of air poppet and thread fitting into end plate and tighten fitting.

23. Place new gasket on air control tube and attach tube to control valve and air cylinder, securely tightening nuts.

Lubrication

Do not lubricate "Air-Pak" until it has been permanently installed on the vehicle. This is a safeguard against lubricating oil entering the hydraulic section of the "Air-Pak" which might cause damage to the rubber cups and seals.

The "Air-Pak" should be lubricated every 10,000 miles or every six months, whichever occurs first, with Bendix Vacuum cylinder oil.

To lubricate the "Air-Pak", remove the ⅛" pipe plug from the air cylinder shell and inject the oil through the fitting up to the point where the oil begins to run out of the port. Replace and tighten the plug.

During lubrication, the engine should be shut off and the "Air-Pak" should be in the released position.

ALLISON AUTOMATIC TRANSMISSION

CONTENTS

DESCRIPTION

This transmission, Fig. 1. called Powermatic by Chevrolet and Transmatic Drive by Ford, and Torqmatic by Dodge, is a hydraulically-operated automatic transmission with six forward gear ratios and one reverse ratio. It is made in two versions, a lighter unit for medium duty trucks and a heavier one for heavy duty trucks. The two models differ chiefly in the hydraulic control system.

The transmission consists basically of a torque converter, a planetary gear train and a hydraulic control system for shifting gears.

The torque converter operates as a hydraulic torque multiplier and a fluid coupling between the truck's engine and the gear train. The torque multiplying phase of the converter operates when the truck starts moving from a standstill and when a heavy load slows down the truck. When no torque multiplication is needed, the fluid coupling phase starts operating automatically.

If the truck should slow down and the converter turbine resists turning, such as when climbing hills or driving in stop-and-go traffic, the converter operation automatically changes from a fluid coupling phase to a torque multiplication phase. This phase occurs after the gears have shifted into third gear ratio (when driving in Drive or Intermediate ranges) or first gear ratio (when in Low range).

At certain engine speeds when the action of the torque converter is no longer needed, an automatic lockup clutch in the converter locks the engine directly to the gear train for greater efficiency, Fig. 2. The hydraulic system which operates the lockup clutch automatically disengages the clutch each time an automatic or manual upshift or downshift is being made.

A pedal-operated hydraulic retarder in the transmission assists the service brakes in controlling the truck's speed during long downhill braking or when slowing down in stop-and-go traffic. When the retarder pedal is depressed and the retarder valve opens, transmission fluid flows into the retarder cavity located between the converter and transmission housings. The cavity contains a rotor, which is connected to the turbine output shaft, and stationary reaction vanes on both sides of the rotor. When the fluid fills the cavity, it churns against the reaction vanes and slows down the rotor. The retarding effort is transmitted to the drive line and slows down the truck.

The retarder will continue to operate

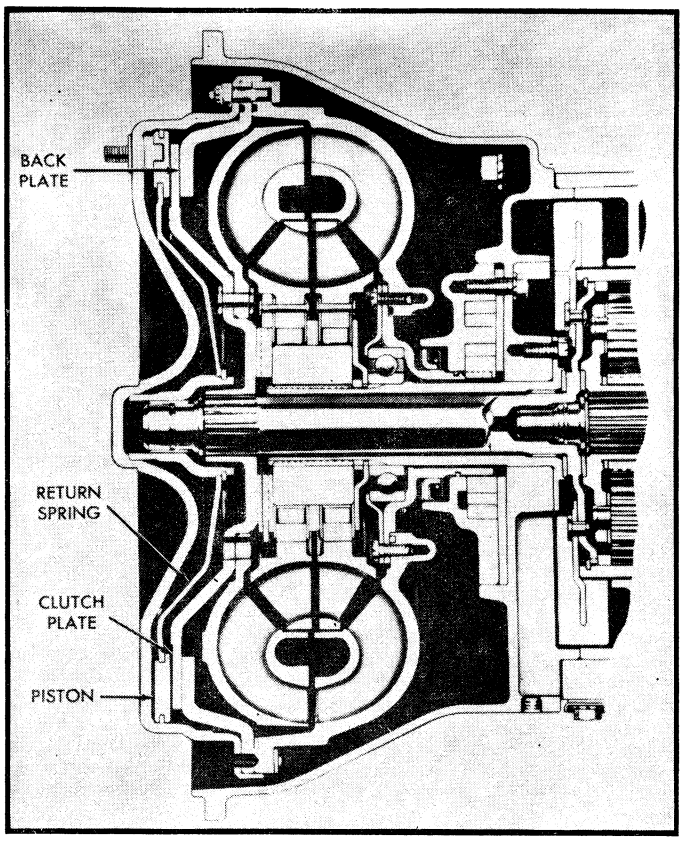


Fig. 2 Lockup clutch

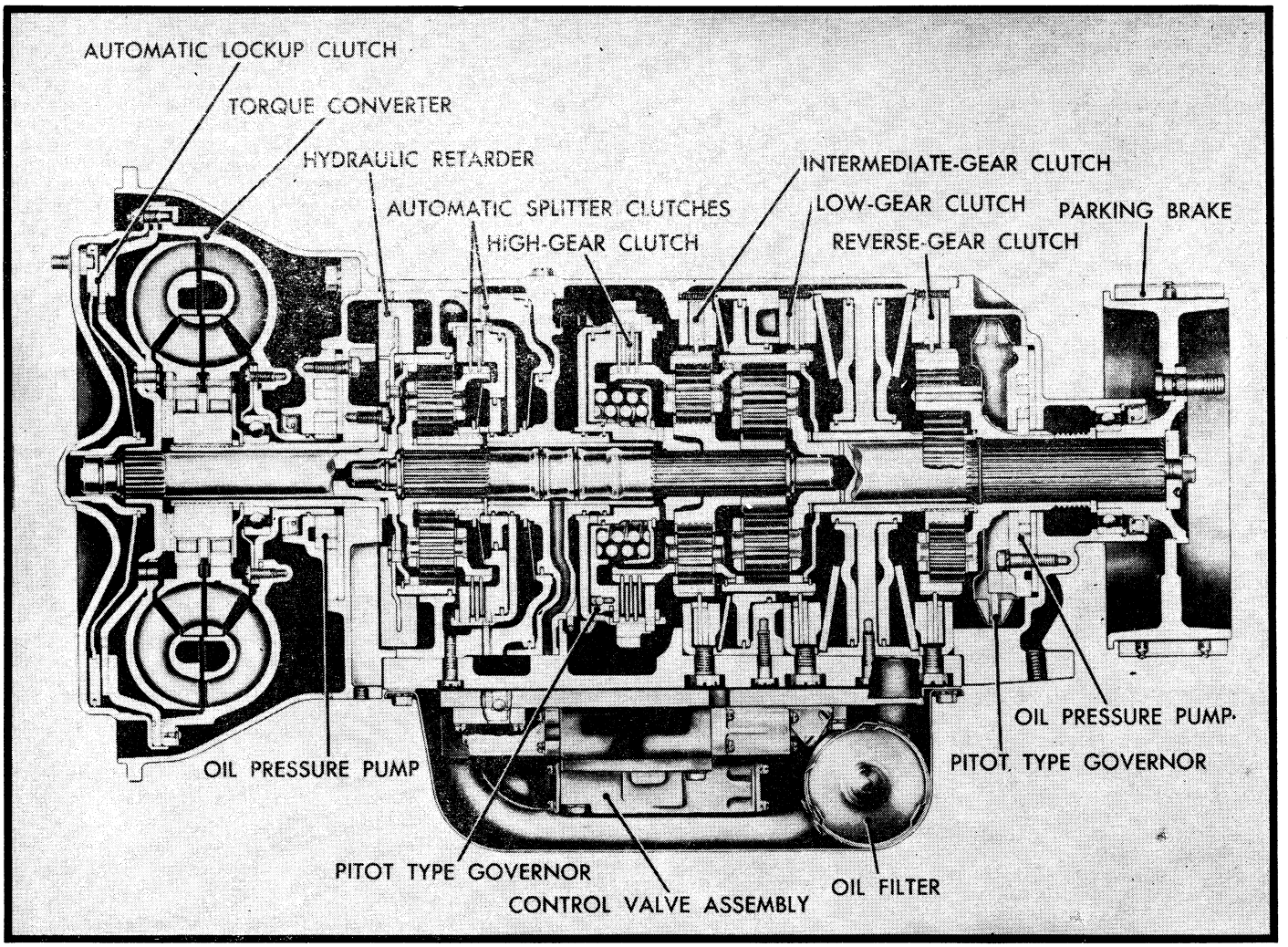


Fig. 1 Sectional view of Allison six-speed automatic transmission

as long as the retarder pedal is depressed. However, heat is generated in the fluid by the retarder action, and the fluid temperature may rise faster than it can be cooled if the retarder is operated continuously. A warning light on the instrument panel indicates that the retarder operation should be discontinued until the fluid cools and the warning light goes out. When the pedal is released and the retarder valve closes, the fluid in the cavity automatically discharges and permits the rotor to turn without drag.

The transmission gear train contains four sets of constant-mesh planetary gears which are operated by hydraulically-actuated clutches. All forward gear shifts, except the upshift and downshift between second and third gear ratios, are fully automatic and are controlled, through a system of hydraulic valves, by throttle position and truck speed.

The four planetaries are arranged in series to permit one of them to become a "splitter" for the others. The splitter planetary, located between the torque converter and the range gears, has two ratios that are used when the low, intermediate or high clutch is applied. A reduction ratio, or low splitter, operates in neutral, first, third, fifth and reverse gears. A direct drive ratio, or high splitter, is used in second, fourth and sixth gears.

Two separate fluid-velocity governors in the transmission provide the fluid pressures needed to operate the hydraulic control system and make the shifts.

Two regular duty power take-off openings are located at the sides of the transmission housing.

DRIVING INSTRUCTIONS

The manual controls needed to operate the transmission are a range selector lever, an accelerator pedal, and a pedal for the hydraulic retarder.

A neutral position (N), three forward speed positions (Dr, Int and Lo) are provided for the range selector lever to control the various automatic gear ratio shifts in the transmission.

The selector lever must be at N to start the engine. When the lever is at Dr, the transmission can be operated in 3rd, 4th, 5th and 6th gear ratios. The Int (intermediate range) position permits the use of only 3rd and 4th gear ratios. When the lever is in Lo (low range) the transmission will operate only in 1st and 2nd gear ratios. The reverse gear ratio can be used when the selector lever is at R.

When the truck is moving forward, the selector lever can be moved from one forward speed to another to obtain gear ratios in the other ranges. However, the lever should not be moved from Dr to Int when the truck is moving faster than 30 mph, or from Dr or Int to Lo at speeds faster than 15 mph. *Do not move the lever between ranges when the hydraulic retarder is operating. The truck should always be completely stopped when shifting the selector lever from Dr, Int or Lo to R. Severe damage to the transmission may result from shifting the selector lever at road speeds faster than those specified for the shifts.*

The gear ratios within the selected range are upshifted or downshifted automatically to meet changing road and load conditions. When the accelerator is depressed to provide maximum or full throttle, each gear ratio shift point should occur at the highest speed for the shift. When the throttle is partly

open, the shift points should occur at lower speeds.

A detent at full-throttle position of the accelerator pedal permits the driver to control certain shifts. When the pedal is pushed through the full-throttle detent, the transmission will remain in the same gear ratio during acceleration or will immediately downshift to a lower gear ratio to provide the best engine performance for the driving conditions. The transmission cannot upshift when the accelerator is pushed through the full-throttle detent. The pedal must be released until it comes back through the full-throttle detent to obtain an upshift.

Driving On Glare Ice

To start the truck moving from a standstill on glare ice when traction is poor, place the selector lever at Dr or Int and depress the accelerator pedal as lightly as possible to avoid spinning the wheels. *Do not downshift to Lo.*

"Rocking" Out of Deep Ruts

To "rock" the truck out of deep ruts, move the selector lever back and forth between Lo and R while keeping the engine running at a steady speed. Time the movement of the lever to take advantage of the "rocking" momentum of the truck.

Pushing or Towing To Start The Engine

If the truck has to be pushed or towed to start the engine, place the selector lever at N and turn on the ignition switch. When the truck's speed reaches about 25 mph, move the selector lever to Dr and hold the accelerator pedal about halfway down. If the truck is being towed, be careful not to run into the towing truck when the engine starts.

Towing The Truck

To tow a truck when the transmission is not functioning properly, raise the rear wheels off the ground or disconnect the drive shaft.

When the transmission is functioning properly but has not been driven more than 1000 miles, or when mechanical trouble exists elsewhere in the truck, place the selector lever at N and maintain a towing speed between 15 and 35 mph. Check the transmission fluid level after each three miles of towing, and add fluid if the level falls more than ¼" below the full mark.

Operating The Hydraulic Retarder

The hydraulic retarder is not a substitute for the service brakes but is designed only to slow down the truck. It assists the brakes and relieves them from excessive use and wear during long downhill braking and when slowing down in stop-and-go traffic.

To slow down the truck, push down and hold the hydraulic retarder pedal. The retarder operates most effectively in the intermediate and low ranges at engine speeds of 2800-3500 rpm.

Trouble Shooting & Maintenance

TROUBLE SHOOTING

Shift Points High on 1st and 2nd and all Lockup Shifts

1. G-1 Pressure insufficient.
2. Lube pressure low.
3. Anchor bolts holding diaphragm in housing loose.
4. G-1 circuit leakage.
5. Front fluid velocity governor damaged.
6. Front pitot tube loose or damaged.

Lockup Shift Points High and Transmission Won't Shift to 2nd Gear

1. G-1 pressure insufficient.
2. Lube pressure low.
3. G-1 circuit leakage.
4. Lockup shift valve sticking.
5. Anchor bolts holding high range clutch diaphragm in housing loose.
6. Front fluid velocity governor damaged.
7. Front pitot tube loose or damaged.

