.

NOTE

Notice pencil pointing to block of metal temporarily installed.



Figure 327. Installing Bearing

14. Place rear countershafts in position, and install rear bearing retaining snap rings, using snap ring pliers J-25445, or equivalent. See Figure 328.

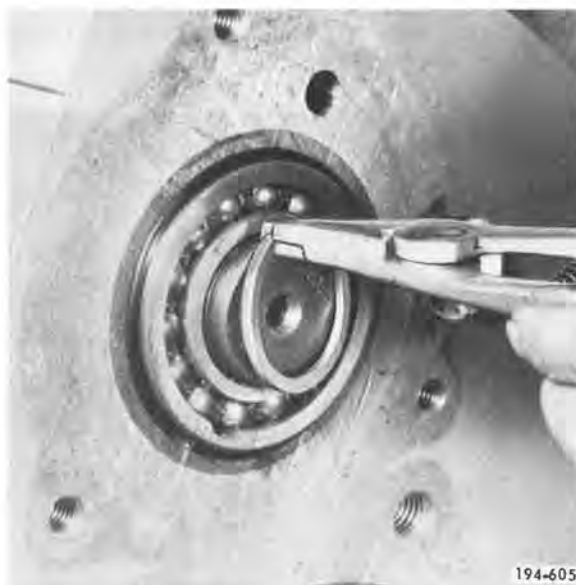


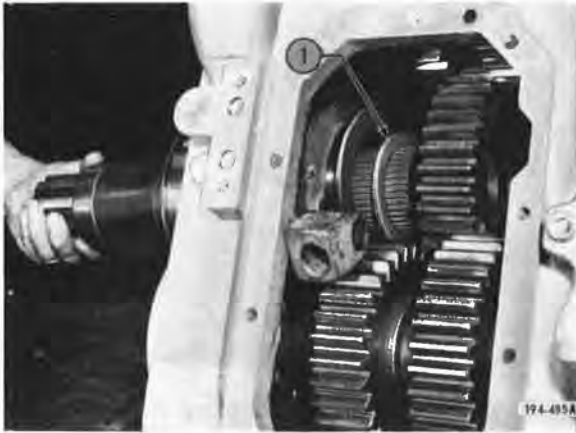
Figure 328. Installing Snap Ring

15. Install Lo/Hi range gear into rear case (clutch teeth facing forward) and position it between the countershaft Direct gear and the countershaft Lo/Hi range gear. See Figure 329.



Figure 329. Installing Gear

16. Install rear mainshaft into rear case through rear opening. Advance shaft carefully through the reverse gear, and then install the mainshaft Lo/Hi range gear rear thrust washer onto shaft. See Figures 330 and 331.



1. Lo/Hi Range Gear Rear Thrust Washer

Figure 330. Installing Mainshaft

NOTE

Thrust washer must be installed so that notch in washer mates with pin in mainshaft.



Figure 331. Lo/Hi Range Gear Rear Thrust Washer and Locating Pin

17. Continue advancing shaft through Lo/Hi range gear until rear bearing positioning snap ring seats against case.

18. Install O-ring into each countershaft rear bearing cover. See Figure 332.



Figure 332. Installing O-Ring

19. Place countershaft rear bearing covers in place, install capscrews, and tighten to 36 to 44 lb. ft. torque. Refer to Torque and Tolerance Table, Item 9. See Figures 333 and 334.



Figure 333. Installing Cover



Figure 334. Installing Capscrew

20. Apply sealer compound and install rear mainshaft rear bearing cover gasket and cover. See Figure 335.



Figure 335. Installing Cover and Gasket

21. Install cover cap screws and tighten to 106 to 130 lb.ft. torque. Refer to Torque and Tolerance Table, Item 15. See Figure 336.

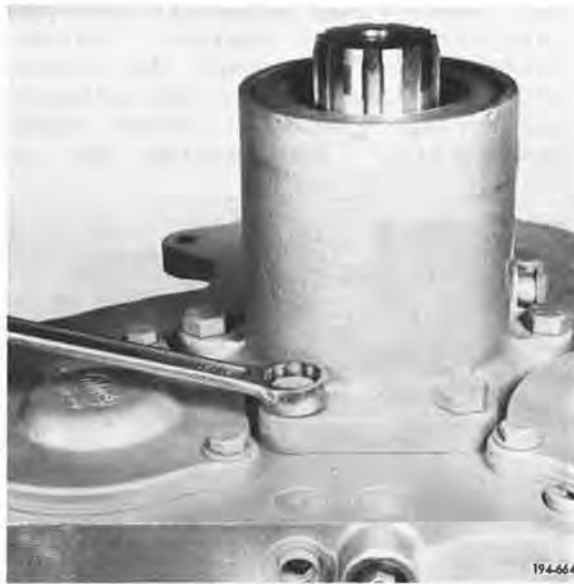


Figure 336. Installing Capscrews

23. Disengage reverse gear from its idler gears.

24. Locate the three "O" marks on the face of the mainshaft Lo/Hi range gear, and locate the painted timing marks on the countershaft Direct gear.

25. Place "O" marks and painted timing marks in alignment, and engage the mainshaft Lo/Hi range gear with the countershaft Lo/Hi range gears. See Figure 337.



1. Mainshaft Lo/Hi Range Gear
Timing Marks
2. Countershaft Direct Gear
Timing Marks

Figure 337. Timing Mark Alignment

26. Through rear case front opening, install Lo/Hi range gear front thrust washer, with bronze side rearward, against gear. See Figure 338.



Figure 338. Installing Thrust Washer

27. Install Lo/Hi range gear retaining snap ring, using snap ring pliers J-6435, or equivalent. See Figure 339.



Figure 339. Installing Snap Ring

28. Install Lo/Hi range sliding clutch and its shift fork as an assembly. See Figure 340.



Figure 340. Installing Sliding Clutch and Shift Fork

WARNING

Lo/Hi range sliding clutch and shift fork could fall out of case and cause injury if they are not secured.

29. Install a wire to hold the Lo/Hi range shift fork from sliding forward. See Figure 341.

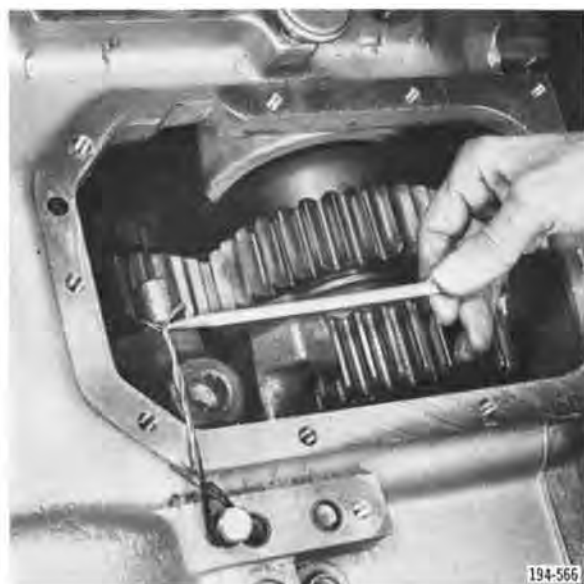
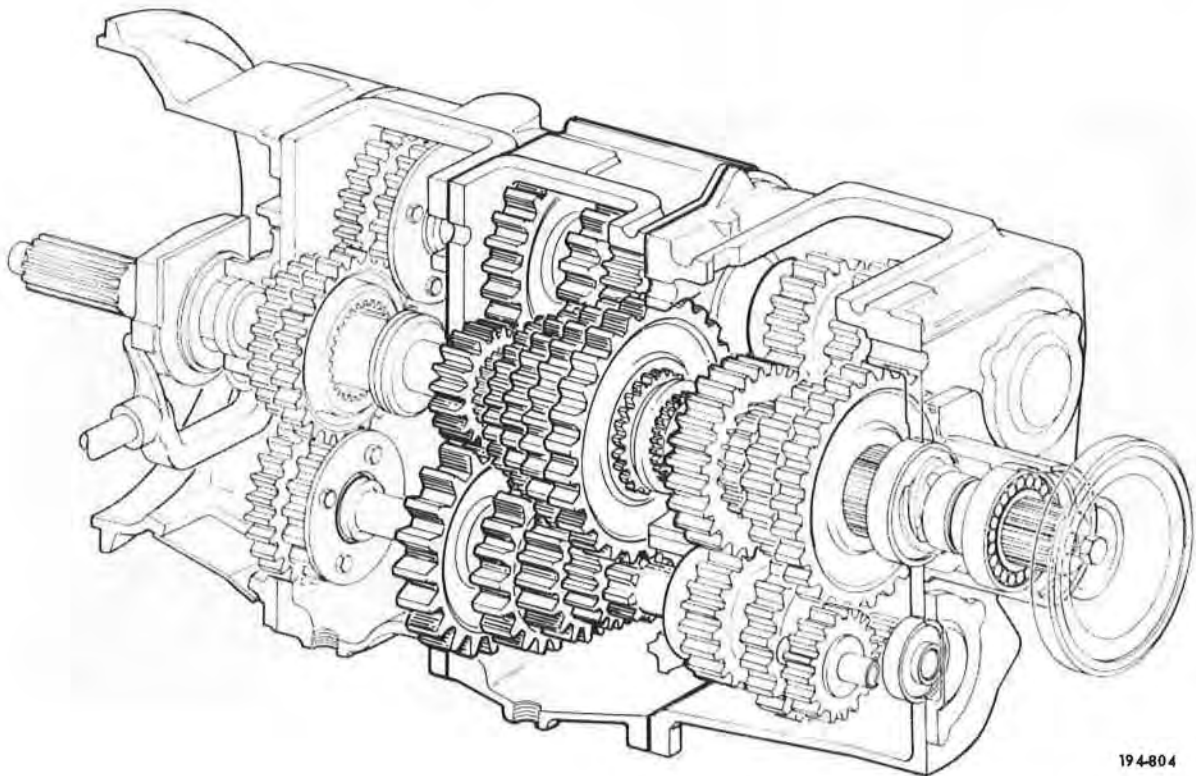


Figure 341. Wire Holding Shift Fork

NOTES

Main Box Reassembly



1. Position main box in a vertical position, and install the three countershafts. See Figure 342.

2. Position main box in a horizontal position, and install countershaft front bearing dished retaining ring. See Figure 343.

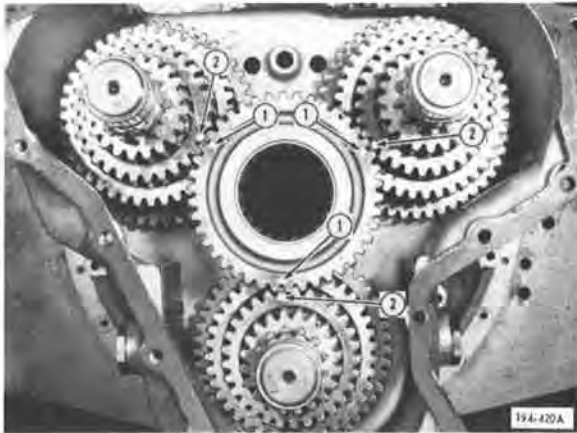


Figure 342. Installing Countershafts



Figure 343. Installing Retaining Ring

3. Temporarily install main box mainshaft third speed gear, so that the three alignment "O" marks on the face of the gear mate with the alignment "O" marks on the countershaft third speed gears. See Figure 344.



1. Mainshaft Third Speed Gear Timing Marks
2. Countershaft Third Speed Gear Timing Marks

Figure 344. Third Speed Gear Temporarily Installed.

4. Install the main drive pinion into place. See Figure 345.



Figure 345. Installing Pinion

NOTE

After main drive pinion is installed, the countershafts are timed and held in alignment by the main drive pinion. Therefore, the third speed gear may now be removed from the main box and set aside until needed.

5. Install main drive pinion bearing cover, and tighten capscrews to 36 to 44 lb.ft. torque. Refer to Torque and Tolerance Table, Item 8. See Figure 346.



Figure 346. Installing Cover

6. Install second/third speed sliding clutch onto main box mainshaft. See Figure 347.



Figure 347. Installing Sliding Clutch

NOTE

Figure 347 shows non-current production mainshaft, with the pencil pointing to an oil hole. Current production no longer uses oil passages in the mainshaft. (TRTXL1070 serial number 903151 and later.)