Low-Main Pressure In All Ranges

1. Air leak at oil transfer tubes or seals in oil pan.
2. Oil filter element clogged.
3. Main pressure regulator valve primary and secondary springs weak or improper.
4. TV pressure low at full throttle; normal at closed throttle.
5. TV spring weak or broken.
6. Range selector valve body leakage.
7. Oil transfer plate gasket blown or damaged.
8. Rear pump ball not in range selector valve body.
9. Valves sticking.
10. Front pump worn or damaged.

Low Main Pressure In Low Range

1. Low range circuit of range selector valve body leaking.
2. Leakage between low range piston housing and transmission housing.
3. Excessive leakage at low range piston seals.
4. Gasket at oil transfer plate leaking.

Misses 2nd Gear On Downshift to Low Range

1. Shifting manually at too low vehicle speed.
2. G-1 pressure insufficient.
3. Rear oil pump malfunctioning.

Transmission Will Not Shift to 4th Gear In Int or Dr Ranges

1. G-2 pressure insufficient.
2. Rear pitot tube loose.
3. Rear pitot (G-2) splitter plug sticking.
4. Rear fluid velocity governor damaged.
5. Rear oil pump malfunction or orifice in pump housing clogged.
6. Rear pitot tube damaged or improperly installed.

All Shift Points Too Low At Full Throttle

1. TV pressure low at full throttle.
2. Throttle valve spring weak or broken.
3. Main pressure leaking into governor circuit.

All Shift Points Too High Except Lockup and 1st and 2nd Shift At Part Throttle

1. G-2 pressure insufficient.
2. Rear pitot tube loose.
3. Rear fluid velocity governor damaged.
4. Rear pitot tube damaged.

Buzzing Noise Occurring Intermittently

1. Low oil level.
2. Oil filter element clogged.
3. Air leak at oil transfer tubes or seals in oil pan.

Insufficient G-2 Pressure

1. Rear pitot tube loose.
2. Rear fluid velocity governor damaged.
3. Rear pitot tube damaged or improperly installed.
4. Rear oil pump malfunction.
5. Oil transfer plate gasket blown or damaged.

Insufficient G-1 Pressure

1. Lube pressure low.
2. G-1 circuit leak or obstruction.
3. Anchor bolts holding high range clutch diaphragm in housing loose.
4. Front fluid velocity governor damaged.
5. Front pitot tube damaged or loose.

Low Lube Pressure

1. Oil lines restricted.
2. Cooler lines or fittings leaking.
3. Lube regulator valve ball or spring in hydraulic retarder control valve body faulty.
4. Oil filter element clogged.
5. Pump overage regulator malfunction.
6. Front oil pump malfunction.
7. Converter pressure regulator valve ball malfunction.
8. Oil level low.

Oil Leakage Into Converter Housing

1. Engine crankshaft rear oil seal leaking.
2. Torque converter seals leaking.
3. Front oil pump lip-type seal faulty or seal drain restricted.
4. Hook-type seal ring on converter pump hub broken.
5. Drive studs in converter pump cover loose.
6. O-type seal ring at front oil pump leaking.

Transmission Heating Up In All Ranges

1. Oil level low.
2. Oil level high.
3. Engine cooling system malfunction.
4. Oil cooler lines restricted.
5. Hydraulic retarder partially applied.
6. Bushing in converter ground sleeve worn.

Lockup Clutch Will Not Engage

1. G-1 pressure insufficient.
2. Lockup shift valve or lockup cutoff valve sticking.
3. Hook-type seal rings on splitter shaft or turbine shaft broken.
4. Lockup clutch piston seal ring leaking.
5. Excessive internal leakage.

No Response to Movement of Shift Lever

1. Oil filter clogged.
2. Oil level low.
3. Range selector linkage defective.
4. Main pressure low.
5. Low splitter clutch failure.
6. Clutch piston seals leaking.

High Stall Speed

1. Oil level low.
2. Clutch pressure low.
3. Converter pressure low.
4. Range clutches failure.
5. Low splitter clutch failure.

Low Stall Speed

1. Engine not performing efficiently.
2. Converter stators functioning improperly due to improper assembly or failure of components.

Rough Shifting

1. Manual selector linkage out of adjustment.
2. Throttle valve linkage out of adjustment.
3. Valves sticking.

Engine Overspeeds On Full Throttle Shift Out of Low Range

1. Downshift timing valve sticking.
2. Seals on intermediate range clutch piston excessively worn.

Loss of Hydraulic Retarder Braking Effect

1. Oil level low.
2. Hydraulic retarder valve linkage out of adjustment.
3. Oil filter element clogged.
4. Air leaks at oil transfer tubes or seals in oil pan.
5. Lube regulator valve in hydraulic retarder valve body failure.
6. Hook-type seal ring on outside diameter of splitter ring gear faulty.

Excessive Slippage and Clutch Chatter In 1st and 2nd Lockup Only

1. Low range clutch failure.
2. Excessive leakage of low range clutch piston seals.

Excessive Slippage and Clutch Chatter In 1st, 3rd and 5th Gear Lockup Only

1. Low splitter clutch failure.
2. Anchor bolts holding high range clutch diaphragm in housing loose.
3. Excessive leaking of low splitter clutch piston seals.

Excessive Slippage and Clutch Chatter in 2nd, 4th and 6th Gear

1. High splitter clutch slipping.
2. Anchor bolts holding high range clutch diaphragm in housing loose.
3. Excessive leaking of high splitter clutch piston seals.

Excessive Slippage In 3rd and 4th Gear Lockup Only

1. Intermediate range clutch failure.
2. Intermediate range clutch piston seals leaking excessively.

Dirty Oil

1. Failure to change at specified interval.
2. Oil filter element faulty.
3. Excessive heat.
4. Clutch failure.

Slippage In 5th and 6th Gear Lockup Only

1. High range clutch slippage.
2. High range clutch piston seals leaking excessively.

Slippage In All Gears

1. Oil level low.
2. Clutch pressure low.
3. Lockup clutch slipping.

Excessive Slippage In Reverse Range Lockup Only

1. Reverse range clutch failure.
2. Reverse range clutch piston seals leaking excessively.

Vehicle Moves Forward In Neutral

1. Range selector linkage out of adjustment.
2. Range clutch failure or dragging.
3. Insufficient range clutch clearances.

Vehicle Moves Backward In Neutral

1. Range selector linkage out of adjustment.
2. Reverse range clutch failure or dragging.

Vehicle Will Not Push Start

1. Engine trouble.
2. Oil level low.
3. Rear oil pump malfunction.
4. Also refer to troubles concerning excessive clutch slippage and failure of vehicle to move when engine is running and selector is shifted to forward ranges.

Throws Oil Out of Transmission Filler Tube

1. Dipstick loose.
2. Breather line clogged, disconnected or pinched.
3. Oil level too high.

Oil Leak At Rear Bearing Retainer

1. Bearing retainer bolts loose.
2. Retainer gasket blown.
3. Gasket of improper thickness installed.

OIL PRESSURE CHECKS

Plugged holes are provided for checking oil pressures, Fig. 3. These plugs can be removed for the installation of oil pressure gauges.

CAUTION—*Do not install any gauges while the engine is running. By using these oil pressure check points, abnormal oil pressures that will cause malfunction of the hydraulic-controlled components can be found. The following data applies to the medium duty unit. Full throttle pressures for the heavy duty unit are 10% higher.*

Gear	*Operation*	*P.S.I.**
1st	Converter	
	closed throttle	185
	full throttle	220
	Lockup	
	closed throttle	70
	full throttle	82
2nd	Lockup	
	closed throttle	70
	full throttle	82
3rd	Converter	
	closed throttle	185
	full throttle	220
	Lockup	
	closed throttle	85
	full throttle	100
4th	Lockup	
	closed throttle	70
	full throttle	82
5th	Lockup	
	closed throttle	70
	full throttle	82
6th	Lockup	
	closed throttle	70
	full throttle	82
Reverse	Converter	
	closed throttle	185
	full throttle	220
	Lockup	
	closed throttle	70
	full throttle	82

*The above data are for medium duty units; full throttle operation on heavy duty units are 10% higher.

AIR PRESSURE CHECKS

Compressed air may be used to check the operation of the various clutches in the transmission and to find leaks that

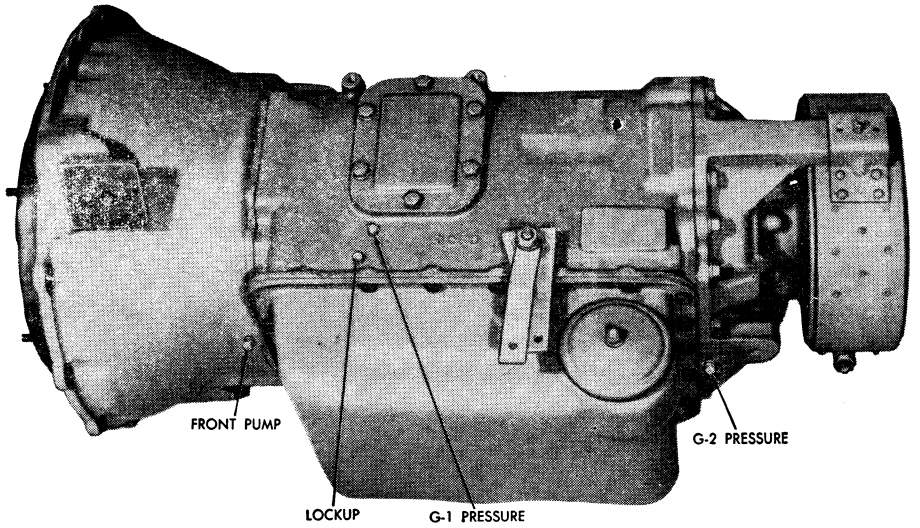


Fig. 3 Pressure check point locations

may be caused by broken, damaged or omitted seals.

To make the air pressure checks, remove the oil pan, valve body and oil transfer plate from the transmission. Then apply 80-100 lbs. (psi) air pressure at the appropriate holes in the mounting pad at the bottom of the transmission housing, Fig. 4.

When compressed air is applied as directed, listen for the noise that occurs when the clutch is applied. If no clutch application noise is heard, a leak may exist in the hydraulic system. Refer to the fluid leakage data below to determine the cause of the leaks at any of the check points.

Low Splitter Clutch

1. Leak between diaphragm and case:—Bottom two anchor bolts loose or not drawing diaphragm to case.

High Splitter Clutch

1. Leak between diaphragm and case:—Bottom two anchor bolts loose or not drawing diaphragm to case.
2. Leak at piston I.D.: — Broken or omitted hook-type oil seal.
3. Leak at piston O.D.: — Broken, nicked or omitted synthetic seal.
4. Air comes out of lube hole in retarder valve body pad:—Front hub hook-type seal ring broken or omitted.
5. Air comes out of retarder feed:—Rear hub hook-type seal ring broken or omitted.

High Range Clutch

1. Leak between diaphragm and case:—Bottom two anchor bolts loose or not drawing diaphragm to case.
2. Air escapes at front pitot hole (8) or at lube hole in retarder valve body pad:—Inner hook-type seal ring on rear hub broken or omitted.
3. Air escapes at lube hole in retarder valve body pad:—Rear hook-type seal ring on rear hub broken or omitted.
4. Air may escape around clutch piston spring:—Hook-type seal ring for clutch I.D. broken or omitted.
5. Air may escape around high range clutch hub:—Synthetic seal at piston O.D. broken, nicked or omitted.

Intermediate Range Clutch

1. Leak between case and intermediate clutch piston housing:—Anchor bolts loose. Intermediate clutch housing not tight against hole in case.
2. Leak at piston I.D.: — Hook-type ring broken or omitted.
3. Air escapes around low range clutch plate:—Hook-type ring broken or omitted.
4. Leak at piston O.D.:—Synthetic seal at piston O.D. broken, nicked or omitted.

Low Range Clutch

1. Leak between case and low-reverse piston housing:—Anchor bolt loose. Low-reverse clutch housing not tight against case.
2. Leak at piston I.D.:—Hook-type seal broken or omitted.
3. Air escapes around clutch I.D.:—Hook-type seal broken or omitted.
4. Leak at piston O.D.:—Synthetic seal broken, nicked or omitted.

Reverse Clutch

1. Leak between case and low-reverse piston housing:—Anchor bolt loose. Low-reverse clutch housing not tight against case.
2. Leak at piston I.D.:—Hook-type seal broken or omitted.
3. Air escapes around clutch I.D.:—Hook-type seal broken or omitted.
4. Leak at piston O.D.:—Synthetic seal broken, nicked or omitted.

Lockup Clutch

1. Leak at piston I.D.:—Synthetic seal broken, nicked or omitted.
2. Leak at O.D. of converter cover:—Synthetic seal between reaction plate and cover, or between plate and converter pump flange damaged or omitted.
3. Leak at turbine shaft:—Broken or omitted hook-type rings at front end of turbine shaft, front end of splitter shaft, or center of splitter shaft.

MAINTENANCE

Adding Fluid

The oil level should be checked every

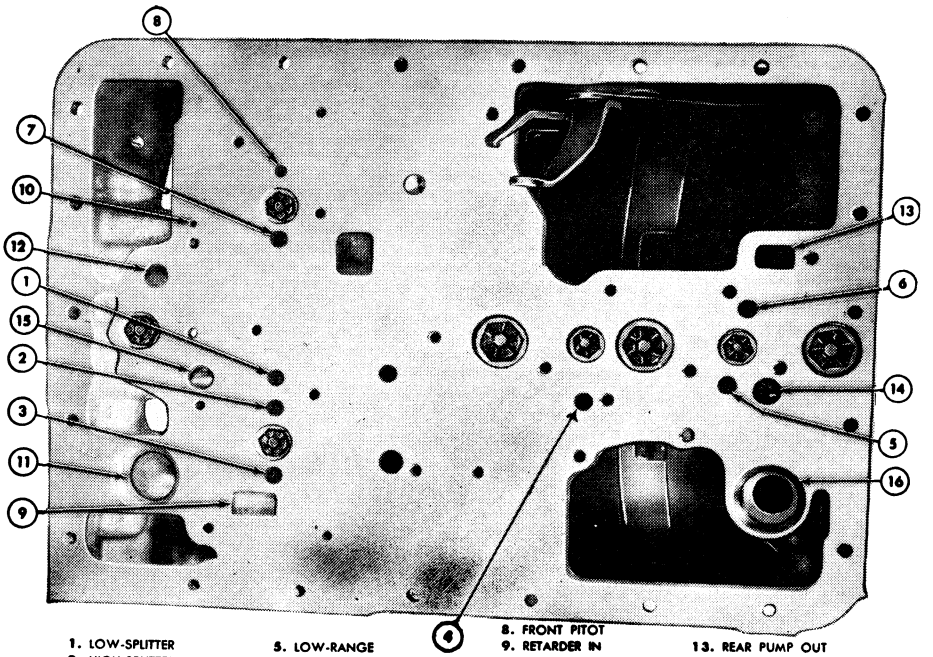


Fig. 4 Transmission housing fluid passage holes

1000 miles and oil added as necessary as outlined below:

1. Transmission oil should be at normal operating temperature of 150 to 200°.
2. Apply hand brake and service brakes securely. *Do not apply the hydraulic retarder while checking the oil level.* Applying the hydraulic retarder while in a stalled condition will aerate the oil, making an accurate oil level check impossible.
3. Place range selector lever in Dr range and run engine at normal idle speed.
4. Before removing dipstick clean the area around the dipstick opening as a precaution against dirt entering transmission.
5. The oil level should be at the "Full" mark on the dipstick. If the oil level it at the "Add" mark, or below it, add enough oil to bring the level up to the "Full" mark. If the oil level is higher than the level specified above, drain the oil back to the correct level.
6. Securely seat the dipstick in the filler tube.

Changing Fluid

The oil should be changed every 5000 miles under normal operating conditions for off-highway or urban operation. The oil should be changed at 10,000 mile intervals for normal highway operation. Replace the oil filter at each change.

1. Drain oil immediately after operation while the oil is still warm.
2. Loosen the transmission oil filter cover and allow oil to drain thoroughly. Do not completely remove the cover until drainage is complete.
3. Remove cover and filter and install new filter.
4. Pour eight quarts of Hydraulic Transmission Fluid "Type A" or Automatic Transmission Fluid "Type C" into the transmission.
5. Apply parking brake and position range selector in N and start engine.
6. Move range selector lever to Dr.
7. Run engine at normal idle speed and add sufficient oil to bring the level up to the "Add" oil mark on the dipstick.
8. With service brakes applied, shift the transmission through all ranges. Continue to run the engine until normal operating temperature of the transmission is attained. Then add oil, if necessary, to bring the level up to the "Full" mark.

Oil Cooler

The oil cooler (heat exchanger), through which the transmission oil is circulated before returning to the oil pan, dissipates the heat created by normal operation of the torque converter, transmission and hydraulic retarder. The cooling medium is the engine coolant.

When a clutch failure or other internal trouble has occurred in the transmission, any metal particles or clutch plate material that may have been carried into the oil cooler should be removed from the system by flushing the cooler before the transmission is put back into service. Foreign matter in the oil cooler could block off the front pitot feed hole, get into various gears and clutches, or block off the output shaft bushing lubrication orifice in the splitter shaft.

1. Disconnect both oil cooler lines at the fittings in the hydraulic retarder valve body.
2. Back-flush the oil cooler and lines with clean solvent and compressed air. *Do not exceed 100 psi air pressure.* An engine de-sludge gun may be used for flushing.
3. Remove all remaining solvent from the system with compressed air.
4. Flush the system again with Automatic Transmission Fluid. If, after the final flushing, there is no flow through the cooler, or if the flow is restricted, replace the radiator.

Transmission Repair Section

"In Truck" Repairs

Servicing the fluid filter, oil pan, valve body, oil transfer plate and hand brake may be performed without removing the transmission from the truck.

When removing or installing the parking brake drum with the transmission in the truck, the rear pitot tube must be loosened to prevent damage to the rear governor. Loosen both rear pitot tube retaining screws four turns. *Do not turn these screws outward more than four turns as the pitot tube may fall off the screws.* Be sure that the screws and pitot tube are not binding or sticking on the housing.

TRANSMISSION, DISASSEMBLE

After removing the transmission from the truck, mount the transmission in a suitable repair stand and disassemble as follows:

1. Remove fluid filter.
2. Remove oil pan.
3. Remove range selector valve body, Fig. 5. *The shift valve steel detent ball and spring and the rear pump nylon ball are free to fall out of the valve body when it is removed from transfer plate.*
4. Remove downshift timing valve body.
5. Remove oil transfer plate. *A nylon ball in the plate is free to fall when the plate is removed.*
6. Remove hydraulic retarder valve body. *Remove nylon ball from housing.*
7. Remove converter pump cover, lock-up clutch back plate and clutch plate.
8. Remove hook-type seal and snap ring from turbine shaft and then remove turbine.
9. Remove first stator. *Each stator contains eight springs and eight rollers which may fall out when stator is removed.* Remove bronze spacing washer.
10. Remove second stator and roller race.
11. Remove snap ring and spacer from converter ground sleeve, then lift out converter pump.
12. Lift off converter housing, being careful to avoid dropping the retarder rotor and shaft. *If this assembly lifts with the housing, tap the end of the shaft to dislodge it from the housing so it will remain in the transmission.*
13. Remove thrust washer from rear face of converter ground sleeve.
14. Lift out retarder rotor and shaft, Fig. 6.
15. Loosen bolt at top of transmission housing which anchors diaphragm in housing.
16. Remove low spitter clutch reaction plate, Fig. 6.
17. Remove splitter mechanism, Fig. 7.
18. Remove parking brake band.
19. Remove speedometer driven gear fitting from rear bearing retainer.
20. Remove two rear pitot tube mounting bolts (near brake anchor). *These bolts must be removed to allow the pitot tube to drop into the rear pitot collector ring before loosening the output flange retaining bolt and bearing retainer bolts to prevent damage to governor valves.*
21. Remove parking brake drum, Fig. 8.
22. Remove rear bearing retainer and rear pump. *Do not remove the reverse planetary carrier and rear pitot collector ring with the retainer; be sure they remain on the output shaft.*

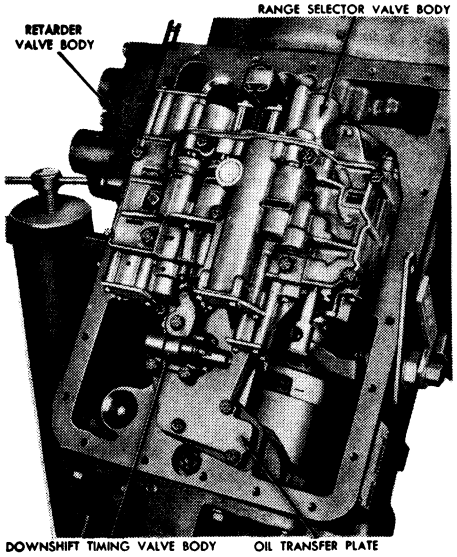


Fig. 5 Valve body and oil transfer plate

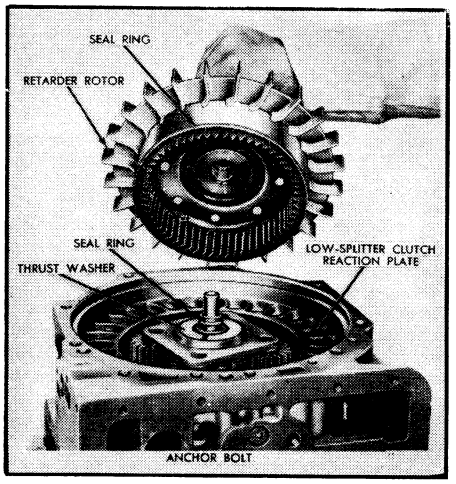


Fig. 6 Hydraulic retarder rotor

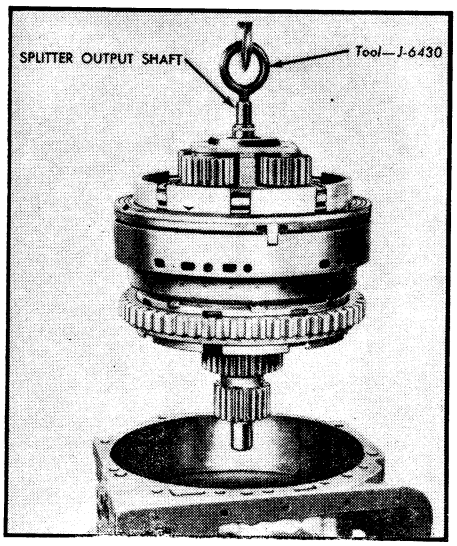


Fig. 7 Splitter mechanism

23. Remove rear pitot tube from collector ring.
24. Remove reverse planetary carrier and rear pitot collector ring from output shaft. *Various clutch parts are color coded, and should be assembled in the same locations when the transmission is serviced to insure proper fitting.*
25. Remove reverse sun gear after removing thrust washer and snap ring.
26. Remove reverse clutch pressure plate and backing plate, and Belleville spring.
27. Working through openings in transmission housing, remove low range and reverse clutch piston housing, Fig. 9.
28. Remove low range clutch Belleville spring.
29. Remove reverse range sun gear shaft after removing snap ring.
30. Remove thrust washer and take out output shaft assembly.
31. Remove low clutch apply plate and low clutch plate.
32. Remove low clutch reaction housing after removing anchor bolt, Fig. 10.
33. Remove low ring gear and intermediate planetary carrier, Fig. 11.
34. Remove intermediate clutch piston housing after removing anchor bolt, Fig. 11.
35. Remove intermediate clutch Belleville spring. Then remove apply plate, clutch plate and ring gear as a unit.
36. Remove reaction housing after removing anchor bolt from bottom of transmission.
37. Remove oil collector.
38. Remove range selector and throttle control levers as required.

TRANSMISSION, ASSEMBLE

Low and Intermediate Clutches and Gears and Low and Reverse Clutch Piston Housing

1. If a housing shim was removed during disassembly, install the same shim.
2. Install oil collector with conical portion facing toward front of housing.
3. Install intermediate clutch reaction housing so that threaded anchor bolt hole is aligned with hole in bottom of transmission case.
4. Install intermediate ring gear with longer section of gear toward front of transmission and toward reaction plate, Fig. 12.
5. Install intermediate clutch apply plate. This plate has an oil collector ring installed at its inner diameter.
6. Install, *but do not tighten,* the intermediate clutch reaction housing anchor bolt.
7. Install intermediate clutch Belleville spring with convex side toward rear of transmission. *Make sure spring is centered pefectly on clutch apply plate on which it seats so the piston housing will seat properly around it.*
8. Install intermediate piston housing with piston facing Belleville spring and with tapped hole in piston housing in line with the corresponding anchor bolt hole in bottom of case.
9. Install, *but do not tighten,* the intermediate clutch piston housing anchor bolt.

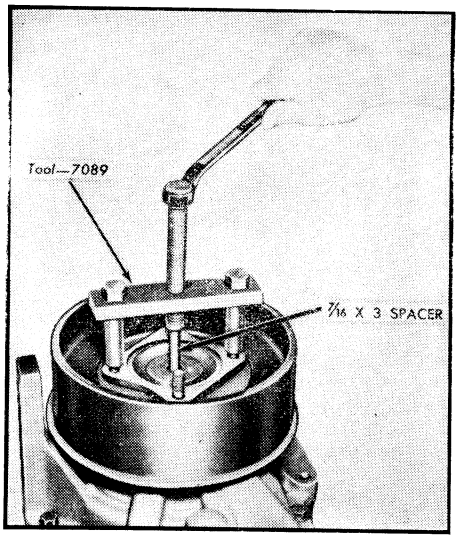


Fig. 8 Brake drum removal

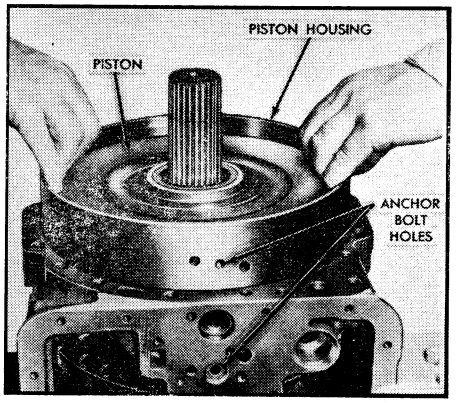


Fig. 9 Low and reverse clutch piston housing

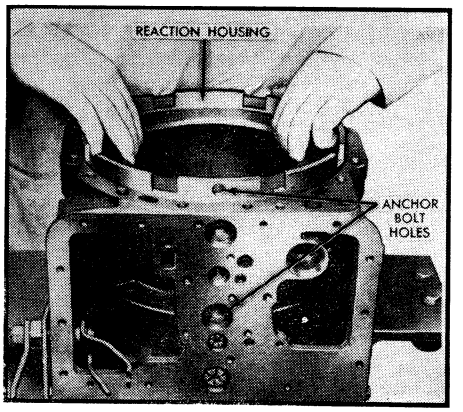


Fig. 10 Low clutch reaction housing

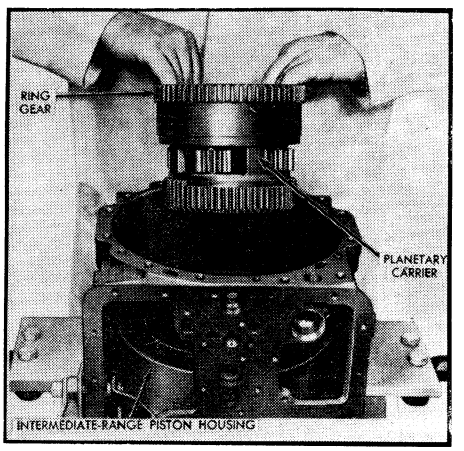


Fig. 11 Low ring gear and intermediate planetary carrier

10. Install low ring gear and intermediate planetary carrier, Fig. 11. Rotate assembly until planetary pinion teeth engage internal teeth of ring gear.
11. Install low clutch reaction housing, aligning the tapped hole in the plate with its corresponding anchor bolt hole in bottom of transmission case, Fig. 10. Install, *but do not tighten,* reaction housing anchor bolt.
12. Install clutch plate and clutch apply plate.
13. Install transmission output shaft as-

sembly, engaging planetary pinion teeth with internal teeth of low ring gear.