7. Install third speed gear onto mainshaft. See Figure 348.

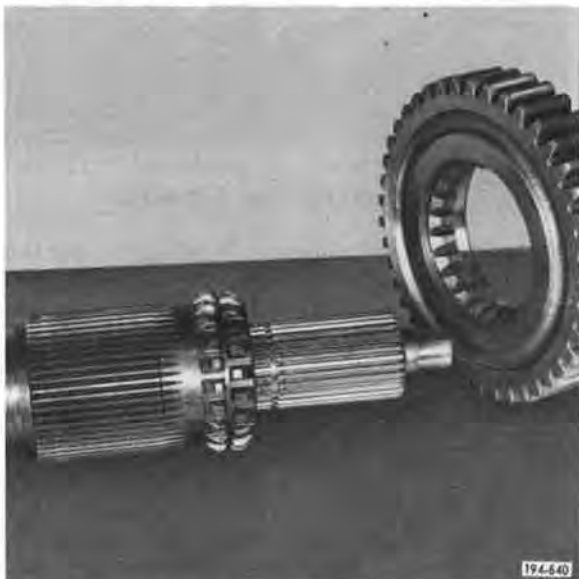


Figure 348. Installing Gear

8. Install third speed gear flanged thrust washer, and fourth speed gear. See Figure 349.



Figure 349. Installing Thrust Washer and Gear

9. Install fourth speed gear flanged thrust washer, and fourth speed gear splined thrust washer. See Figure 350.

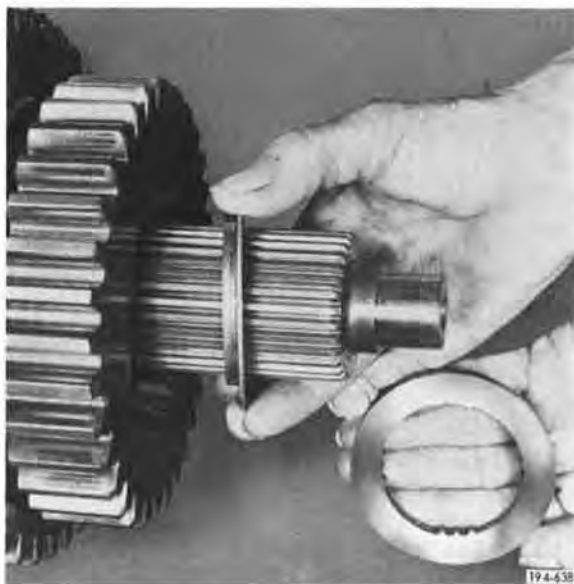


Figure 350. Installing Thrust Washers

10. Install fourth speed gear retaining snap ring, using snap ring pliers J-29045, or equivalent. See Figure 351.



Figure 351. Installing Snap Ring

11. Install fourth/fifth speed sliding clutch. See Figure 352.



Figure 352. Installing Clutch

12. Install spigot bearing onto front of mainshaft, using a soft mallet and a suitable driving sleeve. Apply force to the inner race only. See Figure 353.

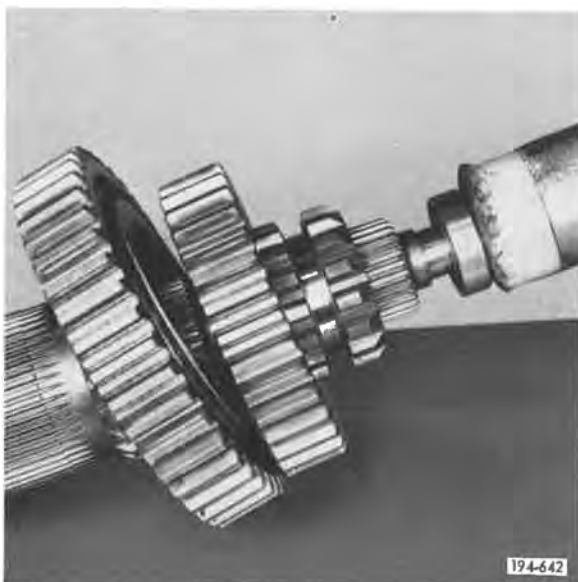


Figure 353. Installing Bearing

NOTE

If bearing is so equipped, the bearing filling notches must be facing forward, as shown in Figure 354.



Figure 354. View of Bearing Filling Notches Facing Forward

13. (TRTXL107 only) Prior to serial number 9X1342, a snap ring was used to retain the mainshaft spigot bearing, and must now be installed.

NOTE

TRTXL107 transmissions built after above serial number, and all TRTXL1070 transmissions, DO NOT have a mainshaft spigot bearing retaining snap ring.

14. Install mainshaft assembly into main box. Advance mainshaft all the way forward to completely seat the spigot bearing into the main box main drive pinion. See Figure 355.



Figure 355. Installing Mainshaft

NOTE

Beginning with Serial Number 903151, TRTXL1070 transmissions are built without oil transfer tubes and without drilled oil passages in the main drive pinion and mainshafts.

15. Apply a light coat of grease to the front face of the second speed gear, and then place the second speed gear thrust washer onto the front face of the gear. The grease will hold the thrust washer in position during installation. See Figure 356.



Figure 356. Installing Thrust Washer

16. Install second speed gear and thrust washer (beveled side of clutch teeth toward front of transmission), and engage with countershaft second speed gears. See Figure 357.



Figure 357. Installing Second Speed Gear

17. Secure first speed gear thrust washer to the front face of the first speed gear with a light coat of grease, and then install the first speed gear and thrust washer (beveled side of clutch teeth toward rear of transmission), and engage with countershaft first speed gears. See Figure 358.



Figure 358. Installing First Speed Gear

18. Install first speed gear sliding clutch. See Figure 359.



Figure 359. Installing Clutch

19. Install main box countershaft selective thrust washers on each of the three countershafts. See Figure 360.



Figure 360. Installing Washers

20. Install thrust washer retaining snap rings, using snap ring pliers J-6435, or equivalent. See Figure 361.



Figure 361. Installing Snap Rings

CAUTION

Before measuring mainshaft end-play, the three countershafts must be secured in their proper operating position. This may be done

either by installing front compound case to main case, or by temporarily installing the front compound countershaft front bearing covers onto the front of the main case countershafts.

21. Measure mainshaft end-play clearance (each countershaft) by inserting a feeler gauge between the mainshaft first speed gear and the countershaft selective thrust washer. Hold each thrust washer squarely against its snap ring when measuring. End-play to be 0.015 to 0.035 inches, and must not vary more than 0.005 inches among the three countershafts. Refer to Torque and Tolerance Table, Item 20, for available thicknesses of selective thrust washers. See Figure 362.

NOTE

If too much end-play is measured, use thicker washers. If too little end-play is measured, use thinner washers.



Figure 362. Measuring End-Play

22. If mainshaft oil tube was removed previously, install it now using a suitable driver. See Figure 363.



Figure 363. Installing Oil Tube

23. Install compound main drive gear. See Figure 364.



Figure 364. Installing Gear

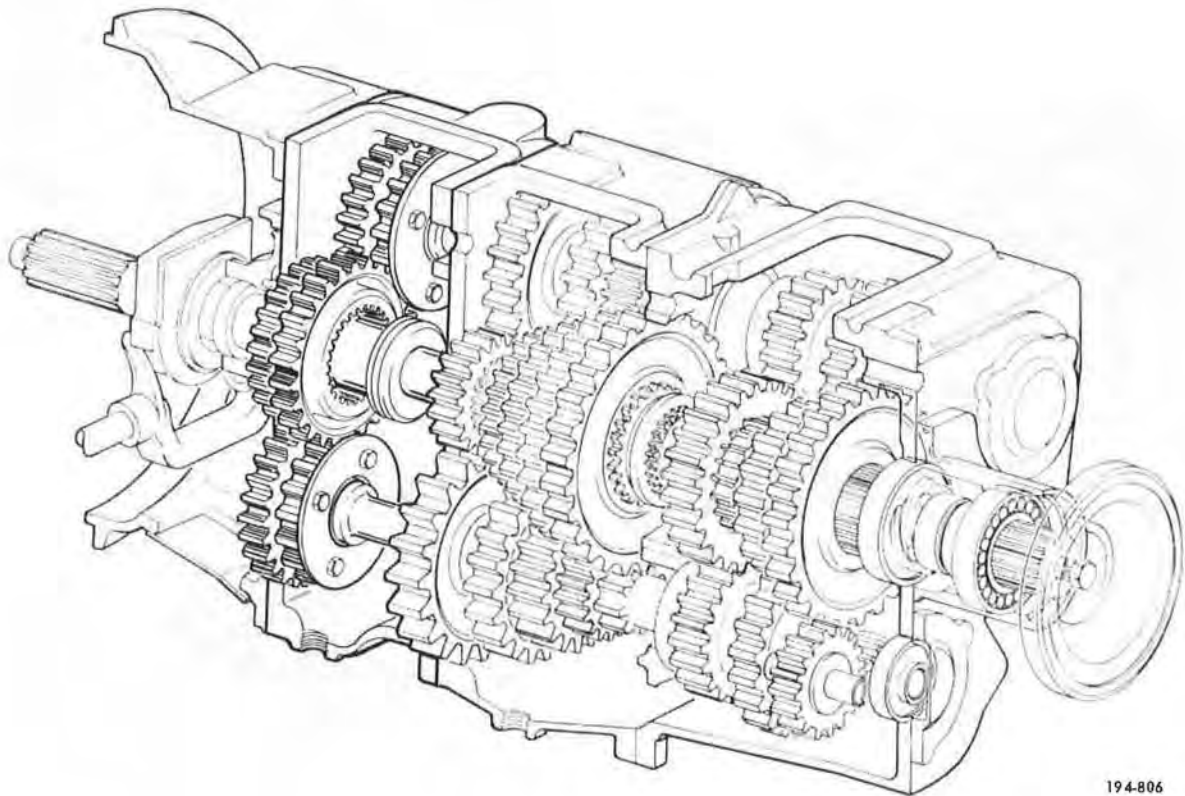
24. Install compound main drive gear retaining snap ring, using snap ring pliers J-6435, or equivalent. See Figure 365.



Figure 365. Installing Snap Ring

NOTES

Front Compound Reassembly



1. Install the gear retaining thrust washers loosely on each of the front compound countershafts. See Figure 366.

2. Install the three countershaft assemblies into the front compound. See Figure 367.



Figure 366. Installing Washers



Figure 367. Installing Countershaft

3. Place a steel plate under front end of each countershaft, and then install rear bearing using a driver that applies force to the bearing inner race only. See Figure 368.



Figure 368. Installing Bearing

4. Remove the steel plate. Place countershafts in position, and install rear bearing retaining snap ring, using snap ring pliers J-4646, or equivalent. See Figure 369.



Figure 369. Installing Snap Ring

5. Install front compound main drive pinion into box. See Figure 370.



Figure 370. Installing Pinion

6. Align the timing O-marks on the main drive pinion with the O-marks on each of the countershaft gears, and mesh gears. See Figure 371.

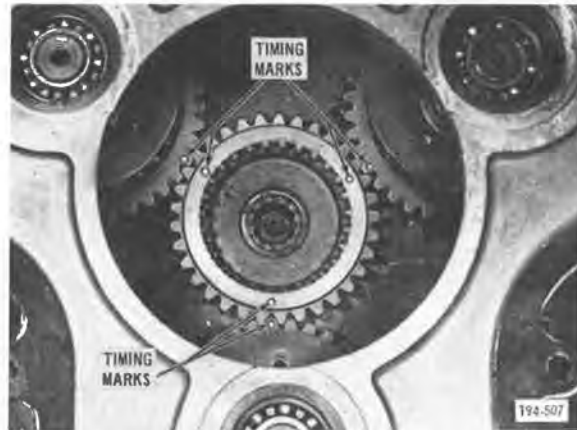


Figure 371. Aligning O-marks

7. Position transmission horizontally. Install front compound main drive pinion bearing positioning snap ring, using snap ring pliers J-25445, or equivalent. See Figure 372.



Figure 372. Installing Snap Ring

8. Install front compound countershaft front bearing positioning snap ring, using snap ring pliers J-25445, or equivalent. See Figure 373.



Figure 373. Installing Snap Ring

9. Tap main drive pinion and countershafts rearward until positioning snap rings seat against case.

10. Place oil pump vane into its bore in the compound main drive pinion. See Figure 374.

NOTE

Vane should be flush with the right-hand side of the shaft, and protruding slightly from the left-hand side (as observed from the front of the transmission). This will assure alignment of the vane with the eccentric bore in the cover when the cover is installed.



Figure 374. Installing Pump Vane

11. Install main drive pinion bearing cover gasket. See Figure 375.

NOTE

Notice pencil pointing to oil hole in gasket, which must align with oil hole in front compound case.