14. Install bronze thrust washer on output shaft. Then install reverse sun gear shaft over output shaft. Mesh teeth on flange with internal teeth of ring gear.
15. Install new snap ring in internal groove of low ring gear. Then install low clutch Belleville spring with convex side toward rear of transmission. *Make sure spring is centered perfectly on clutch apply plate on which it seats so low and reverse piston housing will seat around it.*
16. Install low and reverse clutch piston housing, aligning tapped hole in piston housing with corresponding anchor bolt hole in bottom of transmission case, Fig. 9. *Do not install anchor bolt at this time.*

Reverse Planetary Gearing and Clutch

1. Install reverse clutch Belleville spring with concave side toward rear of transmission.
2. Before installing reverse clutch pack in housing, assemble it as follows: Place clutch apply plate on bench with flat surface up. Position reverse ring gear and clutch plate assembly on apply plate with longer section of ring gear external teeth up. Over these two parts position reverse reaction housing with slots down so slots engage clutch apply plate tangs. Install this assembly in transmission case, aligning tapped hole in reaction housing with corresponding anchor bolt in bottom of transmission case. *Do not install anchor bolt at this time.*
3. Install reverse sun gear on sun gear shaft and secure with new snap ring.
4. Install bronze thrust washer over output shaft.
5. Install reverse planetary carrier and rear pitot collector ring on output shaft. Make sure planetary pinions mesh with sun gear and reverse ring gear.

Selecting Proper Rear Bearing Retainer Gasket

1. With rear pump and speedometer drive gear removed, install rear bearing retainer, *without gasket,* on rear of transmission case.
2. Install four bearing retainer mounting bolts at 90° intervals, and tighten them to 85 *inch-pounds* torque.
3. Check clearance between bearing retainer and rear surface of transmission case near points where bolts are installed. This clearance will determine which gasket or gaskets to use. Gaskets are available in .012″, .016″ and .021″ thickness.
4. If the measured clearance is .005-.015″ use .012″ gasket. If clearance is .016-.021″ use .016″ gasket. If clearance is .022-.027″ use .021″ gasket. If clearance is .028-.029″ use one .012″ and one .016″ gasket.
5. Install, *but do not tighten,* low and reverse clutch piston housing anchor bolt and reverse clutch reaction housing anchor bolt.
6. Remove bearing retainer.

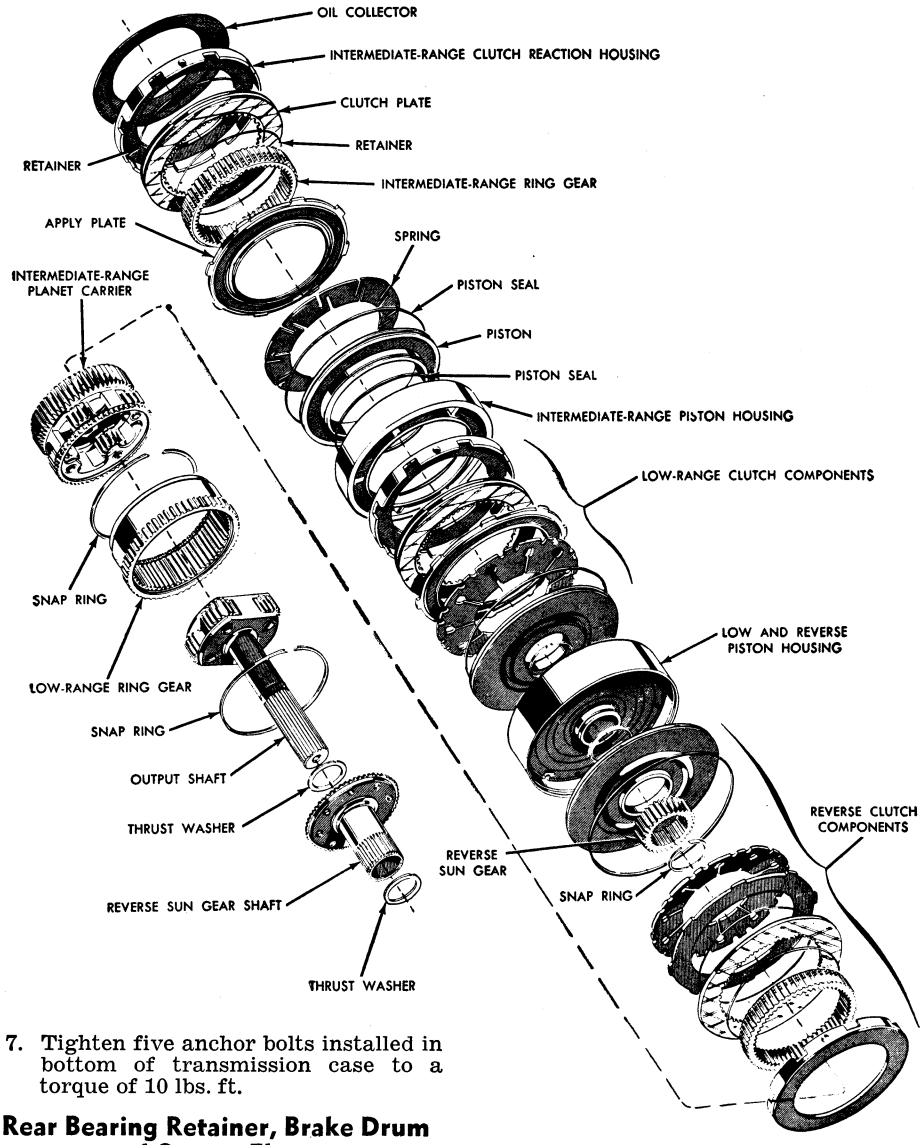


Fig. 12 Clutches and gears

7. Tighten five anchor bolts installed in bottom of transmission case to a torque of 10 lbs. ft.

Rear Bearing Retainer, Brake Drum and Output Flange

1. Install correct bearing retainer gasket.

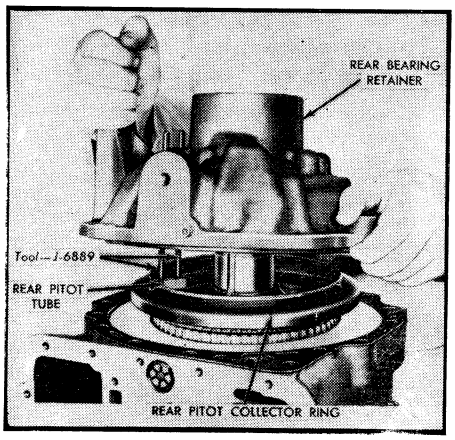


Fig. 13 Rear bearing retainer installation. Guide bolts shown may be made from ¼″ brazing rod 6″ long and threaded for a length of ⅜″

2. Install two guide bolts in rear pitot tube, making sure open (drilled port) side of pitot tube is toward bolts.
3. Place pitot tube in rear pitot collector ring with tube portion toward vanes and guide bolts toward rear of transmission, Fig. 13.
4. Carefully lower rear bearing retainer over output shaft while guiding guide bolts through pitot tube mounting bolt holes in retainer. It also will be necessary to guide rear pump drive lugs into driving slots in reverse planetary carrier and to start speedometer drive gear and spacer on output shaft. *Do not remove guide bolts at this time. Do not turn output shaft until flange retaining bolt is installed, otherwise damage to pitot tube and governor vanes may result.*
5. Install rear bearing retainer bolts and torque to 42-50 lb. ft.
6. Remove low and intermediate and reverse clutch reaction housing

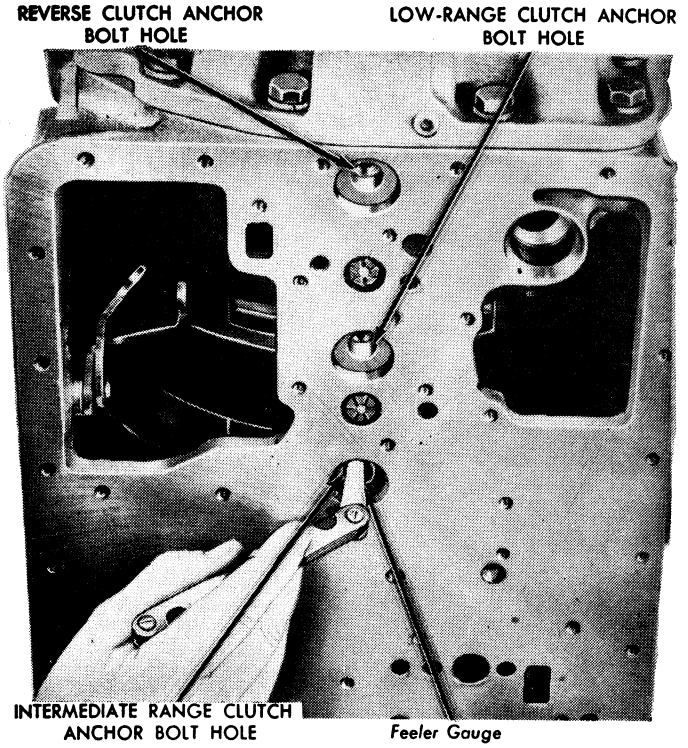


Fig. 14 Checking reverse, low and intermediate clutch plate clearances

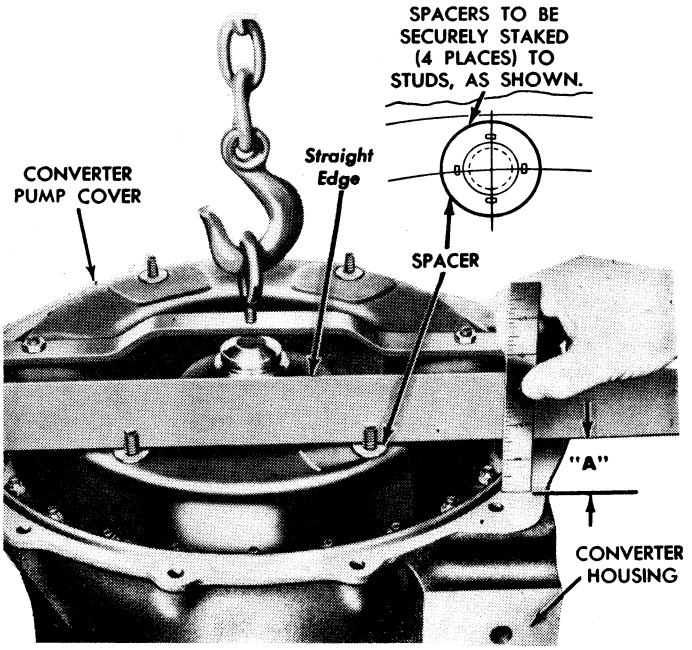


Fig. 16 Converter stack control spacer measurement

anchor bolts and, using a narrow feeler gauge in bolt holes and narrow screwdriver, separate apply plates and friction clutch plates in each range and measure clearance between them, Fig. 14. Clearance for intermediate range should be .020-.030". A minimum clearance of .008" in the low and reverse clutches and .018" in intermediate clutch is allowable. If clearances are correct, install anchor bolts removed and torque them to 35-40 lb. ft.

7. Torque two piston housing anchor bolts to 17-20 lb. ft.
8. Remove one pitot tube guide bolt and start one mounting bolt, while holding out firmly on remaining guide bolt. Now, hold out firmly on mounting bolt, which has just been started, and remove remaining guide bolt. Then start other mounting bolt. *Do not tighten mounting bolts at this time.* The bolts should protrude $\frac{1}{16}$" or more.
9. Install output flange and parking brake drum. *Do not turn output shaft while installing these parts; if shaft is turned, pitot tube or governor may be damaged.*
10. Install O-type ring seal, tab washer and output shaft bolt. Tighten bolt to 10 lb. ft. torque, being careful not to allow drum to rotate while tightening.
11. Torque pitot tube bolts to 10-12 lb. ft.
12. Torque output flange bolt to 83-100 lb. ft.
13. Install speedometer fitting in rear bearing retainer.