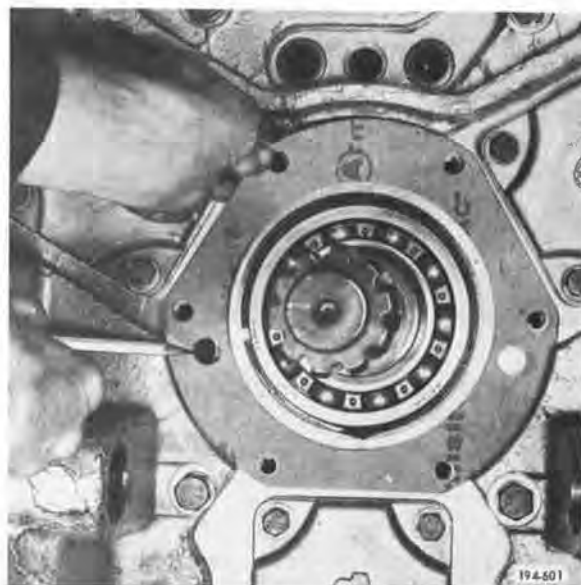
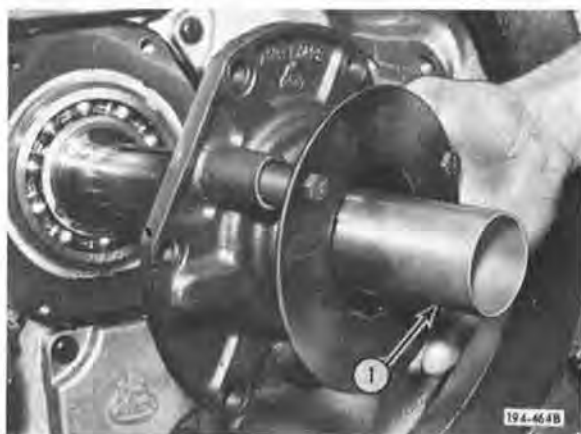


Figure 375. Installing Gasket

12. For pull-type clutches only: Install front compound main drive pinion bearing cover, using tool J-23796 to protect sealing lip of oil seal. See Figure 376.



1. Tool J-23796 For Use With Pull-Type Clutches Only

Figure 376. Installing Cover

13. For push-type clutches only: Install front compound main drive pinion bearing cover, using care not to damage sealing lip of oil seal. No special tool is required. See Figure 377.

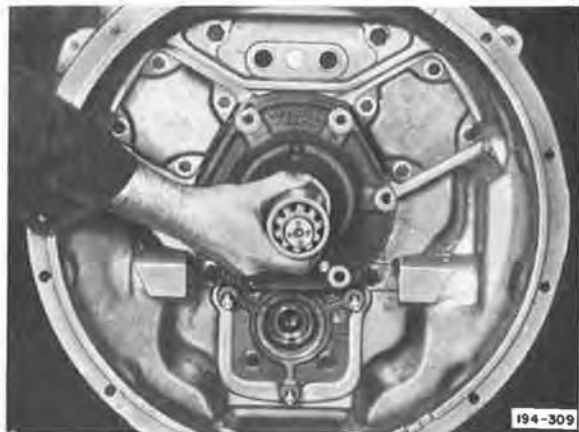


Figure 377. Installing Cover

15. Install O-ring in each of the three front compound countershaft front bearing covers. See Figure 379.



Figure 379. Installing O-Ring

14. Install front compound main drive pinion bearing cover capscrews and tighten to 36 to 44 lb. ft. torque. Refer to Torque and Tolerance Table, Item 8. See Figure 378.

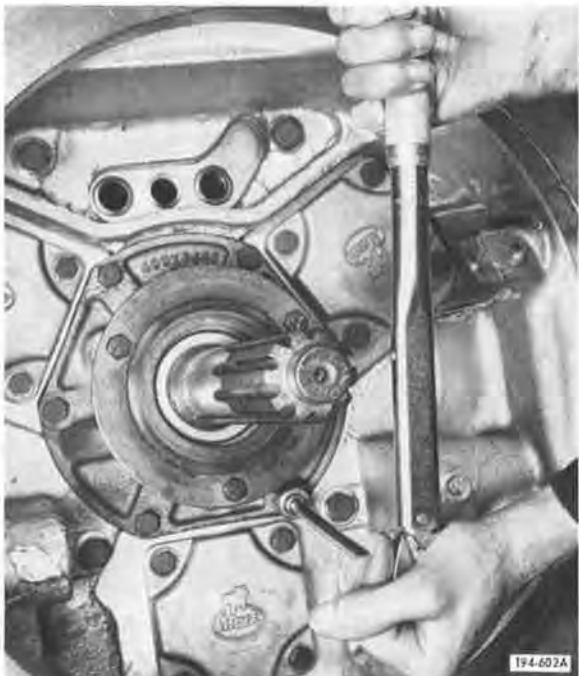


Figure 378. Torquing Capscrews

16. Place covers in position, install capscrews, and tighten to 24 to 30 lb. ft. torque. Refer to Torque and Tolerance Table, Item 5. See Figure 380.



Figure 380. Torquing Capscrews

17. Assemble the Lo-range gear onto the front compound main drive pinion sliding clutch. See Figure 381.



Figure 381. Installing Gear

19. Install existing split adjusting shims between the three front compound countershaft Lo-range gears and their gear retaining thrust washers. See Figure 383.

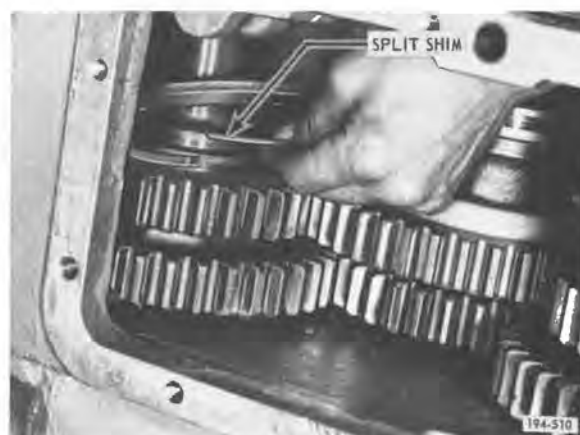


Figure 383. Installing Shims

18. Position front compound vertically. Install sliding clutch assembly, engaging Lo-range gear teeth with the teeth of the three countershaft gears. See Figure 382.



Figure 382. Installing Clutch and Lo-range Gear

20. Install thrust washer capscrews and run down finger tight. So that gears cannot turn, place a soft iron wedge between the gear teeth, and tighten capscrews to 24 to 30 lb. ft. torque (reference Torque and Tolerance Table, Item 6). See Figure 384.

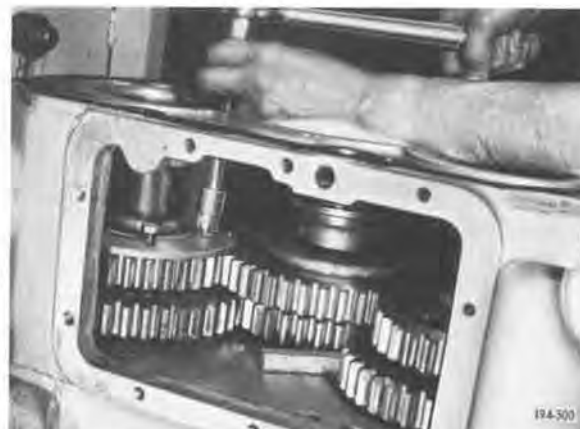


Figure 384. Torquing Capscrews

21. Position front compound horizontally. Using two identical feeler gauges inserted between compound main drive pinion and Lo-range gear, check for 0.010 to 0.020 inch end play clearance (reference Torque and Tolerance Table, Item 24). See Figure 385.



Figure 385. Measuring End Play

NOTE

The adjusting shims are split so that they may be easily installed without removing the countershafts. If end play is less than recommended, add split shims as required. Remove shims as required if clearance is greater than recommended.

Main Components Reassembly

1. Install a new main case to rear case gasket. See Figure 386.



Figure 386. Installing Gasket

2. Install rear case to main case, using a hoist and a lifting eye. See Figure 387.

WARNING

Keep hands clear of mating surfaces when installing rear case to main case, to avoid serious personal injury.

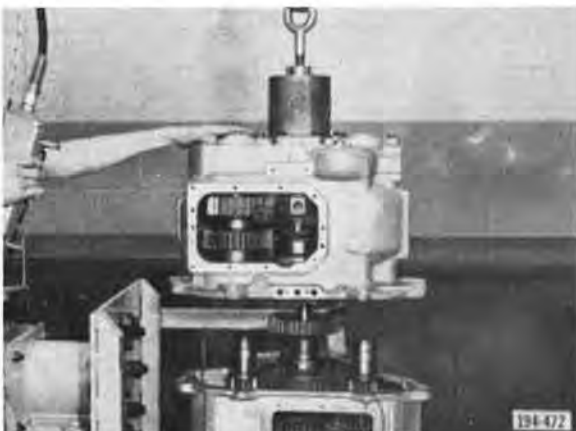


Figure 387. Installing Rear Case

3. Align cases, and install main case to rear case dowel bolts and nuts, and tighten to 66 to 80 lb. ft. torque. Refer to Torque and Tolerance Table, Item 12. See Figure 388.



Figure 388. Installing Dowel Bolt

4. Install main case to rear case capscrews, and tighten to 56 to 70 lb. ft. torque. Refer to Torque and Tolerance Table, Item 11. See Figure 389.



Figure 389. Installing Capscrew

5. Remove wire previously installed to hold Lo/Hi shift fork. See Figure 390.

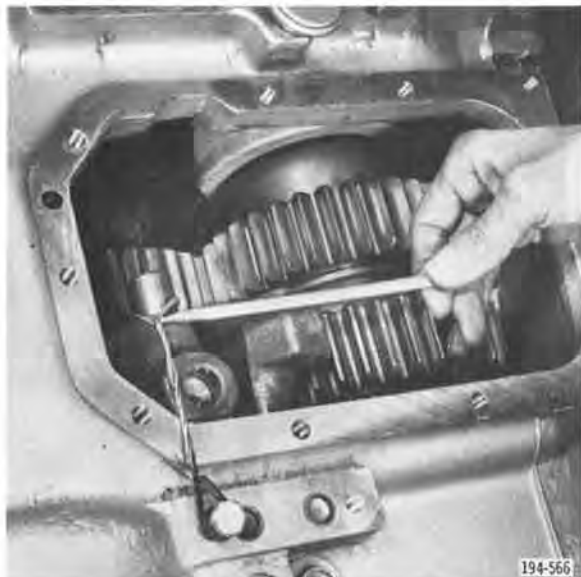


Figure 390. Wire Holding Shift Fork

6. Install drive flange (or yoke) on rear mainshaft. See Figure 391.



Figure 391. Installing Drive Flange

7. Lubricate threads of drive flange (or yoke) clamp plate screw, and install clamp plate and screw. See Figure 392.



Figure 392. Lubricating Screw

CAUTION

Premature spigot bearing failure may occur if drive flange (or yoke) is driven on by hitting with a hammer. Install only by pulling the flange (or yoke) with the clamp plate and capscrew.

8. Place two sliding clutches into engaged position, which will lock up the mainshaft, and tighten drive flange (or yoke) clamp plate capscrew to 474 to 574 lb. ft. torque. Refer to Torque and Tolerance Table, Item 16. See Figure 393.



Figure 393. Torquing Capscrew

9. Install second/third speed shift fork. See Figure 394.

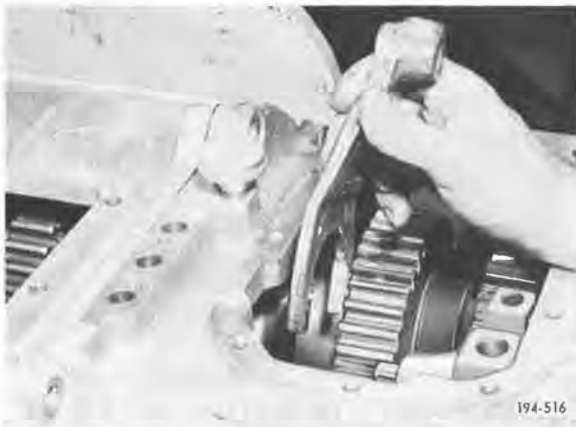


Figure 394. Installing Shift Fork

10. (Rearward Controls Only) Slide second/third speed shift rail through front of main box, and install second/third speed shifter onto rail. See Figure 395.



Figure 395. Installing Shifter

11. (Rearward Controls Only) Advance rail through intermediate bore of case and through second/third speed shift fork, until rail reaches neutral position.

12. (Rearward Controls Only) Install second/third speed shifter setscrew, and tighten to 35 to 45 lb. ft. torque. Refer to Torque and Tolerance Table, Item 10. See Figure 396.



Figure 396. Installing Setscrews

13. Install first speed shift fork onto first speed sliding clutch. See Figure 397.



Figure 397. Installing Shift Fork

14. (Rearward Controls Only) Slide first speed shift rail through front of case, and install first speed shifter and reverse lockout spacer onto rail. See Figure 398.



Figure 398. Installing Shifter and Spacer

15. (Rearward Controls Only) Advance first speed shift rail through intermediate bore of case and through first speed shift fork, until rail reaches neutral position. Install first speed shifter setscrew, and tighten to 35 to 45 lb. ft. torque. Refer to Torque and Tolerance Table, Item 10.

16. (Forward Controls Only) Install first speed shift rail, and second/third speed shift rail, through front of case. Advance them through intermediate bore and through their respective shift forks, until they reach neutral position

17. Install fourth/fifth speed shift fork onto its sliding clutch. See Figure 399.



Figure 399. Installing Shift Fork

18. Slide fourth/fifth speed shift rail through front of case, into and through hub of fourth/fifth speed shift fork, into intermediate bore of case, until rail reaches neutral position. See Figure 400.

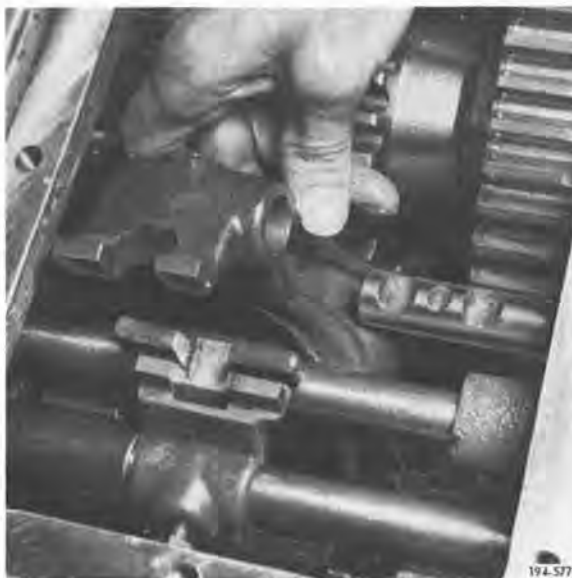


Figure 400. Sliding Shift Rail Rearward

19. Install setscrew into fourth/fifth speed shift fork, and tighten to 35 to 45 lb. ft. torque. Refer to Torque and Tolerance Table, Item 10. See Figure 401.



Figure 401. Installing Setscrew

20. Install setscrews into first speed shift fork, and into second/third speed shift fork, and tighten to 35 to 45 lb. ft. torque. Refer to Torque and Tolerance Table, Item 10. See Figure 402.



Figure 402. Installing Setscrew

21. Install a new gasket, and then install rear compound and main box to front compound, using a hoist and a lifting eye. See Figure 403.

WARNING

Keep hands clear of mating surfaces when installing rear and main cases to front case, to avoid serious injury.

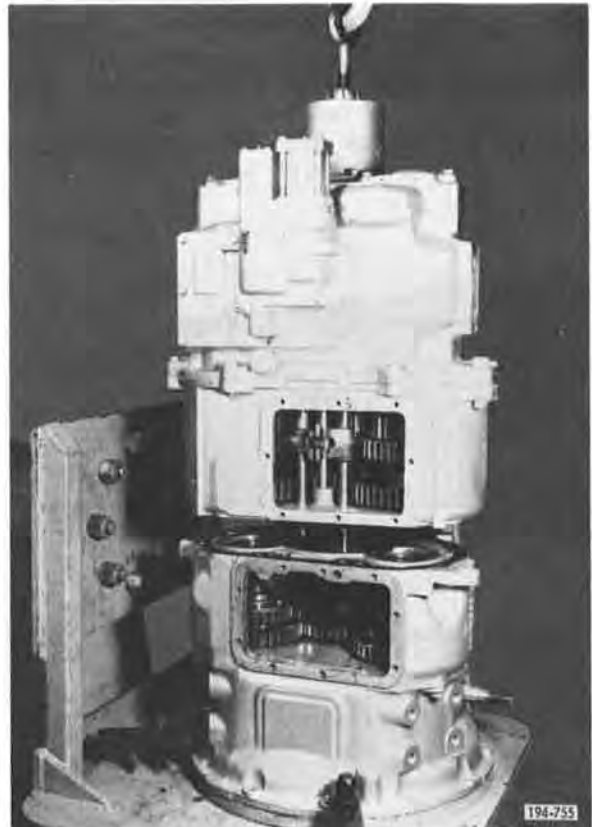


Figure 403. Installing Main Case and Rear Case

22. Install the front compound case to main case capscrews, located on the outside of the cases, and tighten to 84 to 94 lb. ft. torque. Refer to Torque and Tolerance Table, Item 14. See Figure 404.



Figure 404. Installing Capscrews

23. Install the two front compound case to main case capscrews, located inside the front compound case, and tighten to 84 to 94 lb. ft. torque. Refer to Torque and Tolerance Table, Item 14. See Figure 405.



Figure 405. Installing Capscrews

25. (Forward Controls Only) Install second/third speed shifter and fourth/fifth speed shifter onto their shift rails, and tighten setscrews to 35 to 45 lb. ft. torque. Refer to Torque and Tolerance Table, Item 10. See Figure 407.



Figure 407. Installing Shifter and Setscrew

24. (Forward Controls Only) Install reverse lockout spacer and first speed shifter onto end of first speed shift rail. See Figure 406.



Figure 406. Installing Spacer and Shifter.

26. Install front compound shift fork. See Figure 408.



Figure 408. Installing Shift Fork

27. Slide front compound shift rail through front of case, into and through front compound shift fork, and through intermediate bore, until it reaches neutral position. See Figure 409.



Figure 409. Installing Shift Rail

29. (Rearward Controls Only) Install front compound shifter onto front compound shift rail. See Figure 411.

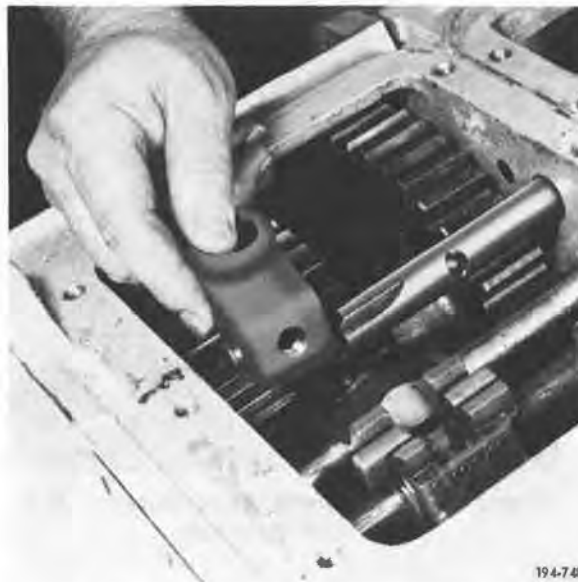


Figure 411. Installing Shifter

28. Install front compound shift fork setscrew, and tighten to 35 to 45 lb. ft. torque. Refer to Torque and Tolerance Table, Item 10. See Figure 410.



Figure 410. Installing Setscrew

30. (Rearward Controls Only) Install front compound shifter setscrew, and tighten to 35 to 45 lb. ft. torque. Refer to Torque and Tolerance Table, Item 10. See Figure 412.



Figure 412. Installing Setscrew

31. Install poppet balls and springs. See Figure 413.



Figure 413. Installing Poppet Balls and Springs

32. Install poppet ball cover with capscrews, and tighten capscrews to 24 to 30 lb. ft. torque. Refer to Torque and Tolerance Table, Item 4. See Figure 414.



Figure 414. Installing Cover

33. Install a new main box top cover gasket. See Figure 415.



Figure 415. Installing Gasket

34. Install main box top cover, and tighten capscrews to 24 to 30 lb. ft. torque. Refer to Torque and Tolerance Table, Item 3. See Figure 416.



Figure 416. Installing Cover

35. Install front compound poppet ball and spring. See Figure 417.



Figure 417. Installing Spring and Ball

36. Install a new front compound top cover gasket. See Figure 418.



Figure 418. Installing Gasket

37. Install front compound top cover, and tighten capscrews to 24 to 30 lb. ft. torque. Refer to Torque and Tolerance Table, Item 3. See Figure 419.



Figure 419. Installing Cover

38. Install clutch brake onto input shaft. See Figure 420.



Figure 420. Installing Clutch Brake

39. Insert clutch release stub shaft into clutch release yoke, place in position in bell housing, and tap stub shaft into housing. See Figure 421.

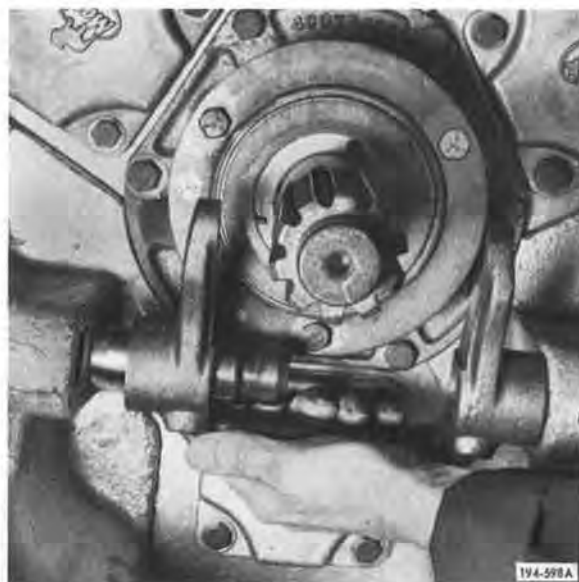


Figure 421. Installing Yoke and Stub Shaft

40. Install setscrew and tighten to 14 to 24 lb. ft. torque. Refer to Torque and Tolerance Table, Item 1.

41. Tap splined clutch release shaft into housing from outside, and install Woodruff key. See Figure 422.

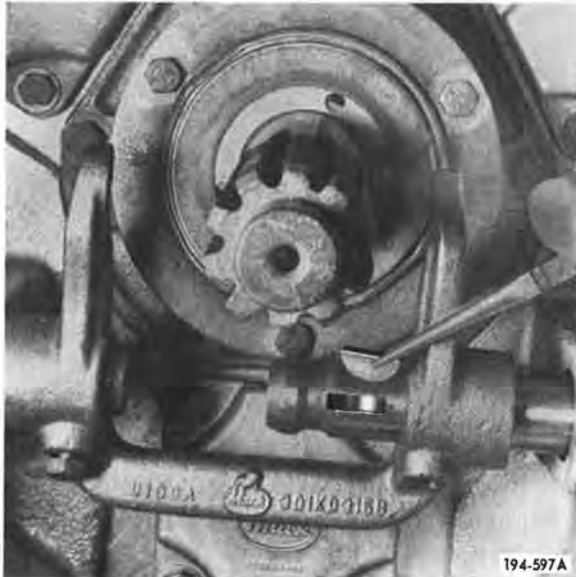


Figure 422. Installing Woodruff Key

42. Tap splined clutch release shaft outward to seat Woodruff key in keyway of clutch release yoke.

43. Install setscrew and tighten to 14 to 24 lb. ft. torque. Refer to Torque and Tolerance Table, Item 1. See Figure 423.

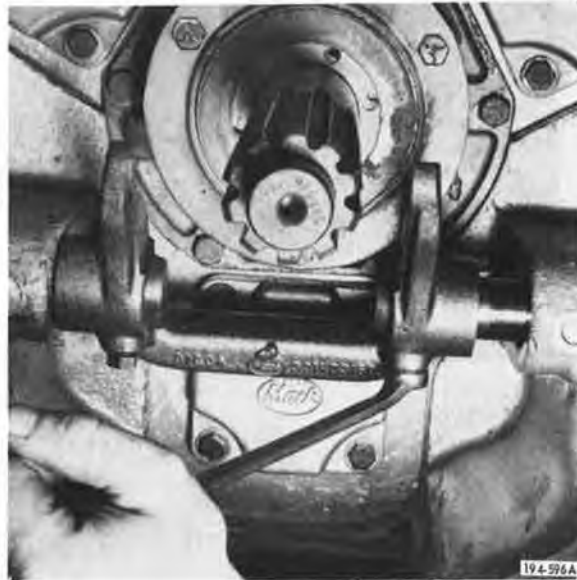


Figure 423. Installing Setscrew

Air Shift Cover Adjustment and Installation (Non-Current Production)

1. Temporarily install air shift cover assembly on rear compound. See Figure 424.



Figure 424. Installing Cover

2. Connect shop air lines to the Lo/Hi and Direct fittings of shift cover, and apply equal air to both sides.

3. Insert screw driver into slot provided in forward end of Lo/Hi shift rail. See Figure 425.



1. Air Lines

Figure 425. Adjusting Rail

4. Turn shift rail clockwise with screwdriver, and at the same time rotate output flange (or yoke) until gear clash is heard.

5. Now turn shift rail counter-clockwise, counting number of turns until gear clash is again heard.

6. Turn shift rail clockwise again for half the number of turns counted from gear clash to gear clash. Shift rail will now be in neutral position.