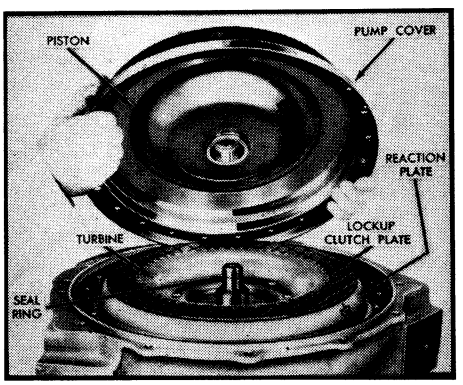


Fig. 15 Converter pump cover installation

Splitter Mechanism, High Clutch and Power Take-Off Gear

1. Position transmission with front surface facing upward.
2. Install splitter mechanism, Fig. 7. The three anchor bolt holes in the high clutch diaphragm must align with the three transmission case holes, two in the bottom and one hole in the top of the housing.
3. Install three anchor bolts, the shorter one at top of transmission. Tighten two bottom bolts to a torque of 17-20 lb. ft. *Do not tighten the top bolt at this time; failure to tighten bolts in the correct order may cause internal oil leakage.*

Hydraulic Retarder

1. Install low splitter reaction plate with vanes toward front of housing and anchor bolt hole in line with hole in bottom of housing.
2. Install reaction plate anchor bolt and torque to 17-20 lb. ft.
3. Tighten diaphragm anchor bolt at top of housing to 17-20 lb. ft.
4. Install hook-type ring seal around splitter ring gear of turbine shaft and retarder rotor, Fig. 6.
5. Make sure thrust washer is in front of splitter planetary carrier and that the hook-type seal ring is in the

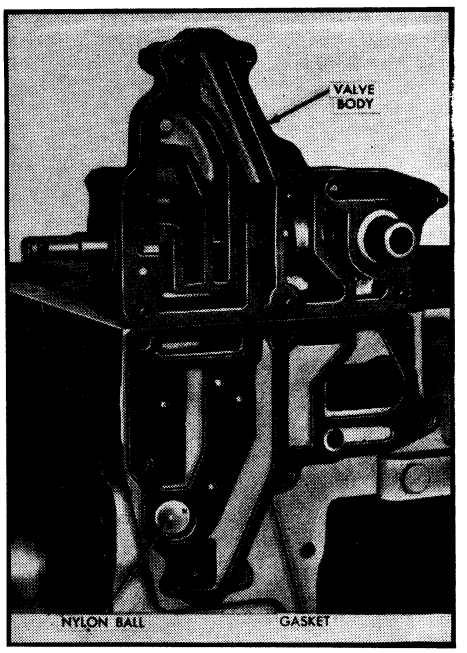


Fig. 17 Hydraulic retarder valve installation

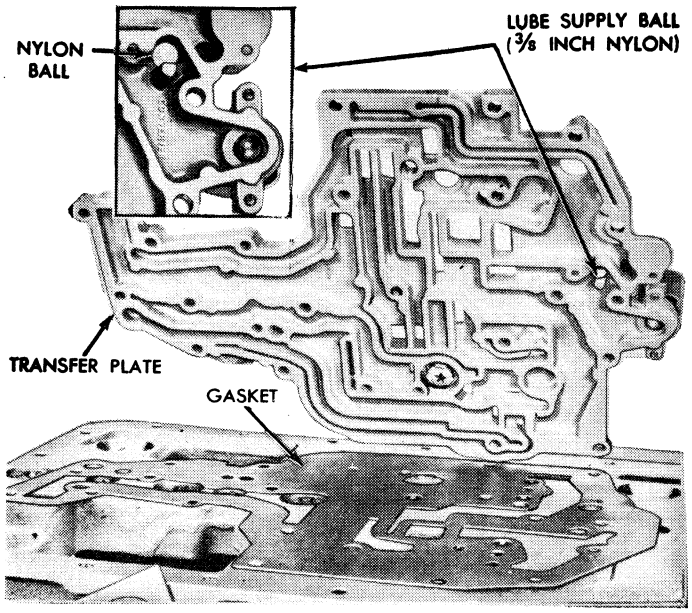


Fig. 18 Oil transfer plate installation

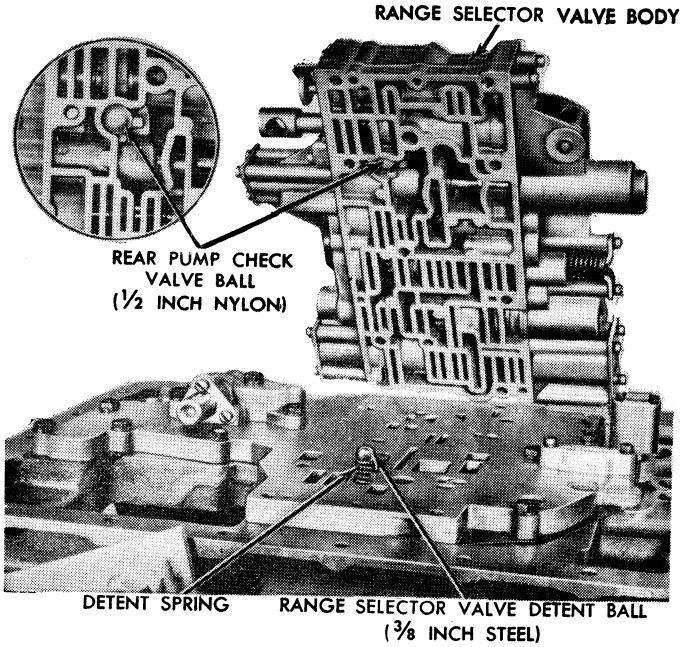


Fig. 20 Range selector valve body installation

groove at front of splitter output shaft. Oil the thrust washer and hook seal, then install turbine shaft and retarder rotor.

Torque Converter

1. Place converter housing gasket on transmission case.
2. Remove converter pump and hub. *Converter pump should be installed within one hour after removal while seal is still pre-stretched.*
3. The bronze thrust washer should be checked to be sure it is being held in place at the rear of the ground sleeve by oil soluble grease. Install converter housing on transmission case and torque mounting bolts to 42-50 lb. ft.
4. Install hook-type seal ring on converter pump hub.
5. Install converter pump. Make sure slots in hub mate with front pump drive lugs and that hook-type ring seal on hub passes through front pump seal without damage to seal ring or seal.
6. Install seal in groove just inside bolt circle.
7. Install freewheel race spacer on ground sleeve with concave side up.
8. Install new snap ring to retain freewheel race spacer, then install freewheel roller race on ground sleeve.
9. Carefully install second stator. When installed, stator should freewheel in direction of arrow on converter pump, and lock when turned in opposite direction.
10. Install bronze spacer washer, then install first stator over roller race so that springs and rollers do not fall out. The first stator, when installed, should freewheel in the direction of the arrow on the converter pump, and should lock when turned in the opposite direction.
11. Install turbine on turbine shaft, Fig. 15.
12. Install snap ring and hook-type ring seal on turbine shaft, Fig. 15.
13. Install seal ring in groove just inside bolt circle on front of lockup clutch reaction plate.
14. Install reaction plate, Fig. 15. *If inked balance marks are found on reaction plate, converter pump, lockup piston and pump cover, assemble the parts with the marks aligned.*
15. Install lockup clutch plate on reaction plate with internal teeth engaging turbine splined ring, Fig. 15.
16. Install pump cover on converter pump studs. *If balance marks are on cover and pump, align balance marks.* Install four nuts at 90° intervals and tighten alternately to 10 lb. ft. to prevent synthetic seal from being forced out of its groove. install remaining nuts and torque all nuts to 19-23 lb. ft.
17. If any of the parts listed below are replaced in the course of the work, the dimension indicated by "A" in Fig. 16 must be checked. The required dimension is 1.572-1.592". Parts replacement which may affect dimension "A" are: Converter pump cover assembly, lockup clutch reaction plate, converter pump, converter pump hub, converter ground sleeve assembly and converter housing. Dimension "A" may be checked by fastening a sling as shown and applying a pull of 100 lbs. or more to remove all end play. If the dimension is not within specified limits, install or remove converter stack control spacers as needed. Spacers are furnished in five thicknesses ranging from .027" to .101".

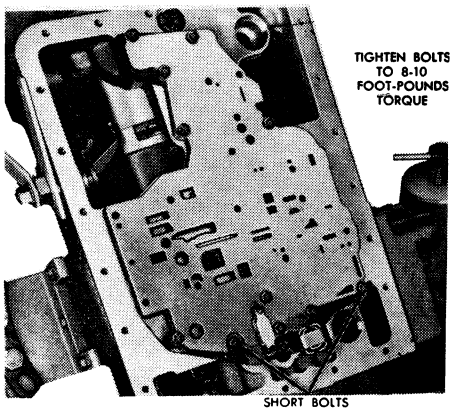


Fig. 19 Oil transfer plate attaching bolts

Oil Transfer Plate, Valve Bodies, Oil Pan and Filter

1. Install hydraulic retarder valve body and nylon ball, Fig. 17. Tighten mounting bolts to 15-18 lb. ft.
2. Install oil transfer plate as shown in Figs. 18 and 19. Tighten bolts to 8-10 lb. ft.
3. Install downshift timing valve body on oil transfer plate and torque bolts to 8-10 lb. ft.
4. Install range selector valve body as shown in Fig. 20 and torque bolts to 4-6 lb ft.
5. Place new seals on both pump pickup tubes and install oil pan, torqueing bolts to 8-10 lb. ft.
6. Install fluid filter and tighten nut to 8-10 lb. ft.

Sub-Assemblies, Overhaul

CONVERTER PUMP COVER & LOCKUP CLUTCH

Disassemble

1. Remove lockup clutch reaction plate, Fig. 21, and lift out clutch plate. Tap edge of cover against wooden block, if necessary, to remove reaction plate.
2. Remove seal ring from front flange of reaction plate.
3. Remove snap ring which retains lockup clutch piston in pump cover.
4. Remove piston from pump cover by tapping edge of cover against a wooden block.
5. Remove seal from outer groove in piston.

Assemble

1. Install seal ring in outer groove in lockup clutch piston, then apply a light coat of oil to the seal.
2. Install piston in converter pump cover so that dowel holes in piston engage dowels in cover, Fig. 22. Be sure that balance marks on both parts are also aligned. *If the dowels do not enter the dowel holes, the lockup clutch will not disengage and the converter will not function.*
3. Install snap ring. If piston does not push far enough into the pump cover to install the snap ring, use a suitable sleeve and press ram to compress the piston.

CONVERTER PUMP

Disassemble

1. Remove large seal ring from converter pump, Fig. 23.
2. Tap out all damaged or worn converter pump bolts. Only damaged bolts should be removed from the pump. *Do not lose the positions of the balance weights.*
3. Remove bearing retainer from pump.
4. Tap hub from pump.
5. Remove synthetic seal ring from pump and hook-type seal ring from hub.
6. Drive bearing from hub, using a soft drift and light hammer.

Assemble

1. If any pump cover bolts were removed, insert new bolts and press them in place. Install balance weights in their proper positions.
2. Install new synthetic seal ring in outer groove of pump face just inside pump circle.
3. Install new seal ring on hub mounting surface groove of pump.
4. Install bearing in pump hub and position hub in pump.
5. Install bearing retainer on hub, align mounting holes, and install bolts, tightening them to 9-11 lb. ft. torque. *Do not install the hook-type seal ring in the pump hub at this time as the converter pump hub is to be used to pre-fit the front pump oil seal.*

CONVERTER STATORS

Disassemble and Inspect

Remove the springs or rollers which did not fall out of the stators during removal.

Check both stators for cracks or excessive wear. Check springs and rollers for nicks, burrs or other damage.

Assemble

1. Apply oil soluble grease in stator cam pockets, then place roller springs in openings with open ends facing stator bore.
2. Compress springs with a small screwdriver to allow roller to be inserted in shallow end of each cam pocket. Install one spring and roller in each of the eight cam pockets in each stator. *Be sure springs and rollers are properly installed in roller race so that stators lock when they are turned in opposite direction of engine rotation, and that they freewheel when turned in direction of engine rotation.*