7. Disconnect air lines and remove air shift cover from transmission.

8. Lock Lo/Hi shifter in neutral position by tightening the locknut. See Figure 426.

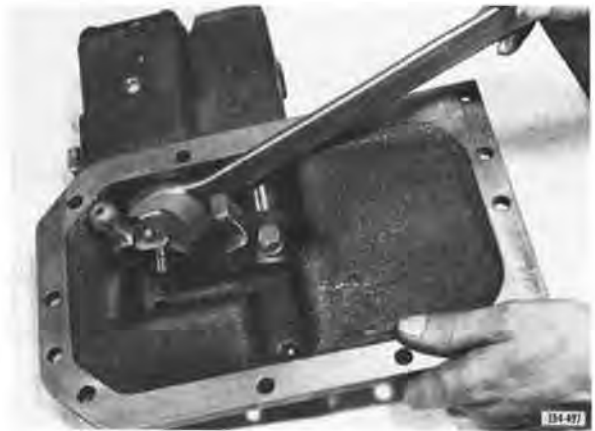


Figure 426. Tightening Locknut

9. Install expansion plug into shift cover at front end of Lo/Hi shift rail. This plug was previously omitted (Item 31 in Figure 253, or Item 27 in Figure 273).

10. Install a new air shift cover gasket. See Figure 427.



Figure 427. Installing Gasket

11. Install air shift cover, being careful that shift levers engage shift forks. See Figure 428.

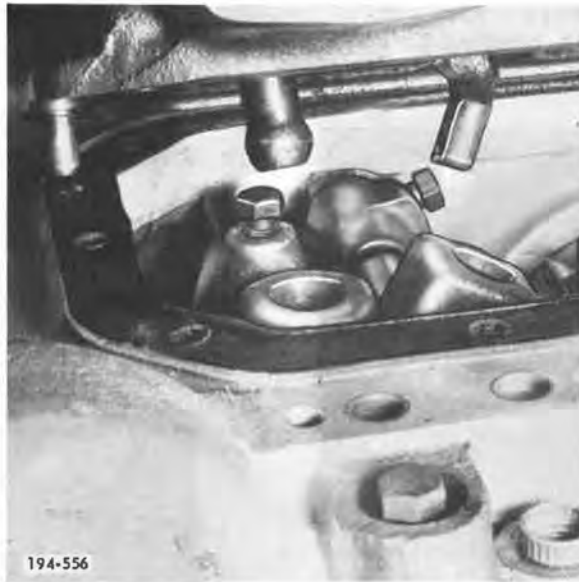


Figure 428. Installing Cover

12. Install capscrews, and tighten to 24 to 30 lb. ft. torque. Refer to Torque and Tolerance Table, Item 3.

Air Shift Cover Installation
(Current Production)

1. Install a new air shift cover gasket. See Figure 429.



Figure 429. Installing Gasket

2. Install air shift cover, being careful that shift levers engage shift forks. See Figure 430.

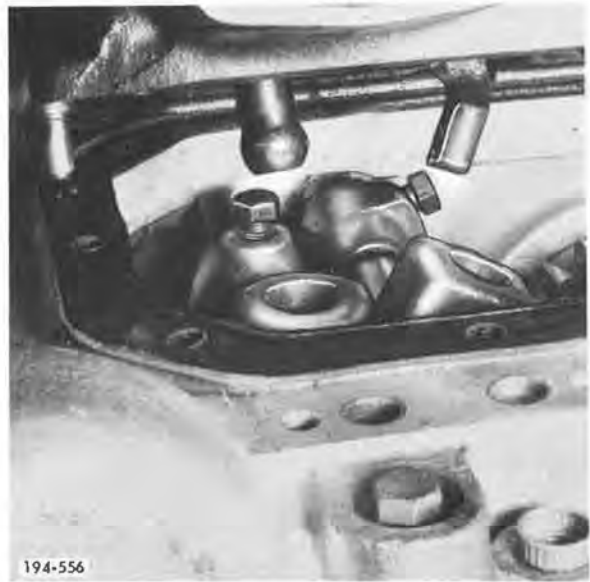


Figure 430. Installing Cover

3. Install capscrews, and tighten to 24 to 30 lb. ft. torque. Refer to Torque and Tolerance Table, Item 3.

NOTES

POWER FLOW DIAGRAMS
TRTXL1070

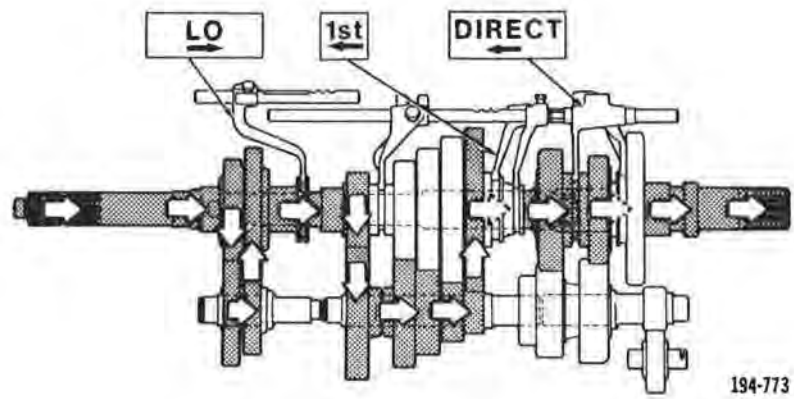


Figure 431. Lo - First - Direct

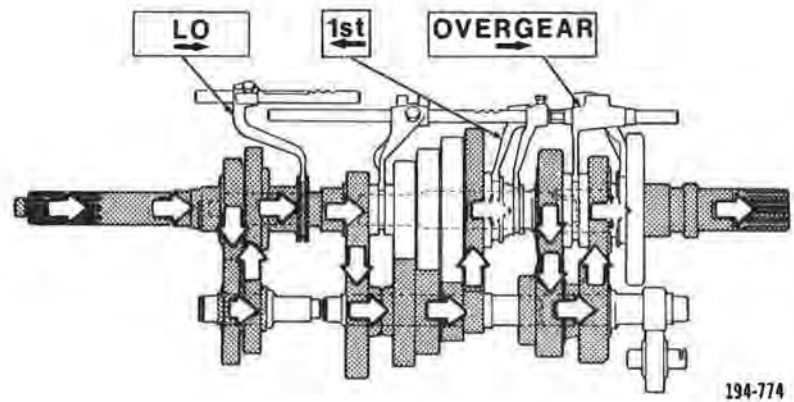


Figure 432. Lo - First - Overgear

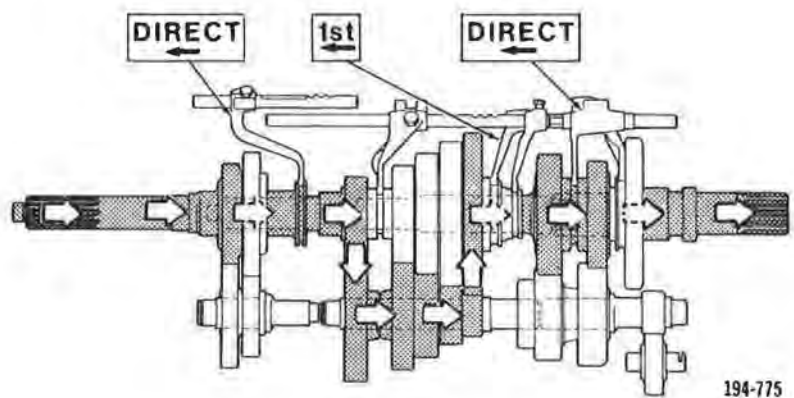


Figure 433. Direct - First - Direct

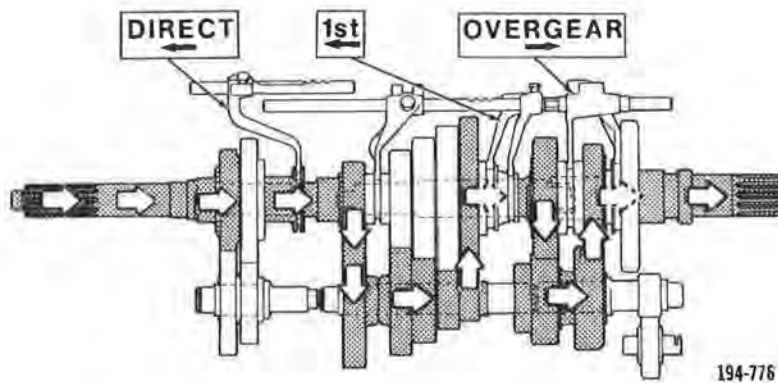


Figure 434. Direct - First - Overgear

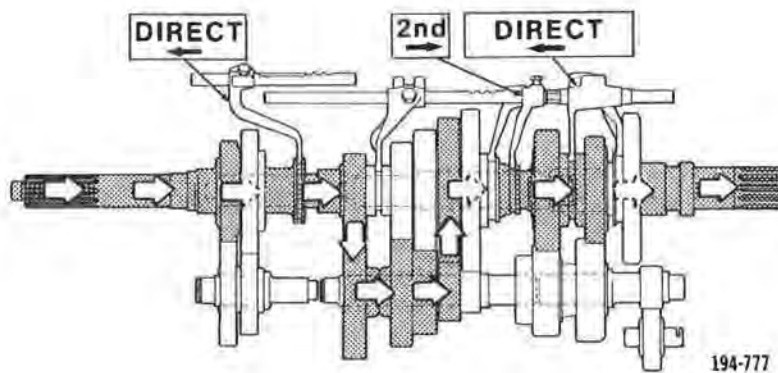


Figure 435. Direct - Second - Direct

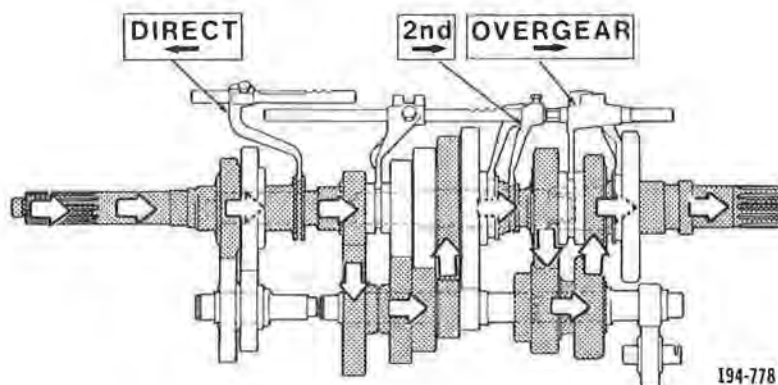
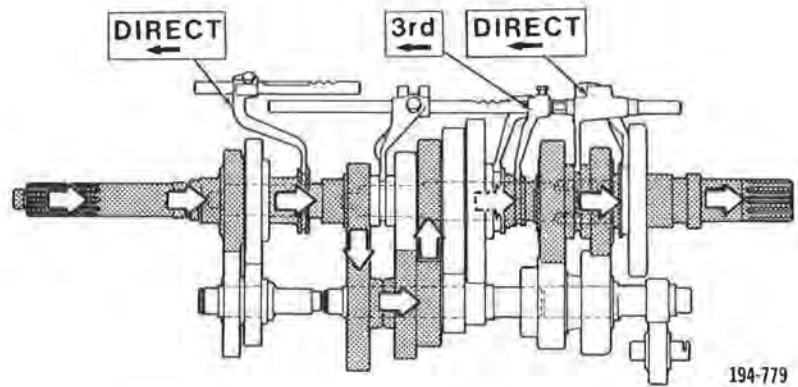
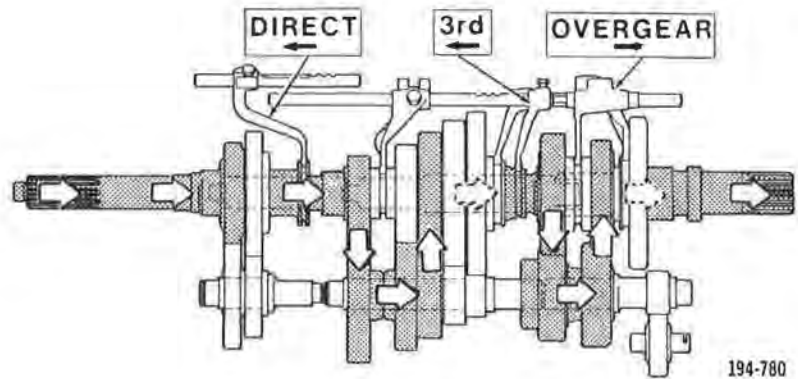