CONVERTER HOUSING & FRONT PUMP

Disassemble

1. Remove front pump body and gears

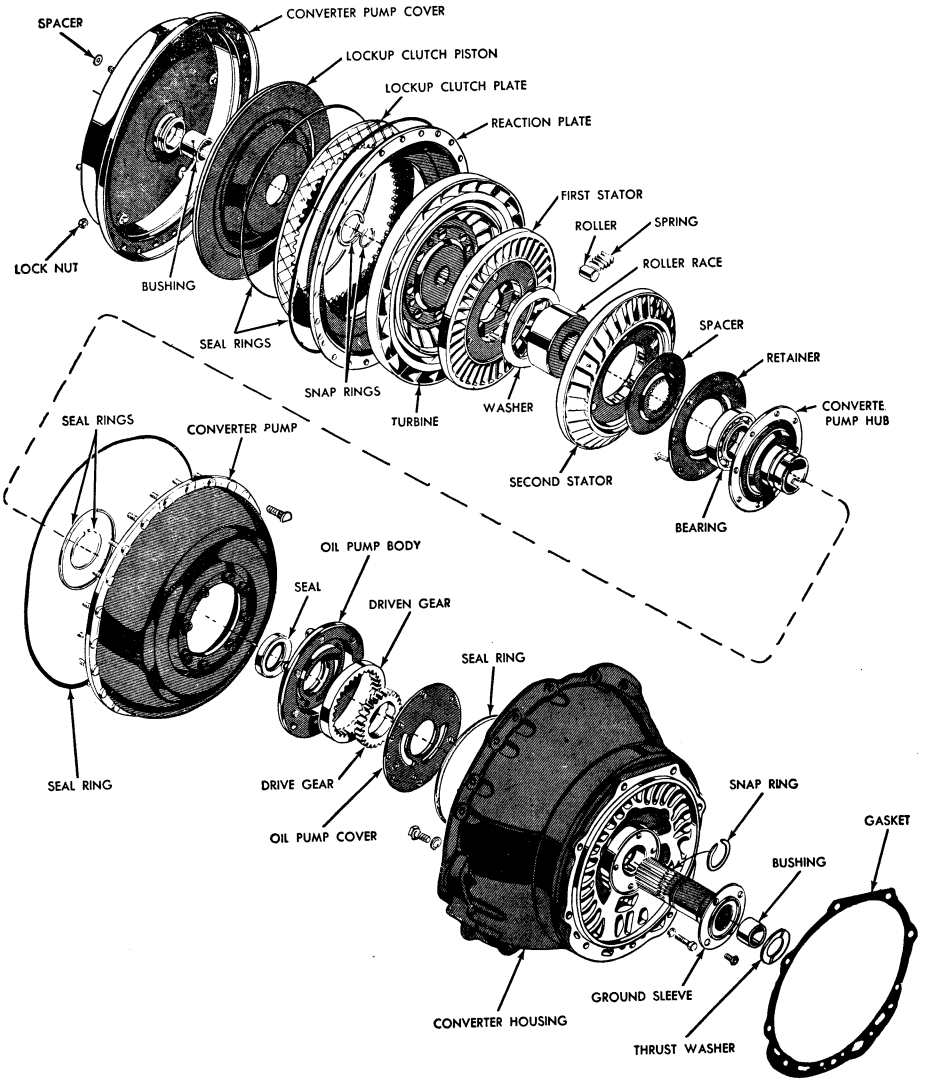


Fig. 21 Torque converter, lockup clutch and front pump

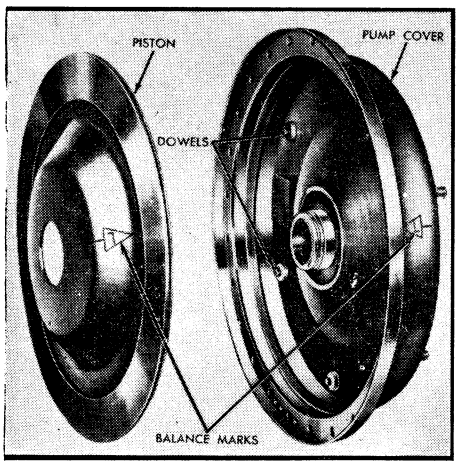


Fig. 22 Lockup clutch piston and converter pump cover balance marks and dowels

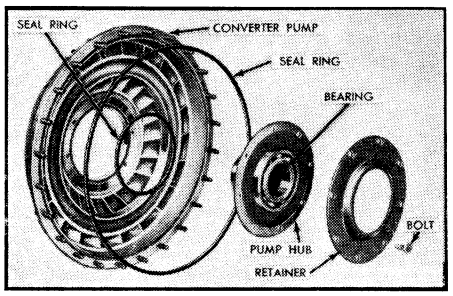


Fig. 23 Converter pump

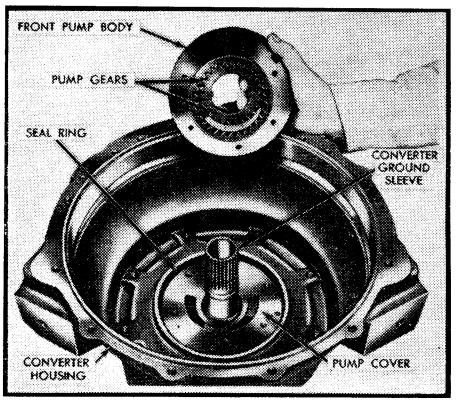


Fig. 24 Front pump body

from housing, Fig. 24.
2. Lift pump cover and seal ring out of converter housing.
3. Remove gears from pump body and drive seal ring out the front of pump body.
4. Unfasten converter ground sleeve from converter housing, using a wood block to drive sleeve from housing.

Assemble

1. Align the holes in the ground sleeve with the holes in the converter housing by installing two headless bolts in the converter housing.
2. Place the sleeve through the rear of the housing so the bolt holes slip over the headless bolts.
3. Using a wood block against the rear of the sleeve, drive the sleeve tight against the housing.
4. Remove the headless bolts and install the retaining bolts, tightening them to a torque of 17-20 lb. ft.
5. Coat a new front pump seal with Permatex on the outer diameter. Start seal into front bore of pump body.
6. Support machined rear face of pump body on a flat surface and press seal into body. *Use a hand press for this operation as a hydraulic press may damage the seal.* Press seal into body until there is 1.595-1.605″ from front surface of seal to rear machined surface of pump body.
7. Place gears in pump body.
8. Position pump cover and install two guide bolts in body.
9. Install square section O-type seal ring aroung pump cover.
10. Place pump in front of converter housing and insert guide bolts through proper holes in housing and install four bolts with lock washers through rear of converter housing into pump body.
11. Remove guide bolts, install two remaining bolts and tighten all bolts to a torque of 15-18 lb. ft.
12. With hook-type seal ring removed from converter pump hub, align slots in hub with pump drive lugs and insert hub through seal. *Leave these parts assembled in this manner until ready for final assembly.*
13. Using oil soluble grease to hold bronze thrust washer in place, position washer in rear of ground sleeve.

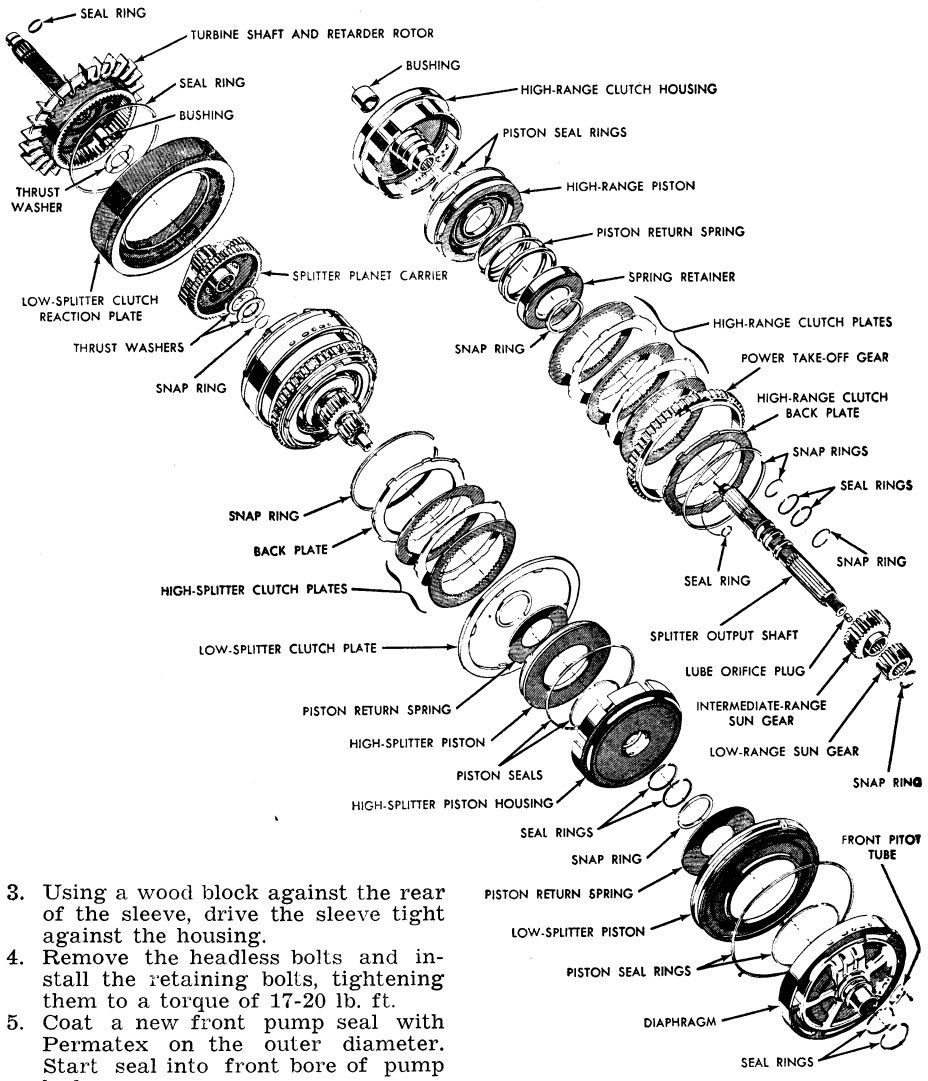


Fig. 25 Splitter mechanism, high clutch and power take-off drive gear

SPLITTER MECHANISM, HIGH CLUTCH & PTO DRIVE GEAR

Disassemble, Fig. 25

1. Remove low and intermediate sun gears after removing snap ring.
2. Grasp unit with fingers under high clutch and the thumbs over low splitter clutch friction plate to prevent it falling apart; then place it on blocks.
3. Remove thrust washer and snap ring. Then remove splitter planetary carrier and thrust washer.
4. Remove high splitter clutch and low splitter clutch friction plate.
5. Remove high splitter clutch back plate after removing snap ring.
6. Remove clutch plates and low splitter clutch friction plate.
7. Place high splitter clutch housing in press, supporting rear of housing

and compress piston Belleville spring and remove snap ring. *When releasing Belleville spring pressure be sure that spring does not catch in snap ring groove.*

8. Remove Belleville spring and tap forward edge of clutch housing against wood block to remove high splitter piston.
9. Remove synthetic seal ring from piston and hook-type seal ring from housing.
10. Remove thrust washer and two hook-type seal rings from diaphragm, Fig. 26.
11. Remove splitter output shaft assembly, doing so slowly so that hook ends of seal rings do not break off.
12. If necessary, remove two wire snap rings and three hook-type seal rings.
13. Support rear of high clutch housing in a press and compress low splitter clutch piston Belleville spring and remove snap ring. Carefully release pressure on Belleville spring to keep its inner edge from catching in snap ring groove. *Do not attempt to lift diaphragm from assembly at this time as the vanes in the front fluid velocity governor may be damaged by the pitot tube.*
14. Remove assembly from press and lift out Belleville spring.
15. Remove low splitter clutch piston from high clutch diaphragm and remove synthetic seal ring from piston and hook-type seal ring from diaphragm. *Do not attempt to remove diaphragm from assembly.*
16. Remove the two front pitot tube mounting screws and lockwashers from front surface of diaphragm to allow pitot tube to drop into front governor collector ring. Lift diaphragm from assembly and remove two hook-type seal rings from rear of diaphragm. Remove pitot tube from collector ring.
17. Support front surface of high clutch housing assembly in a press, using a suitable block in center of housing so that governor collector ring will not be damaged. Compress piston return spring retainer and remove snap ring. *Release pressure on piston return spring retainer slowly, making sure inner edge of spring retainer does not catch in snap ring groove as spring expands.*
18. Remove assembly from press and lift off retainer and spring.
19. Remove large internal snap ring from high clutch housing.
20. Remove high clutch reaction plate, three internal splined plates, two external splined plates and the power take-off gear.
21. Tap rear of housing on a wood block to loosen high clutch piston. Remove piston, then remove synthetic seal from piston and hook-type seal ring from housing.

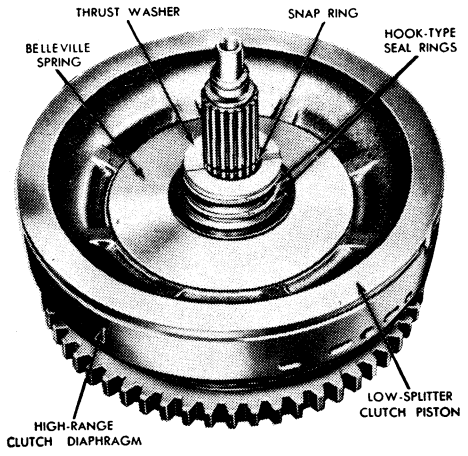


Fig. 26 Low splitter clutch piston

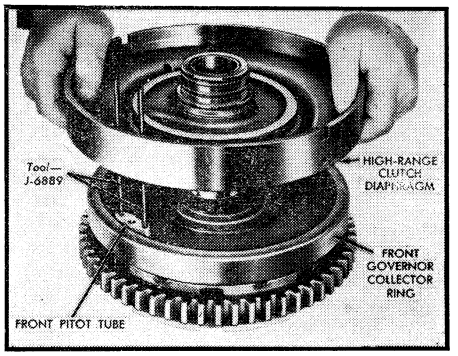


Fig. 27 High clutch diaphragm installation

Assemble, Fig. 25

1. Install hook-type seal ring on high clutch housing and synthetic seal ring on high clutch piston. Coat seals lightly with oil.
2. Install piston in housing.
3. Support front surface of piston housing in a press, using a suitable block at center of housing so that governor collector ring will not be damaged.
4. Position coil-type piston return spring on top of piston, set retainer on spring and, using a suitable sleeve on the retainer, align the hole in the retainer with the hub of the housing. Then center the sleeve tool on the retainer. Compress the spring until the retainer is below the snap ring groove and install the snap ring. *Make sure the inner edge of the retainer does not catch in the snap ring groove.*
5. Install snap ring in housing hub groove and slowly release pressure on retainer. *Make certain snap ring is fully seated and that the retainer is straight and returns firmly against snap ring.* Remove assembly from press.
6. Install power take-off gear, aligning drive slots with slots in high clutch housing.
7. Install high clutch plates.
8. Install high clutch reaction plate so that the two longer tangs engage drive slots in power take-off gear.
9. Install large internal snap ring in high clutch housing to retain high clutch reaction plate.
10. Install two hook-type seal rings on rear of high clutch diaphragm.
11. Install high clutch with front governor collector ring facing upward.
12. Install two guide bolts in front pitot tube on the side of pitot tube that the drilled port is located, Fig. 27. (Guide bolts can be made from two 5-inch lengths of $\frac{3}{16}$" brazing rod threaded with a 10-32 die a distance of $\frac{3}{8}$".)
13. Place pitot tube in governor collector ring with intake port toward outer diameter of ring.
14. Install high clutch diaphragm over high clutch. Make sure diaphragm enters high clutch housing without damaging hook-type seal rings at rear of diaphragm. At the same time, direct guide bolts through pitot tube mounting screw holes, Fig. 27.
15. While holding up firmly on one of the guide bolts, remove other guide bolt and install pitot tube mounting screw and lockwasher. Tighten screw just enough to keep pitot tube from moving. Remove other guide bolt and install other mounting screw. Tighten both screws 38-48 lb. ft. torque. *Do not separate this assembly while pitot tube is in position.*
16. Install synthetic seal ring on low splitter clutch piston and the hook-type seal ring on low splitter piston housing side of diaphragm.
17. Lightly coat seal rings with oil and carefully install low splitter piston into diaphragm so that seal rings are not damaged.
18. Place assembly in press with low splitter clutch piston up. Then install the Belleville return spring on piston with convex side up. Compress spring carefully far enough to install snap ring. *Do not allow Belleville spring to catch in snap ring groove while compressing spring.*
19. Place high clutch and diaphragm assembly on blocks. Install two wire snap rings and three hook-type seal rings on splitter output shaft. Lightly coat seal rings with oil and carefully install splitter shaft so that seal rings are not damaged.
20. Install hook-type seal ring on inner diameter of high splitter clutch housing and gear.
21. Install synthetic seal on outer diameter of high splitter piston.
22. Lightly coat seals with oil and install piston in housing, being careful not to damage seals.
23. Place piston and housing assembly in a press with piston up. Then install Belleville spring on piston with convex side up. Compress the spring carefully and only far enough to install the snap ring. Remove from press.
24. Install low splitter clutch friction

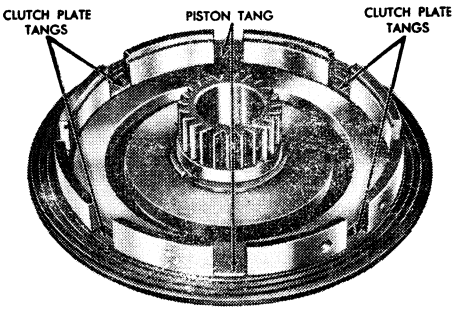


Fig. 28 Low splitter clutch plate installation

plate on high splitter clutch housing so that the six internal tangs do not engage the slots in the housing where the high splitter piston tangs are located, Fig. 28. If the tangs through error are installed in the same slots, both splitter clutches would be applied when the high splitter piston is actuated.