Figure 436. Direct - Second - Overgear



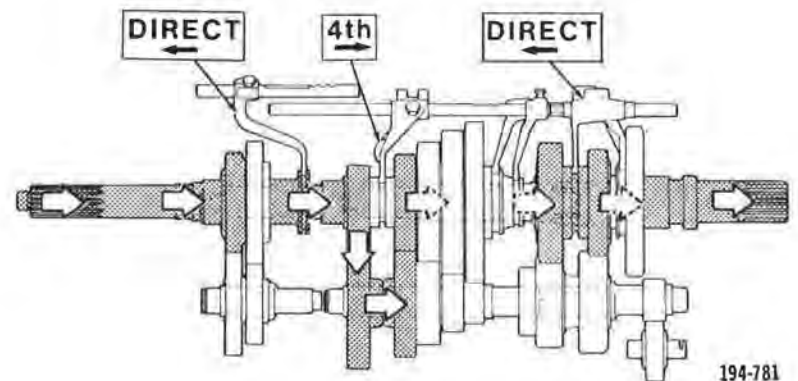
194-779

Figure 437. Direct - Third - Direct



194-780

Figure 438. Direct - Third - Overgear



194-781

Figure 439. Direct - Fourth - Direct

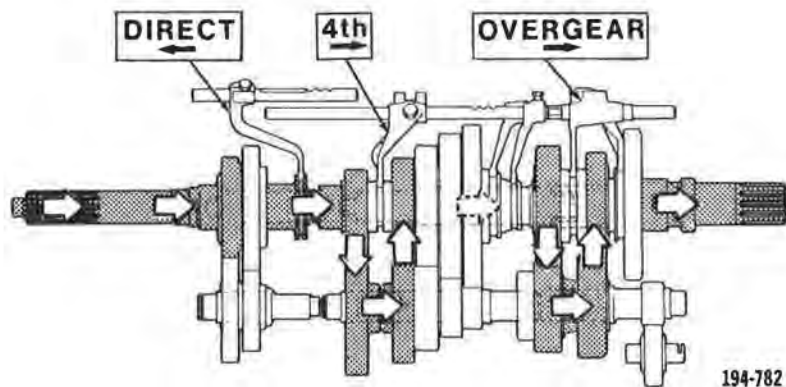


Figure 440. Direct - Fourth - Overgear

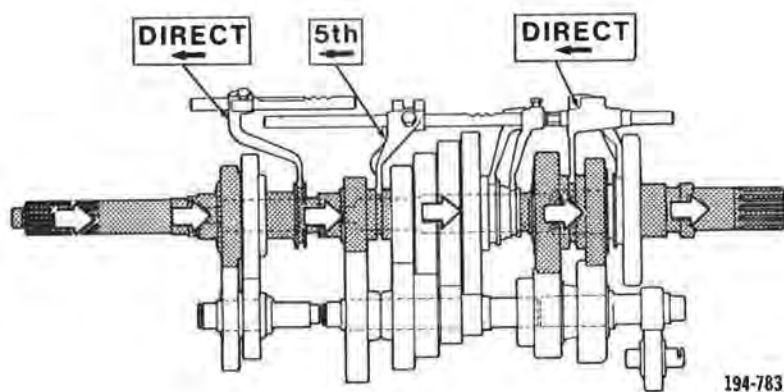


Figure 441. Direct - Fifth - Direct

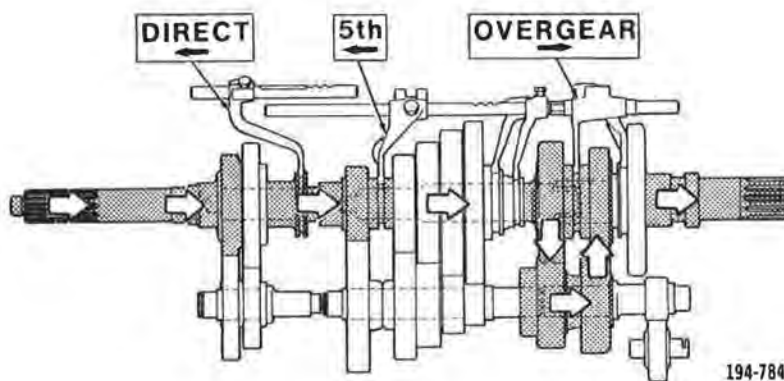


Figure 442. Direct - Fifth - Overgear

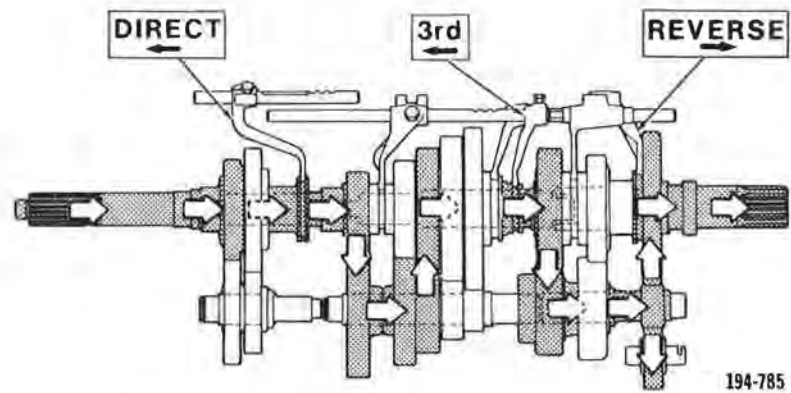
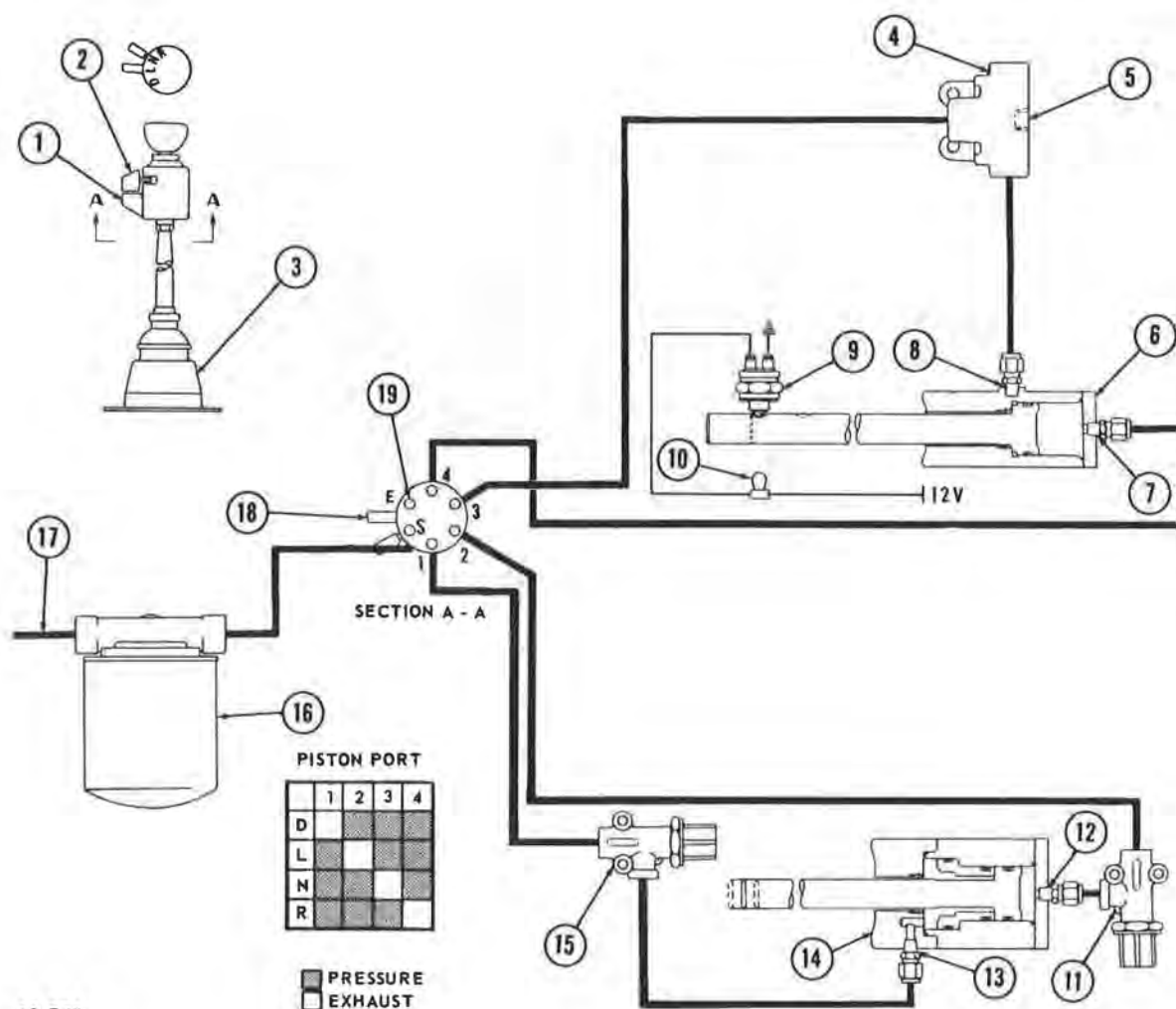


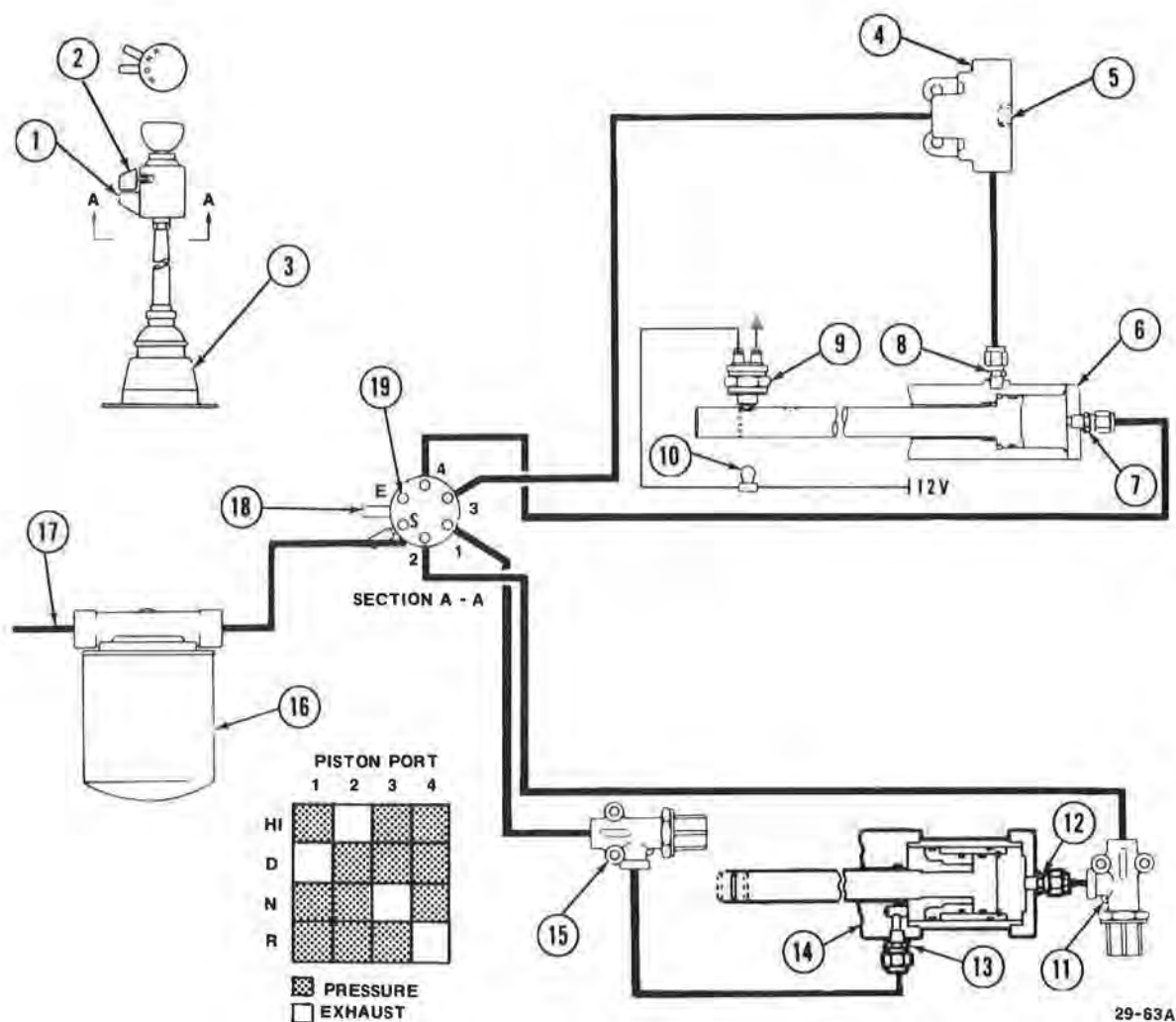
Figure 443. Reverse (Using Third)