25. Install two internal splined plates and one external splined plate.
26. Install high splitter clutch back plate, retaining it with large snap ring.
27. Install two hook-type seal rings and the bronze thrust washer on the front face of the diaphragm, then apply a light coat of oil to these parts.
28. Install high splitter clutch and low splitter clutch friction plate, being careful not to damage seal rings.
29. Coat bronze thrust washer with oil soluble grease and install in splitter planetary carrier.
30. Install splitter planetary, splining it on splitter output shaft and meshing with external teeth of high splitter clutch plates. Install snap ring on splitter shaft.
31. Lightly coat bronze thrust washer with oil and install on splitter planetary carrier.
32. Remove splitter assembly from blocks and place it on its side. *Be careful in handling the low and intermediate sun gears until they are installed and retained by snap rings so that the front pitot tube will not damage the front governor collector ring.*
33. Install low and intermediate sun gears. Then while holding splitter shaft by opposite end, install snap ring to retain sun gears.

TRANSMISSION REAR SUB-ASSEMBLIES

Rear Bearing Retainer & Rear Pump

1. To disassemble, refer to Fig. 29 and remove pump from bearing retainer.
2. Remove pump cover and speedometer drive gear.
3. Pry out output shaft flange seal from retainer and remove internal snap ring.
4. Drive ball bearing out through rear of retainer; spacer washer will come out with retainer.
5. To assemble, install steel spacer washer in retainer.
6. Press ball bearing in retainer until it is tight against shoulder in retainer.
7. Install bearing retainer snap ring.
8. Coat outside diameter of output shaft flange oil seal with Permatex and install seal so it is 1/32-3/64" above rear surface of retainer. *Do not assemble rear bearing retainer further until it has been used in the selection of the proper retainer-to-transmission gasket; this procedure is outlined under Transmission, Assemble.*
9. Install speedometer drive gear.
10. Install two guide bolts in rear bearing retainer. Then place pump cover over guide bolts. Install gears in pump body and slip pump body over guide bolts.
11. Start two of the pump retaining bolts, remove guide bolts and install other three bolts. Tighten all bolts to a torque of 15-18 lb. ft.

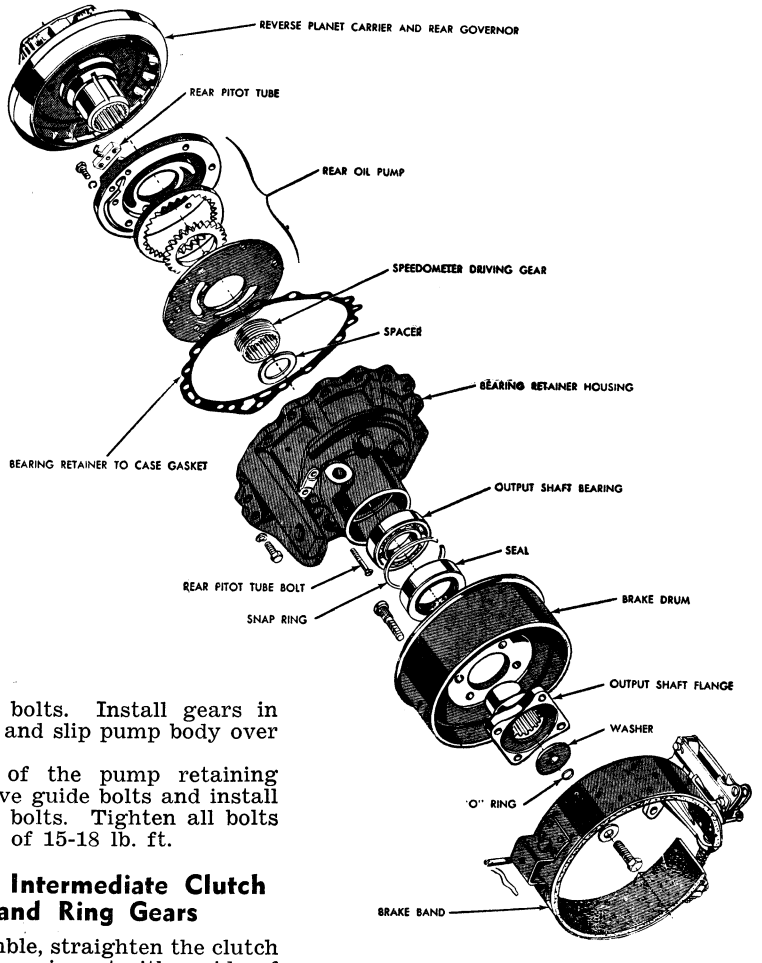


Fig. 29 Rear bearing retainer and rear pump

Reverse and Intermediate Clutch Plates and Ring Gears

1. To disassemble, straighten the clutch plate retainer ring at either side of the plate and remove the ring. Lift plate off gear. Then straighten and remove other ring.
2. To assemble, position clutch plate between the two grooves cut around the outside diameter of the ring gear. Place a new clutch plate retainer ring in one of the two grooves and crimp the ring at five evenly spaced intervals around the gear. Turn assembly over and install the other ring in the same manner as the first ring. *Do not crimp rings where cutouts are made in friction facings.*

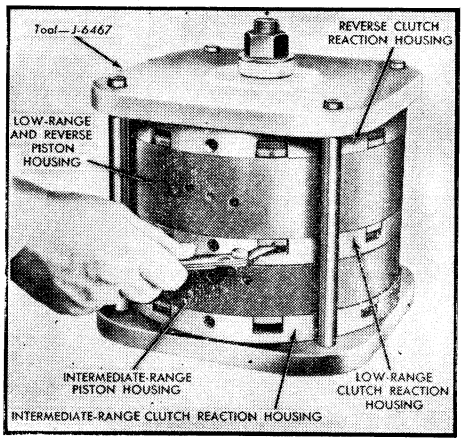


Fig. 30 Checking range clutch clearances

Low, Reverse or Intermediate Piston Housing

1. To disassemble, tap edge of housing on wood block to loosen pistons and remove pistons from housings. Remove synthetic seal ring from outer groove of piston and hook-type seal ring from housing (or from piston in the case of the intermediate piston).
2. Assemble in the reverse order, lightly coating seals with oil and pushing them all the way into the housings.

Low Ring Gear and Intermediate Planetary Carrier

1. To disassemble, remove snap ring from low ring gear and lift out intermediate planetary carrier.
2. To assemble, mesh the teeth of the carrier with the teeth of the ring gear and push the carrier into the ring gear. Install the snap ring to hold the assembly together.

Checking Clutch Clearances

It will be necessary to check the clutch clearances if any pistons, piston housings, apply plates, reaction housings, Belleville springs, or clutch plates have been replaced in the low, intermediate or

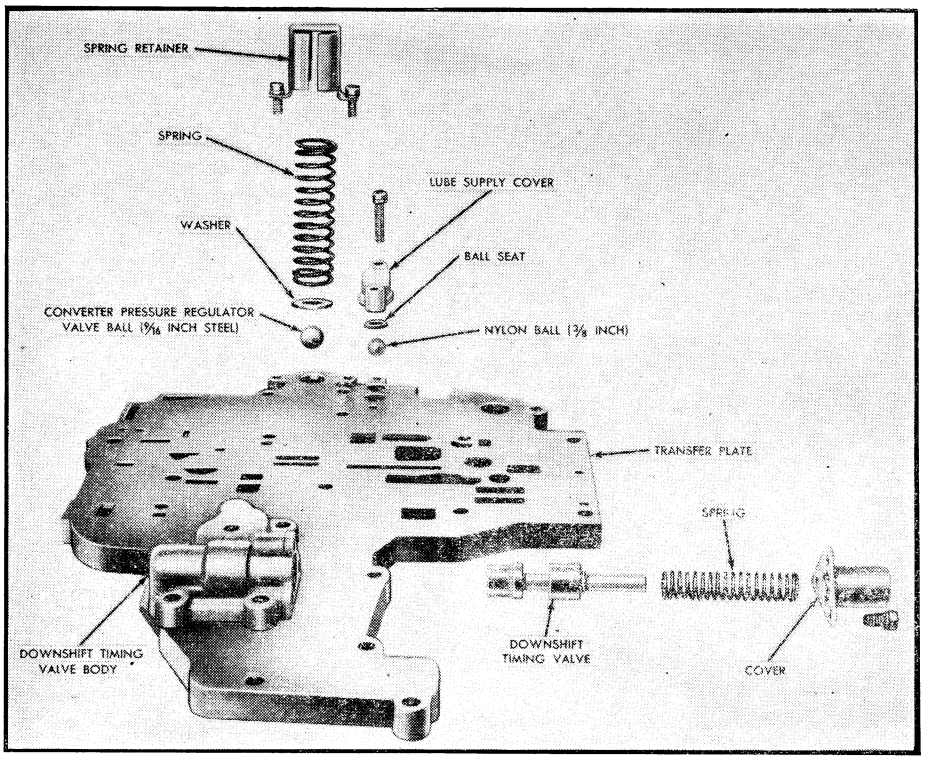


Fig. 31 Oil transfer plate

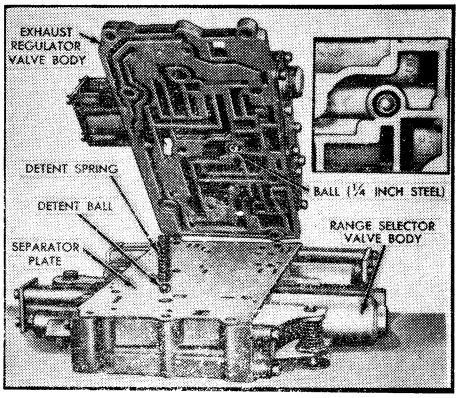


Fig. 32 Range selector and exhaust regulator valve bodies

reverse clutches. This check is performed before assembly of the clutches in the transmission housing, using the tool shown in Fig. 30. It is advisable to check these clutches on every rebuild or teardown to be certain the clutches meet the proper clearance specifications.

Assemble the clutches in the tool as shown in Fig. 30. Then check the clearances as follows:

1. Use a small screwdriver to separate the plates. Then measure the clearances between the clutch friction plates and apply plates of the reverse clutch with a feeler gauge. This clearance should be .010-.015".
2. Repeat this operation on the low clutch, the clearance of which should also be .010-.015".
3. Use the same procedure to check the intermediate clutch, the clearance of which should be .020-.030".
4. If the clutches do not have the specified clearances, it will be necessary to replace the apply plates, which are available in three thicknesses for each clutch: .338-.342", .345-349" and .352-356".
5. Measure the maximum thickness of the apply plate from the clutch stack and, by considering the clearance measurement taken while the stack is assembled, choose the correct plate to bring the clearance within specifications.
6. Establish the correct clutch clearances for the three ranges. Then remove the clutch pack from the fixture and stack them on the bench in the reverse order. Now, each part may be selected in the correct order for assembly in the transmission housing.

HYDRAULIC VALVES OVERHAUL

Oil Transfer Plate

Referring to Fig. 31, remove lube

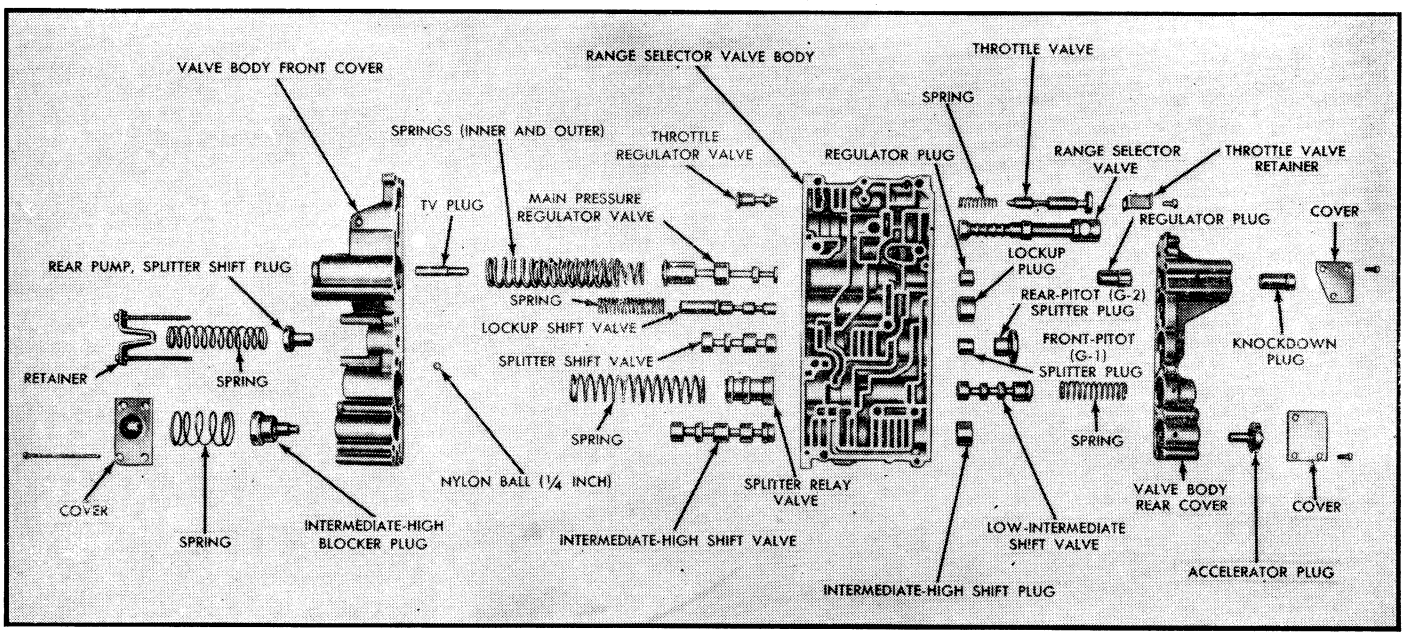


Fig. 33 Range selector valve body

supply cover, converter pressure regulator valve retainer, spring, seat and steel ball. The low range clutch exhaust regulator valve is pressed into the oil transfer plate and should not be removed unless it is to be replaced with a new one. Check the operation of the valve while cleaning the transfer plate. The valve should retain the cleaning solvent on the side opposite the spring for at least 15 seconds.