29-57A

- | | |
|---|---|
| 1. Air Control Reference Locator | 11. Pressure Reducing Valve (60 psi delivery) |
| 2. Air Control Select Lever | 12. Port No. 2 |
| 3. Gear Select Lever | 13. Port No. 1 |
| 4. Quick Release Valve | 14. Lo/Direct Shift Cylinder |
| 5. Exhaust | 15. Pressure Reducing Valve (60 psi delivery) |
| 6. Reverse Shift Cylinder | 16. Air Filter |
| 7. Port No. 4 | 17. Air Supply |
| 8. Port No. 3 | 18. Selectair Valve |
| 9. Back-Up Switch (normally open) | 19. Exhaust |
| 10. Amber Indicator Light (on in reverse) | |

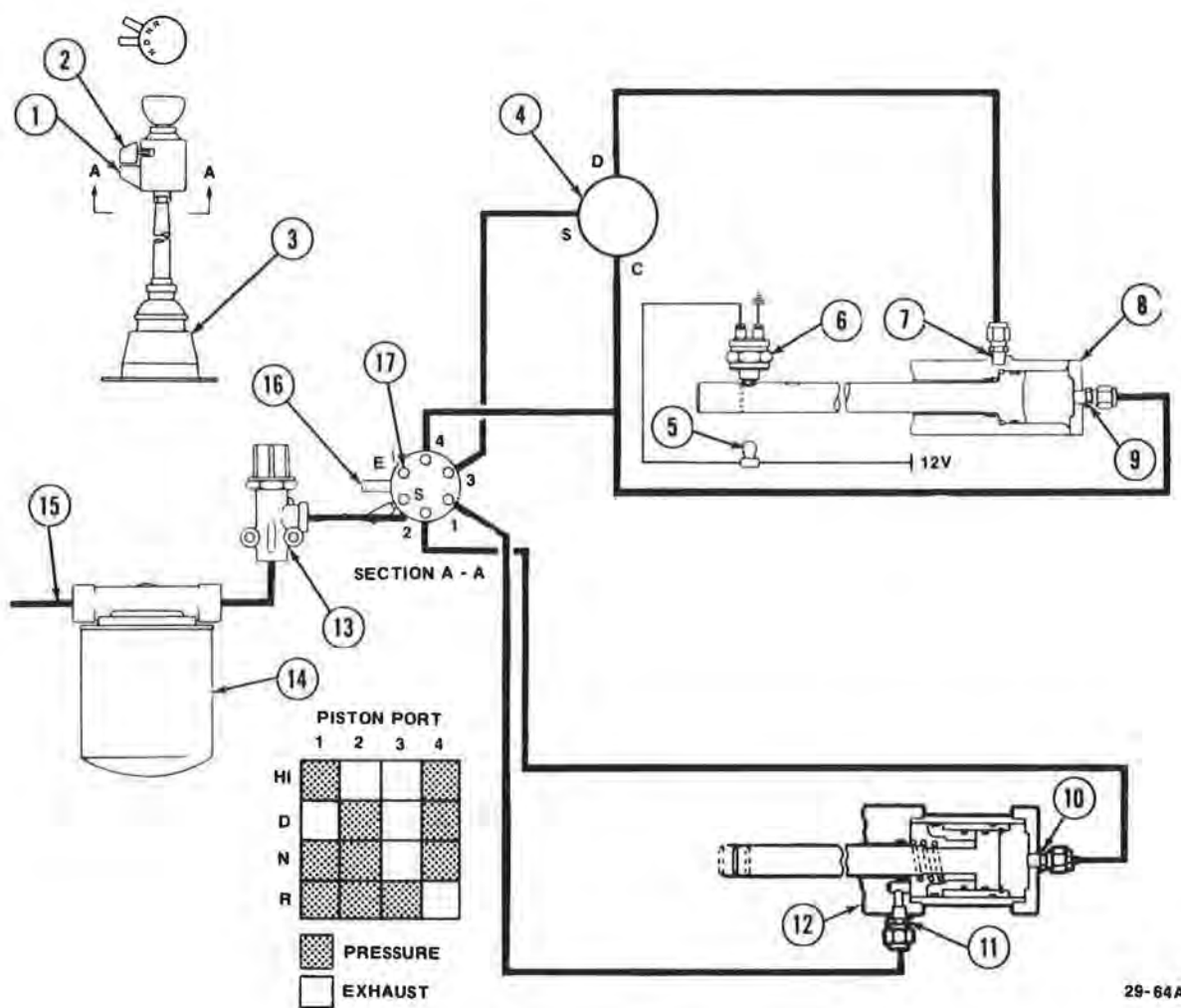
Figure 444. Air Control System Schematic
(TRTXL107 Prior to Serial Number 9G9071)



29-63A

1. Selectair Valve Reference Locator
2. Selectair Valve Select Lever
3. Gear Shift Lever
4. Quick Release Valve
5. Exhaust
6. Reverse Shift Cylinder
7. Port No. 4
8. Port No. 3
9. Back-Up Switch (normally open)
10. Amber Indicator Light (on in reverse)
11. Pressure Reducing Valve (60 psi delivery)
12. Port No. 2
13. Port No. 1
14. Hi/Direct Shift Cylinder
15. Pressure Reducing Valve (60 psi delivery)
16. Air Filter
17. Air Supply
18. Selectair Valve
19. Exhaust

Figure 445. Air Control System Schematic
(TRTXL107, Serial Number 9G9071 and later)
(TRTXL1070 Prior to Serial Number 8S6798)



29-64A

1. Selectair Valve Reference Locator
2. Selectair Valve Select Lever
3. Gear Shift Lever
4. Inversion Valve
5. Amber Indicator Light (on in reverse)
6. Back-Up Switch (normally open)
7. Port No. 3
8. Reverse Shift Cylinder
9. Port No. 4
10. Port No. 2
11. Port No. 1
12. Hi/Direct Shift Cylinder
13. Pressure Reducing Valve (70 psi delivery)
14. Air Filter
15. Air Supply
16. Selectair Valve
17. Exhaust

Figure 446. Air Control System Schematic
(TRTXL1070, Serial Number 8S6798 and later)

TOOLS

- S500 Main Box Countershaft Rear Bearing Inner Race Removal Tool
- S501 Rear Compound Mainshaft Front Bearing Removal Tool
- S593C Main Box Countershaft Front Bearing, and
Rear Compound Countershaft Rear Bearing Removal Tool

Above tools available from:

Shel's Supply and Equipment Company
496 - 504 Orange Avenue
West Haven, Connecticut 06516
Phone (203) 934-8544

- J-23387-01 Front Compound Main Drive Pinion Bearing
Cover Sleeve Removal Tool
- J-23796 Front Compound Main Drive Pinion Bearing
Cover Installation Tool
- J-28668 Reverse Idler Shaft Removal Tool
- J-29031 Drive Flange Removal Tool
- J-4646 Snap Ring Pliers
- J-6435 Snap Ring Pliers
- J-24339 Snap Ring Pliers
- J-25445 Snap Ring Pliers
- J-29045 Snap Ring Pliers
- J-25031-2 Front Compound Countershaft Rear Bearing Removal Tool and
Front Compound Countershaft Front Bearing Removal Tool

Above tools available from:

Kent-Moore Tool Division
Kent Moore Corporation
29784 Little Mack Avenue
Roseville, Michigan 48066
Telephone: (313) 774-9500

- CG-250 Main Box Mainshaft Front Spigot Bearing Removal Tool
- CG-270 Rear Compound Countershaft Front Bearing Removal Tool

Above tools available from:

Snap-On Tools Corporation
Kenosha, Wisconsin 53140
Phone (414) 654-8681

- 956 Front Compound Main Drive Pinion Spigot Bearing Removal
Tool

Above tool available from: Owatonna Tool Co.
Owatonna, MN 55060
Phone (507) 451-5310

TORQUE AND TOLERANCE TABLE

<u>Item</u>	<u>Location</u>	<u>Lb. Ft.</u>
<u>Screw Torques</u>		
1	Clutch release yoke setscrew	14 to 24
2	Lo/Hi shift cylinder cover capscrews	24 to 30
3	Transmission case top cover capscrews	24 to 30
4	Poppet ball cover capscrews	24 to 30
5	Countershaft front cover capscrews	24 to 30
6	Front compound countershaft gear retaining thrust washer capscrews	24 to 30
7	Bell housing to flywheel housing capscrews	36 to 44
8	Front compound and main box main drive pinion bearing cover capscrews	36 to 44
9	Countershaft rear cover capscrews	36 to 44
10	Shifter and shift fork setscrews	35 to 45
11	Main case to rear case capscrews	56 to 70
12	Main case to rear case dowel bolts	66 to 80
13	Bell housing to front compound case capscrews	84 to 94
14	Front compound case to main box case capscrews	84 to 94
15	Mainshaft rear cover capscrews	106 to 130
16	Mainshaft drive flange (or yoke) clamp plate capscrews	474 to 574
		<u>Lb. In.</u>
17	Reverse shift cylinder cover capscrews	81 to 101

Tolerances

18	All Forks in Sliding Clutches			
		Minimum New	Maximum New	Maximum Wear
	Side Clearance	0.005	0.020	0.050*

* If unit has experienced disengagement, side clearance must not exceed 0.030 maximum.

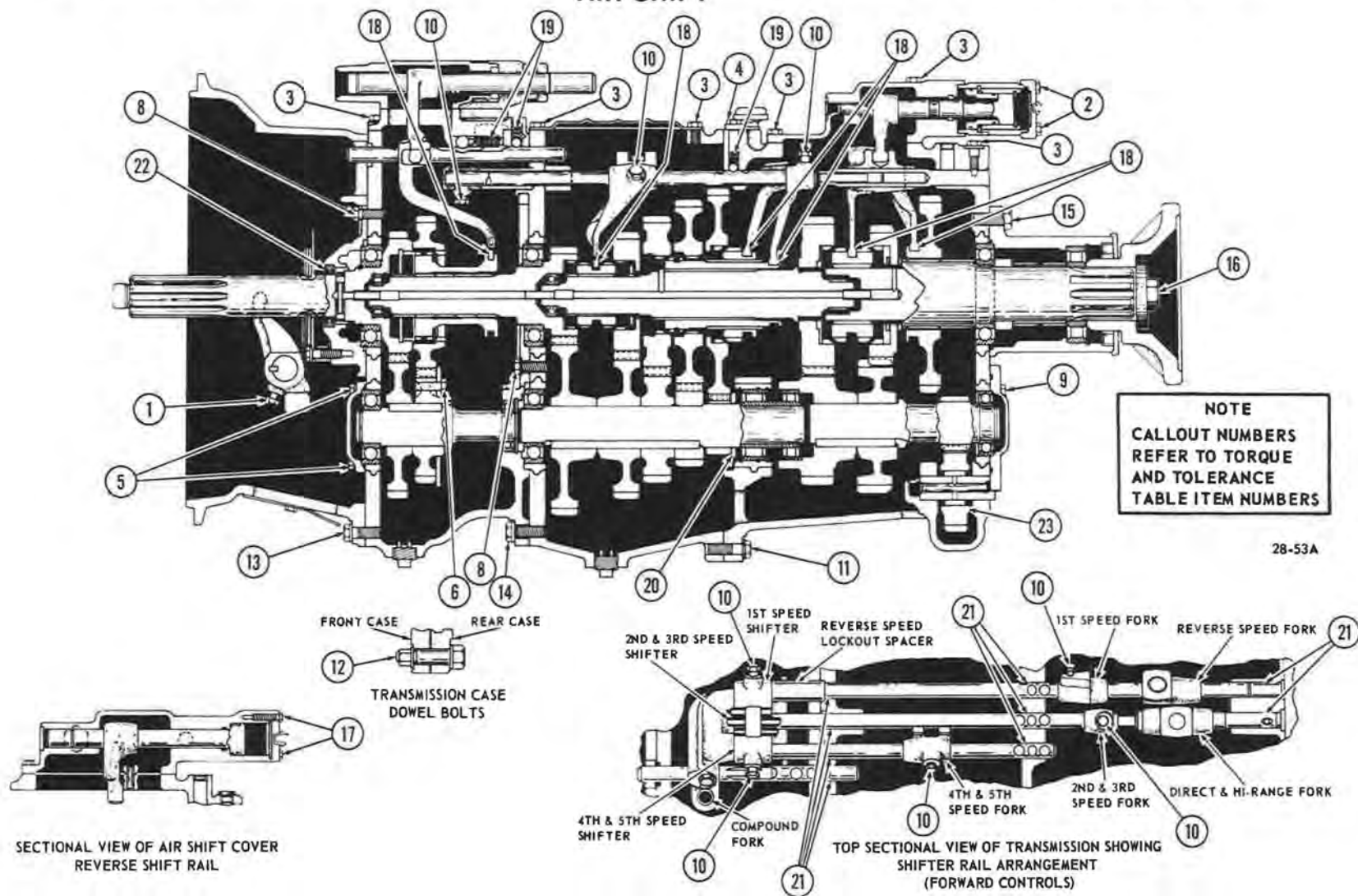
19	Shift rail poppet springs
	Free Height 2.25 inches
	Test at 1-17/32 inches 42.4 pounds

TORQUE AND TOLERANCE TABLE
(continued)

<u>Item</u>	<u>Thrust Washer</u>	<u>Available Thickness</u>
20	First Speed Gear: Select correct thickness to obtain 0.015 to 0.035 inch mainshaft gear end play.	0.143 inch 0.158 inch 0.173 inch 0.188 inch 0.203 inch 0.218 inch
	NOTE	0.233 inch 0.248 inch 0.263 inch
	The 0.015 to 0.035 inch mainshaft gear end play cannot vary more than 0.005 inch among the three countershaft measurements.	
21	Shift rail to mating housing bore	0.010 inch maximum
22	Oil pump vane to mating bore	0.006 inch maximum
23	Reverse idler gear end play	0.003 inch minimum to 0.023 inch maximum
24	Front Compound Main Drive Pinion Lo-Range Gear End Play	0.010 inch minimum to 0.020 inch maximum

TRTXL-1070 12-SPEED TRIPLE COUNTERSHAFT TRANSMISSION

AIR SHIFT



TORQUE LIMITING CONTROL

Description

The Torque Limiting Control arrangement is required on all chassis featuring the TRXL-107 or TRXL1071 transmission and bogie loading exceeding 34,000 lbs.