When assembling, tighten the lube supply cover screws to a torque of 24-36 inch-lbs. *The nylon ball is installed from the other side of the oil transfer plate when the plate is assembled to the transmission.* Tighten converter pressure regulator valve retainer screws to a torque of 24-36 inch-lbs.

Downshift Timing Valve

Remove this valve as indicated in Fig. 31. When assembled, tighten the cover screws to a torque of 24-36 inch-lbs.

Range Selector Valve Body

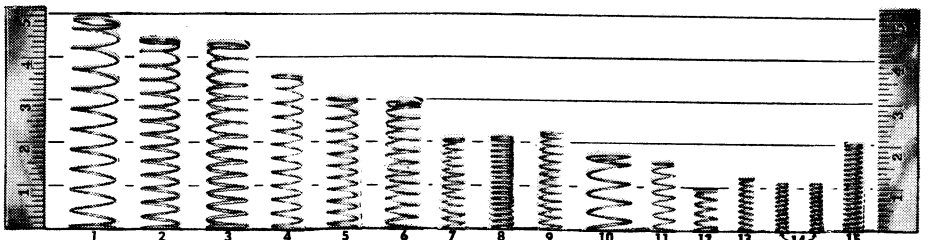
In servicing this valve, refer to Figs. 32 and 33. Also do not mix the various springs located in the valve body. Fig. 34 identifies the springs and balls and their dimensions.

When disassembled, wash all parts in cleaning solvent and dry thoroughly with air pressure. Check all parts and castings for cracks, nicks or burrs. Replace any cover or casting that is cracked or damaged. Remove any nicks or burrs with a fine stone.

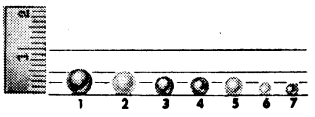
Do not sand or polish any radius on the valves or plugs. The valves and plugs are manufactured with a sharp edge to prevent dirt from sticking in the valve bore.

All valves and plugs should be installed dry and must move in the valve body bore by their own weight. Do not attempt to force any valves into the bores as damage to the casting will result. If any valve or plug sticks, remove it and recheck for nicks or burrs.

When installing the front cover to the range selector valve body, check the mating surfaces between these parts. Be sure there is a tight seal and that none of the springs are caught between the housings. The front cover should not protrude above the main valve body face since it assembles against the oil transfer plate. Tighten all screws to a torque of 24-36 inch-lbs.



	SPRING	FREE HEIGHT (Inches)	NUMBER OF COILS
1.	EXHAUST FEED PLUG	5.00	12½
2.	SPLITTER RELAY VALVE	4.59	15½
3.	MAIN PRESSURE REGULATOR VALVE (Outer)	4.46	16
4.	MAIN PRESSURE REGULATOR VALVE (Inner)	3.67	13½
5.	SPLITTER SHIFT VALVE	3.25	13
6.	CONVERTER PRESSURE REGULATOR VALVE (Ball)	3.14	13½
7.	LOCKUP CUT-OFF VALVE	2.50	12½
8.	LOCKUP SHIFT VALVE	2.22	18½
9.	LOW-TO-INTERMEDIATE SHIFT VALVE	2.34	13½
10.	INTERMEDIATE-TO-HIGH SHIFT VALVE	1.82	6
11.	LOW-SPLITTER EXHAUST REGULATOR VALVE	1.72	8½
12.	INTERMEDIATE EXHAUST REGULATOR VALVE	.93	6
13.	THROTTLE VALVE	1.210	11
14.	RANGE SELECTOR VALVE DETENT	1.161	12
15.	DOWNSHIFT TIMING VALVE	2.15	17



1. CONVERTER PRESSURE REGULATOR VALVE (STEEL) 5/16 INCH
2. REAR PUMP CHECK VALVE (NYLON) ½ INCH
3. and 4. RANGE SELECTOR VALVE DETENT (STEEL) 3/8 INCH
5. LUBRICATION SUPPLY CHECK (NYLON) 3/8 INCH
6. SPLITTER RELAY CHECK (NYLON) ¼ INCH
   (INSTALLED IN RANGE SELECTOR VALVE BODY FRONT COVER)
7. EXHAUST FEED PLUG PASSAGE CHECK (STEEL) ¼ INCH

Fig. 34 Control valve body spring and ball identification

Check the mating surface between the valve body rear cover and range selector valve body. Be sure there is a tight seal and the intermediate shift valve spring is not caught between the housings.

If the rear cover and range selector valve body are in proper position (not distorted), tighten the screws to a torque of 24-36 inch-lbs., starting at the center of the cover and working toward the ends.

The range selector valve body must now be checked with a straight edge. Place the straight edge on the surface

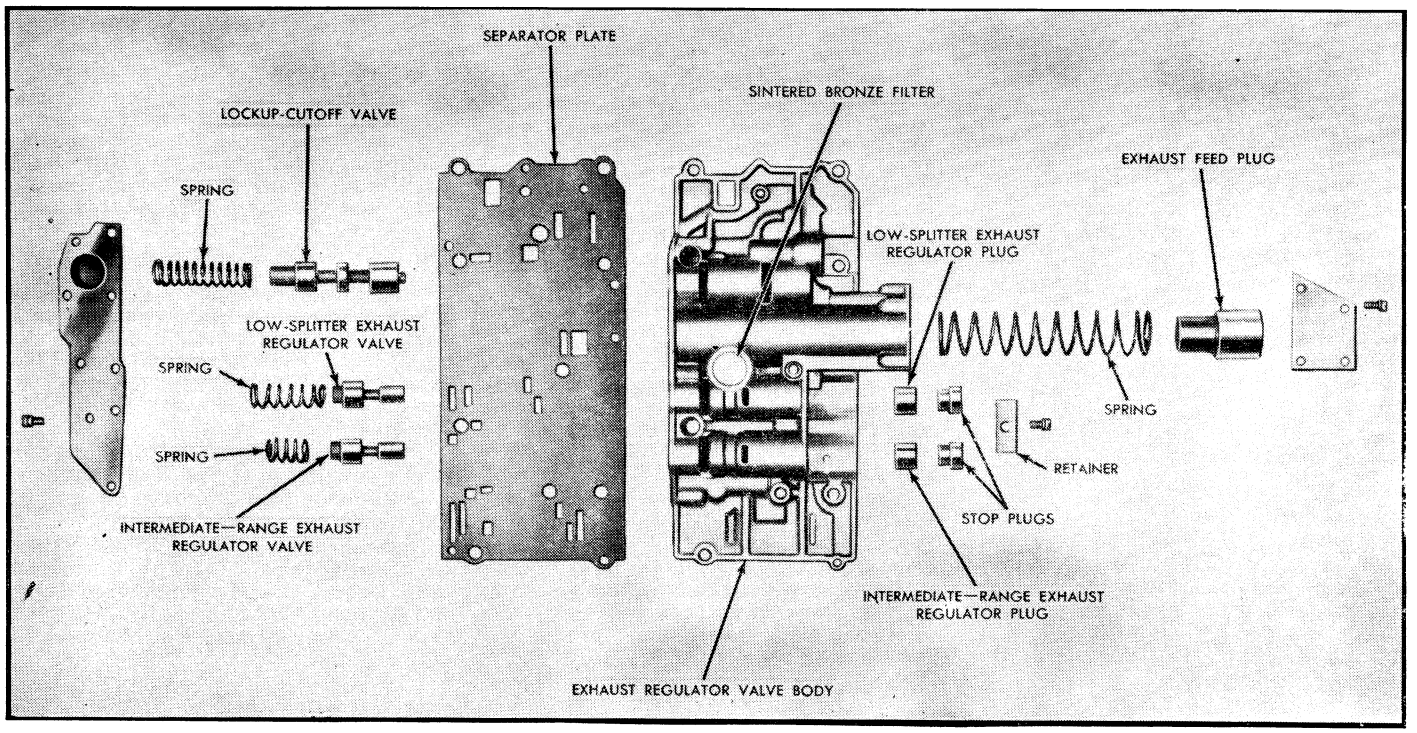


Fig. 35 Exhaust regulator valve body

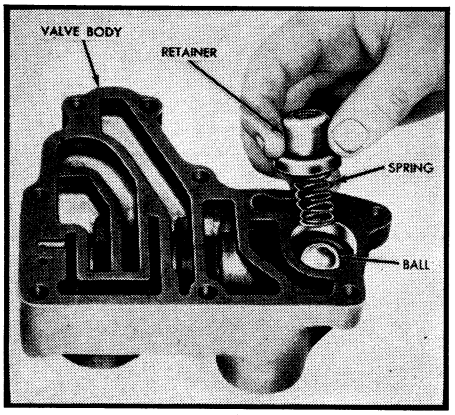


Fig. 36 Lube regulator valve retainer, spring and ball

that mates to the oil transfer plate (only the pump overage should be above the surface). If any of the cover assemblies protrude above this surface, the screws will have to be loosened and the cover shifted to a position below the range selector valve body surface.

Exhaust Regulator Valve

Refer to Fig. 35 when servicing this valve. When disassembled, do not tamper with the bronze exhaust feed filter since the valve body is easily damaged. Wash all parts with cleaning solvent and dry thoroughly with compressed air. Remove nicks or burrs with a fine stone. Replace any cover or casting which is cracked or damaged. Do not sand or polish any radius on valves or plugs as they are made with a sharp edge to prevent dirt from sticking in the valve bore.

All valves and plugs must be installed dry and must move in their respective bores by their own weight. If a valve or plug sticks, remove it and recheck for nicks and burrs. When completely assembled, tighten all screws to a torque of 24-36 inch-lbs.

Hydraulic Retarder Control Valve

1. To disassemble, place the valve body on wood blocks with the mounting surface down. Drive the pin out of the valve body, Fig. 36.
2. Place the valve body on a wood surface with valve pointing up. Then, using a soft hammer and rapid, light blows, drive the valve against the spring in the body.
3. Remove seal, valve and spring from valve body.
4. Loosen the lube regulator valve retainer by tapping lightly around the edge of the retainer. Then remove retainer, spring and steel ball, Fig. 36.
5. Assemble the valve in the reverse order of removal, referring to Fig. 37. The lube regulator valve retainer should be pressed in until the large diameter is flush with the mounting surface to .030″ maximum below the surface of the valve body.
6. Coat the outer shell of the new oil seal with Permatex and start the seal straight into the vlave body. Press the seal in until it is flush with the valve body.
7. After the assembly is completed, the valve must be in its normal position, against the retaining pin, after actuation.

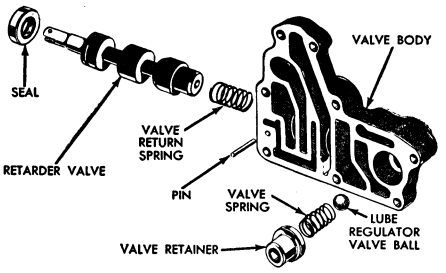


Fig. 37 Hydraulic retarder valve

FORD-O-MATIC, LOADFLITE, METRO-MATIC

CONTENTS

DESCRIPTION

These units combine an air-cooled three-element torque converter and a hydraulically controlled three speed and reverse planetary gearbox, Fig. 1.

The drive is always through the torque converter and one of the planetary gear ranges. The range selector lever, located on a dial above the hub of the steering wheel, has a choice of five positions lettered "P" (park), "R" (reverse), "N" (neutral), "D" (drive) and "L" (low).

The path of power under all conditions is shown diagramatically in Fig. 2.

Torque Converter

The torque converter, Fig. 3, is a simple three-element type, consisting of a pump or drive member, a turbine or output member, and a stator or reaction member.

The stator has a sprag type of overrunning clutch nested in the center of its hub assembly. The stator redirects fluid flow or increases torque up to an engine speed of approximately 1,900 rpm (48 mph in high). It then freewheels (turns in direction of pump and turbine) to form a fluid coupling.

The pump, forming part of the housing, has 31 steel blades of vanes and is driven by the engine through a flexible plate. This plate, forward of the starter ring gear, cuts down the amount of vibration transferred from the engine to the transmission.

The 33-blade turbine is the forward member that transmits the power to the planetary gearbox.

Cooling of the converter and transmission oil is accomplished by fins cast in the aluminum pump cover or housing. These fins serve as a cooling surface and pump cool air through the inlet on the left side to the outlet at the bottom right.

Planetary Gearbox

The hydraulically controlled planetary gearbox employs a gearset of the double (long and short) pinion type with two sun gears and one internal gear. This total of nine gears provides three forward ratios—two geared, one direct and one reverse.

Two multiple disc clutches and two brake bands, all hydraulically actuated, determine the path through which power flows in various gears.

Two oil pumps, one driven at all times by the engine and one by the output shaft, deliver oil under pressure to charge the converter, actuate and control bands and clutches and pressure lubricate the entire mechanism.

The control system consists of a pressure regulator assembly, a hydraulic governor mounted on the output shaft, and the main hydraulic control unit or