NOTE

Boost-a-load and tag axles which result in rear chassis load in excess 34,000 lbs., regardless of bogie specified, will also require a torque limiter.

The Torque Limiting Control Arrangement consists of a special air cylinder installed in the injection pump, a transmission control valve, reducing fittings and connecting piping. Two arrangements are required; one torque limiting control arrangement for chassis equipped with the Mack Puff Limiter and one without. The same basic components are required for both arrangements; however, the function of the transmission control valve differs. On chassis with the Mack Puff Limiter, this control valve functions as an exhaust valve. When the TRXL107 is shifted into reverse or the TRXL1071 is shifted into reverse and lo-lo, the valve opens allowing any manifold pressure in the control line to exhaust. However, on chassis without the Mack Puff Limiter, the transmission control valve functions as a shut-off valve. Operating air for this arrangement comes directly from the air reservoir directly to the valve. When the TRXL107 is shifted into reverse or the TRXL1071 is shifted into reverse and lo-lo, the valve opens allowing the operating air to pass through to the torque limiting air cylinder attached to the fuel injection pump.

TORQUE LIMITING CONTROL VALVE ADJUSTMENT

TRXL107 Transmission

NOTE

Governor valve to open in reverse only.

1. Shift transmission into Lo range position.
2. Attach air line to supply end of valve.
3. Screw valve into cover until the valve opens.
4. Back valve out, just enough to close the valve and tighten the locknut.

5. Now shift transmission into reverse position; valve should open.
6. If valve is not open in reverse, repeat above procedure until the valve is open in reverse and closed in Lo range.
7. Valve should be open in reverse position only. See Figure 5-1.

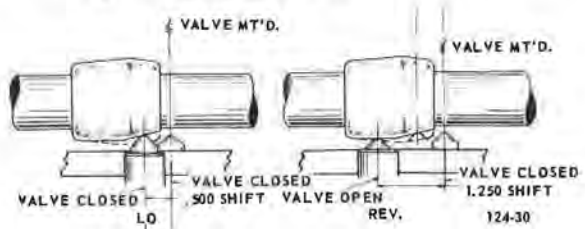


Figure 5-1. Valve Adjustment TRXL107 Transmission

TRXL1071 Transmission

NOTE

Governor valve to open in reverse position and Lo-Lo range position.

1. Shift transmission into LoLo range position.
2. Attach air line to supply end of valve.
3. Screw valve into cover just enough, so that the valve is open. Tighten the locknut.
4. Now shift transmission into neutral; valve should be closed.
5. Now shift transmission into reverse position; valve should be open.
6. Valve might require some additional adjustment to allow the transmission to be shifted into reverse. If this is required check the valve to be sure that it is still open in the LoLo range position.
7. Valve should be open in reverse and in Lo-Lo range positions. See Figure 5-2.

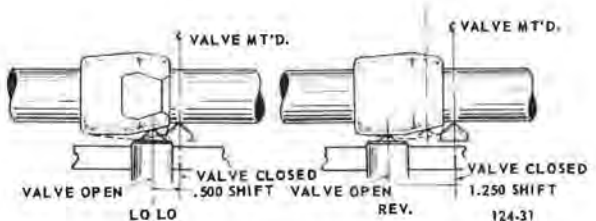


Figure 5-2. Valve Adjustment TRXL1071 Transmission

NOTES

**POWER TAKE-OFF
TRL107 SERIES TRANSMISSIONS**

DESCRIPTION

The design of the Maxitorque transmission permits either the right-hand or left-hand power take-off gear to be removed and replaced without removing transmission from the chassis. Briefly, the operation is simple; oil in the transmission must be drained, the right-hand and left-hand power take-off covers and the lower and right-hand rear countershaft bearing covers removed. Then two retaining snap rings are disengaged to allow the countershaft to be moved back far enough for the gear to be removed. Transmissions used in highway vehicles do not have power take-off gears installed at the factory. If necessary to install power take-off gears in these transmissions or to replace existing gears, proceed as follows.

LOWER COUNTERSHAFT (8 Hole P. T. O.)

1. Drain lubricant.
2. Remove lower countershaft rear bearing cover with O-ring.
3. Remove left-hand power take-off cover (8 bolts).
4. Slide countershaft rearward slightly and **OBSERVE TIMING "O" MARKS** on front and rear countershaft splines. See Figure 5-1. If timing "O" marks are not visible, mark each countershaft so that it will be properly timed at reassembly.



Figure 5-1 . Countershaft Timing Marks

5. Withdraw countershaft partially from rear bearing opening.
6. Remove oil slinger, see Figure 5-2 . Using special snap ring pliers J23186, remove

the front snap ring. Slide spring and oil slinger from shaft, leaving rear snap ring in place.

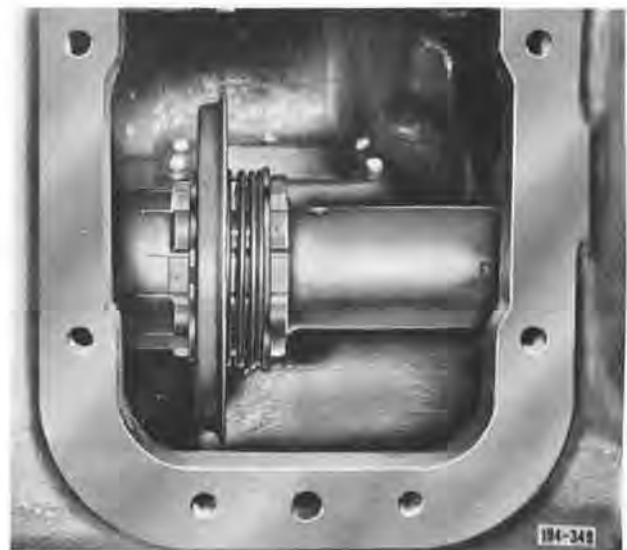


Figure 5-2 . Countershaft Oil Slinger

7. Install power take-off gear with its retaining front snap ring on shaft. See Figure 5-3 .

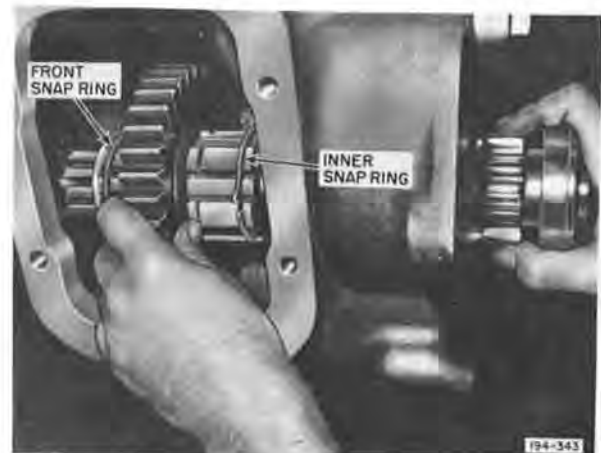


Figure 5-3 . Installing Gear and Front Snap Ring

8. Align timing mark on rear countershaft with timing mark on front countershaft. See Figure 5-1 . Advance shaft until countershaft rear bearing positioning snap ring seats against case.

9. Position power take-off gear on countershaft splines; then install gear front snap ring in groove provided in shaft to retain gear. See Figure 5-4 .

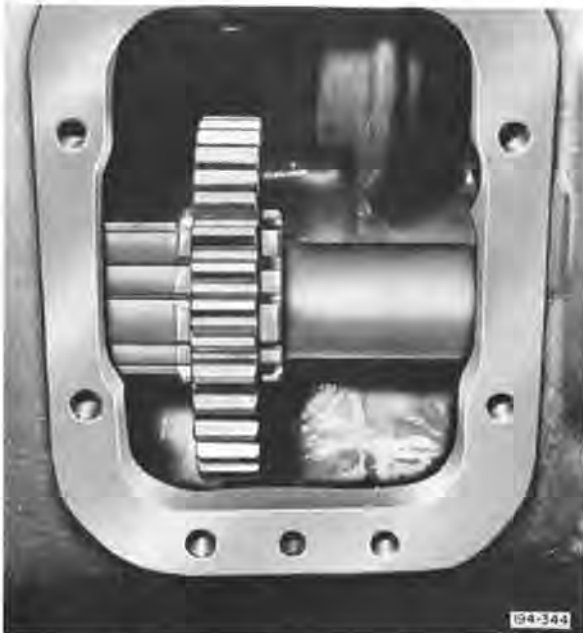


Figure 5-4 . Gear and Snap Rings Installed

10. Install O-ring in countershaft rear bearing cover. Install cover with washers and capscrews; then torque capscrews 30 to 40 lb. ft. (lubricated).

11. Install power take-off assembly.

12. Fill transmission to bottom of fill plug hole with recommended lubricant.

RIGHT COUNTERSHAFT (6 Hole P.T.O.)

NOTE

Installation of the right countershaft power take-off gear in some vehicles can be performed by removing transmission top cover; however, this method is not recommended due to the hazardous potential of dirt entering transmission at this point. The recommended method is as follows.

1. Drain lubricant.

2. Remove lower and right countershaft rear bearing covers with O-rings.

3. Remove left and right-hand power take-off covers.

4. Slide lower rear countershaft rearward slightly and OBSERVE TIMING "O" MARKS on front and rear countershaft splines. See Figure 5-1 . If timing "O" marks are not visible, mark each countershaft so that it will be properly timed at reassembly.

5. Remove lower rear countershaft from case through rear bearing opening.

6. Slide right rear countershaft rearward slightly and OBSERVE TIMING "O" MARKS on front and rear countershaft splines. See Figure 5-5 . If timing "O" marks are not visible, mark each countershaft so that it will be properly timed at reassembly.



Figure 5-5 . Countershaft Timing Marks

7. Withdraw right rear countershaft partially from rear bearing opening.

8. Using special snap ring pliers J23186, remove front snap ring from oil slinger. Slide spring and oil slinger from shaft, leaving rear snap ring in place.

9. Insert power take-off gear through left hand power take-off opening. See Figure 5-6 . Work gear across transmission and install on right-hand countershaft. Install power take-off gear retaining front snap ring on shaft.



Figure 5-6 . Installing Right-Hand Power Take-off Gear Through Lower Power Take-off Opening

10. Align right rear countershaft timing mark with timing mark on front countershaft. See Figure 5-7 . Advance shaft until countershaft rear bearing positioning snap ring seats against case.
11. Position power take-off gear on countershaft splines; then install gear front snap ring in groove provided in shaft to retain gear.
12. Align lower rear countershaft timing mark with timing mark on front countershaft,

see Figure 5-1 . Advance shaft until rear bearing positioning snap ring seats against case.



Figure 5-7 . Aligning Timing Marks

13. Install left-hand power take-off cover with washers and capscrews.
14. Install O-rings in countershaft rear bearing covers. Install covers with washers and capscrews; then torque capscrews 30 to 40 lb. ft. (lubricated).
15. Install power take-off assembly.
16. Fill transmission to bottom of fill plug hole with recommended lubricant.

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